

PROJECT MANUAL FOR:

Campus Temporary Gym Structures

MONTANA STATE UNIVERSITY
BOZEMAN, MONTANA

April 21, 2019

PPA No. 19-0061

SET NO.:



**MONTANA
STATE UNIVERSITY**

CAMPUS PLANNING,
DESIGN AND CONSTRUCTION
BOZEMAN, MONTANA
PHONE: (406) 994-5413 FAX: (406) 994-5665

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| Sample Standard Form of Contract, Form 110 | State of Montana General Conditions |
| MSU Supplemental Conditions | Montana Prevailing Wage Rates |

The following documents are included in electronic versions but not included in the printed project manual.

- | | |
|---|---|
| Substitution Request, Form 99 | Certificate of Substantial Completion, Form 107 |
| Schedule of Values for Payment, Form 100 | Construction Change Directive, Form 109 |
| Periodic Estimate for Partial Payment, Form 101 | Request for Information, Form 111 |
| Acknowledgement of Subcontractors, Form 102 | Performance Bond, Form 112 |
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CAMPUS PLANNING, DESIGN & CONSTRUCTION

Sixth Avenue and Grant Street • P.O. Box 172760 • Bozeman, Montana 59717-2760

Phone: (406) 994-5413 • Fax: (406) 994-5665

PERMIT NOTICE

The drawings and specifications for this project have been submitted to the city of Bozeman for review. The contractor will pay all permit fees. The owner shall pay for plan review fee and the impact fee required for this project. The building permit must be appropriately displayed at the project site before construction may begin. The contractor shall contact the city of Bozeman for further clarification at the following:

CITY OF BOZEMAN
BUILDING INSPECTION DIVISION
DEPARTMENT OF PUBLIC WORKS
20 EAST OLIVE STREET, SUITE 208
PO BOX 640
BOZEMAN, MONTANA 59771-0640
(406) 582-2300

INVITATION TO BID

Sealed bids will be received until **2:00 PM on Thursday, May 9, 2019**, and will be publicly opened and read aloud in the offices of **MSU Campus Planning, Design and Construction, Plew Building, 6th & Grant, Bozeman, Montana**, for: **Campus Temporary Gym Structures, PPA No. 19-0061**.

Bids shall be submitted on the form provided within the Contract Documents. Contract documents may be obtained at the offices of:

**Montana State University
Campus Planning, Design and Construction
Plew Building, 6th & Grant
PO Box 172760
Bozeman, Montana 59717-2760**

On the web at:

<http://www.montana.edu/pdc/bids.html>

A PRE-BID WALK-THROUGH IS SCHEDULED FOR Tuesday, April 23, 2019, AT 1:00 PM PARTICIPANTS SHOULD MEET AT: MSU Bozeman Plew Building, Room 214, 6th & Grant Street, Bozeman, Montana. ATTENDANCE IS STRONGLY RECOMMENDED. Bidders should thoroughly review the contract documents before the pre-bid conference.

Bids must be accompanied by a bid security meeting the requirements of the State of Montana in the amount of 10% of the total bid. After award, the successful bidder must furnish an approved Performance Security and a Labor & Material Payment Security each in the amount of 100% of the contract for contracts equal to or greater than \$25,000.

No bidder may withdraw his bid for at least thirty (30) calendar days after the scheduled time for receipt of bids except as noted in the Instructions to Bidders.

The Owner reserves the right to reject any or all bids and to waive any and all irregularities or informalities and the right to determine what constitutes any and all irregularities or informalities.

Time of Completion

Bidder agrees to commence work immediately upon receipt of the Notice to Proceed and to substantially complete the project **by: Complete turnkey Temporary Gym Structure by August 29, 2019 with Substantial Completion by September 23, 2019.**

The State of Montana makes reasonable accommodations for any known disability that may interfere with an applicant's ability to compete in the bidding and/or selection process. In order for the state to make such accommodations, applicants must make known any needed accommodation to the individual project managers or agency contacts listed in the contract documents.

State of Montana - Montana State University

INSTRUCTIONS TO BIDDERS

1. Table of Contents

Provided in the Printed Project Manual:

Invitation to Bid
 Instruction to Bidders
 Bid Proposal, Form 098
 Sample Standard Form of Contract
 State of Montana General Conditions
 MSU Supplementary Conditions
 State of Montana Prevailing Wage Rates
 Specifications
 Drawings

These additional forms can be found on our website or will be provided upon request:

<http://www.montana.edu/pdc/docs/index.html>

Substitution Request, Form 99
 Schedule of Values, Form 100
 Periodic Estimate for Partial Payment, Form 101
 Acknowledgement of Subcontractors, Form 102
 Consent of Surety to Final Payment, Form 103
 Contract Change Order, Form 104
 Contractor's Affidavit, Form 106
 Certificate of Substantial Completion, Form 107
 Construction Change Directive, Form 109
 Request for Information, Form 111
 Performance Bond, Form 112
 Labor and Material Payment Bond, Form 113
 Certificate of Final Acceptance, Form 118

2. Viewing of Contract Documents

2.1. The Contract Documents may be viewed at the following locations:

Builders Exchange of Billings
 2050 Broadwater STE A
 Billings MT 59102
 406/652-1311
bbx@billingsplanroom.com

NW MT - Flathead Builders Exchange
 2303 Hwy 2 E
 Kalispell, MT 59901
 406/755-5888
planex@kalcop.com

Helena Plans Exchange
 1530 Cedar Street Suite C
 Helena MT 59601
 406/457-2679
helenaplanex@helenacopycenter.com

Bozeman Builders Exchange
 1105 Reeves RD W STE 800
 Bozeman MT 59718
 406/586-7653
exchange@bozemanplanroom.com

Great Falls Builders Exchange
 202 2ND Avenue S
 Great Falls MT 59401
 406/453-2513
gfbe@greatfallsplans.com

Missoula Plans Exchange
 201 N Russell ST
 Missoula MT 59801
 406/549-5002
mpe@vemcoinc.com

Butte Builders Exchange
 4801 Hope Road
 Butte MT 59701
 406/782-5433
butteplans@gmail.com

3. Borrowing of Documents: Up to two hard copy sets may be obtained for General Contractors. Additionally, Contract Documents will be available electronically. If shipping of hard copies is required, it will be at the contractor's expense.

3.1. Contract Documents may be obtained at the office of:
MONTANA STATE UNIVERSITY
CAMPUS PLANNING, DESIGN & CONSTRUCTION
PLEW BUILDING 1st FLOOR
6TH AND GRANT
BOZEMAN, MONTANA 59717-2760
406/994-5413

3.2. All borrowed Contract Documents shall be returned to Campus Planning, Design & Construction within ten (10) calendar days after the bid opening for the deposit refund (if deposit was required). However, if the Contract Documents are not in a condition where they can be reused by the Owner to construct the project, the Owner may at its sole discretion may retain the deposit or levy costs to contractor in order to

reproduce a replacement set.

4. Visits to Site

4.1. Prospective bidders are requested to contact the following for inspection of the site:

Karen Hedglin, Project Manager
Montana State University
Campus Planning, Design & Construction
6th and Grant, PO Box 172760
Bozeman, Montana 59717-2760
Ph: 406/570-4304; Fax: 406/994-5665

4.2. Failure to visit site will not relieve the Contractor of the conditions of the contract.

5. Requests for Substitution

5.1 Any requests for product substitutions must be submitted on the "Substitution Request" Form 099, to the Architect/Engineer at least ten (10) days prior to the date of the bid opening for consideration by the Architect/Engineer. Any request for substitution made after this time restriction, including those made after award during project construction may be rejected without consideration by either the Architect/Engineer or the Owner.

6. Bids/Proposals

6.1. The bidder shall submit his bid on the Bid Proposal Form furnished with the Contract Documents.

6.2. DO NOT send the Contract Documents with the Proposal. The Contract Documents shall be returned as noted in Article 3.2 of the Instructions to Bidders.

6.3. If the project is funded by any portion of federal funds, the following may apply: on Federally-funded projects, a "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion" form must be submitted with the bid proposal. If the debarment form is not included within the Construction Documents, federal funds (if included) do not require the form or are not included in the project and the debarment form is not required.

6.4. Proposals shall be in a sealed envelope and addressed to:

STATE OF MONTANA, MONTANA STATE UNIVERSITY
CAMPUS PLANNING, DESIGN & CONSTRUCTION
PLEW BUILDING 1ST FLOOR
6TH AND GRANT
PO BOX 172760, BOZEMAN, MONTANA 59717-2760

6.5. The envelope shall state that it contains a "BID PROPOSAL" and indicate the following information:

Name of Project:	Campus Temporary Gym Structures
Location:	Montana State University Bozeman Campus
MSU PPA Project Number:	19-0061
Name of Bidder:	_____
Acknowledge Addendum Number:	___, ___, ___, ___

6.6. It is the bidder's responsibility to deliver or ensure delivery of the bid proposal to Montana State University, Campus Planning, Design, and Construction. Proposals received after the scheduled closing time for bids by either the bidder, a delivery service (e.g. Federal Express, U.S. Postal Service, United Parcel Service, etc.), or the state's own mail delivery system, will be rejected. Proposals entitled for consideration must be time-stamped in the Owner's office prior to the closing time for receipt of bids. The official time clock for receipt of bids and fax modifications is the Owner's time and date stamp clock located in the reception area of the Owner's office. No other clocks, calendars or timepieces are recognized. All bidders are responsible to ensure all bids and fax modifications are received in the Owner's office prior to the scheduled closing time.

6.7. If requested on the Bid Proposal, any person making a bid to perform the Work shall, as a requirement of a responsible bid, set forth the name of each subcontractor specified in the "List of Subcontractors" which is part of the bid proposal. The bidder shall list only one subcontractor for each such portion or work

- listed. The bidder whose bid is accepted shall not:
- 6.7.1. Substitute any other subcontractor in place of the subcontractor listed in the original bid, except by specific consent of the Owner. The Owner, at its sole discretion, may grant substitution with consent of the originally listed subcontractor, or in consideration of other factor(s) involved if deemed relevant to the successful performance of the Contract.
 - 6.7.2. Permit any such subcontract to be voluntarily assigned, transferred or allow it to be performed by any party other than the subcontractor listed in the original bid without the consent of the Owner.
- 6.8. Bid Proposals entitled to consideration shall be made in accordance with the following instructions:
- 6.8.1. Made upon form provided;
 - 6.8.2. All blank spaces properly filled;
 - 6.8.3. All numbers stated in both writing and in figures;
 - 6.8.4. Shall contain no additions, conditional or alternate bids, erasures or other irregularities;
 - 6.8.5. Shall acknowledge receipt of all addenda issued.
- 6.9. Bid Proposals entitled to consideration shall be signed by the proper representative of the firm submitting the proposal as follows:
- 6.9.1. The principal of a single owner firm;
 - 6.9.2. A principal of a partnership firm;
 - 6.9.3. An officer of an incorporated firm, or an agent whose signature is accompanied by a certified copy of the resolution of the Board of Directors authorizing that agent to sign; or,
 - 6.9.4. Other persons signing for a single-owner firm or a partnership shall attach a power-of-attorney evidencing his authority to sign for that firm.
- 6.10. Unit Prices: When a Bid Proposal Form contains unit prices, any errors discovered in the extension of those unit prices will be corrected by the Owner using the unit price figures. The adjusted extended amount will then be used to determine the correct total bid. Only after the amounts have been checked and adjusted, if necessary, will the valid low bid be determined.
- 6.11. Estimated Quantities: All estimated quantities stipulated in the Bid Proposal and other Contract Documents are approximate and are to be used only as a basis for estimating the probable cost of the work and for the purpose of comparing proposals submitted for the work. It is understood and agreed that the actual amounts of work done and materials furnished under unit price items may vary from such estimated quantities. The actual quantities will depend on the conditions encountered at the time the work is performed.
- 6.12. Any bidder may modify his bid by fax communication only.
- 6.12.1 It is the bidder's responsibility to ensure that the entire modification is received at the bid opening location prior to the scheduled closing time for receipt of bids. The modification shall not reveal the bid price, but shall only provide the ADDITION or SUBTRACTION from the original proposal.
 - 6.12.2 The Owner is not responsible for the performance of the facsimile/printer machine, maintaining adequate paper levels, toner levels, the telephone connection, quality of the facsimile, or any other factors affecting receipt of the fax. Unreadable or difficult-to-read facsimiles may be rejected at the sole discretion of the Owner.
 - 6.12.3 Changes in the listed subcontractors, if any, shall also be provided.
 - 6.12.4 Bid modifications must be verified by hard copy provided to the Owner within two (2) business days after the bid opening.
 - 6.12.5 Bid modifications shall be directed to fax phone (406) 994-5665.
 - 6.12.6 All facsimiles shall be date and time stamped on the same time-stamp clock in the Owner's office that is used for receipt of bids in order to be considered valid. The Owner may also use the date and time on the automatically-generated email notification of facsimile receipt as generated by the State's system. Any date and time indicated at the top of the facsimile on either the bidder's or the Owner's facsimile/printer machine will not be used in determining time of arrival of the modification.
- 6.13. The Owner reserves the sole right to reject any or all bids and to waive any irregularities or informalities. The Owner also reserves the sole right to determine what constitutes irregularities or informalities and/or

what is material and/or immaterial to the bids received.

7. Bid Security

- 7.1. IF THE PROJECT COST IS LESS THAN \$25,000, AT ITS SOLE DISCRETION THE STATE OF MONTANA MAY OR MAY NOT REQUIRE BID SECURITY (18-2-302 MCA).
- 7.2. All proposals shall be accompanied by a bid security in the amount of 10% of the bid price, as evidence of good faith (18-2-302 MCA). (**MSU does not waive bid security.**)
- 7.3. Bid security shall be in the form of lawful moneys of the United States, cashier's check, certified check, bank money order or bank draft, bid bond or bonds payable to the State of Montana (18-2-302 MCA).
- 7.4. If the bidder, to whom a contract is awarded, fails to enter into and execute the proposed contract within fifteen (15) calendar days of award, the bidder shall forfeit the bid security (18-1-204 MCA).
- 7.5. The bid security of unsuccessful bidders will be returned when the contract has been awarded to the successful bidder or when all bids have been rejected (18-1-205 MCA).
- 7.6. Execution of and entering into a contract includes providing all necessary insurance certificates, bonds, signed contract and current copy of the construction contractor registration certificate.
- 7.7. **NOTE: PER STATE POLICY, IF CASH, CHECK, MONEY ORDER, OR BANK DRAFT ARE PROVIDED AS BID SECURITY, IT WILL BE DEPOSITED IN THE TREASURY. UNSUCCESSFUL BIDDERS WILL HAVE THEIR SECURITY RETURNED UPON CONTRACT AWARD. THE SUCCESSFUL BIDDER'S SECURITY MAY BE RETURNED UPON ISSUANCE OF NOTICE TO PROCEED.**

8. Withdrawal of Bids

- 8.1. Any bidder may withdraw his bid proposal at any time prior to the scheduled closing time for the receipt of bids.
- 8.2. Once the closing time for the receipt of bids is reached, a bid may not be withdrawn for a period of thirty (30) calendar days.

9. Interpretation of Contract Documents

- 9.1. Bidders shall promptly notify the Architect/Engineer of any ambiguity, inconsistency, or error which they may discover upon examination of the Contract Documents or of the site and local conditions.
- 9.2. Bidders requiring clarification or interpretation of the Contract Documents shall request, in writing, clarification from the Architect/Engineer at least ten (10) calendar days prior to the date set for receipt of bids.
- 9.3. Any interpretations, corrections, or change in the Contract Documents prior to the bid opening will be made by written addendum issued by the Architect/Engineer. The Architect/Engineer will endeavor to notify all plan holders of any addenda issued but it shall be the responsibility of the individual bidders to insure they have received all addenda prior to the submission of their bid.
- 9.4. All written addenda issued by the Architect/Engineer will become part of the Contract Documents and all bidders shall be bound by such addenda whether or not received and/or acknowledged by the bidder. No oral or telephone modifications of the Contract Documents will be considered or allowed.

10. Award of Bids

- 10.1. All bids received by the stated hour will be opened and publicly read aloud.
- 10.2. The Owner reserves the right to reject any and all bids and to waive any informality or irregularity in any bid received. Owner reserves the right to determine what constitutes material and/or immaterial informalities and/or irregularities.
- 10.3. The low bid shall be determined on the basis of the lowest Base Bid or the lowest combination of Base Bid and Alternate Bids, accepted in consecutive order.

- 10.4. The Owner shall award such contract to the lowest responsible bidder (18-1-102 MCA).
- 10.4.1. The Owner may make such investigations as it deems necessary to determine whether or not any or all bidders are responsible.
- 10.4.2. The term “responsible” does not refer to pecuniary ability only, nor the ability to tender sufficient performance and payment bonds.
- 10.4.3. The term “responsible” includes, but is not limited to:
- 10.4.3.1. Having adequate financial resources to perform the contract or the ability to obtain them;
- 10.4.3.2. Being able to comply with the required delivery, duration, and performance schedule;
- 10.4.3.3. Having a satisfactory record of integrity and business ethics;
- 10.4.3.4. Having the necessary organization, experience, accounting, and operational controls;
- 10.4.3.5. Having the necessary production, construction, technical equipment, and facilities; and,
- 10.4.3.6. Having the technical skill, ability, capacity, integrity, performance, experience, lack of claims and disputes, lack of actions on bonds, lack of mediations, arbitrations and/or lawsuits related to construction work or performance, and such like.
- 10.4.4. Bidders shall furnish to the Owner all information and data for this purpose as the Owner may request.
- 10.4.5. The Owner reserves the right to reject any bid if the investigation or evidence of any Bidder fails to satisfy the Owner that such Bidder is properly and adequately qualified to suitably perform and satisfactorily execute the obligations of the Contract and Work defined in the Contract Documents.
- 10.5. The Owner shall award such contract to the lowest responsible bidder without regard to residency except on a reciprocal basis: a resident bidder will be allowed a preference on a contract against the bid of any non-resident bidder from any state or country that enforces a preference for resident bidders. The preference given to resident bidders of the State of Montana must be equal to the preference given in the other state or country (18-1-102, MCA). This does not apply when prohibited by Federal requirements.
- 10.6. The State of Montana may negotiate deductive changes, not to exceed 7% of the total cost of the project, with the lowest responsible bidder when the lowest responsible bids causes the project cost to exceed the appropriation; or with the lowest responsible bidders if multiple contracts will be awarded on the projects when the total of the lowest responsible bids causes the project cost to exceed the appropriation. A bidder is not required to negotiate his bid but is required to honor his bid for the time specified in the bidding documents. The Owner may terminate negotiations at any time (18-2-105(7) MCA).

11. Contract

- 11.1. The sample Standard Form of Contract between Contractor and Owner, as issued by the Owner, will be used as the contracting instrument and is bound within the Contract Documents.
- 11.2. The form shall be signed by a proper representative of the bidder as defined above in these instructions.
- 11.3. The contractor shall also complete and return a federal form W-9 with the Contract.

12. Performance, Labor and Material Payment Security

- 12.1. IF THE PROJECT COST IS LESS THAN \$25,000, AT ITS SOLE DISCRETION THE STATE OF MONTANA MAY OR MAY NOT REQUIRE A PERFORMANCE OR LABOR AND MATERIAL PAYMENT SECURITY (18-2-201 MCA). **(MSU REQUIRES BONDS ON ALL PROJECTS ABOVE \$25,000.)**
- 12.2. THE CONTRACTOR SHALL PROVIDE BOTH SECURITIES FOR THIS PROJECT AS SPECIFIED BELOW, UNLESS SPECIFICALLY DIRECTED THAT THIS REQUIREMENT HAS BEEN WAIVED ELSEWHERE IN THESE DOCUMENTS.
- 12.3. The Owner shall require the successful bidder to furnish a Performance Bond in the amount of 100% of the contract price as security for the faithful performance of his contract (18-2-201, MCA).

- 12.4. The Owner shall require the successful bidder to furnish a Labor and Material Payment Bond in the amount of 100% of the contract price as security for the payment of all persons performing labor and furnishing materials in connection therewith (18-2-201 MCA).
- 12.5. The bonds shall be executed on forms furnished by the Owner. No other forms will be acceptable.
- 12.6. The bonds shall be signed in compliance with State statutes (33-17-111 MCA).
- 12.7. Bonds shall be secured from a State licensed bonding company.
- 12.8. Power of Attorney
 - 12.8.1. Attorneys-in-fact who sign contract bonds must file with each bond a certified and effectively dated copy of their power of attorney;
 - 12.8.2. One original copy shall be furnished with each set of bonds.
 - 12.8.3. Others furnished with a set of bonds may be copies of that original.
13. Notice To Proceed
 - 13.1. The successful bidder who is awarded the contract for construction will not be issued a Notice to Proceed until there is a signed Contract, the specified insurance certificates and a copy of the bidder's current Construction Contractor Registration Certificate in the Owner's possession. All items are required within fifteen (15) calendar days of contract award made by the Owner.
14. Laws and Regulations
 - 14.1. The bidders' attention is directed to the fact that all applicable federal and state laws, municipal ordinances, and the rules and regulations of all authorities having jurisdiction over the project shall apply to the contract throughout and will be deemed to be included in this contract as if bound herein in full.
15. Payments
 - 15.1. NOTICE OF APPROVAL OF PAYMENT REQUEST PROVISION. Per Title 28, Chapter 2, Part 21, this contract allows the Owner to change the number of days to approve a Contractor's payment request. This contract allows the Owner to approve the Contractor's payment request within thirty-five (35) calendar days after it is received by the Owner without being subject to the accrual of interest.
16. Time of Completion
 - 16.1. Bidder agrees to commence work immediately upon receipt of the Notice to Proceed and to substantially complete the project by: **Complete turnkey Temporary Gym Structure by August 29, 2019 with Substantial Completion by September 23, 2019.**
 - 16.2. If liquidated damages are assessed for exceeding the completion date, they shall accrue at the rate of **ONE THOUSAND 00/100 (\$1,000.00) DOLLARS** per calendar day. Liquidated damages charges will be deducted from the amount due the Contractor.

~END OF INSTRUCTIONS~



BID PROPOSAL

TEMPORARY GYM STRUCTURES
PPA No. 19-0061

TO:
State of Montana, Montana State University
Campus Planning, Design & Construction
Attn: Rebecca Barney, Contract Administrator
Plew Building, 6th & Grant,
PO Box 172760
Bozeman, Montana 59717-2760

Prospective Bidders:

The undersigned, having familiarized themselves with the Contract Documents, site, location, and conditions of the Work as prepared by NE 45 ARCHITECTURE, 1216 WEST LINCOLN STREET D, BOZEMAN, MONTANA 59715, 406/577-2345, by submission of this Bid Proposal, hereby agrees to provide all materials, systems, equipment and labor necessary to complete the Work for the total sum as follows:

BASE BID:

_____ and _____ /100 DOLLARS
(ALPHA notation) \$ _____ (NUMERIC notation)

ALTERNATE NO. 1: ADD Air-Supported Fabric Structures to include (1) 50-tonne bottom discharge recirc unit Model #TCH60DBE the 162' x 242' structure and provide (1) 30-tonne bottom discharge recirc unit Model #TCH36DBE to the 130'-8" x 162' structure, as identified by the Basis of Design Manufacturer in Specification Section 133113.

THE BIDDER AGREES TO ADD THE SPECIFIED SCOPE OF WORK FOR THE TOTAL SUM OF:

_____ and _____ /100 DOLLARS
(ALPHA notation) \$ _____ (NUMERIC notation)

This bidder acknowledges receipt of the following addenda:

ADDENDUM No.:	_____	Dated:	_____
ADDENDUM No.:	_____	Dated:	_____
ADDENDUM No.:	_____	Dated:	_____

By signing below, the bidder agrees to all terms specified and AGREES TO fulfill the requirements of the CONTRACT in strict accordance with the bidding documents.

Company Name: _____

Signature: _____

Print Name: _____

Title: _____

Business Address: _____

Construction Contractor

Registration No.: _____

Phone No.: _____

Fax No.: _____

Email: _____

Date.: _____



STANDARD FORM OF CONTRACT BETWEEN OWNER AND CONTRACTOR FOR CONSTRUCTION

THIS CONTRACT IS SUBJECT TO ARBITRATION PURSUANT TO THE UNIFORM ARBITRATION ACT, MCA TITLE 27, CHAPTER 5

This CONTRACT is made as of:

(date)

BETWEEN:

[FIRM NAME]
[ADDRESS]
[CITY, STATE, ZIP]
[PHONE, FAX]

Herein after identified as the "CONTRACTOR" and the State of Montana, acting through its Director, Campus Planning, Design, and Construction, hereinafter identified as the "OWNER":

State of Montana
Montana State University
Campus Planning, Design, and Construction
Plew Building 6th & Grant, PO Box 172760
Bozeman, Montana 59717-2760

WITNESSETH that the Contractor and the Owner, for the consideration hereinafter named, agree as follows:

ARTICLE 1 – SCOPE OF WORK

The Contractor shall perform all Work as shown in the Contract Documents entitled:

[PROJECT NAME]

PPA NO.: [PPA NO.]

Bid Documents Dated: (alpha date)

As prepared by:

[FIRM NAME]
[ADDRESS]
[CITY, STATE, ZIP]
[PHONE, FAX]

Hereinafter identified as the "ARCHITECT/ENGINEER."

ARTICLE 2 – TIME OF COMPLETION

As time is of the essence in performance, coordination, and completion of the Work contemplated under this Contract, the Work to be performed shall commence on a date set forth by the Owner in a written "Notice To Proceed" and shall be completed Within or by:

CONSECUTIVE CALENDAR DAYS.

If the Work is not completed within the time specified, the Owner may assess liquidated damages in the amount of:

[DOLLARS IN ALPHA] DOLLARS (\$numeric) PER CALENDAR DAY.

ARTICLE 3 – CONTRACT SUM

The Owner shall pay the Contractor for performance of the Work, subject to additions and/or deductions by Change Order or damages as provided in the Contract Documents, the Contract Sum of:

[DOLLARS IN ALPHA] DOLLARS (\$(dollars in numeric)).

ARTICLE 4 – PROGRESS PAYMENTS

The Owner shall make payments on account in accordance with the Contract Documents as follows: Ninety-Five (95%) of the portion of the Contract Sum for labor, materials, and equipment incorporated in the Work and for materials suitable stored. The Contractor shall be aware that the Owner has thirty-five (35) calendar days upon receipt in which to make approval and payment without being in

violation of statute or being subject to the accrual of interest shall, or the need to make written notice or justification to deny payment in whole or in part. The Contractor shall, within seven (7) calendar days following receipt of payment from the Owner, make payment to subcontractor(s).

ARTICLE 5 – FINAL PAYMENT

Final Payment, constituting the entire unpaid balance of the Contract Sum, shall be paid by the Owner to the Contractor when: 1) the Work is completed in accordance with the Contract Documents; 2) the Contract fully performed; 3) a final Form 101, Periodic Estimate for Partial Payment showing the final correct amounts is approved by the Architect/Engineer; 4) a Form 106, "Contractor's Affidavit of Completion, Payment of Debts and Claims, and Release of Liens" is completed and submitted; and 5) a Form 103, "Consent of Surety Company To Final Payment" if required, is completed and submitted.

ARTICLE 6 – CONTRACT DOCUMENTS

The Contract Documents, together with this Contract, form the entire Contract and Agreement between the Contractor and Owner. The Contract Documents, which are totally and completely a part of this Contract as if attached hereto or repeated herein, are enumerated in the General Conditions of the Contract for Construction inclusive of Wage Rates, Reports, and all other items bound with the Specifications and/or Project Manual(s).

ARTICLE 7 – PREVAILING WAGE SCHEDULE

The Contractor and all subcontractors at any tier or level shall, as a minimum, pay the standard prevailing rate of wages schedule (including per diem, fringe benefits for health, welfare, and pension contributions and travel allowance) in effect and as applicable to the district in which the Work is being performed.

ARTICLE 8 – VENUE

In the event of any mediation, arbitration, or litigation concerning any matter or dispute arising out of or related to the Contract, venue shall be the Eighteenth Judicial District in and for the County of Gallatin, Montana. The Contract shall be interpreted and subject to the laws of the State of Montana.

ARTICLE 9 – MISCELLANEOUS PROVISIONS

Other documents if any forming part of these contract documents are as follows:

Addendum #1 dated: [] Addendum #2 dated: [] Addendum #3 dated: []

Contractor's Bid Proposal dated: []

Contractor's Revised Proposal dated: []

EXECUTION OF THIS CONTRACT

This Contract is entered into as of the day and year first written above:

CONTRACTOR: (COMPANY)
(ADDRESS)
(CITY, STATE, ZIP)
(PHONE, FAX)

OWNER: STATE OF MONTANA
MONTANA STATE UNIVERSITY
CAMPUS PLANNING, DESIGN, AND
CONSTRUCTION
6TH & GRANT AVENUE, P.O. Box 172760
BOZEMAN, MONTANA 59717-2760

(Signature)

John How, Interim Director

(Print Name)

(Title)

(Date)

(Date)

Contractor's Registration Certificate No. _____

Federal Tax Identification No. _____

Incorporated? _____ No _____ yes

Please refer to PPA No. in all correspondence.



**GENERAL CONDITIONS
OF THE CONTRACT FOR CONSTRUCTION**

State of Montana Version
(Form Revision Date: May 2, 2016)

FRONT PAGE HIGHLIGHTS

Note: This list of items is not an exhaustive or all-inclusive list of the contractor's responsibilities for the Project but is provided solely for convenience and reference.

ITEM	REFERENCE	GENERAL CONDITIONS
Prevailing Wage Rates	Article 3.4.4	The Commissioner of The Montana Department of Labor and Industry (DOLI) has established the standard prevailing rate of wages in accordance with 18-2-401 and 18-2-402, MCA.
Warranty	Article 3.5.2	The warranty period shall be defined as commencing with Substantial Completion (or with each Substantial Completion if there is more than one) of the Project, or any portion thereof, and continuing for one (1) calendar year from the date of Final Acceptance of the entire project.
Schedule	Article 3.10.1	The Contractor's schedule shall be in the "Critical Path Method" and shall be in a form that is acceptable to the Owner and meet all the conditions of 3.10.
Time Limit on Claims	Article 4.3.1.1	Claims by either party must be initiated within 21 calendar days after occurrence of the event giving rise to such claim.
Weather Delays	Article 4.3.5.2	If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated, and had an adverse effect on the current critical- path scheduled construction activities.
Waiver of Consequential Damages	Article 4.3.6	The Contractor and Owner waive Claims against each other for consequential damages arising out of or relating to this Contract.
Mediation & Arbitration	Article 4.5 & 4.6	The parties shall endeavor to resolve their Claims by mediation unless the parties mutually agree otherwise. Claims not resolved by mediation shall be decided by arbitration.
Changes	Article 7	Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Change Order, Construction Change Directive, or order for a minor change in the Work subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents.
Change Order Allowable Costs	Article 7.2.2.1	As described with a 5% allowance for overhead and a 10% allowance for profit.
Time	Article 8	Time is of the essence in performance, coordination, and completion of the Work contemplated herein.
Liquidated Damages	Article 8.1.6	The Contractor and his surety shall be liable for and shall pay to the Owner the sums stipulated as liquidated damages for each calendar day of delay until the Work is substantially complete.
Contract Duration/Milestones/Phases	Article 8.1.8	All Work shall reach Substantial Completion by the date(s) listed or within the consecutive calendar days indication after the start date on the written Notice To Proceed.
Applications for Payment	Article 9.3.2	The Owner has thirty-five (35) calendar days after receipt for approval of the Contractor's Pay Request without being subject to the accrual of interest.
Retainage	Article 9.3.7	Until the Work is complete, the Owner will pay 95% of the amount due the Contractor on account of progress payments. If the Work and its progress are not in accordance with all or any part, piece, or portion of the Contract Documents, the Owner may, at its sole discretion and without claim by the Contractor, increase the amount held as retainage to whatever level deemed necessary to effectuate performance and progress of the Work.
Safety & Protection	Article 10	The Contractor shall be solely responsible for initiating, maintaining and supervising all safety, safety precautions, and safety programs in connection with the performance of the Contract.
Indemnification and Insurance Requirements	Article 11	The Contractor shall indemnify the Owner against the Contractor's negligence. The Contractor shall least carry Workers' Comp, General Liability, Automobile/Equipment, and Property (all-risk) Insurance Coverages as identified. State of Montana shall be listed as an additional insured with copy of ENDORSEMENT provided along with certificates of insurance. No waivers of subrogation shall be accepted.
Performance & Payment Bonds	Article 11.7	The Contract shall furnish a Performance Bond in the amount of 100% of the contract price as security for the faithful performance of his contract. The Contractor shall also furnish a Labor and Material Payment Bond in the amount of 100% of the contract price as security for the payment of all persons performing labor and furnishing materials in connection therewith.
Payroll & Basic Records	Article 13.8	Payrolls and basic records pertaining to the project shall be kept on a generally recognized accounting basis and shall be available to the Owner, Legislative Auditor, the Legislative Fiscal Analyst or his authorized representative at mutually convenient times. Accounting records shall be kept by the Contractor for a period of three years after the date of the Owner's Final Acceptance of the Project.

GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION

State of Montana Version
(Form Revision Date: March 1, 2016)

1. ARTICLE 1 – GENERAL PROVISIONS

1.1. BASIC DEFINITIONS

1.1.1. CONTRACT DOCUMENTS The Contract Documents consist of the Contract between Owner and Contractor (hereinafter the “Contract”), Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to execution of the Contract, other documents listed in the Contract and Modifications issued after execution of the Contract. A Modification is: (1) a written amendment to the Contract signed by both parties; (2) a Change Order; (3) a Construction Change Directive; or, (4) a written order for a minor change in the Work issued by the Architect/Engineer. The Contract Documents shall include the bidding documents and any alterations made thereto by addenda. In the event of a conflict, discrepancy, contradiction, or inconsistency within the Contract Documents and for the resolution of same, the following order of hierarchy and control shall apply and prevail:

1) Contract; 2) Addenda; 3) Supplementary General Conditions; 4) General Conditions; 5) Specifications; 6) Drawings; 7) Instructions To Bidders; 8) Invitation To Bid; 9) Sample Forms.

If a conflict, discrepancy, contradiction, or inconsistency occurs within or between the Specifications and the Drawings, resolution shall be controlled by the following:

1.1.1.1. As between figures, dimensions, or numbers given on drawings and any scaled measurements, the figures, dimensions, or numbers shall govern;

1.1.1.2. As between large scale drawings and small scale drawings, the larger scale drawings shall govern;

1.1.1.3. As between the technical specifications and drawings; the technical specifications shall govern.

1.1.1.4. Shop Drawings and Submittals: Shop drawings and other submittals from the Contractor, subcontractors, or suppliers do not constitute a part of the Contract Documents.

The Contractor acknowledges, understands and agrees that the Contract Documents cannot be changed except as provided herein by the terms of the Contract. No act(s), action(s), omission(s), or course of dealing(s) by the Owner or Architect/Engineer with the Contractor shall alter the requirements of the Contract Documents and that alteration can be accomplished only through a written Modification process defined herein.

1.1.2. THE DRAWINGS The Drawings are the graphic and pictorial portions of the Contract Documents showing the design, intent, location, and dimensions of the Work, generally including plans, elevations, sections, details, schedules and diagrams.

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

1.1.4. THE CONTRACT The entire Contract for Construction is formed by the Contract Documents. The Contract represents the entire, complete, and integrated agreement between the Owner and Contractor hereto and supersedes prior negotiations, representations or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind between: (1) the Architect/Engineer and Contractor; (2) the Owner and any

Subcontractor, Sub-subcontractor, or Supplier; (3) the Owner and Architect/Engineer; or, (4) between any persons or entities other than the Owner and Contractor. However, the Architect/Engineer shall at all times be permitted and entitled to performance and enforcement of its obligations under the Contract intended to facilitate performance of the Architect/Engineer's duties.

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

1.1.6. THE PROJECT The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by the Owner or by separate contractors.

1.1.7. TIME Time is of the essence in performance, coordination, and completion of the Work contemplated herein. The Owner may suffer damages if the Work is not completed as specified herein. When any duration or time period is referred to in the Contract Documents by days, the first day of a duration or time period shall be determined as the day following the current day of any event or notice starting a specified duration. All durations in the Contract Documents are calendar days unless specifically stated otherwise.

1.2. CORRELATION, INTER-RELATIONSHIP, AND INTENT OF THE CONTRACT DOCUMENTS

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

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

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

1.3. CAPITALIZATION

Terms capitalized in these General Conditions include those which are: (1) specifically defined; and, (2) the titles of numbered articles and identified references to Paragraphs, Subparagraphs and Clauses in the document.

1.4. INTERPRETATION

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

1.5. EXECUTION OF THE CONTRACT AND CONTRACT DOCUMENTS

1.5.1. The Contract shall be signed by the Owner and Contractor. Execution of the Contract by the Contractor constitutes the complete and irrevocable binding of the Contractor and his Surety to the Owner for complete performance of the Work and fulfillment of all obligations. By execution of the Contract, the Contractor acknowledges that it has reviewed and familiarized itself with all aspects of the Contract Documents and agrees to be bound by the terms and conditions contained therein.

1.5.2. Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become generally familiar with local conditions under which the Work is to be performed, and correlated personal observations with requirements of the Contract Documents.

1.5.3. The Contractor acknowledges that it has taken all reasonable actions necessary to ascertain the nature and location of the work, and that it has investigated and satisfied itself as to the general and local conditions which can affect the work or its cost, including but not limited to: (1) conditions bearing upon transportation, disposal, handling, and storage of materials; (2) the availability of labor, water, gas, electric power, phone service, and roads; (3) uncertainties of weather, river stages, tides, or similar physical conditions at the site; (4) the conformation, topography, and conditions of the ground; and, (5) the character of equipment and facilities needed for performance of the Work. The Contractor also acknowledges that it has satisfied itself as to the character, quality, and quantity of surface and subsurface materials or obstacles to be encountered insofar as this information is reasonably ascertainable from an inspection of the site, including all exploratory geotechnical work done by the Owner, as well as from the drawings and specifications made a part of this contract. Any failure of the Contractor to take the action described and acknowledged in this paragraph will not relieve the Contractor from responsibility for properly ascertaining and estimating the difficulty and cost of successfully performing the Work or for proceeding to successfully perform the Work without additional expense to the Owner.

1.5.4. The Owner assumes no responsibility for any conclusions or interpretations made by the Contractor based on the information made available by the Owner, nor does the Owner assume responsibility for any understanding reached or representation made by any of its officers, agents, or employees concerning conditions which can affect the Work unless that understanding or representation is expressly stated in the Contract Documents.

1.5.4.1. Performance of any portion of the Work, beyond that required for complying with the specifications and all other requirements of the Contract, shall be deemed to be for the convenience of the Contractor and shall be at the Contractor's sole expense.

1.5.4.2. There shall be no increase in the contract price or time allowed for performance which is for the convenience of the Contractor.

1.6. OWNERSHIP AND USE OF DRAWINGS, SPECIFICATIONS, AND OTHER INSTRUMENTS OF SERVICE

1.6.1. The Drawings, Specifications and other documents, including those in electronic form, prepared by the Architect/Engineer and the Architect/Engineer's consultants are Instruments of Service through which the Work to be executed by the Contractor is described. The Contractor may retain one record set. Neither the Contractor nor any Subcontractor, Sub-subcontractor or material or equipment supplier shall own or claim a copyright in the Drawings, Specifications and other documents prepared by the Architect/Engineer or the Architect/Engineer's consultants. Unless otherwise indicated, the Architect/Engineer and the Architect/Engineer's consultants shall be deemed the authors of them and will retain all common law, statutory and other reserved rights, in addition to the copyrights except as defined in the Owner's Contract with the Architect/Engineer. All copies of Instruments of Service, except the Contractor's record set, shall be returned or suitably accounted for to the Architect/Engineer upon completion of the Work. The Drawings, Specifications and other documents prepared by the Architect/Engineer and the Architect/Engineer's consultants, and copies thereof furnished to the Contractor, are for use solely with respect to this Project. They are not to be used by the Contractor or any Subcontractor, Sub-subcontractor or material or equipment supplier on other projects or for additions to this Project outside the scope of the Work without the specific written consent of the Owner, Architect/Engineer, and the Architect/Engineer's consultants. The Contractor, Subcontractors, Sub-subcontractors and material or equipment suppliers are authorized to use and reproduce applicable portions of the Drawings, Specifications and other documents prepared by the Architect/Engineer and the Architect/Engineer's consultants appropriate to and for use in the execution of their Work under the Contract Documents. All copies made under this authorization shall bear the statutory copyright notice, if any, shown on the Drawings Specifications and other documents prepared by the Architect/Engineer and the Architect/Engineer's consultants. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with this Project is not to be construed as publication in derogation of the Architect/Engineer's or Architect/Engineer's consultants' copyrights or other reserved rights.

1.6.2. Owner's Disclaimer of Warranty: The Owner has requested the Architect/Engineer prepare the Contract Documents for the Project which are adequate for bidding and constructing the Project. However, the Owner makes no representation, guarantee, or warranty of any nature whatsoever to the Contractor concerning such documents. The Contractor hereby acknowledges and represents that it has not, does not, and will not rely upon any such representation, guarantee, or warranty concerning the Contract Documents as no such representation, guarantee, or warranty have been or are hereby made.

2. ARTICLE 2 – THE OWNER

2.1. THE STATE OF MONTANA

2.1.1. The Owner is the State of Montana and is the sole entity to be identified as Owner in the Contract and as referred to throughout the Contract Documents as if singular in number.

2.1.2. Except as otherwise provided in Subparagraph 4.2.1, the Architect/Engineer does not have authority to bind the Owner. The observations and participations of the Owner or its authorized representative do not alleviate any responsibility on the part of the Contractor. The Owner reserves the right to observe the work and make comment. Any action or lack of action by the Owner shall not be construed as approval of the Contractor's performance.

2.1.3. The Owner reserves the right to require the Contractor, all sub-contractors and material suppliers to provide lien releases at any time. The Owner reserves the right to withhold progress payments until such lien releases are received for all work for which prior progress payments have been made. Upon the Owner's demand for lien releases (either verbally or written), the Contractor, all sub-contractors and material suppliers shall provide such releases with every subsequent application for payment through Final Acceptance of the Project.

2.1.4. Except for permits and fees, including those required under Subparagraph 3.7.1, which are the responsibility of the Contractor under the Contract Documents, the Owner shall secure and pay for necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities.

2.1.5. Information or services required of the Owner by the Contract Documents shall be furnished by the Owner with reasonable promptness. Any other information or services relevant to the Contractor's performance of the Work under the Owner's control shall be furnished by the Owner after receipt from the Contractor of a written request for such information or services.

2.1.6. Unless otherwise provided in the Contract Documents, the Contractor will be furnished, free of charge, such copies of Drawings and Specifications as are reasonably necessary for execution of the Work.

2.2. OWNER'S RIGHT TO STOP WORK

If the Contractor fails to correct Work which is not in accordance with the requirements of the Contract Documents as required by Paragraph 12.2 or persistently fails to carry out Work in accordance with the Contract Documents, the Owner may issue a written order to the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated. However, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity, except to the extent required by Subparagraph 6.1.3. The issuance of a stop work order by the Owner shall not give rise to a claim by the Contractor or any subcontractor for additional cost, time, or other adjustment.

2.3. OWNER'S RIGHT TO CARRY OUT THE WORK

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a 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 after such seven-day period give the Contractor a second written notice to correct such deficiencies within a three-day period. If the Contractor within such three-day period after receipt of such second notice fails to commence and continue to correct any deficiencies, the Owner may, without prejudice to other remedies the Owner may have, correct such deficiencies. In such case an appropriate Change Order shall be issued deducting from payments then or thereafter due the Contractor the reasonable cost of correcting such deficiencies, including Owner's expenses and increased costs, and compensation for the Architect/Engineer's additional services made necessary by such default, neglect, or failure. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner.

2.4. OWNER'S RIGHT TO PERSONNEL

2.4.1. The Owner reserves the right to have the Contractor and/or subcontractors remove person(s) and/or personnel from any and all work on the project with cause but without cost to the Owner. Such requests from the Owner may be made verbally or in writing and may be done directly with the Contractor or indirectly through the Architect/Engineer. Cause may be, but not limited to, any of the following: incompetence, poor workmanship, poor scheduling abilities, poor coordination, disruption to the facility or others, poor management, causes delay or delays, disruption of the Project, will not strictly adhere to facility procedures and Project requirements either knowingly or unknowingly, insubordination, drug/alcohol use, possession of contraband, belligerent acts or actions, etc. The Contractor shall provide replacement person(s) and/or personnel acceptable to the Owner at no cost to the Owner.

2.4.2. Any issue or circumstance relating to or resulting out of this clause shall not be construed or interpreted to be interference with or impacting upon the Contractor's responsibilities and liabilities under the Contract Documents.

2.4.3. Person(s) and/or personnel who do not perform in accordance with the Contract Documents, shall be deemed to have provided the Owner with cause to have such persons removed from any and all involvement in the Work.

2.4.4. The Contractor agrees to indemnify and hold harmless the Owner from any and all causes of action, demands, claims, damages, awards, attorneys' fees, and other costs brought against the Owner and/or Architect/Engineer by any and all person(s) or personnel as a result of actions under this clause.

3. ARTICLE 3 – THE CONTRACTOR

3.1. GENERAL

3.1.1. The Contractor is the person or entity identified as such in the Contract and is referred to throughout the Contract Documents as if singular in number. The term "Contractor" means the Contractor or the Contractor's authorized representative.

3.1.2. Construction Contractor Registration: The Contractor is required to be registered with the Department of Labor and Industry under 39-9-201 and 39-9-204 MCA prior to the Contract being executed by the Owner. A bidder must demonstrate that it has registered or promises that it will register immediately upon notice of award and prior to the commencement of any work. If the prevailing bidder cannot or does not register in time for the Owner to execute the Contract within fifteen (15) days of the date on the notice of award, the Owner may award, at its sole discretion, to the next lowest responsible bidder who meets this requirement. The Owner will not execute a contract for construction nor issue a Notice to Proceed to a Contractor who is not registered per 39-9-401(a) MCA. It is solely the Contractor's responsibility to ensure that all Subcontractors are registered in accordance with Title 39, Chapter 9, MCA.

3.1.3. The Owner's engagement of the Contractor is based upon the Contractor's representations by submission of a bid to the Owner that it:

3.1.3.1. has the requisite skills, judgment, capacity, expertise, and financial ability to perform the Work;

3.1.3.2. is experienced in the type of labor and services the Owner is engaging the Contractor to perform;

3.1.3.3. is authorized, licensed and registered to perform the type of labor and services for which it is being engaged in the State and locality in which the Project is located;

3.1.3.4. is qualified, willing and able to perform the labor and services for the Project in the manner and scope defined in the Contract Documents; and,

3.1.3.5. has the expertise and ability to provide labor and services that will meet the Owner's objectives, intent and requirements, and will comply with the requirements of all governmental, public, and quasi-public authorities and agencies having or asserting jurisdiction over the Project.

3.1.4. The Contractor shall perform the Work in accordance with the Contract Documents.

3.1.5. The Contractor shall not be relieved of obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Architect/Engineer in the Architect/Engineer's administration of the Contract, or by tests, inspections or approvals required or performed by persons other than the Contractor.

3.1.6. Quality Control (i.e. ensuring compliance with the Contract Documents) and Quality Assurance (i.e. confirming compliance with the Contract Documents) are the responsibility of the Contractor. Testing, observations, and/or inspections performed or provided by the Owner are solely for the Owner's own purposes and are for the benefit of the Owner. The Owner is not liable or responsible in any form or fashion to the Contractor regarding quality assurance or extent of such assurances. The Contractor shall not, under any circumstances, rely upon the Owner's testing or inspections as a substitute or in lieu of its own Quality Control or Assurance programs.

3.2. REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY CONTRACTOR

3.2.1. Since the Contract Documents are complementary and inter-related, before starting each portion of the Work, the Contractor shall carefully study and compare the various Drawings and other Contract Documents relative to that portion of the Work, shall take field measurements of any existing conditions related to that portion of the Work and shall observe any conditions affecting the Work. These obligations are for the purpose of facilitating construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents. However, any errors, inconsistencies or omissions discovered by the Contractor shall be reported promptly to the Architect/Engineer as a request for information in such form as the Architect/Engineer may require.

3.2.2. Any errors or omissions noted by the Contractor during this review shall be reported promptly to the Architect/Engineer, but it is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional unless otherwise specifically provided in the Contract Documents.

3.2.3. If the Contractor believes that additional cost or time is involved because of clarifications or instructions issued by the Architect/Engineer in response to the Contractor's notices or requests for information pursuant to Subparagraphs 3.2.1 and 3.2.2, the Contractor shall make Claims as provided in Subparagraphs 4.3.4 and 4.3.5. If the Contractor fails to perform the obligations of Subparagraphs 3.2.1 and 3.2.2, the Contractor shall pay such costs and damages to the Owner as would have been avoided if the Contractor had performed such obligations. The Contractor shall not be liable to the Owner or Architect/Engineer for damages resulting from errors, inconsistencies, or omissions in the Contract Documents or for differences between field measurements or conditions and the Contract Documents unless the Contractor recognized such error, inconsistency, omission or difference and failed to report it to the Architect/Engineer.

3.2.4. Except as otherwise expressly provided in this Contract, the Contractor assumes all risks, liabilities, costs, and consequences of performing any effort or work in accordance with any written or oral order (including but not limited to direction, instruction, interpretation, or determination) of a person not authorized in writing by the Owner to issue such an order.

3.2.5. By entering into this Contract, the Contractor acknowledges that it has informed itself fully regarding the requirements of the Drawings and Specifications, the General Conditions, the Supplementary General Conditions, all other documents comprising a part of the Contract Documents and all applicable laws, building codes, ordinances and regulations. Contractor hereby expressly acknowledges, guarantees, and warrants to the Owner that:

3.2.5.1. the Contract Documents are sufficient in detail and scope to enable Contractor to construct the finished project;

3.2.5.2. no additional or further work should be required by Owner at the time of Owner's acceptance of the Work; and,

3.2.5.3. when the Contractor's work is finished and the Owner accepts, the Work will be complete and fit for the purpose intended by the Contract Documents. This acknowledgment and guarantee does not imply that the Contractor is assuming responsibilities of the Architect/Engineer.

3.2.6. Sufficiency of Contract Documents: Prior to submission of its bid, and in all events prior to and upon signing the Contract, the Contractor certifies, warrants and guarantees that it has received, carefully reviewed, and evaluated all aspects of the Contract Documents and agrees that said Documents are adequate, consistent, coordinated, and sufficient for bidding and constructing the Work requested, intended, conceived, and contemplated therein.

3.2.6.1. The Contractor further acknowledges its continuing duty to review and evaluate the Contract Documents during the performance of its services and shall immediately notify the Architect/Engineer of any problems, conflicts, defects, deficiencies, inconsistencies, errors, or omissions it discovers in the Contract Documents and the Work to be constructed; and, any variances it discovers between the Contract Documents and applicable laws, statutes, building codes, rules or regulations.

3.2.6.2. If the Contractor performs any Work which it knows or should have known due to its experience, ability, qualifications, and expertise in the construction industry, that involves problems, conflicts, defects, deficiencies, inconsistencies, errors, or omissions in the Contract Documents and the Work to be constructed and, any variances between the Contract Documents and applicable laws, statutes, building codes, rules or regulations, without prior written notification to the Architect/Engineer and without prior authorization to proceed from the Architect/Engineer, the Contractor shall be responsible for and bare the costs and delays (including costs of any delay) of performing such Work and all corrective actions as directed by the Architect/Engineer.

3.2.6.3. Any and all claims resulting from the Contractor's failure, including those of any subcontractor or supplier, to carefully review, evaluate, and become familiar with all aspects of the Contract Documents shall be deemed void and waived by the Contractor.

3.2.7. Sufficiency of Site Conditions: Prior to submission of its bid, and in all events prior to and upon signing the Contract, the Contractor certifies, warrants and guarantees that it has visited, carefully reviewed, evaluated, and become familiar with all aspects of the site and local conditions at which the Project is to be constructed. The Contractor agrees that the Contract Documents are an adequate, consistent, coordinated, and sufficient representation of the site and local conditions for the Work.

3.2.7.1. The Contractor has reviewed and become familiar with all aspects with the Site Survey and Geotechnical Report for the Project and has a full understanding of the information provided therein.

3.2.7.2. If the Work involves modifications, renovations, or remodeling of an existing structure(s) or other man-made feature(s), the Contractor certifies, warrants and guarantees that it has reviewed, evaluated, and become familiar with all available as-built and record drawings, plans and specifications, and has thoroughly inspected and become familiar with the structure(s) or man-made feature(s).

3.2.7.3. Any and all claims resulting from the Contractor's failure, including those of any subcontractor or supplier, to visit, carefully review, evaluate, and become familiar with all aspects of the site, available geotechnical information, and local conditions at which the Project is to be constructed shall be deemed void and waived by the Contractor.

3.3. SUPERVISION AND CONSTRUCTION PROCEDURES

3.3.1. The Contractor shall supervise and direct the Work using the Contractor's best skill and attention recognizing that time and quality are of the essence of the Work. The Contractor shall be solely responsible for and have control over construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work under the Contract, unless the Contract Documents give other specific instructions concerning these matters. It is the responsibility of and incumbent upon the Contractor to ensure, confirm, coordinate, inspect and oversee all Work (which is inclusive of but not limited to all submittals, change orders, schedules, workmanship, and appropriate staffing with enough competent and qualified personnel) so that the Work is not impacted in terms of any delays, costs, damages, or additional time, or effort on the part Architect/Engineer or Owner. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences or procedures, the Contractor shall evaluate the jobsite safety thereof and, except as stated below, shall be fully and solely responsible for the jobsite safety of such means, methods, techniques, sequences or procedures. If the Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely written notice to the Owner and Architect/Engineer and shall not proceed with that portion of the Work without further written instructions from

the Architect/Engineer. If the Contractor is then instructed to proceed with the required means, methods, techniques, sequences or procedures without acceptance of changes proposed by the Contractor, the Architect/Engineer or Owner as appropriate shall be solely responsible for any resulting loss or damage. The Contractor will be required to: review any specified construction or installation procedure; advise the Architect/Engineer if the specified procedure deviates from good construction practice; to advise the Architect/Engineer if following the procedure will affect any warranties, including the Contractor's general warranty, or of any objections the Contractor may have to the procedure and shall propose any alternative procedure which the Contractor will warrant and guarantee. The Contractor is required to: review any specified construction or installation procedure; advise the Architect/Engineer if the specified procedure deviates from good construction practice; to advise the Architect/Engineer if following the procedure will affect any warranties, including the Contractor's general warranty, or of any objections the Contractor may have to the procedure and to propose any alternative procedure which the Contractor will warrant.

3.3.2. The Contractor shall furnish management, supervision, coordination, labor and services that: (1) expeditiously, economically, and properly completes the Work; (2) comply with all requirements of the Contract Documents; and, (3) are performed in a quality workmanlike manner and in accordance with the standards currently practiced by persons and entities performing or providing comparable management, supervision, labor and services on projects of similar size, complexity, cost, and nature to this Project. However, the standards currently practiced within the construction industry shall not relieve the Contractor of the responsibility to perform the Work to the level of quality, detail, and excellence defined and intended by the Contract Documents as interpreted by the Architect/Engineer.

3.3.3. All services and labor rendered by the Contractor, including any subcontractors or suppliers, shall be performed under the immediate supervision at the site of persons possessing expertise and the requisite knowledge in the discipline or trade of service being rendered. The Contractor shall maintain such supervision and personnel at all times that the Contractor's personnel, subcontractors, and/or suppliers are at the site. The Contractor shall never be absent from the site during performance of any portion of the Work by any entity under the supervision and direction of the Contractor. Full time attendance by the Contractor from Notice to Proceed through Final Acceptance is an explicit requirement of this Contract.

3.3.4. The Contractor shall be responsible to the Owner for acts, damages, errors, and omissions of the Contractor's employees, subcontractors and their agents and employees, and other persons or entities performing portions of the Work for or on behalf of the Contractor or any of its Subcontractors.

3.3.5. The Contractor shall be responsible for inspection of portions of Work already performed to determine that such portions are in proper condition to receive subsequent Work.

3.4. LABOR, WAGES, AND MATERIALS

3.4.1. Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, permits, licenses, goods, products, equipment, tools, construction equipment and machinery, water, heat, all utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work in accordance with the Contract Documents, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

3.4.2. The Contractor may make substitutions only with the consent of the Owner, after evaluation by the Architect/Engineer and in accordance with a Change Order. This opportunity to request substitutions does not negate or waive any requirement for the Contractor to follow a pre-bidding "prior approval" requirement nor obligate the Owner to approve any substitution request.

3.4.3. The Contractor shall enforce strict discipline, appropriate behavior, and good order among the Contractor's employees, subcontractors at every tier and level, and other persons carrying out the Contract. The Contractor shall not permit employment of unfit persons or persons not skilled in tasks assigned to them.

3.4.4. Prevailing Wages and Montana Residents.

3.4.4.1. The Contractor and all subcontractors at any level or tier of the Work shall give preference to the employment of bona fide Montana residents in the performance of the Work and shall pay the standard prevailing rate of wages, including fringe benefits for health and welfare and pension contributions and travel

allowance provisions in effect and applicable to the county or locality in which the work is being performed. (18-2-403, MCA)

3.4.4.2. At least 50% of the workers, as defined by the Department of Labor & Industry (DOLI), must be bona fide Montana residents. (18-2-401, 18-2-402, MCA)

3.4.4.3. Indian Employment Preference within the Boundaries of an Indian Reservation. All contractors that are awarded a state agency construction contract within the exterior boundaries of an Indian Reservation shall extend a hiring preference to qualified Indians as provided herein:

3.4.4.3.1. "State agency" means a department, office, board, bureau, commission, agency, or other instrumentality of the executive or judicial branches of the government of this State. "Indian" means a person who is enrolled or who is a lineal descendent of a person enrolled in an enrollment listing of the Bureau of Indian Affairs or in the enrollment listing of a recognized Indian tribe domiciled in the United States.

3.4.4.3.2. Qualified Indians – Employment Criteria: An Indian shall be qualified for employment in a permanent, temporary, or seasonal position if he or she has substantially equal qualifications for any position and resides on the reservation where the construction contract is to be performed.

3.4.4.3.3. Non-Applicability: The Indian Employment Preference Policy does not apply to a project partially funded with federal-aid money from the United States Department of Transportation or when residency preference laws are specifically prohibited by federal law. It does not apply to independent contractors and their employees, student interns, elected officials, or appointed positions.

3.4.4.4. The Commissioner of The Montana Department of Labor and Industry (DOLI) has established the standard prevailing rate of wages in accordance with 18-2-401 and 18-2-402, MCA. A copy of the Rates entitled "State of Montana, Prevailing Wage Rates" are bound herein. The Commissioner of the Montana DOLI has established the resident requirements in accordance with 18-2-409, MCA. The Contractor and all subcontractors at any level or tier of the Work shall direct any and all questions concerning prevailing wage and Montana resident issues for all aspects of the Work to DOLI.

3.4.4.5. The Contractor and all subcontractors at any tier or level of the Work, and as determined by the Montana DOLI, shall classify all workers in the project in accordance with the State of Montana, Prevailing Wage Rates. In the event the Contractor is unable to classify a worker in accordance with these rates he shall contact DOLI for a determination of the classification and the prevailing wage rate to be paid.

3.4.4.6. The Contractor and all subcontractors at any tier or level of the Work shall be responsible for obtaining wage rates for all workers prior to their performing any work on the project. The Contractor is required to pay and insure that its subcontractors at any tier or level and others also pay the prevailing wage determined by the DOLI, insofar as required by Title 18 of the MCA and the pertinent rules and standards of DOLI.

3.4.4.7. It is not the responsibility of the Owner to determine who classifies as a subcontractor, sub-subcontractor, material man, supplier, or any other person involved in any aspect of the Work at any tier or level. All such determinations shall be the sole responsibility of the Contractor, subcontractors, sub-subcontractors, material men, suppliers and others involved in the project at any tier or level. The Contractor, subcontractors, sub-subcontractors, material men, suppliers and others involved in the project shall indemnify and hold harmless the Owner from all claims, attorneys' fees, damages and/or awards involving prevailing wage or Montana resident issues. Any changes to wages or penalties for failure to pay the correct wages will be the sole responsibility of the Contractor and/or his subcontractors and no further charges or claims shall be made to the Owner. If the parties mutually agree or an arbitrator or court determines that any change in wages is due and any part is attributable to the Owner, the Owner's sole liability shall be for the amount of wages ordered only and not for other expenses, charges, penalties, overhead, profit or other mark-ups.

3.4.4.8. In accordance with 18-2-422(1) MCA, each job classification's standard prevailing wage rate, including fringe benefits, that the contractors and employers shall pay during construction of the project is included herein by both reference to DOLI's "Building" or "Heavy/Highway" schedules and as part of these Contract Documents.

3.4.4.9. The Contractor and every employer, including all subcontractors at any tier or level, is required by 18-2-422(2) MCA to maintain payroll records in a manner readily capable of being certified for submission under 18-2-423 MCA, for a period of not less than 3 years after the contractor's, subcontractor's, or employer's completion of work on the project or the Final Acceptance by the Owner, whichever is later.

3.4.4.10. Each contractor is required by 18-2-422(3) MCA to post in a visible and accessible location a statement of all wages and fringe benefits in compliance with 18-2-423.

3.5. WARRANTY AND GUARANTEE

3.5.1. The Contractor warrants to the Owner and Architect/Engineer that materials and equipment furnished under the Contract will be new and of good quality unless otherwise required or permitted by the Contract Documents, that the Work will be free from defects not inherent in the quality required or permitted, and that the Work will conform to the requirements of the Contract Documents. Work not conforming to these requirements, including substitutions not properly approved and authorized, may be considered defective and rejected. The Contractor's warranty excludes remedy for damage or defect caused by abuse, modifications not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. If required by the Architect/Engineer, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

3.5.2. The Contractor shall and does hereby warrant and guarantee all work, workmanship, and materials for the full warranty period as specified in the Contract Documents. The warranty period shall be defined as commencing with Substantial Completion (or with each Substantial Completion if there is more than one) of the Project, or any portion thereof, and continuing for one (1) calendar year from the date of Final Acceptance of the entire project by the Owner. The date of Final Acceptance shall be the date of the Architect/Engineer's signature on the final request for payment unless otherwise agreed upon in writing for the entire project or any portion thereof, by the Owner, Architect/Engineer and Contractor.

3.5.3. In addition to the one (1) calendar year warranty and guarantee specified in this herein above, the Contractor warrants and guarantees all materials and workmanship for the roofing system for a period of two (2) calendar years from the date of Final Acceptance. This warranty shall cover all labor and materials for roof and roofing finish systems (e.g. flashing, terminations, parapet caps, etc.) repairs from moisture penetration and/or defects in workmanship.

3.5.4. Manufacturer and product warranties and guarantees, as provided by the manufacturer or as specified in the Contract Documents, are in addition to the Contractor's warranty.

3.6. TAXES

3.6.1. The Contractor is responsible for and shall pay all sales, consumer, use, and similar taxes for the Work provided by the Contractor which are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect.

3.6.2. In compliance with 15-50-206 MCA, the Contractor will have 1% of his gross receipts withheld by the Owner from all payments due and sent to the Montana Department of Revenue. Each subcontractor who performs work greater than \$5,000 shall have 1% of its gross receipts withheld by the Contractor and sent to the Montana Department of Revenue. The Contractor shall notify the Department of Revenue on the Department's prescribed form.

3.7. PERMITS, FEES, AND NOTICES

3.7.1. Unless otherwise provided in the Contract Documents, the Contractor shall secure and pay for the building permit and other permits and governmental fees, licenses and inspections necessary for proper execution and completion of the Work which are customarily secured after execution of the Contract, including but not limited to, the building permit fee, electrical, plumbing, sewer connection fee and mechanical permit fee, and any required impact fees and which are legally required when bids are received or negotiations concluded.

3.7.2. The Contractor shall comply with and give notices required by laws, ordinances, rules, regulations and lawful orders of public authorities applicable to performance of the Work.

3.7.3. If the Contractor performs Work knowing it to be contrary to laws, statutes, ordinances, building codes, and rules and regulations, and does so without providing notice to the Architect/Engineer and Owner, the Contractor shall assume responsibility for such Work and shall bear the costs attributable to correction. The Contractor shall be solely responsible to insure that all work it performs is in full compliance with all prevailing and applicable codes and regulations.

3.7.4. Incident Reporting: The Contractor shall immediately notify the Owner and Architect/Engineer, both orally and in writing, of the nature and details of all incidents which may adversely affect the quality or progress of the Work, including, but not limited to, union disputes, accidents, delays, damages to Work, and other significant occurrences. Such notices are in addition to any other notices required regarding claims.

3.8. ALLOWANCES

3.8.1. The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may direct.

3.8.2. Unless otherwise provided in the Contract Documents:

3.8.2.1. allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;

3.8.2.2. Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit and other expenses contemplated for stated allowance amounts shall be included by the Contractor in the Contract Sum but not in the allowances;

3.8.2.3. whenever costs are more than or less than stated allowances, the Contract Sum shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect: (1) the difference between actual costs and the allowances under Clause 3.8.2.1; and, (2) changes in Contractor's costs under Clause 3.8.2.2.

3.8.3. Materials and equipment under an allowance shall be selected by the Owner.

3.9. CONTRACTOR'S PERSONNEL

3.9.1. The Contractor shall employ competent personnel, supervisors, project managers, project engineers, project superintendent, and all others who shall be assigned to the Work throughout its duration. Contractor's personnel extend to those employed by the Contractor whether at the site or not. The Owner shall have right to review and approve or reject all replacement of Contractor's personnel. All personnel assigned by the Contractor to the Work shall possess the requisite experience, skills, abilities, knowledge, and integrity to perform the Work.

3.9.2. The superintendent and others as assigned shall be in attendance at the Project site during the performance of any and all Work. The superintendent shall represent the Contractor. All communications given to the Contractor's personnel such as the project manager or the superintendent, whether verbal, electronic or written, shall be as binding as if given to the Contractor.

3.9.3. It is the Contractor's responsibility to appropriately staff, manage, supervise and direct the Work which is inclusive of the performance, acts, and actions of his personnel and subcontractors. As such, the Contractor further agrees to indemnify and hold harmless the Owner and the Architect/Engineer, and to protect and defend both from and against all claims, attorneys' fees, demands, causes of action of any kind or character, including the cost of defense thereof, arising in favor of or against the Owner, Architect/Engineer, Contractor, their agents, employees, or any third parties on account of the performance, behavior, acts or actions of the Contractor's personnel or subcontractors.

3.9.4. Prior to the commencement of any work, the Contractor shall prepare and submit a personnel listing and organizational chart in a format acceptable to the Owner which lists by name, phone number (including cell phone), job category, and responsibility the Contractor's key/primary personnel who will work on the Project. The Contractor shall promptly inform the Owner in writing of any proposed replacements, the reasons therefore, and the name and qualifications of any proposed replacements. The Owner shall have the right to reject any

proposed replacements without cost or claim being made by the Contractor. The chart shall be provided to the Owner at the time of the pre-construction conference.

3.9.5. The Contractor shall immediately remove for the duration of the Project, any person making an inappropriate racial, sexual, or ethnic comment, statement, joke, or gesture toward any other individual.

3.9.6. The Contractor shall immediately remove for the duration of the Project, any person who is incompetent, careless, disruptive, or not working in harmony with others.

3.10. CONSTRUCTION SCHEDULES

3.10.1. The Contractor shall, promptly after being awarded the Contract, prepare and submit for the Owner's and Architect/Engineer's information a Contractor's construction schedule for the Work. The schedule shall not exceed time limits current under the Contract Documents, shall be revised at appropriate intervals as required by the conditions of the Work and per the requirements of the Contract Documents, shall be related to the entire Project to the extent required by the Contract Documents, and shall provide for expeditious and practicable execution of the Work. The Contractor's schedule shall be in the "Critical Path Method" and shall show the Critical Path of the Work in sufficient detail to evaluate the Contractor's progress. A request for time extension by the Contractor will not be allowed unless a change in the Work is approved by the Owner and materially affects the Critical Path. It is the Contractor's responsibility to demonstrate that any time extensions requests materially affect the Critical Path.

3.10.2. The Contractor shall prepare and keep current, for the Architect/Engineer's approval, a schedule of submittals which is coordinated with the Contractor's Construction Schedule and allows the Architect/Engineer reasonable time to review submittals.

3.10.3. The Contractor shall perform the Work in accordance with the most recent schedule submitted to the Owner and Architect/Engineer.

3.10.4. The Contractor's operations (including but not limited to the Contractor's forces employed, sequences of operations, and methods of operation) at all times during the performance of the contract shall be: (a) subject to the review of the Owner or the Architect/Engineer; and, (b) sufficient to insure the completion of the Work within the specified performance period.

3.10.5. The Critical Path Method Construction Schedule prepared by the Contractor must be in a form that is acceptable to both the Architect/Engineer and the Owner.

3.10.5.1. The Schedule shall show the estimated progress of the entire Project through the individual time periods allowed for completion of each discipline, trade, phase, section, and aspect of the Work. The Contractor shall provide written reports of all logic and resource loading data with the Schedule and with all updates to the Schedule.

3.10.5.2. The Schedule shall show percent complete, progress to date, project work, and projected time to complete the work for all activities. The percent complete and minor schedule changes, including additions of activities, change orders, construction change directives, changes to sequences of activities and significant changes in activity demands must be shown by a revised Schedule. A written report providing details about the changes and what actions are anticipated to get the work completed in the contractual time period shall be submitted with the revised schedule.

3.10.5.3. The Construction Schedule shall include coordinate dates for performance of all divisions of the Work, including shipping and delivery, off-site requirements and tasks, so the Work can be completed in a timely and orderly fashion consistent with the required dates of Substantial Completion and Final Acceptance.

3.10.5.4. The Construction Schedule shall include: (i) the required commencement date, the required dates of Substantial Completion(s) and Final Acceptance for the complete Project and all phases (if any); (ii) any guideline and milestone dates required by the Owner or the Contract Documents; (iii) subcontractor and supplier schedules; (iv) a submittal schedule which allows sufficient time for review and action by the Architect/Engineer; (v) the complete sequence of all construction activities with start and completion dates; and, (vi) required decision dates.

3.10.5.5. By receiving, reviewing, and/or commenting on the Construction Schedule or any portion thereof (including logic and resource loading), neither the Owner or Architect/Engineer assume any of the Contractor's responsibility or liability that the Schedule be coordinated or complete, or for timely and orderly completion of the Work.

3.10.5.6. Receiving, reviewing, and/or commenting on the Schedule, any portion thereof, or any revision thereof, does not constitute an approval, acknowledgement, or acceptance of any duration, dates, milestones, or performance indicated therein.

3.10.5.7. A printout of the Schedule's logic showing all activities and all resource loading is required with the Schedule and with all updates to the Schedule.

3.10.6. The Contractor shall review and compare, at a minimum on a weekly basis, the actual status of the Work against its Construction Schedule.

3.10.7. The Contractor shall routinely, frequently, and periodically (but not less than monthly) update and/or revise its Construction Schedule to show actual progress of the Work through the date of the update or revision, projected level of completion of each remaining activity, activities modified since the previous update or revision, and major changes in scope or logic. The updated/revised Schedule shall be accompanied by a narrative report which: (1) states and explains any modifications of the critical path, if any, including any changes in logic; (2) defines problem areas and lists areas of anticipated delays; (3) explains the anticipated impact the change in the critical path or problems and delays will have on the entire Schedule and the completion of the Work; (4) provides corrective action taken or proposed; and, (5) states how problems or delays will be resolved in order to deliver the Work by the required phasing milestones (if any), Substantial Completion(s), and Final Acceptance dates.

3.10.8. Delay in Performance: If at any time the Contractor anticipates that performance of the Work will be delayed or has been delayed, the Contractor shall: (1) immediately notify the Architect/Engineer by separate and distinct correspondence of the probably cause and effect of the delay, and possible alternatives to minimize the delay; and, (2) take all corrective action reasonably necessary to deliver the Work by the required dates. Nothing in this paragraph or the Contract Documents shall be construed by the Contractor as a granting by the Architect/Engineer or Owner of constructive acceleration. The results of failure to anticipate delays, or to timely notify the Owner and Architect/Engineer of an anticipated or real delay, are entirely the responsibility of the Contractor whether compensable or not.

3.10.9. Early Completion: The Contractor may attempt to achieve Substantial Completion(s) on or before the date(s) required in the Contract. However, such early completion shall be for the Contractor's sole convenience and shall not create any real or implied additional rights to Contractor or impose any additional obligations on the Owner or Architect/Engineer. The Owner will not be liable for nor pay any additional compensation of any kind to the Contractor for achieving Substantial Completion(s) or Final Acceptance prior to the required dates as set forth in the Contract. The Owner will not be liable for nor pay any additional compensation of any kind should there be any cause whatsoever that the Contractor is not able to achieve Substantial Completion(s) earlier than the contractually required dates of Substantial Completion(s) or Final Acceptance.

3.10.10. Float in Schedule. Any and all float time in the Contractor's schedule, regardless of the path or activity, shall accrue to the benefit of the Owner and the Work, and not to the Contractor. Float also includes any difference shown between any early completion dates shown on the Contractor's Schedule for any phasing milestone(s), Substantial Completion(s) or Final Acceptance and the dates or durations as required by the Contract Documents.

3.10.11. Modification of Required Substantial Completion(s) or Final Acceptance Dates: Modification of the required dates shall be accomplished only by duly authorized, accepted, and approved change orders stating the new date(s) with specificity on the change order form. All rights, duties, and obligations, including but not limited to the Contractor's liability for actual, delay, and/or liquidated damages, shall be determined in relation to the date(s) as modified.

3.11. DOCUMENTATION AND AS-BUILT CONDITIONS AT THE SITE

3.11.1. The Contractor shall maintain at the site for the Owner one record copy of the Drawings, Specifications, Addenda, Change Orders and other Modifications, in good order and accurately marked to record current field changes and selections made during construction, and one record copy of approved Shop Drawings, Product Data, Samples and similar required submittals. These shall be available to the Architect/Engineer or Owner at any time and shall be delivered to the Architect/Engineer for submittal to the Owner upon completion of the Work.

3.11.2. The Owner shall not be required to process final payment until all documentation and data required by the Contract Documents is submitted to and approved by the Architect/Engineer including, but not limited to, the As-Built Drawings. The Owner will not process any final request for payment until the Architect/Engineer has received and verified that the Contractor has performed the requirements pertaining to the as-built drawings.

3.11.3. The as-built drawings shall be neatly and clearly marked during construction to record all deviations, variations, changes, and alterations as they occur during construction along with such supplementary notes and details necessary to clearly and accurately represent the as-built condition. The as-built drawings shall be available at all times to the Owner, Architect/Engineer and Architect/Engineer's consultants.

3.12. SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

3.12.1. Definitions:

3.12.1.1. Shop Drawings are drawings, diagrams, schedules and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier or distributor to illustrate some portion of the Work.

3.12.1.2. Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.

3.12.1.3. Samples are physical examples which illustrate materials, equipment or workmanship and establish standards by which the Work will be judged.

3.12.2. Shop Drawings, Product Data, Samples and similar submittals are not Contract Documents. The purpose of their submittal is to demonstrate for those portions of the Work for which submittals are required by the Contract Documents the way by which the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents. Review by the Architect/Engineer is subject to the limitations of Subparagraph 4.2.7. Informational submittals upon which the Architect/Engineer is not expected to take responsive action may be so identified in the Contract Documents. Submittals which are not required by the Contract Documents may be returned by the Architect/Engineer without action.

3.12.3. The Contractor shall review, approve, and submit to the Architect/Engineer, Shop Drawings, Product Data, Samples and similar submittals required by the Contract Documents within sixty (60) calendar days of being issued the Notice To Proceed unless noted otherwise and shall do so in such sequence as to cause no delay in the Work or in the activities of the Owner or of separate contractors. Any and all items submitted by the Contractor which are not marked as reviewed for compliance with the Contract Documents and approved by the Contractor, or in the opinion of the Architect/Engineer, have not been reviewed for compliance by the Contractor even if marked as such, may be returned by the Architect/Engineer without action and shall not result in any accusation or claim for delay or cost by the Contractor. Any submittal that, in the opinion of the Architect/Engineer, is incomplete in any area or detail may be rejected and returned to the Contractor. It is the responsibility of and incumbent upon the Contractor to ensure and confirm that all submittals are complete, accurate, and in conformance to the Contract Documents prior to submission.

3.12.4. By approving and submitting Shop Drawings, Product Data, Samples and similar submittals, the Contractor represents and guarantees to the Architect/Engineer and Owner that the Contractor has determined and verified materials, field measurements and field construction criteria related thereto, or will do so, and has checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

3.12.5. The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples or similar submittals until the respective

submittal has been approved by the Architect/Engineer. Should the Contractor, Subcontractors or Sub-subcontractors install, construct, erect or perform any portion of the Work without approval of any requisite submittal, the Contractor shall bear the costs, responsibility, and delay for removal, replacement, and/or correction of any and all items, material, and /or labor.

3.12.6. The Work shall be in accordance with approved submittals except that the Contractor shall not be relieved of responsibility for deviations from requirements of the Contract Documents by the Architect/Engineer's approval of Shop Drawings, Product Data, Samples or similar submittals unless the Contractor has specifically informed the Architect/Engineer in writing of such deviation at the time of submittal and: (1) the Architect/Engineer has given written approval to the specific deviation as a minor change in the Work; or, (2) a Change Order or Construction Change Directive has been issued authorizing the deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples or similar submittals by the Architect/Engineer's approval thereof.

3.12.7. The Contractor shall direct specific attention, in writing or on re-submitted Shop Drawings, Product Data, Samples or similar submittals, to revisions other than those requested by the Architect/Engineer on previous submittals. In the absence of such written notice the Architect/Engineer's approval of a re-submission shall not apply to such revisions.

3.12.8. The Contractor shall not be required to provide professional services which constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. The Contractor shall not be required to provide professional services in violation of applicable law. If professional design services or certifications by a design professional related to systems, materials or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect/Engineer will specify all performance and design criteria that such services must satisfy. The Contractor shall cause such services or certifications to be provided by a properly licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings and other submittals prepared by such professional. Shop Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect/Engineer. The Owner and the Architect/Engineer shall be entitled to rely upon the adequacy, accuracy and completeness of the services, certifications or approvals performed by such design professionals, provided the Owner and Architect/Engineer have specified to the Contractor all performance and design criteria that such services must satisfy. Pursuant to this subparagraph, the Architect/Engineer will review, approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Contractor shall not be responsible for the adequacy of the performance or design criteria required by the Contract Documents but shall be responsible and held liable for review and verification of all performance or design criteria as required by Paragraph 3.2.

3.12.9. Unless noted otherwise in the Contract Documents, the Contractor shall submit to the Architect/Engineer within sixty (60) days from the date of the Notice To Proceed a minimum of six (6) complete copies of all shop/setting drawings, schedules, cut sheets, products, product data, and samples required for the complete Work. Copies shall be reviewed, marked, stamped and approved on each and every copy by the Contractor prior to submission to the Architect/Engineer or they shall be returned without review or action. The Architect/Engineer shall review with reasonable promptness, making corrections, rejections, or other actions as appropriate. The Architect/Engineer's approval or actions on shop/setting drawings, schedules, cut sheets, products, product data, or samples shall not relieve the Contractor from responsibility for, nor deviating from, the requirements of the plans and specifications. Any deviations from the plans and specifications requested or made by the Contractor shall be brought promptly to the attention of the Architect/Engineer.

3.12.10. Cost for Re-Submissions: the Contractor is responsible for ensuring that all shop drawings, product data, samples, and submittals contain all information required by the Contract Documents to allow the Architect/Engineer to take action. The Contractor shall pay the Architect/Engineer's cost for any re-submission of any rejected item. Such costs shall be deducted from the contract sum by Change Order. The Contractor agrees that any action taken by the Architect/Engineer is solely in the Architect/Engineer's discretion and is non-negotiable for the purposes of the Architect/Engineer's cost recovery for multiple (i.e. more than one) review.

3.13. USE OF SITE

3.13.1. The Contractor shall confine operations at the site to areas permitted by law, ordinances, permits and the Contract Documents and shall not unreasonably encumber the site with materials or equipment.

3.13.2. The Contractor shall not damage, endanger, compromise or destroy any part of the Project or the site, including but not limited to work performed by others, monuments, stakes, bench marks, survey points, utilities, existing features or structures. The Contractor shall be fully and exclusively responsible for and bare all costs and delays (including and costs of delay) for any damage, endangerment, compromise, or destruction of any part of the Project or site.

3.14. CUTTING AND PATCHING

3.14.1. The Contractor shall be responsible for cutting, fitting or patching required to complete the Work or to make its parts fit together properly.

3.14.2. The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or separate contractors by cutting, patching or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter such construction by the Owner or a separate contractor except with written consent of the Owner and of such separate contractor; such consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold from the Owner or a separate contractor the Contractor's consent to cutting or otherwise altering the Work.

3.15. CLEAN UP AND SITE CONTROL

3.15.1. The Contractor shall keep the premises and surrounding area free from accumulation of waste materials or rubbish caused by operations under the Contract during performance of the Work and at the direction of the Owner or Architect/Engineer. At completion of the Work, the Contractor shall remove from and about the Project waste materials, rubbish, the Contractor's tools, construction equipment, machinery and surplus materials.

3.15.2. If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and the cost thereof shall be charged to the Contractor.

3.16. ACCESS TO WORK

3.16.1. The Contractor shall provide the Owner and Architect/Engineer access to the Work at all times wherever located.

3.17. ROYALTIES, PATENTS AND COPYRIGHTS

3.17.1. The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of copyrights and patent rights and shall hold the Owner and Architect/Engineer harmless from loss on account thereof, but shall not be responsible for such defense or loss when a particular design, process or product of a particular manufacturer or manufacturers is required by the Contract Documents or where the copyright violations are contained in Drawings, Specifications or other documents prepared by the Owner or Architect/Engineer. However, if the Contractor has reason to believe that the required design, process or product is an infringement of a copyright or a patent, the Contractor shall be responsible for such loss unless such information is promptly furnished to the Architect/Engineer.

3.18. INDEMNIFICATION

3.18.1. To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the Owner, Architect/Engineer, Architect/Engineer'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 by the negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity which would otherwise exist as to a party or person described in this Paragraph. The Contractor agrees that it will defend, protect, indemnify and save harmless the State of Montana and the Owner against and from all claims, liabilities, demands, causes of action, judgments (including costs and reasonable attorneys' fees), and losses from any cause whatever (including patent, trademark and copyright infringement) except the Owner's sole

or partial negligence. This includes any suits, claims, actions, losses, costs, damages of any kind, including the State and Owner's legal expenses, arising out of, in connection with, or incidental to the Contract, but does not include any such suits, claims, actions, losses, costs or damages which are the result of the negligent acts, actions, losses, costs, or damages which are acts, omissions or misconduct of the Owner if they do not arise out of, depend upon or relate to a negligent act, omission or misconduct of the Contractor in whole or in part.

3.18.2. In claims against any person or entity indemnified under this Paragraph 3.18 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, the indemnification obligation under Subparagraph 3.18.1 shall not be limited by a limitation on amount or type of damages, compensation or benefits payable by or for the Contractor or a Subcontractor under workers' compensation acts, disability benefit acts or other employee benefit acts.

4. ARTICLE 4 – ADMINISTRATION OF THE CONSTRUCTION CONTRACT

4.1. THE ARCHITECT/ENGINEER

4.1.1. The Architect/Engineer is the person lawfully licensed to practice or an entity lawfully practicing identified as such in the Agreement with the Owner and is referred to throughout the Contract Documents as if singular in number. The term "Architect/Engineer" means the Architect/Engineer's duly authorized representative.

4.1.2. Duties, responsibilities and limitations of authority of the Architect/Engineer as set forth in the Contract Documents shall not be restricted, modified or extended without written consent of the Owner.

4.1.3. If the employment of the Architect/Engineer is terminated, the Owner shall employ a new Architect/Engineer at the sole choice and discretion of the Owner, whose status under the Contract Documents shall be that of the former Architect/Engineer.

4.2. ARCHITECT/ENGINEER'S ADMINISTRATION OF THE CONSTRUCTION CONTRACT

4.2.1. The Architect/Engineer will provide administration of the Contract as described in the Contract Documents, and will be an Owner's representative throughout the complete duration of the Project, including the warranty period. The Architect/Engineer will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents, unless otherwise modified in writing in accordance with the Architect/Engineer Contract.

4.2.2. The Architect/Engineer, as a representative of the Owner, will visit the site at intervals appropriate to the stage of the Contractor's operations to: (1) become generally familiar with and to keep the Owner informed about the progress and quality of the portion of the Work completed; (2) endeavor to guard the Owner against defects and deficiencies in the Work; and, (3) to determine in general if the Work is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Owner and Architect/Engineer will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Contractor's Work. The Owner and Architect/Engineer will neither have control over or charge of, nor be responsible for, the construction means, methods, techniques, sequences or procedures, for the safety of any person involved in the work, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents.

4.2.3. The Architect/Engineer will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect/Engineer will not have control over or charge of and will not be responsible for acts or omissions of the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.

4.2.4. Communications Facilitating Contract Administration. Except as otherwise provided in the Contract Documents or when direct communications have been specially authorized, the Owner and Contractor shall endeavor to communicate with each other through the Architect/Engineer about matters arising out of or relating to the Contract. Communications by and with the Architect/Engineer's consultants shall be through the Architect/Engineer. Communications by and with Subcontractors and material suppliers shall be through the Contractor to the Architect/Engineer. Communications by and with separate contractors shall be through the Owner to the Architect/Engineer.

4.2.5. Based on the Architect/Engineer's evaluations of the Contractor's Applications for Payment, the Architect/Engineer will review and certify the amounts due the Contractor and will issue Certificates for Payment in such amounts. The Contractor is fully aware that the Owner (i.e. the State of Montana) has established a billing cycle for processing payments in Article 9 of these General Conditions. The Contractor and all Subcontractors are subject to all provisions of Title 28, Chapter 2, Part 21 MCA regarding all aspects of the Work.

4.2.6. The Architect/Engineer will have authority to reject Work that does not conform to the Contract Documents. Whenever the Architect/Engineer considers it necessary or advisable, the Architect/Engineer will have authority to require inspection or testing of the Work in accordance with the General Conditions and any applicable technical specification requirements, whether or not such Work is fabricated, installed or completed. However, neither this authority of the Architect/Engineer nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect/Engineer to the Contractor, Subcontractors, material and equipment suppliers, their agents or employees, or other persons or entities performing portions of the Work.

4.2.7. The Architect/Engineer will review and approve or take other appropriate action upon the Contractor's submittals such as Shop Drawings, Product Data and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect/Engineer's action will be taken with such reasonable promptness as to cause no delay in the Work or in the activities of the Owner, Contractor or separate contractors, while allowing sufficient time in the Architect/Engineer's professional judgment to permit adequate review. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Architect/Engineer's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Paragraphs 3.3, 3.5 and 3.12. The Architect/Engineer's review shall not constitute approval of safety precautions or, unless otherwise specifically stated by the Architect/Engineer, of any construction means, methods, techniques, sequences or procedures. The Architect/Engineer's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

4.2.8. The Architect/Engineer will prepare Change Orders and Construction Change Directives, and may authorize minor changes in the Work as provided in Paragraph 7.4.

4.2.9. The Architect/Engineer will conduct inspections to determine the date or dates of Substantial Completion(s) and the date of Final Acceptance, will receive and forward to the Owner, for the Owner's review and records, written warranties and related documents required by the Contract and assembled by the Contractor, and will issue a final Certificate for Payment upon compliance with the requirements of the Contract Documents.

4.2.10. If the Owner and Architect/Engineer agree, the Architect/Engineer will provide one or more project representatives to assist in carrying out the Architect/Engineer's responsibilities. The duties, responsibilities and limitations of authority of such project representatives shall be as set forth in the Owner's Agreement with the Architect/Engineer.

4.2.11. The Architect/Engineer will interpret and decide matters concerning performance under and requirements of the Contract Documents on written request of either the Owner or Contractor. The Architect/Engineer's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. If no agreement is made concerning the time within which interpretations required of the Architect/Engineer shall be furnished in compliance with this Paragraph 4.2, then delay shall not be recognized on account of failure by the Architect/Engineer to furnish such interpretations until 15 days after written request is made for them.

4.2.12. Interpretations and decisions of the Architect/Engineer will be consistent with the intent of and reasonably inferable from the Contract Documents and will be in writing or in the form of drawings. When making such interpretations and initial decisions, the Architect/Engineer will endeavor to secure faithful performance by both Owner and Contractor, will not show partiality to either and will render such interpretations and decisions in good faith.

4.2.13. The Architect/Engineer's decisions on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents.

4.2.14. The Architect/Engineer's or Owner's observations or inspections do not alleviate any responsibility on the part of the Contractor. The Architect/Engineer and the Owner reserves the right to observe and inspection the work and make comment. Action or lack of action following observation or inspection is not to be construed as approval of Contractor's performance.

4.3. CLAIMS AND DISPUTES

4.3.1. Definition. A Claim is a demand or assertion by one of the parties seeking, as a matter of right, adjustment or interpretation of Contract terms, payment of money, extensions of time or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes, controversies, and matters in question between the Owner and Contractor arising out of or relating to the Contract. Claims must be initiated by written notice. The responsibility to substantiate Claims shall rest solely with the party making the Claim.

4.3.1.1. Time Limits on Claims. Claims by either party must be initiated within 21 calendar days after occurrence of the event giving rise to such claim. The following shall apply to the initiation of a claim:

4.3.1.1.1. A written notice of a claim must be provided to the Architect/Engineer and the other party within 21 calendar days after the occurrence of the event or the claim is waived by the claiming party and void in its entirety.

4.3.1.1.2. Claims must be initiated by separate, clear, and distinct written notice within the 21 calendar day time frame to the Architect/Engineer and the other party and must contain the notarized statement in Sub-Paragraph 4.3.1.5 when the claim is made by the Contractor. Discussions in any form with the Architect/Engineer or Owner, whether at the site or not, do not constitute initiation of a claim. Notes in project meeting minutes, email correspondence, change order proposals, or any other form of documentation does not constitute initiation of a claim. The written notice must be a separate and distinct correspondence provided in hardcopy to both the Architect/Engineer and Owner and must delineate the specific event and outline the causes and reasons for the claim whether or not cost or time have been fully determined. Written remarks or notes of a generic nature are invalid in their entirety. Comments made at progress meetings, project site visits, inspections, emails, voice mails, and other such communications do not meet the requirement of providing notice of claim.

4.3.1.1.3. Physical Injury or Physical Damage. Should the Owner or Contractor suffer physical injury or physical damage to person or property because of any error, omission, or act of the other party or others for whose acts the other party is legally and contractually liable, claim will be made in writing to the other party within a reasonable time of the first observance of such physical injury or physical damage but in no case beyond 30 calendar days of the first observance. The notice shall provide sufficient detail to enable the other party to investigate the matter. The provisions of this paragraph shall not be construed as a substitute for or a waiver of the provisions of any applicable statute of limitations or repose. In all such cases, the indemnification provisions of the Contract shall be effectual and the Contractor's insurance shall be primary and in full effect.

4.3.1.2. All Claims must contain sufficient justification and substantiation with the written notice or they may be rejected without consideration by the Architect/Engineer or other party with no additional impact or consequence to the Contract Sum, Contract Time, or matter(s) in question in the Claim.

4.3.1.3. If additional compensation is claimed, the exact amount claimed and a breakdown of that amount into the following categories shall be provided with each and every claim:

4.3.1.3.1. Direct costs (as listed in Subparagraph 7.3.9.1 through 7.3.9.5);

4.3.1.3.2. Indirect costs (as defined in Paragraph 7.2.5); and,

4.3.1.3.3. Consequential items (i.e. time extensions, credits, logic, reasonableness, impacts, disruptions, dilution) for the change.

4.3.1.4. If additional time is claimed the following shall be provided with each and every claim:

- 4.3.1.4.1. The specific number of days and specific dates for which the additional time is sought;
- 4.3.1.4.2. The specific reasons, causes, and/or effects whereby the Contractor believes that additional time should be granted; and,
- 4.3.1.4.3. The Contractor shall provide analyses, documentation, and justification of its claim for additional time in accordance with the latest Critical Path Method schedule in use at the time of event giving rise to the claim.

4.3.1.5. With each and every claim, the Contractor shall submit to the Architect/Engineer and Owner a notarized statement containing the following language:

“Under penalty of law (including perjury and/or false/fraudulent claims against the State), the undersigned,

 (Name) (Title)

Of _____
 (Company) (Date)

hereby certifies, warrants, and guarantees that this claim made for Work on this Contract is a true statement of the costs, adjustments and/or time sought and is fully documented and supported under the contract between the parties.

 (Signature) (Date)”

4.3.2. Continuing Contract Performance.

Pending final resolution of a Claim except as otherwise agreed in writing or as provided in Subparagraph 9.7.1 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents on the portion of the Work not involved in a Claim.

4.3.3. Claims for Cost or Time for Concealed or Unknown Conditions.

If conditions are encountered at the site which are: (1) subsurface or otherwise concealed physical conditions which differ materially from those indicated in the Contract Documents; or, (2) unknown physical conditions of an unusual nature, which differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, then notice by the observing party shall be given to the other party promptly before conditions are disturbed.

4.3.3.1. The Architect/Engineer will promptly investigate such conditions and, if they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend an equitable adjustment in the Contract Sum or Contract Time, or both. If the Architect/Engineer determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect/Engineer shall so notify the Owner and Contractor in writing, stating the reasons. Claims by either party in opposition to such determination must be made within 21 days after the date of the Architect/Engineer's decision.

4.3.3.2. If the conditions encountered are materially different, the Contract Sum and Contract Time shall be equitably adjusted, but if the Owner and Contractor cannot agree on an adjustment in the Contract Sum or Contract Time, the adjustment shall be referred to the Architect/Engineer for initial determination, subject to further proceedings pursuant to Paragraph 4.4.

4.3.3.3. Nothing in this paragraph shall relieve the Contractor of its obligation to adequately and sufficiently investigate, research, and examine the site, the site survey, topographical information, and the

geotechnical information available whether included by reference or fully incorporated in the Contract Documents.

4.3.4. Claims for Additional Cost.

4.3.4.1. If the Contractor wishes to make Claim for an increase in the Contract Sum, written notice as provided herein shall be given before proceeding to execute the Work. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Paragraph 10.6.

4.3.4.2. If the Contractor believes additional cost is involved for reasons including but not limited to: (1) a written interpretation from the Architect/Engineer; (2) an order by the Owner to stop the Work solely for the Owner's convenience or where the Contractor was not at least partially at fault; (3) a written order for a minor change in the Work issued by the Architect/Engineer; (4) failure of payment by the Owner per the terms of the Contract; (5) termination of the Contract by the Owner; or, (6) other reasonable grounds, Claim must be filed in accordance with this Paragraph 4.3.

4.3.5. Claims for Additional Time

4.3.5.1. If the Contractor wishes to make Claim for an increase in the Contract Time, written notice as specified in these General Conditions shall be provided along with the notarized certification. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. In the case of a continuing delay for the same event or cause only one Claim is necessary. However, separate and distinct written notice is required for each separate event.

4.3.5.2. Weather Delays:

4.3.5.2.1. If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated, and had an adverse effect on the scheduled construction activities.

4.3.5.2.2. Inclement or adverse weather shall not be a prima facie reason for the granting of an extension of time, and the Contractor shall make every effort to continue work under prevailing conditions. The Owner may grant an extension of time if an unavoidable delay occurs as a result of inclement/severe/adverse weather and such shall then be classified as a "Delay Day". Any and all delay days granted by the Owner are and shall be non-compensable in any manner or form. The Contractor shall comply with the notice requirements concerning instances of inclement/severe/adverse weather before the Owner will consider a time extension. Each day of inclement/severe/adverse weather shall be considered a separate instance or event and as such, shall be subject to the notice requirements.

4.3.5.2.3. An "inclement", "severe", or "adverse" weather delay day is defined as a day on which the Contractor is prevented by weather or conditions caused by weather resulting immediately there from, which directly impact the current controlling critical-path operation or operations, and which prevent the Contractor from proceeding with at least 75% of the normal labor and equipment force engaged on such critical path operation or operations for at least 60% of the total daily time being currently spent on the controlling operation or operations.

4.3.5.2.4. The Contractor shall consider normal/typical/seasonal weather days and conditions caused by normal/typical/seasonal weather days for the location of the Work in the planning and scheduling of the Work to ensure completion within the Contract Time. No time extensions will be granted for the Contractor's failure to consider and account for such weather days and conditions caused by such weather for the Contract Time in which the Work is to be accomplished.

4.3.5.2.5. A "normal", "typical", or "seasonal" weather day shall be defined as weather that can be reasonably anticipated to occur at the location of the Work for each particular month involved in the Contract Time. Each month involved shall not be considered individually as it relates to claims for additional time due to inclement/adverse/severe weather but shall consider the entire Contract Time as it compares to normal/typical/seasonal weather that is reasonably anticipated to occur. Normal/typical/seasonal weather days shall be based upon U.S. National Weather Service climatic data for the location of the Work or the nearest location where such data is available.

4.3.5.2.6. The Contractor is solely responsible to document, prepare and present all data and justification for claiming a weather delay day. Any and all claims for weather delay days shall be tied directly to the current critical-path operation or operations on the day of the instance or event which shall be delineated and described on the Critical-Path Schedule and shall be provided with any and all claims. The Contractor is solely responsible to indicate and document why the weather delay day(s) claimed are beyond those weather days which are reasonably anticipated to occur for the Contract Time. Incomplete or inaccurate claims, as determined by the Architect/Engineer or Owner, may be returned without consideration or comment.

4.3.5.3. Where the Contractor is prevented from completing any part of the Work with specified durations or phases due to delay beyond the control of both the Owner and the Contractor, an extension of the contract time or phase duration in an equal amount to the time lost due to such delay shall be the Contractor's sole and exclusive remedy for such delay.

4.3.5.4. Delays attributable to and/or within the control of subcontractors and suppliers are deemed to be within the control of the Contractor.

4.3.5.5. In no event shall the Owner be liable to the Contractor, any subcontractor, any supplier, Contractor's surety, or any other person or organization, for damages or costs arising out of or resulting from: (1) delays caused by or within the control of the Contractor which include but are not limited to labor issues or labor strikes on the Project, federal, state, or local jurisdiction enforcement actions related directly to the Contractor's Work (e.g. safety or code violations, etc.); or, (2) delays beyond the control of both parties including but not limited to fires, floods, earthquakes, abnormal weather conditions, acts of God, nationwide material shortages, actions or inaction by utility owners, emergency declarations by federal, state, or local officials enacted in the immediate vicinity of the project, or other contractors performing work for the Owner.

4.3.6. Claims for Consequential Damages

4.3.6.1. The Contractor and Owner waive Claims against each other for consequential damages arising out of or relating to this Contract. This mutual waiver includes:

4.3.6.1.1. damages incurred by the Owner for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and,

4.3.6.1.2. damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, income, and for loss of profit.

4.3.6.2. This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Article 14. Nothing contained in this waiver of consequential damages shall be deemed to preclude an award of liquidated or actual damages, when applicable, in accordance with the requirements of the Contract Documents.

4.4. RESOLUTION OF CLAIMS, DISPUTES, AND CONTROVERSIES

4.4.1. Decision of Architect/Engineer. Claims, including those alleging an error or omission by the Architect/Engineer, shall be referred initially to the Architect/Engineer for decision. A decision by the Architect/Engineer shall be required as a condition precedent to mediation, arbitration or litigation of all Claims between the Contractor and Owner arising prior to the date of Final Acceptance, unless 30 days have passed after the Claim has been referred to the Architect/Engineer with no decision having been rendered by the Architect/Engineer. The Architect/Engineer will not decide disputes between the Contractor and persons or entities other than the Owner. Any Claim arising out of or related to the Contract, except those already waived in Subparagraphs 4.3.6, 7.2.6, 7.3.8, 9.10.4 and 9.10.5 shall, pending compliance with Subparagraph 4.4.5, be subject to mediation, arbitration, or the institution of legal or equitable proceedings. Claims waived in Subparagraphs 4.3.6, 7.2.6, 7.3.8, 9.10.4, and 9.10.5 are deemed settled, resolved, and completed.

4.4.2. The Architect/Engineer will review Claims and within ten (10) days of the receipt of the Claim take one or more of the following actions: (1) request additional supporting data from the claimant or a response with

supporting data from the other party; (2) reject the Claim in whole or in part; (3) approve the Claim; (4) suggest a compromise; or (5) advise the parties that the Architect/Engineer is unable to resolve the Claim if the Architect/Engineer lacks sufficient information to evaluate the merits of the Claim or if the Architect/Engineer concludes that, in the Architect/Engineer's sole discretion, it would be inappropriate for the Architect/Engineer to resolve the Claim.

4.4.3. If the Architect/Engineer requests a party to provide a response to a Claim or to furnish additional supporting data, such party shall respond within ten (10) days after receipt of such request and shall either provide a response on the requested supporting data, advise the Architect/Engineer when the response or supporting data will be furnished, or advise the Architect/Engineer that no supporting data will be furnished. Upon either no response or receipt of the response or supporting data, the Architect/Engineer will either reject or approve the Claim in whole or in part.

4.4.4. The Architect/Engineer will approve or reject Claims by written decision, which shall state the reasons therefore and which shall notify the parties of any change in the Contract Sum or Contract Time or both. The approval or rejection of a Claim by the Architect/Engineer shall be final and binding on the parties but subject to mediation and arbitration.

4.4.5. When 30 days have passed upon submission of a Claim without decision or action by the Architect/Engineer, or the Architect/Engineer has rendered a decision or taken any of the actions identified in Subparagraph 4.4.2, a demand for arbitration of a Claim covered by such decision or action must be made within 30 days after the date of expiration of Subparagraph 4.4.1 or within 30 days of the Architect/Engineer's decision or action. Failure to demand arbitration within said 30 day period shall result in the Architect/Engineer's decision becoming final and binding upon the Owner and Contractor whenever such decision is rendered.

4.4.6. If the Architect/Engineer renders a decision after arbitration proceedings have been initiated, such decision may be entered as evidence but shall not supersede arbitration proceedings unless the decision is acceptable to all parties concerned.

4.4.7. Upon receipt of a Claim against the Contractor or at any time thereafter, the Architect/Engineer or the Owner may, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim. If the Claim relates to a possibility of a Contractor's default, the Architect/Engineer or the Owner may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

4.4.8. A Claim subject to or related to liens or bonds shall be governed by applicable law regarding notices, filing deadlines, and resolution of such Claim prior to any resolution of such Claim by the Architect/Engineer, by mediation, or by arbitration, except for claims made by the Owner against the Contractor's bonds.

4.5. MEDIATION

4.5.1. Any Claim arising out of or related to the Contract, except Claims relating to aesthetic effect and except those waived as provided for in Subparagraphs 4.3.6, 7.2.6, 7.3.8, 9.10.4 and 9.10.5 shall, after initial decision by the Architect/Engineer or 30 days after submission of the Claim to the Architect/Engineer, be subject to mediation as a condition precedent to arbitration or the institution of legal or equitable proceedings by either party.

4.5.2. The parties shall endeavor to resolve their Claims by mediation which, unless the parties mutually agree otherwise, shall be in accordance with the Construction Industry Mediation Rules of the American Arbitration Association currently in effect and/or those rules specified in the contract documents or separately agreed upon between the parties. Construction Industry Mediation Rule M-2 (filing with AAA) is void. The parties shall mutually agree upon a mediator who shall then take the place of AAA in the Construction Industry Mediation Rules. The parties must mutually agree to use AAA and no filing of a request for mediation shall be made to AAA by either party until such mutual agreement has been made. Request for mediation shall be filed in writing with the other party to the Contract and with the American Arbitration Association. The request may be made concurrently with the filing of a demand for arbitration but, in such event, mediation shall proceed in advance of arbitration or legal or equitable proceedings, which shall be stayed pending mediation for a period of 60 days from the date of filing, unless stayed for a longer period by agreement of the parties or court order.

4.5.3. The parties shall share the mediator's fee and any filing fees equally. The mediation shall be held in the place where the Project is located, unless another location is mutually agreed upon. Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction thereof.

4.6. ARBITRATION

4.6.1. Any controversy or Claim arising out of or related to this Contract or the breach thereof shall be settled by arbitration in accordance with the Montana Uniform Arbitration Act (MUAA). To the extent it does not conflict with the MUAA, the Construction Industry Arbitration Rules of the American Arbitration Association shall apply except as modified herein. The parties to the arbitration shall bear their own costs and expenses for participating in the arbitration. Costs of the Arbitration panel shall be borne equally between the parties except those costs awarded by the Arbitration panel (including costs for the arbitration itself).

4.6.2. Prior to the arbitration hearing all parties to the arbitration may conduct discovery subject to the provisions of Montana Rules of Civil Procedure. The arbitration panel may award actual damages incurred if a party fails to provide full disclosure under any discovery request. If a party claims a right of information privilege protected by law, the party must submit that claim to the arbitration panel for a ruling, before failing to provide information requested under discovery or the arbitration panel may award actual damages.

4.6.3. The venue for all arbitration proceedings required by this Contract shall be the seat of the county in which the work occurs or the First Judicial District, Lewis & Clark County, as determined solely by the Owner. Arbitration shall be conducted by a panel comprised of three members with one selected by the Contractor, one selected by the Owner, and one selected by mutual agreement of the Owner and the Contractor.

4.6.4. Any Claim arising out of or related to the Contract, except Claims relating to aesthetic effect and except those waived as provided for in Subparagraphs 4.3.6, 7.2.6, 7.3.8, 9.10.4 and 9.10.5, shall, after decision or action by the Architect/Engineer or 30 days after submission of the Claim to the Architect/Engineer, be subject to arbitration provided a demand for arbitration is made within the time frame provided in Subparagraph 4.4.5. If such demand is not made with the specified time frame, the Architect/Engineer's decision or action is final. Prior to arbitration, the parties shall endeavor to resolve disputes by mediation in accordance with the provisions of Paragraph 4.5.

4.6.5. Claims not resolved by mediation shall be decided by arbitration which, unless the parties mutually agree otherwise, shall be in accordance with the Construction Industry Arbitration Rules of the American Arbitration Association currently in effect and/or those rules specified in the Contract Documents or separately agreed upon between the parties. Construction Industry Arbitration Rule R-3 (filing with AAA) is void. The parties shall mutually agree upon an arbitrator or arbitrators who shall then take the place of AAA in the Construction Industry Arbitration Rules. The parties must mutually agree to use AAA and no filing of a demand for arbitration shall be made to AAA by either party until such mutual agreement has been made. The demand for arbitration shall be filed in writing with the other party to the Contract and a copy shall be filed with the Architect/Engineer.

4.6.6. A demand for arbitration shall be made within the time limits specified in Subparagraphs 4.4.5 and in no event shall it be made after the date when institution of legal or equitable proceedings based on such Claim would be barred by the applicable statute of limitations as determined pursuant to Paragraph 13.7.

4.6.7. Pending final resolution of a Claim including arbitration, unless otherwise mutually agreed in writing, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract on Work or amounts not in dispute.

4.6.8. Limitation on Consolidation or Joinder. Arbitration arising out of or relating to the Contract may include by consolidation or joinder the Architect/Engineer, the Architect/Engineer's employees or consultants, except by written consent containing specific reference to the Agreement and signed by the Architect/Engineer, Owner, Contractor and any other person or entity sought to be joined. No arbitration shall include, by consolidation or joinder or in any other manner, parties other than the Owner, Architect/Engineer, Contractor, a separate contractor as described in Article 6 and other persons substantially involved in a common question of fact or law whose presence is required if complete relief is to be accorded in arbitration. No person or entity other than the Owner, Architect/Engineer, Contractor or a separate contractor as described in Article 6 shall be included as an original third party or additional third party to an arbitration whose interest or responsibility is insubstantial. The foregoing agreement to arbitrate and other agreements to arbitrate with an additional person or entity duly

consented to by parties to the Agreement shall be specifically enforceable under applicable law in any court having jurisdiction thereof.

4.6.9. Claims and Timely Assertion of Claims. The party filing a demand for arbitration must assert in the demand all Claims then known to that party on which arbitration is permitted to be demanded.

4.6.10. Judgment on Final Award. The award rendered by the arbitrator or arbitrators shall be final, and judgment may be entered upon it in accordance with applicable law in any court having jurisdiction thereof. The parties agree that the costs of the arbitrator(s)' compensation and expenses shall be borne equally. The parties further agree that the arbitrator(s) shall have authority to award to either party some or all of the costs and expenses involved, including attorney's fees.

5. ARTICLE 5 – SUBCONTRACTORS

5.1. DEFINITIONS

5.1.1. A Subcontractor is a person or entity who has a direct or indirect contract at any tier or level with the Contractor or any Subcontractor to the Contractor to perform a portion of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include a separate contractor or subcontractors of a separate contractor.

5.2. AWARD OF SUBCONTRACTS AND OTHER CONTRACTS FOR PORTIONS OF THE WORK

5.2.1. Unless otherwise stated in the Contract Documents or the bidding requirements, the Contractor, as soon as practicable after award of the Contract and in no instance later than (30) days after award of the Contract, shall furnish in writing to the Owner through the Architect/Engineer the names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for each principal portion of the Work. The Architect/Engineer will promptly reply to the Contractor in writing stating whether or not the Owner or the Architect/Engineer, after due investigation, has reasonable objection to any such proposed person or entity.

5.2.2. The Contractor shall not contract with a proposed person or entity to which the Owner or Architect/Engineer has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

5.2.3. If the Owner or Architect/Engineer has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner or Architect/Engineer has no reasonable objection. If the proposed but rejected Subcontractor was reasonably capable of performing the Work, the Contract Sum and Contract Time shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute Subcontractor's Work. However, no increase in the Contract Sum or Contract Time shall be allowed for such change unless the Contractor has acted promptly and responsively in submitting names as required.

5.2.4. The Contractor shall not change a Subcontractor, person or entity previously selected if the Owner or Architect/Engineer makes reasonable objection to such substitute. The Contractor shall not change or substitute for a Subcontractor who was required to be listed on the bid without first getting the approval of the Owner.

5.3. SUBCONTRACTUAL RELATIONS

5.3.1. By appropriate agreement, written where legally required for validity, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work, which the Contractor, by these Documents, assumes toward the Owner and Architect/Engineer. Each subcontract agreement shall preserve and protect the rights of the Owner and Architect/Engineer under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies and redress against the Contractor that the Contractor, by the Contract Documents, has against the

Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement which may be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

5.3.2. Upon written request by the Owner, the Contractor shall require its subcontractors to provide to it performance and payment securities for their portion of the Work in the types and form defined in statute (18-2-201 and 18-2-203 MCA) for all sub-contractual agreements.

5.3.3. The Contractor shall prepare a Subcontractors' and Suppliers' chart in CSI division format acceptable to the Owner which lists by name, all contact information, job category, and responsibility the Contractor's Subcontractors (at all tiers or levels) and Suppliers with a pecuniary interest in the Project of greater than \$5,000.00. The Contractor shall not enter into any agreement with any subcontractor or supplier to which the Owner raises a timely objection. The Contractor shall promptly inform the Owner in writing of any proposed replacements, the reasons therefore, and the name and qualifications of any proposed replacements. The Owner shall have the right to reject any proposed replacements without cost or claim being made by the Contractor. The chart shall be provided to the Owner at the time of the pre-construction conference but no less than 30 days after award of the Contract.

5.3.4. All Contractors and Subcontractors to this contract must comply with all Montana Department of Labor and Industry requirements, regulations, rules, and statutes.

5.3.5. In accordance with 39-51-1104 MCA, any Contractor who is or becomes an employer under the provisions of Title 39, Chapter 51 of Montana Code Annotated, who contracts with any Subcontractor who also is or becomes an employer under the provisions of Title 39, Chapter 51 of Montana Code Annotated, shall withhold sufficient money on the contract to guarantee that all taxes, penalties, and interest are paid upon completion of the contract.

5.3.5.1. It is the duty of any Subcontractor who is or becomes an employer under the provisions of Title 39, Chapter 51 of Montana Code Annotated, to furnish the Contractor with a certification issued by the Montana Department of Labor and Industry, prior to final payment stating that said Subcontractor is current and in full compliance with the provisions of Montana Department of Labor and Industry.

5.3.5.2. Failure to comply shall render the Contractor directly liable for all taxes, penalties, and interest due from the Subcontractor, and the Montana Department of Labor and Industry has all of the remedies of collection against the Contractor under the provisions of Title 39, Chapter 51 of Montana Code Annotated, as though the services in question were performed directly for the Contractor.

5.3.6. In compliance with state statutes, the Contractor will have the 1% Gross Receipts Tax withheld from all payments. Each "Public Contractor" includes all Subcontractors with contracts greater than \$5,000 each. The Contractor and all Subcontractors will withhold said 1% from payments made to all Subcontractors with contracts greater than \$5,000.00 and make it payable to the Montana Department of Revenue. The Contractor and all Subcontractors shall also submit documentation of all contracts greater than \$5,000.00 to the Montana Department of Revenue on the Department's prescribed form.

5.3.7. Construction Contractor Registration: All Subcontractors at any tier or level are required to be registered with the Department of Labor and Industry under 39-9-201 and 39-9-204 MCA prior to the Contract being executed by the Owner. Subcontractors shall demonstrate to the Contractor that it has registered or promises that it will register immediately upon notice of award and prior to the commencement of any work.

5.4. CONTINGENT ASSIGNMENT OF SUBCONTRACTS

5.4.1. Each subcontract agreement for a portion of the Work is assigned by the Contractor to the Owner provided that:

5.4.1.1. assignment is effective only after termination of the Contract by the Owner for cause pursuant to Paragraph 14.2 and only for those subcontract agreements which the Owner accepts by notifying the Subcontractor and Contractor in writing; and,

5.4.1.2. assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

5.4.2. Upon such assignment, if the Work has been suspended for more than 30 days as a result of the Contractor's default, the Subcontractor's compensation shall be equitably adjusted for increases in cost resulting from the suspension. Such adjustment shall be at the expense of the Contractor.

5.4.3. The Contractor shall engage each of its subcontractors and suppliers with written contracts that preserve and protect the rights of the Owner and include the acknowledgement and agreement of each subcontractor and supplier that the Owner is a third-party beneficiary of their sub-contractual and supplier agreements. The Contractor's agreements shall require that in the event of default by the Contractor or termination of the Contractor, and upon request of the Owner, the Contractor's subcontractors and suppliers will perform services for the Owner.

5.4.4. Construction Contractor Registration: All Subcontractors at any tier or level are required to be registered with the Department of Labor and Industry under 39-9-201 and 39-9-204 MCA prior to the Contract being executed by the Owner. Subcontractors shall demonstrate to the Contractor that it has registered or promises that it will register immediately upon notice of award and prior to the commencement of any work.

6. ARTICLE 6 – CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

6.1. OWNER'S RIGHT TO PERFORM CONSTRUCTION AND TO AWARD SEPARATE CONTRACTS

6.1.1. The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and to award separate contracts in connection with other portions of the Project or other construction or operations on the site under Conditions of the Contract identical or substantially similar to these including those portions related to insurance and waiver of subrogation. If the Contractor claims that delay or additional cost is involved because of such action by the Owner, the Contractor shall make such Claim as provided in Paragraph 4.3.

6.1.2. When separate contracts are awarded for different portions of the Project or other construction or operations on the site, the term "Contractor" in the Contract Documents in each case shall mean the Contractor who executes each separate Owner-Contractor Agreement.

6.1.3. The Owner shall provide for coordination of the activities of the Owner's own forces and of each separate contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with other separate contractors and the Owner in reviewing their construction schedules when directed to do so. The Contractor shall make any revisions to the construction schedule deemed necessary after a joint review and mutual agreement. The construction schedules shall then constitute the schedules to be used by the Contractor, separate contractors and the Owner until subsequently revised.

6.1.4. Unless otherwise provided in the Contract Documents, when the Owner performs construction or operations related to the Project with the Owner's own forces, the Owner shall be deemed to be subject to the same obligations and to have the same rights which apply to the Contractor under the Conditions of the Contract, including, without excluding others, those stated in Article 3, this Article 6 and Articles 10, 11 and 12.

6.2. MUTUAL RESPONSIBILITY

6.2.1. The Contractor shall afford the Owner and separate contractors reasonable opportunity' for introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor's construction and operations with theirs as required by the Contract Documents.

6.2.2. If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a separate contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly report to the Architect/Engineer apparent discrepancies or defects in such other construction that would render it unsuitable for such proper execution and results. Failure of the Contractor so to report shall constitute an acknowledgment that the Owner's or separate contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work, except as to defects not then reasonably discoverable.

6.2.3. The Owner shall be reimbursed by the Contractor for costs incurred by the Owner which are payable to a separate contractor because of delays, improperly timed activities or defective construction of the Contractor. The Owner shall be responsible to the Contractor for costs incurred by the Contractor because of delays, improperly timed activities, damage to the Work or defective construction of a separate contractor.

6.2.4. The Contractor shall promptly remedy damage wrongfully caused by the Contractor to completed or partially completed construction or to property of the Owner or separate contractors as provided in Subparagraph 12.2.

6.2.5. The Owner and each separate contractor shall have the same responsibilities for cutting and patching as are described for the Contractor in Subparagraph 3.14.

6.3. OWNER'S RIGHT TO CLEAN UP

6.3.1. If a dispute arises among the Contractor, separate contractors and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish, the Owner may clean up and the Architect/Engineer will determine the responsibility of those involved and allocate the cost accordingly.

7. ARTICLE 7 – CHANGES IN THE WORK

7.1. GENERAL

7.1.1. Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Change Order, Construction Change Directive, or order for a minor change in the Work subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents. Minor changes as ordered by the Architect/Engineer has the definition provided in Paragraph 7.4

7.1.2. A Change Order shall be based upon agreement among the Owner, Contractor, and Architect/Engineer; a Construction Change Directive requires agreement by the Owner and Architect/Engineer and may or may not be agreed to by the Contractor; an order for a minor change in the Work may be issued by the Architect/Engineer alone.

7.1.3. Changes in the Work shall be performed under applicable provisions of the Contract Documents and the Contractor shall proceed promptly, unless otherwise provided in the Change Order, Construction Change Directive, or order for a minor change in the Work.

7.1.4. No act, omission, or course of dealing, shall alter the requirement that Change Orders or Construction Change Directives shall be in writing and signed by the Owner, and that Change Orders and Construction Change Directives are the exclusive method for effecting any adjustment to the Contract. The Contractor understands and agrees that neither the Contract Sum nor the Contract Time can be changed by implication, oral agreement, verbal directive, or unsigned Change Order.

7.2. CHANGE ORDERS

7.2.1. A Change Order is a written instrument prepared by the Architect/Engineer and signed by the Owner, Contractor and Architect/Engineer, stating their agreement upon all of the following:

- 7.2.1.1. change in the Work;
- 7.2.1.2. the amount of the adjustment, if any, in the Contract Sum; and,
- 7.2.1.3. the extent of the adjustment, if any, in the Contract Time.

7.2.2. The cost or credit to the Owner resulting from a change in the Work shall be determined as follows:

- 7.2.2.1. Per the limitations of this Subparagraph, plus a 5% allowance for overhead and a 10% allowance for profit. The allowances for overhead and for profit are limited to the percentages as specified herein unless they are determined to be unreasonable by the Architect/Engineer (not the Contractor) per Subparagraph 7.3.9 for each Change Order or Construction Change Directive; or,

7.2.2.2. By one of the methods in Subparagraph 7.3.4, or as determined by the Architect/Engineer per Subparagraph 7.3.9, plus a 5% allowance for overhead and a 10% allowance for profit. The allowances for overhead and for profit are limited to the percentages as specified herein unless they are determined to be unreasonable by the Architect/Engineer (not the Contractor) per Subparagraph 7.3.9 for each Change Order or Construction Change Directive.

7.2.2.3. The Contractor's proposed increase or decrease in cost shall be limited to costs listed in Subparagraph 7.3.9.1 through 7.3.9.5.

7.2.3. The Contractor shall not submit any Change Order, response to requested cost proposals, or requested changes which are incomplete and do not contain full breakdown and supporting documentation in the following three areas:

7.2.3.1. Direct costs (only those listed in Subparagraph 7.3.9.1 through 7.3.9.5 are allowable);

7.2.3.2. Indirect costs (limited as a percentage on each Change Order per Supplementary General Conditions, Paragraph 7.2.2); and

7.2.3.3. Consequential items (e.g. time extensions, credits, logic, reasonableness, impacts, disruptions, dilution).

7.2.4. Any Change Order, responses to requested proposals, or requested changes submitted by the Contractor which, in the opinion of the Architect/Engineer, are incomplete, may be rejected and returned to the Contractor without comment. It is the responsibility of and incumbent upon the Contractor to ensure and confirm that all Change Orders, responses to requested proposals, or requested changes are complete prior to submission.

7.2.5. Overhead, applicable to all areas and sections of the Contract Documents, means "Indirect Costs" as referenced in Subparagraph 7.2.3.2. Indirect costs are inclusive of, but not limited to, the following: home office overhead; off-site supervision; home office project management; change order and/or proposal preparation, design, research, negotiation and associated travel; effects of disruption and dilution of management and supervision off-site; time delays; coordination of trades; postage and shipping; and, effective increase in guarantee and warranty durations. Indirect costs applicable to any and all changes in the work, either through Change Order or Construction Change Directive, are limited to the percentage allowance for overhead in Subparagraph 7.2.2.

7.2.6. By signature on any Change Order, the Contractor certifies that the signed Change Order is complete and includes all direct costs, indirect costs and consequential items (including additional time, if any) and is free and clear of all claims or disputes (including, but not limited to, claims for additional costs, additional time, disruptions, and/or impacts) in favor of the Contractor, subcontractors, material suppliers, or other persons or entities concerning the signed change order and on all previously contracted Work and does release the Owner from such claims or demands.

7.2.7. Any and all changes or adjustments to the Contract Time requested or claimed by the Contractor as a result of a Change Order shall require documentation and justification for the adjustment by a Critical Path Method analysis of the Contractor's most recent Critical Path Schedule in use prior to the change. Changes which affect or concern activities containing float or slack time (i.e. not on the critical path) and which can be accomplished within such float or slack time, shall not result in an increase in the Contract Time.

7.2.8. Supervision means on-site, field supervision and not home office overhead, off-site management or off-site supervision.

7.2.9. Labor means those persons engaged in construction occupations as defined in Montana Prevailing Wage Rates for Building Construction or Heavy/Highway as bound in the Contract Documents and does not include design, engineering, superintendence, management, on-site field supervision, home office or other off-site management, off-site supervision, office or clerical work.

7.3. CONSTRUCTION CHANGE DIRECTIVES

7.3.1. A Construction Change Directive is a written order prepared by the Architect/Engineer directing a change in the Work prior to agreement on adjustment, if any, in the Contract Sum or Contract Time, or both. The

Owner may by Construction Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions or other revisions, the Contract Sum and Contract Time being adjusted accordingly.

7.3.2. Any and all changes or adjustments to the Contract Time requested or claimed by the Contractor as a result of a Construction Change Directive, shall require documentation and justification for the adjustment by a Critical Path Method analysis of the Contractor's most recent Critical Path Schedule in use prior to the change. Changes that affect or concern activities containing float or slack time (i.e. not on the critical path) and which can be accomplished within such float or slack time shall not result in an increase in the Contract Time.

7.3.3. A Construction Change Directive shall be used in the absence of agreement on the terms of a Change Order.

7.3.4. If the Construction Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods:

7.3.4.1. mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;

7.3.4.2. unit prices stated in the Contract Documents or subsequently agreed upon;

7.3.4.3. cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee;

7.3.4.4. By actual cost as shown by the Contractor's and Subcontractor's itemized invoices; or

7.3.4.5. as provided in Subparagraph 7.3.9.

7.3.5. Costs shall be limited to the following: cost of materials, including cost of delivery; cost of labor, including social security, old age and unemployment insurance and fringe benefits under collective bargaining agreements; workers' compensation insurance; bond premiums; and rental value of power tools and equipment.

7.3.6. Overhead and profit allowances shall be limited on all Construction Change Directives to those identified in 7.2.2.

7.3.7. Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Architect/Engineer of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time.

7.3.8. A Construction Change Directive signed by the Contractor indicates the agreement of the Contractor therewith, including adjustment in Contract Sum and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order.

7.3.9. If the Contractor does not respond or disagrees with the method for adjustment in the Contract Sum in writing within seven (7) calendar days, the method and the adjustment made shall be determined by the Architect/Engineer on the basis of reasonable expenditures and/or savings of those performing the Work directly attributable to the change including, in the case of an increase in the Contract Sum, plus an allowance for overhead and profit as listed under Subparagraph 7.2.2. In such case, and also under Clause 7.3.4.3, the Contractor shall keep and present, in such form as the Architect/Engineer may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Subparagraph 7.3.9 shall be limited to the following:

7.3.9.1. costs of labor, including social security, old age and unemployment insurance, fringe benefits required by agreement or custom, and workers' compensation insurance as determined by the Prevailing Wage Schedules referenced in the Contract Documents;

7.3.9.2. costs of materials, supplies and equipment, including cost of transportation, whether incorporated or consumed;

7.3.9.3. rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;

- 7.3.9.4. costs of premiums for all bonds and insurance, permit fees, and sales, use or similar taxes related to the Work; and
- 7.3.9.5. additional costs of field supervision and field office personnel directly attributable to the change.

7.3.10. The amount of credit to be allowed by the Contractor to the Owner for a deletion or change which results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Architect/Engineer. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.

7.3.11. Pending final determination of the total cost of a Construction Change Directive to the Owner, amounts not in dispute for such changes in the Work shall be included in Applications for Payment accompanied by a Change Order indicating the parties' agreement with part or all of such costs. For any portion of such cost that remains in dispute, the Architect/Engineer will make an interim determination for purposes of monthly certification for payment for those costs. That determination of cost shall adjust the Contract Sum on the same basis as a Change Order, subject to the right of either party to disagree and assert a claim in accordance with Article 4.

7.3.12. When the Owner and Contractor agree with the determination made by the Architect/Engineer concerning the adjustments in the Contract Sum and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and shall be recorded by preparation and execution of an appropriate Change Order.

7.4. MINOR CHANGES IN THE WORK

7.4.1. The Architect/Engineer will have authority to order minor changes in the Work not involving adjustment in the Contract Sum or extension of the Contract Time and not inconsistent with the intent of the Contract Documents. Such changes shall be effected by written order and shall be binding on the Owner and Contractor. The Contractor shall carry out such written orders promptly.

8. ARTICLE 8 – TIME

8.1. DEFINITIONS

8.1.1. Time is of the essence in performance, coordination, and completion of the Work contemplated herein. The Owner may suffer damages if the Work is not completed as specified herein. When any duration or time period is referred to in the Contract Documents by days, the first day shall be determined as the day following the current day of any event or notice starting a specified duration.

8.1.2. Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work.

8.1.3. The date of commencement of the Work is the date established in the NOTICE TO PROCEED AS ISSUED BY THE OWNER.

8.1.4. The date the Contractor reaches Substantial Completion is the date certified by the Architect/Engineer in accordance with Paragraph 9.8.

8.1.5. The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

8.1.6. Liquidated Damages. The Owner may suffer loss if the project is not substantially complete on the date set forth in the contract documents. The Contractor and his surety shall be liable for and shall pay to the Owner the sums hereinafter stipulated as liquidated damages for each calendar day of delay until the work is substantially complete: **SEE INSTRUCTIONS TO BIDDERS.**

8.1.7. The Contractor shall not be charged liquidated or actual damages when delay in completion of the Work is due to:

8.1.7.1. Any preference, priority or allocation order issued by the government;

8.1.7.2. Unforeseeable cause beyond the control and without the fault or negligence of the Contractor, such as acts of God or of the public enemy, fires, floods, epidemics, quarantine restrictions, freight embargoes, and unusually severe weather. All such occurrences resulting in delay must be documented and approved by Change Order.

8.1.7.3. Any delays of Subcontractors or suppliers occasioned by any of the causes specified in 8.1.7.1 and 8.1.7.2 of this article.

8.1.7.4. The Contractor is completely obligated and responsible to provide written notice of each day of delay as provided for in Paragraph 4.3.

8.1.8. Contract Time. All work shall reach Substantial Completion by or within: **SEE INSTRUCTIONS TO BIDDERS.**

8.2. PROGRESS AND COMPLETION

8.2.1. Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Contract the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

8.2.2. The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, prematurely commence operations on the site or elsewhere prior to the date on the Notice to Proceed and in no case prior to the effective date of insurance required by Article 11 to be furnished by the Contractor. The date of commencement of the Work shall not be changed by the effective date of such insurance.

8.2.3. The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time.

8.2.4. If the Contractor falls behind the latest construction schedule by more than 14 calendar days through its own actions or inaction, neglect, inexperience, lack of oversight and management of the Work including that of any Subcontractors, written notice to the Owner and Architect/Engineer shall be provided within three (3) days with explanation of how the Contractor intends to get back on schedule. Response to getting back on schedule consists of providing a sufficient number of qualified workers and/or proper materials or an acceptably reorganized schedule to regain the lost time in a manner acceptable to the Owner.

8.3. DELAYS AND EXTENSIONS OF TIME

8.3.1. If the Contractor is delayed at any time in the commencement or progress of the Work by an act or neglect of the Owner or Architect/Engineer, or of an employee of either, or of a separate contractor employed by the Owner, or by changes ordered in the Work, or by fire, unusual delay in deliveries, unavoidable casualties or other causes beyond the Contractor's control, or by delay authorized by the Owner pending mediation and arbitration, or by other causes which the Architect/Engineer determines may justify delay, then the Contract Time shall be extended by Change Order for such reasonable time as the Architect/Engineer may determine.

8.3.2. Claims relating to time shall be made in accordance with applicable provisions of Paragraph 4.3.

8.3.3. This Paragraph 8.3 does not preclude recovery of damages for delay by either party under other provisions of the Contract Documents.

9. PAYMENTS AND COMPLETION

9.1. CONTRACT SUM

9.1.1. The Contract Sum is stated in the Contract and, including authorized adjustments, is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents.

9.2. SCHEDULE OF VALUES

9.2.1. Before the first Application for Payment, the Contractor shall submit to the Architect/Engineer a schedule of values allocated to various portions of the Work, prepared in such form and supported by such data to substantiate its accuracy as the Architect/Engineer may require. This schedule, unless objected to by the Architect/Engineer, shall be used as a basis for reviewing the Contractor's Applications for Payment.

9.3. APPLICATIONS FOR PAYMENT

9.3.1. The Contractor shall submit to the Architect/Engineer an itemized Application for Payment for operations completed in accordance with the Schedule of Values. Such application shall be signed and supported by such data substantiating the Contractor's right to payment as the Owner or Architect/Engineer may require, such as copies of requisitions from Subcontractors and material suppliers, and reflecting retainage if provided for in the Contract Documents.

9.3.2. NOTICE OF APPROVAL OF PAYMENT REQUEST PROVISION. Per Title 28, Chapter 2, Part 21, this contract allows the Owner to change the number of days to approve a Contractor's payment request. This contract allows the Owner to approve the Contractor's payment request within thirty-five (35) calendar days after it is received by the Owner without being subject to the accrual of interest.

9.3.3. As provided in Subparagraph 7.3.11, such applications may include requests for payment on account of changes in the Work which have been properly authorized by Construction Change Directives, or by interim determinations of the Architect/Engineer, but not yet included in Change Orders.

9.3.4. Applications for payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay to a Subcontractor or material supplier.

9.3.5. Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest, and shall include the costs of applicable insurance, storage and transportation to the site for such materials and equipment stored off the site.

9.3.6. The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor's knowledge, information and belief, be free and clear of liens, claims, security interests or encumbrances in favor of the Contractor, Subcontractors, material suppliers, or other persons or entities making a claim by reason of having provided labor, materials and equipment relating to the Work.

9.3.7. Until the work is complete, the Owner will pay 95% of the amount due the Contractor on account of progress payments.

9.3.7.1. If the Work and its progress are not in accordance with all or any part, piece, or portion of the Contract Documents, the Owner may, at its sole discretion and without claim by the Contractor, increase the amount held as retainage to whatever level deemed necessary to effectuate performance and progress of the Work, for anticipated repairs, warranties or completion of the Work by the Contractor or through the letting of other contracts. The Contractor will not be entitled to additional costs, expenses, fees, time, and such like, in the event the Owner increases the amount held as retainage due to non-compliance and/or non-performance with all or any part, piece, or portion of the Contract Documents.

9.3.7.2. Prior to the first application for payment, the Contractor shall submit the following information on the appropriate forms:

9.3.7.2.1. Schedule of Amounts for Contract Payment (Form 100): This form shall contain a breakdown of the labor, material and other costs associated with the various portions of the work and

shall be the basis for the progress payments to the Contractor. The use of electronic method shall be in the Owner's format.

9.3.7.2.2. Project/Progress Schedule: If no Schedule (or revised Schedule) is provided with each and every Periodic Estimates for Partial Payment, the Architect/Engineer and/or Owner may return the pay request, or hold it, and may choose not pay for any portion of the Work until the appropriate Schedule, indicating all changes, revisions and updates, is provided. No claim for additional costs or interests will be made by the Contractor or any subcontractor on account of holding or non-payment of the Periodic Estimate for Partial Payment request.

9.3.7.3. Progress Payments

9.3.7.3.1. Periodic Estimates for Partial Payment shall be on a form provided by the Owner (Form 101) and submitted to the Architect/Engineer for payment by the Owner. Payment shall be requested for the labor and material incorporated in the work to date and for materials suitably stored, less the aggregate of previous payments, the retainage, and the 1% gross receipts tax.

9.3.7.3.2. The Contractor, by submission of any partial pay request, certifies that every request for partial payment is correct, true and just in all respects and that payment or credit had not previously been received. The Contractor further warrants and certifies, by submission of any partial pay request, that all previous work for which payment has been received is free and clear of all liens, disputes, claims, security interests, encumbrances, or causes of action of any type or kind in favor of the Contractor, subcontractors, material suppliers or other persons or entities and does release the Owner from such.

9.3.7.3.3. Progress payments do not constitute official acceptance of any portion of the work or materials whether stored on or off-site.

9.3.7.3.4. In compliance with 15-50-206 MCA, the Contractor will have 1% of his gross receipts withheld by the Owner from all payments due. Each subcontractor who performs work greater than \$5,000 shall have 1% of its gross receipts withheld by the Contractor. The Contractor shall notify the Department of Revenue on the department's prescribed forms.

9.3.7.4. The Contractor may submit obligations/securities in a form specified in 18-1-301 Montana Code Annotated (MCA) to be held by a Financial Institution in lieu of retainage by the Owner. The Owner will establish the amount that would otherwise be held as retainage. Should the Contractor choose to submit obligations/securities in lieu of retainage, the Owner will require the Financial Institution to execute the Owner's "Account Agreement for Deposit of Obligations Other Than Retainage" (Form 120) prior to submission of any obligations/securities in accordance with 18-1-302 MCA. The Contractor must extend the opportunity to participate in all obligations/securities in lieu of retainage on a pro rata basis to all subcontractors involved in the project and shall be solely responsible for the management and administration of same. The Owner assumes no liability or responsibility from or to the Contractor or Subcontractors regarding the latter's participation.

9.3.7.5. The Contractor shall maintain a monthly billing cycle.

9.4. CERTIFICATES FOR PAYMENT

9.4.1. The Architect/Engineer will, within seven days after receipt of the Contractor's Application for Payment, either issue to the Owner a Certificate for Payment, with a copy to the Contractor, for such amount as the Architect/Engineer determines is properly due, or notify the Contractor and Owner in writing of the Architect/Engineer's reasons for withholding certification in whole or in part as provided in Subparagraph 9.5.1. For the purposes of this paragraph regarding certification of payment, electronic mail and/or notes provided through the use of an electronic approval system shall constitute written notice.

9.4.2. The issuance of a Certificate for Payment will constitute a representation by the Architect/Engineer to the Owner, based on the Architect/Engineer's evaluation of the Work and the data comprising the Application for Payment, that the Work has progressed to the point indicated and that, to the best of the Architect/Engineer's knowledge, information and belief, the quality of the Work is in accordance with the Contract Documents. The foregoing representations are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations

from the Contract Documents prior to completion and to specific qualifications expressed by the Architect/Engineer. The issuance of a Certificate for Payment will further constitute a representation that the Contractor is entitled to payment in the amount certified. However, the issuance of a Certificate for Payment will not be a representation that the Architect/Engineer has: (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work; (2) reviewed construction means, methods, techniques, sequences or procedures; (3) reviewed copies of requisitions received from Subcontractors and material suppliers and other data requested by the Owner to substantiate the Contractor's right to payment; or, (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

9.5. DECISIONS TO WITHHOLD CERTIFICATION

9.5.1. The Architect/Engineer may withhold or reject a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Architect/Engineer's opinion the representations to the Owner required by Subparagraph 9.4.2 cannot be made. If the Architect/Engineer is unable to certify payment in the amount of the Application, the Architect/Engineer will notify the Contractor and Owner as provided in Subparagraph 9.4.1. If the Contractor and Architect/Engineer cannot agree on a revised amount, the Architect/Engineer will promptly issue a Certificate for Payment for the amount for which the Architect/Engineer is able to make such representations to the Owner. The Architect/Engineer may also withhold a Certificate for Payment or, because of subsequently discovered evidence, may nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary in the Architect/Engineer's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from acts and omissions described in Subparagraph 3.3.4, because of:

- 9.5.1.1. defective Work not remedied;
- 9.5.1.2. third party claims filed or reasonable evidence indicating probable filing of such claims unless security acceptable to the Owner is provided by the Contractor;
- 9.5.1.3. failure of the Contractor to make payments properly to Subcontractors or for labor, materials or equipment;
- 9.5.1.4. reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
- 9.5.1.5. damage to the Owner or another contractor;
- 9.5.1.6. reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or,
- 9.5.1.7. persistent failure to carry out the Work in accordance with the Contract Documents.

9.5.2. When the above reasons for withholding certification are removed, certification will be made for amounts previously withheld.

9.5.3. Owner's Right to Refuse Payment: The Architect/Engineer's approval, or partial approval, of the Contractor's request for payment shall not preclude or prevent the Owner from exercising any of its remedies under this Contract. The Owner shall have right to refuse to make payment(s) to the Contractor due to:

- 9.5.3.1. the Contractor's failure to perform the Work in compliance with the Contract Documents;
- 9.5.3.2. the Contractor's failure to correct any defective or damaged Work;
- 9.5.3.3. the Contractor's failure to accurately represent the Work performed in the pay request;
- 9.5.3.4. the Contractor's performance of its Work at a rate or in a manner that, in the Owner's opinion, is likely to result in the Work, or any portion thereof, to be delayed;

- 9.5.3.5. the Contractor's failure to use funds previously paid to it by the Owner to pay for the Contractor's Work-related obligations including, but not limited to, subcontractors and suppliers on this Project;
- 9.5.3.6. claims made, or anticipated by the Owner to be made, against the Owner or its property;
- 9.5.3.7. inclusion in the pay request of any amounts in dispute or part of a claim;
- 9.5.3.8. Damage or loss caused by the Contractor, including its subcontractors and suppliers; or,
- 9.5.3.9. The Contractor's failure or refusal to perform its obligations to the Owner.

9.6. PROGRESS PAYMENTS

9.6.1. After the Architect/Engineer has issued a Certificate for Payment, the Owner shall make payment in the manner and within the time provided in the Contract Documents or the Owner may take any action the Owner deems necessary under Subparagraph 9.5.3.

9.6.2. The Contractor shall promptly pay each Subcontractor in accordance with Title 28, Chapter 2, Part 21, upon receipt of payment from the Owner, out of the amount paid to the Contractor on account of such Subcontractor's portion of the Work, the amount to which said Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of such Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner.

9.6.3. The Contractor is prohibited from holding higher amounts in retainage on any Subcontractor than the Owner is holding from the Contractor.

9.6.4. The Architect/Engineer will, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Architect/Engineer and Owner on account of portions of the Work done by such Subcontractor.

9.6.5. Neither the Owner nor Architect/Engineer shall have an obligation to pay, or to see to the payment of, money to a Subcontractor except as may otherwise be required by law.

9.6.6. Payment to material suppliers shall be treated in a manner similar to that provided in Subparagraphs 9.6.2, 9.6.3, 9.6.4, and 9.6.5.

9.6.7. A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.

9.6.8. Unless the Contractor provides the Owner with a payment bond in the full penal sum of the Contract Sum, payments received by the Contractor for Work properly performed by Subcontractors and suppliers shall be held by the Contractor for those Subcontractors or suppliers who performed Work or furnished materials, or both, under contract with the Contractor for which payment was made by the Owner. Nothing contained herein shall require money to be placed in a separate account and not commingled with money of the Contractor, shall create any fiduciary liability or tort liability on the part of the Contractor for breach of trust or shall entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.

9.7. FAILURE OF PAYMENT

9.7.1. If the Owner does not approve payment to the Contractor within thirty-five (35) calendar days after the receipt of a certified Application for Payment, then the Contractor may, upon seven additional days' written notice to the Owner and Architect/Engineer, suspend the Work until payment of the amount owing has been received. Nothing in the Subparagraph shall limit the Owner's rights and options as provided in Subparagraph 9.5.3. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shut-down, delay and start-up, plus interest as provided for in the Contract Documents.

9.8. SUBSTANTIAL COMPLETION

9.8.1. Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use.

9.8.2. When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Architect/Engineer a comprehensive list of items to be completed or corrected prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

9.8.3. Upon receipt of the Contractor's list, the Architect/Engineer will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect/Engineer's Inspection discloses any item, whether or not included on the Contractor's list, which is not sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect/Engineer. In such case, the Contractor shall then submit a request for another inspection by the Architect/Engineer to determine Substantial Completion.

9.8.4. The Contractor shall ensure the project is substantially complete prior to requesting any inspection by the Architect/Engineer so that no more than one (1) inspection is necessary to determine Substantial Completion for all or any portion of the Work. If the Contractor does not perform adequate inspections to develop a comprehensive list as required in Subparagraph 9.8.2 and does not complete or correct such items upon discovery or notification, the Contractor shall be responsible and pay for the costs of the Architect/Engineer's additional inspections to determine Substantial Completion.

9.8.5. When the Work or designated portion thereof is substantially complete, the Architect/Engineer will prepare a Certificate of Substantial Completion which shall establish the date of Substantial Completion and which shall establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance. After issuance of the Certificate of Substantial Completion, the Contractor shall finish and complete all remaining items within thirty (30) calendar days of the date on the Certificate. The Architect/Engineer shall identify and fix the time for completion of specific items which may be excluded from the thirty (30) calendar day time limit. Failure to complete any items within the specified time frames may be deemed by the Owner as default of the contract on the part of the Contractor.

9.8.6. The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in such Certificate. Upon such acceptance and consent of surety if there are claims or past payment issues, the Owner shall make payment of retainage applying to such Work or designated portion thereof. Such payment shall be adjusted for Work that is incomplete or not in accordance with the requirements of the Contract Documents.

9.9. PARTIAL OCCUPANCY OR USE

9.9.1. The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer and authorized by public authorities having jurisdiction over the Work. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage, if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor shall prepare and submit a list to the Architect/Engineer as provided under Subparagraph 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Architect/Engineer.

9.9.2. Immediately prior to such partial occupancy or use, the Owner, Contractor and Architect/Engineer shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work. Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

9.9.3. Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

9.10. FINAL COMPLETION AND FINAL PAYMENT

9.10.1. Upon receipt of written notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect/Engineer will promptly make such inspection and, when the Architect/Engineer finds the Work acceptable under the Contract Documents and the Contract fully performed, the Architect/Engineer will approve the Contractor's final Certificate for Payment stating that to the best of the Architect/Engineer's knowledge, information and belief, and on the basis of the Architect/Engineer's on-site visits and inspections, the Work has been completed in accordance with terms and conditions of the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Architect/Engineer's signature on the Contractor's final Certificate for Payment will constitute a further representation that conditions listed in Subparagraph 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

9.10.2. Neither final payment nor any remaining retainage shall become due until the Contractor submits to the Architect/Engineer:

9.10.2.1. completed Contractors Affidavit of Completion Payment of Debts and Claims, and Release of Liens (Form 106) that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied;

9.10.2.2. a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect and will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner;

9.10.2.3. a written statement that the Contractor knows of no substantial reason that the insurance will not be renewable to cover the period required by the Contract Documents

9.10.2.4. Consent of Surety (Form 103) to make final payment; and,

9.10.2.5. if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts, releases and waivers of liens, claims, security interests or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner.

9.10.3. The Contractor and his surety accepts and assumes responsibility, liability, and costs for and agrees to defend and hold harmless the Owner for and against any and all actions as a result of the Owner making final payment.

9.10.4. By submitting any Application for Payment to the Architect/Engineer the Contractor and his surety certify and declare that all bills for materials, supplies, utilities and for all other things furnished or caused to be furnished by the Contractor and all Subcontractors and used in the execution of the Contract will be fully paid upon receipt of Final Payment and that there are no unpaid obligations, liens, claims, security interests, encumbrances, liabilities and/or demands of State Agencies, subcontractors, suppliers, mechanics, laborers or any others resulting from or arising out of any work done, caused to be done or ordered to be done by the Contractor under the contract.

9.10.5. In consideration of the prior payments and the final payment made and all payments made for authorized changes, the Contractor releases and forever discharges the Owner from any and all obligations, liens, claims, security interests, encumbrances and/or liabilities arising by virtue of the contract and authorized changes between the parties, either verbal or in writing, and any and all claims and demands of every kind and character whatsoever against the Owner, arising out of or in any way relating to the contract and authorized changes.

9.10.6. The date of Final Payment by the Owner shall constitute Final Acceptance of the Work. The determining date for the expiration of the warranty period shall be as specified in Paragraphs 3.5 and 12.2.2.

9.10.7. If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Architect/Engineer so confirms, the Owner shall, upon application by the Contractor and certification by the Architect/Engineer, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect/Engineer prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of claims.

9.10.8. The making of final payment shall constitute a waiver of Claims by the Owner except those arising from:

9.10.8.1. liens, Claims, security interests or encumbrances arising out of the Contract and unsettled;

9.10.8.2. failure of the Work to comply with the requirements of the Contract Documents; or,

9.10.8.3. terms of special warranties required by the Contract Documents.

9.10.9. Acceptance of final payment by the Contractor, a Subcontractor, or material supplier, shall constitute a waiver of any and all obligations, liens, claims, security interests, encumbrances and/or liabilities against the Owner except those previously made in writing per the requirements of Paragraph 4.3 and as yet unsettled at the time of submission of the final Application for Payment.

9.10.10. The Owner's issuance of Final Payment does not constitute a waiver or release of any kind regarding any past, current, or future claim the Owner may have against the Contractor and/or the surety.

10. ARTICLE 10 – PROTECTION OF PERSONS AND PROPERTY

10.1. SAFETY

10.1.1. Importance of Safety. The Contractor and all Subcontractors (at any tier or level) recognize that safety is paramount at all times. The Contractor shall perform the work in a safe manner with the highest regard for safety of its employees and all other individuals and property at the work site. Contractor shall maintain its tools, equipment, and vehicles in a safe operating condition and take all other actions necessary to provide a safe working environment for performance of work required under this Contract. The Contractor is solely responsible for the means, methods, techniques, sequences and procedures for coordinating and constructing the Work, including all site safety, safety precautions, safety programs, and safety compliance with OSHA and all other governing bodies.

10.1.2. Particular Safeguards. (a) The Contractor shall erect and maintain, as required by Paragraphs 10.1.1 and 10.1.3, safeguards for safety and protection, including posting danger signs and other warnings against hazards, installing suitable barriers and lighting, promulgating safety regulations, and providing notification to all parties who may be impacted by the Contractor's operations. (b) When use or storage of explosives or other Hazardous Materials/Substances (defined below) or equipment are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel. (c) The Contractor shall not encumber or load or permit any part of the construction site to be encumbered or loaded so as to endanger the safety of any person(s).

10.1.3. Compliance with Safety Laws. Contractor represents and warrants to Owner that it knows and understands all federal, state and local safety statutes, rules, and regulations (Laws) related to the work under this Contract. Contractor shall comply with these Laws. Contractor shall keep all material data safety sheets on site and available at all times.

10.1.4. Remedy property damage. The Contractor shall promptly remedy damage and loss to property caused in whole or in part by the Contractor, a Subcontractor of any tier or level, or anyone employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Paragraph 3.18.

10.1.5. Designation of Safety Representative. Unless the Contractor designates, in writing to the Owner and the Architect/Engineer, another responsible member of the Contractor's organization as the Safety Representative, the Contractor's superintendent is the Safety Representative. The Safety Representative is defined as that member of the Contractor's organization responsible for all safety under this Contract.

10.1.6. Release/Indemnity of Owner and Architect/Engineer. The Contractor agrees that the Owner and Architect/Engineer are not responsible for safety at the work site and releases them from all obligations and liability regarding safety at the work site. The Contractor shall indemnify and defend the Owner and the Architect/Engineer against and from all claims, liabilities, fines, penalties, orders, causes of action, judgments, losses, costs and expenses (including but not limited to court costs and reasonable attorney fees), arising from injuries and death to any persons and damage to real and personal property arising from, in connection with, or incidental to Contractor's safety responsibilities under this Contract.

10.2. HAZARDOUS MATERIALS/SUBSTANCES

10.2.1. "Hazardous Materials/Substances" means any substance: (a) the presence of which requires investigation, or remediation under any federal, state or local statute, rule, regulation, ordinance, order, policy or common law; (b) that is or becomes defined as "hazardous waste," "hazardous substance," pollutant, or contaminant under any federal, state or local statute, rule, regulation, or ordinance or amendments thereto; (c) that is toxic, explosive, corrosive flammable, or otherwise hazardous and is or becomes regulated by any government authority, agency, board, commission or instrumentality of the United States, the state of Montana or any political subdivision thereof; (d) gasoline, diesel fuel or other petroleum hydrocarbons; (e) containing contains polychlorinated biphenyls (PCBs) or asbestos; or (f) the presence of which causes or threatens to cause a nuisance or trespass on the work site or adjacent property.

10.2.2. The Contractor is solely responsible for all compliance with all regulations, requirements, and procedures governing Hazardous Materials/Substances at the Work Site or that Contractor brings on the site. The Contractor is solely responsible for remediation, costs, damages, loss, and/or expenses for all Hazardous Materials/Substances brought to the site. The Contractor shall not and is strictly prohibited from purchasing and/or installing any asbestos-containing materials or products as part of the Work. Should the Contractor do so, the Contractor shall be solely responsible for the immediate remediation and all costs, damages, loss, and/or expenses per Paragraphs 10.1.6, 10.2.2, 10.2.3, and 10.2.4.

10.2.3. If the Contractor encounters Hazardous Materials/Substances during the course of the Work, whether or not identified in the Contract Documents, Work, the Contractor agrees that:

10.2.3.1. Encountering any Hazardous Materials/Substances during performance of the Work does not necessarily mean a change in conditions has occurred, nor is it evidence that the Contractor is due additional Contract Time or an increase in the Contract Sum. If encountering Hazardous Materials/Substances is determined to be a change in conditions to the Contract Documents, Paragraph 4.3 and Article 7 apply in determining any additional compensation or extension of time claimed by the Contractor.

10.2.3.2. The Contractor is solely responsible for securing the Work in accordance with this Article 10 involving any Hazardous Materials/Substances against unlawful, unregulated, or improper intrusion, disturbance, or removal. The Contractor shall implement protections and take protective actions throughout the performance of the Work to prevent exposure to workers, occupants, and contamination of the site or area.

10.2.3.3. If the Contractor is unable to or fails to properly secure the Work against unlawful, unregulated, or improper intrusion, disturbance, or removal of Hazardous Materials/Substances, the Contractor shall immediately implement protections and take protective actions, up to and including stopping Work in the area or on the item affected, to prevent exposure to workers, occupants, and contamination of the site or area. The Contractor shall immediately notify the Owner and Architect in writing giving details of the failure and the corrective actions taken. If the condition is an emergency and notice cannot be provided in writing, then Contractor shall orally and immediately notify the Owner and Architect/Engineer of the condition followed by a full written explanation. In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury or loss.

10.2.3.4. If the Contractor notifies the Owner and takes precautions in accordance with this Article 10 upon encountering materials/substances suspected of containing asbestos or polychlorinated biphenyls that

are unidentified in the Contract Documents, the Owner shall verify if the unidentified material or substance contains asbestos or polychlorinated biphenyls and shall arrange for the removal or other measures as necessary to allow the Contractor to proceed with the Work. The Contract Time may be extended as appropriate if the Work affected is on the critical path and the Contract Sum shall be increased in the amount of the Contractor's reasonable additional costs as provided in Article 7. Should the Contractor fail to notify the Owner upon encountering asbestos, polychlorinated biphenyls, or materials/substances suspected of containing asbestos or polychlorinated biphenyls, that are unidentified in the Contract Documents, the Contractor is solely responsible for all mitigation in accordance with Paragraphs 10.1.6, 10.2.2, 10.2.3, and 10.2.4.

10.2.4. The Contractor shall indemnify, hold harmless, and defend the Owner from and against all claims, liabilities, fines, penalties, orders, causes of action, judgments, losses, costs and expenses, including but not limited to court costs and reasonable attorneys' fees, arising from, in connection with, or incidental to the Contractor's handling, disposal, encountering, or release of Hazardous Materials/Substances.

10.3. UTILITIES

10.3.1. Underground Utilities: Buried utilities, including, but not limited to, electricity, gas, steam, air, water, telephone, sewer, irrigation, broadband coaxial computer cable, and fiber optic cables are very vulnerable and damage could result in loss of service. The telephone, broadband and fiber optic cables are especially sensitive and the slightest damage to these components will result in disruption of the operations of the campus.

10.3.2. "One Call" must be notified by phone and in writing at least 72 hours (3 business days) prior to digging to arrange and assist in the location of buried utilities in the field. (Dial 811). The Contractor shall mark the boundary of the work area. The boundary area shall be indicated with white paint and white flags. In winter, pink paint and flags will be accepted.

10.3.3. After buried utilities have been located, the Contractor shall be responsible for any utilities damaged while digging. Such responsibility shall include all necessary care including hand digging. Contractor's responsibility shall also include maintaining markings after initial locate. The area for such responsibility, unless otherwise indicated, shall extend 24 inches to either side of the marked center line of a buried utility line.

10.3.4. The Contractor's responsibility shall include repair or replacement of damaged utilities. The Contractor will also be responsible for all costs associated with reterminations and recertification.

10.3.5. Any buried utilities exposed by the operations of the Contractor shall be marked on the plans and adequately protected by the Contractor. If any buried utilities not located are exposed, the Contractor shall immediately contact the Owner and the Architect/Engineer. If, after exposing an unlocated buried utility, the Contractor continues digging without notifying Owner and Architect/Engineer and further damages the utility, the Contractor will be fully and solely responsible.

10.3.6. Damage to irrigation systems during seasons of no irrigation that are not immediately and adequately repaired and tested will require the Contractor to return when the system is in service to complete the repair.

10.3.7. In the event of a planned interruption of any existing utility service, the Contractor shall make arrangements with Owner at least 72 hours (3 business days) in advance. Shutdowns of the broadband or fiber optic cables will normally require 5 working days' notice to the Owner. The Contractor shall bear all costs associated with the interruptions and restorations of service.

11. ARTICLE 11 - INSURANCE AND BONDS

11.1. CONTRACTOR'S LIABILITY INSURANCE

11.1.1. The Contractor shall purchase from and maintain in a company or companies lawfully authorized to do business in the State of Montana with a rating no less than "A-", such insurance as will protect the Contractor from claims set forth below which may arise out of or result from the Contractor's operations under the Contract and for which the Contractor may be legally liable, whether such operations be by the Contractor or by a Subcontractor or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable:

11.1.1.1. claims under workers' compensation, disability benefit and other similar employee benefit acts which are applicable to the Work to be performed;

11.1.1.2. claims for damages because of bodily injury, occupational sickness or disease, or death of the Contractor's employees;

11.1.1.3. claims for damages because of bodily injury, sickness or disease, or death of any person other than the Contractor's employees;

11.1.1.4. claims for damages insured by usual personal injury liability coverage;

11.1.1.5. claims for damages, other than to the Work itself, because of injury to or destruction of tangible property, including loss of use resulting there from;

11.1.1.6. claims for damages because of bodily injury, death of a person or property damage arising out of ownership, maintenance or use of a motor vehicle;

11.1.1.7. claims for bodily injury or property damage arising out of completed operations; and,

11.1.1.8. claims involving contractual liability insurance applicable to the Contractor's obligations under Paragraph 3.18.

11.1.2. The insurance required by Subparagraph 11.1.1 shall be written for not less than limits of liability specified in the Contract Documents or required by law, whichever coverage is greater. Coverages, whether written on an occurrence or claims-made basis, shall be maintained without interruption from date of commencement of the Work until termination of any coverage required to be maintained after final payment.

11.1.3. Certificates of insurance acceptable to the Owner shall be filed with the Owner prior to commencement of the Work. These certificates and the insurance policies required by this Paragraph 11.1 shall contain a provision that coverages afforded under the policies will not be canceled or allowed to expire at any time prior to Final Acceptance and then not until at least 30 days' prior written notice has been given to the Owner. If any of the foregoing insurance coverages are required to remain in force after final payment, an additional certificate evidencing continuation of such coverage shall be submitted with the final Application for Payment as required by Subparagraph 9.10.2. Information concerning reduction of coverage on account of revised limits or claims paid under the General Aggregate, or both, shall be furnished by the Contractor with reasonable promptness in accordance with the Contractor's information and belief.

11.1.4. At the request of the Owner, the Contractor shall provide copies of all insurance policies to the Owner.

11.2. INSURANCE, GENERAL REQUIREMENTS

11.2.1. The Contractor shall maintain for the duration of the contract, at its cost and expense, insurance against claims for injuries to persons or damages to property, including contractual liability, which may arise from or in connection with the performance of the Work by the Contractor, its agents, employees, representatives, assigns, or subcontractors. The Contractor is responsible for all deductibles regardless of policy or level of coverage. The Owner reserves the right to demand, and the Contractor agrees to provide, copies of any and all policies at any time.

11.2.2. Hold Harmless and Indemnification: The Contractor shall protect, defend, and save the state, its elected and appointed officials, agents, and employees, while acting within the scope of their duties as such, harmless from and against all claims, liabilities, demands, causes of action, and judgments whatsoever (including the cost of defense and reasonable attorney fees): 1) arising in favor of or asserted by third parties on account of damage to property, personal injury, or death which injury, death, or damage; or, 2) arising out of or resulting from performance or failure to perform, or omissions of services, or in any way results from the negligent acts or omissions of the Contractor, its agents, agents, or subcontractors.

11.2.3. Contractor's Insurance: insurance required under all sections herein shall be in effect for the duration of the contract that extends through the warranty period. Insurance required herein shall be provided by insurance policies issued only by insurance companies currently authorized to do business in the state of Montana. No

Contractor or Sub-contractor shall commence any Work under this contract until all required insurance has been obtained. During the term of this contract, the Contractor shall, not less than thirty days prior to the expiration date of any policy for which a certificate of insurance is required, deliver to the Owner a certificate of insurance with respect to the renewal insurance policy. The Contractor shall furnish one copy of insurance certificates of insurance herein required, which shall specifically set forth evidence of all coverage required by these contract documents and which shall be signed by authorized representatives of the insurance company or companies evidencing that insurance as required herein is in force and will not be canceled, limited or restricted without thirty days' written notice by certified mail to the contractor and the Owner. The Contractor shall furnish to the Owner copies of any endorsements that are subsequently issued amending coverage or limits. Additionally, all certificates shall include the project name and A/E project number.

11.2.4. Certificates of Insurance and Endorsements. All certificates of insurance and the additional insured endorsements are to be received by the state prior to issuance of the Notice to Proceed. The contractor is responsible to ensure that all policies and coverages contain the necessary endorsements for the State being listed as an additional insured. The state reserves the right to require complete copies of all insurance policies at any time to verify coverage. The contractor shall notify the state within 30 days of any material change in coverage.

11.3. WORKERS' COMPENSATION INSURANCE

11.3.1. The Contractor shall carry **Workers' Compensation Insurance**. Such Workers' Compensation Insurance shall protect the Contractor from claims made by his own employees, the employees of any Sub-contractor, and also claims made by anyone directly or indirectly employed by the Contractor or Sub-contractor. The Contractor shall require each Sub-contractor similarly to provide Workers' Compensation Insurance.

11.4. COMMERCIAL GENERAL LIABILITY INSURANCE

11.4.1. Each Contractor shall carry per occurrence coverage **Commercial General Liability Insurance** including coverage for premises; operations; independent contractor's protective; products and completed operations; products and materials stored off-site; broad form property damage and comprehensive automobile liability insurance with not less than the following limits of liability:

11.4.1.1. **\$1,000,000 per occurrence; aggregate limit of \$2,000,000;**

11.4.1.2. The **Commercial General and Automobile Liability Insurance** shall provide coverage for both bodily injury, including accidental death, sickness, disease, occupational sickness or disease, personal injury liability coverage and property damage which may arise out of the work under this contract, or operations incidental thereto, whether such work and operations be by the Contractor or by any Subcontractor or by anyone directly or indirectly employed by the Contractor or by Sub-contractor, or by anyone for whose acts any of them may be liable. The Contractor shall maintain the liability insurance required herein for a period of not less than one year after final payment or anytime the Contractor goes on to the location of the project.

11.4.1.3. The Contractor's liability insurance policies shall list the STATE OF MONTANA as an additional insured. **AN ADDITIONAL INSURED ENDORSEMENT DOCUMENT SHALL BE SUBMITTED WITH THE CERTIFICATES OF INSURANCE.** The STATE OF MONTANA includes its officers, elected and appointed officials, employees and volunteers and political subdivisions thereof. Should the Contractor not be able to list the state as an additional insured, the Contractor shall purchase a per occurrence Owner's/Contractor's Protective Policy (OCP) with the STATE OF MONTANA as the insured party in the same occurrence and aggregate limits as that indicated above for the Contractor's Commercial General Liability Policy.

11.4.1.4. Property damage liability insurance shall be written without any exclusion for injury to or destruction of any building, structure, wires, conduits, pipes, or other property above or below the surface of the ground arising out of the blasting, explosion, pile driving, excavation, filling, grading or from the moving, shoring, underpinning, raising, or demolition of any building or structure or structural support thereof.

11.4.1.5. The Contractor's insurance coverage shall be PRIMARY insurance as respects the State, its officers, elected and appointed officials, employees and volunteers. Any insurance or self-insurance maintained by the state, its officers, elected and appointed officials, employees and volunteers shall be excess

of the Contractor's insurance and shall not contribute to it. NO WAIVERS OF SUBROGATION OR ENDORSEMENTS LIMITING, TRANSFERRING, OR OTHERWISE INDEMNIFYING LIABLE OR RESPONSIBLE PARTIES OF THE CONTRACTOR OR ANY SUBCONTRACTOR WILL BE ACCEPTED.

11.5. PROPERTY INSURANCE (ALL RISK)

11.5.1. New Construction (for projects involving new construction): At its sole cost and expense, the contractor shall keep the building and all other improvements on the premises insured throughout the term of the agreement against the following hazards:

11.5.1.1. Loss or damage by fire and such other risks (including earthquake damage for those areas with a shaking level at 10g or above as indicated on the seismic map, <http://rmt.d.mt.gov/content/aboutus/publications/files/NEHRP.pdf>) in an amount sufficient to permit such insurance to be written at all times on a replacement cost basis. This may be insured against by attachment of standard form extended coverage endorsement to fire insurance policies. Certificates of Insurance MUST indicate earthquake coverage if coverage is required per the above referenced map.

11.5.1.2. Loss or damage from leakage or sprinkler systems now or hereafter installed in any building on the premises.

11.5.1.3. Loss or damage by explosion of steam boilers, pressure vessels, and oil or gasoline storage tanks, or similar apparatus now or hereafter installed in a building or buildings on the premises.

11.5.2. Building Renovation (for projects involving building renovation or remodeling)

11.5.2.1. The contractor shall purchase and maintain Builder's Risk/Installation insurance on a "special causes of loss" form (so called "all risk") for the cost of the work and any subsequent modifications and change orders. The contractor is not responsible for insuring the existing structure for Builder's Risk/Installation insurance.

11.5.2.2. At its sole cost and expense, the contractor shall insure all property construction on the premises throughout the term of the agreement against the following hazards:

11.5.2.2.1. Loss or damage by fire and such other risks (including earthquake damage for those areas with a shaking level at 10g or above as indicated on the seismic map at <http://rmt.d.mt.gov/content/aboutus/publications/files/NEHRP.pdf>) in an amount sufficient to permit such insurance to be written at all times on a replacement cost basis. This may be insured against by attachment of standard form extended coverage endorsement to fire policies. Certificates of Insurance MUST indicate earthquake coverage if coverage is required per the above referenced map.

11.5.2.2.2. Loss or damage from leakage or sprinkler systems now or hereafter installed in any building on the premises.

11.5.2.2.3. Loss or damage by explosion of steam boilers, pressure vessels, oil or gasoline storage tanks, or similar apparatus now or hereafter installed in a building or buildings on the premises.

11.6. ASBESTOS ABATEMENT INSURANCE

11.6.1. If Asbestos Abatement is identified as part of the Work under this contract, the Contractor or any subcontractor involved in asbestos abatement shall purchase and maintain **Asbestos Liability Insurance** for coverage of bodily injury, sickness, disease, death, damages, claims, errors or omissions regarding the asbestos portion of the work *in addition to* the CGL Insurance by reason of any negligence in part or in whole, error or omission committed or alleged to have been committed by the Contractor or anyone for whom the Contractor is legally liable.

11.6.2. Such insurance shall be in "per occurrence" form and shall clearly state on the certificate that asbestos work is included in the following limits:

11.6.2.1. **\$1,000,000 per occurrence; aggregate limit of \$2,000,000.**

11.6.3. Asbestos Liability Insurance as carried by the asbestos abatement subcontractor in these limits in lieu of the Contractor's coverage is acceptable provided the Contractor and the State of Montana are named as additional insureds and that the abatement subcontractor's insurance is PRIMARY as respects both the Owner and the Contractor. If the Contractor or any other subcontractor encounters asbestos, all operations shall be suspended until abatement with the associated air monitoring clearances are accomplished. The certificate of coverage shall be provided by the asbestos abatement subcontractor to both the Contractor and the Owner.

**11.7. PERFORMANCE BOND AND LABOR & MATERIAL PAYMENT BOND
(BOTH ARE REQUIRED ON THIS PROJECT)**

11.7.1. The Contract shall furnish a Performance Bond in the amount of 100% of the contract price as security for the faithful performance of his contract (18-2-201 MCA). The Contractor shall also furnish a Labor and Material Payment Bond in the amount of 100% of the contract price as security for the payment of all persons performing labor and furnishing materials in connection therewith (18-2-201MCA). The bonds shall be executed on forms furnished by the Owner and no other forms or endorsements will be acceptable. The bonds shall be signed in compliance with state statutes (33-17-1111 MCA). Bonds shall be secured from a state licensed bonding company. Power of Attorney is required with each bond. Attorneys-in-fact who sign contract bonds must file with each bond a certified and effectively dated copy of their power of attorney:

11.7.1.1. one original copy shall be furnished with each set of bonds.

11.7.1.2. Others furnished with a set of bonds may be copies of that original.

11.7.2. The Owner reserves the right at any time during the performance of Work to require bonding of Subcontractors provided by the General Contractor. Should this occur, the Owner will cover the direct cost. This shall not be construed as to in any way affect the relationship between the General Contractor and his Subcontractors.

11.7.3. Surety must have an endorsement stating that their guarantee of Contractor's performance automatically covers the additional contract time added to a Contractor's contract by Change Order.

11.7.4. A change in the Contractor's organization shall not constitute grounds for Surety to claim a discharge of their liability and requires an endorsement from Surety so stating.

11.7.5. Except as noted below, the Contractor is required to notify Surety of any increase in the contract amount resulting from a Change Order within 48 hours of signing and submitting a Change Order and shall submit a copy of Surety's written acknowledgment and consent to Owner before a Change Order can be approved. The Surety's written acknowledgment and consent on the Change Order form shall also satisfy this consent requirement.

11.7.5.1. Surety consent shall not be required on Change Order(s) which, in the aggregate total amount of all Changes Orders, increase the original contract amount by less than 10%. However, the Contractor is still required to notify Surety of any increase in contract amount resulting from a Change Order(s) within 48 hours of signing and submitting every Change Order.

11.7.5.2. Surety is fully obligated to the Owner for the full contract amount, inclusive of all Change Orders, regardless of whether or not written acknowledgement and consent is received and regardless of whether or not the aggregate total of all Change Orders is more or less than 10% of the original contract amount.

11.7.5.3. A fax with hard copy to follow of Surety's written acknowledgment and consent is acceptable. If hard copy is not received by Owner before Application for Payment on any portion or all of said Change Order, it will not be accepted by Owner for payment.

11.7.6. The Surety must take action within 30 days of notice of default on the part of the Contractor or of any claim on bonds made by the Owner or any Subcontractor or supplier.

12. ARTICLE 12 - UNCOVERING AND CORRECTION OF WORK

12.1. UNCOVERING OF WORK

12.1.1. If a portion of the Work is covered contrary to the Architect/Engineer's request or to requirements specifically expressed in the Contract Documents, it must, if required in writing by the Architect/Engineer, be uncovered for the Architect/Engineer's examination and be replaced at the Contractor's expense without change in the Contract Time.

12.1.2. If a portion of the Work has been covered which the Architect/Engineer has not specifically requested to examine prior to it being covered, the Architect/Engineer may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, costs of uncovering and replacement shall, by appropriate Change Order, be at the Owner's expense. If such Work is not in accordance with the Contract Documents, correction shall be at the Contractor's expense unless the condition was caused by the Owner or a separate contractor in which event the Owner shall be responsible for payment of such costs.

12.2. CORRECTION OF WORK

12.2.1. BEFORE OR AFTER SUBSTANTIAL COMPLETION

12.2.1.1. The Contractor shall promptly correct Work that fails to conform to the requirements of the Contract Documents or that is rejected by the Architect/Engineer, whether discovered before or after Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections and compensation for the Architect/Engineer's services and expenses made necessary thereby, shall be at the Contractor's expense. The Contractor is responsible to discover and correct all defective work and shall not rely upon the Architect/Engineer's or Owner's observations.

12.2.1.2. Rejection and Correction of Work in Progress. During the course of the Work, the Contractor shall inspect and promptly reject any Work that:

12.2.1.2.1. does not conform to the Construction Documents; or,

12.2.1.2.2. does not comply with any applicable law, statute, building code, rule or regulation of any governmental, public and quasi-public authorities, and agencies having jurisdiction over the Project.

12.2.1.3. The Contractor shall promptly correct or require the correction of all rejected Work, whether observed before or after Substantial Completion. The Contractor shall bear all costs of correcting such Work, including additional testing, inspections, and compensation for all services and expenses necessitated by such corrective action.

12.2.2. AFTER SUBSTANTIAL COMPLETION AND AFTER FINAL ACCEPTANCE

12.2.2.1. In addition to the Contractor's obligations under Paragraph 3.5, if, within one year after the date of Final Acceptance of the Work or designated portion thereof or after the date for commencement of warranties, or by terms of an applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of written notice from the Owner to do so unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Architect/Engineer, the Owner may correct it in accordance with Paragraph 2.3.

12.2.2.1.1. The Contractor shall remedy any and all deficiencies due to faulty materials or workmanship and pay for any damage to other work resulting there from, which shall appear within the period of Substantial Completion through one (1) year from the date of Final Acceptance in accordance with the terms and conditions of the Contract and with any special guarantees or warranties provided in the Contract Documents. The Owner shall give notice of observed deficiencies with reasonable

promptness. All questions, claims or disputes arising under this Article shall be decided by the Architect/Engineer. All manufacturer, product and supplier warranties are in addition to this Contractor warranty.

12.2.2.1.2. The Contractor shall respond within seven (7) days after notice of observed deficiencies has been given and he shall proceed to immediately remedy these deficiencies.

12.2.2.1.3. Should the Contractor fail to respond to the notice or not remedy those deficiencies; the Owner shall have this work corrected at the expense of the Contractor.

12.2.2.1.4. Latent defects shall be in addition to those identified above and shall be the responsibility of the Contractor per the statute of limitations for a written contract (27-2-208 MCA) starting from the date of Final Acceptance.

12.2.2.2. The one-year period for correction of Work shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual performance of the Work.

12.2.2.3. The one-year period for correction of Work shall not be extended by corrective Work performed by the Contractor pursuant to this Paragraph 12.2.

12.2.3. The Contractor shall remove from the site portions of the Work which are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

12.2.4. The Contractor shall bear the cost of correcting destroyed or damaged construction, whether completed or partially completed, of the Owner or separate contractors caused by the Contractor's correction or removal of Work which is not in accordance with the requirements of the Contract Documents.

12.2.5. Nothing contained in this Paragraph 12.2 shall be construed to establish a period of limitation with respect to other obligations which the Contractor might have under the Contract Documents. Establishment of the one-year period for correction of Work as described in Subparagraph 12.2.2 relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

12.3. ACCEPTANCE OF NONCONFORMING WORK

12.3.1. If the Owner prefers to accept Work which is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.

13. ARTICLE 13 - MISCELLANEOUS PROVISIONS

13.1. GOVERNING LAW

13.1.1. The Contract shall be governed by the laws of the State of Montana and venue for all legal proceedings shall be the First Judicial District, Lewis & Clark County.

13.2. SUCCESSORS AND ASSIGNS

13.2.1. The Owner and Contractor respectively bind themselves, their partners, successors, assigns and legal representatives to the other party hereto and to partners, successors, assigns and legal representatives of such other party in respect to covenants, agreements and obligations contained in the Contract Documents. Neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempt to make such assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

13.3. WRITTEN NOTICE

13.3.1. Written notice shall be deemed to have been duly served if delivered in person to the individual or a member of the firm or entity or to an officer of the corporation for which it was intended, or if delivered at or sent by registered or certified mail to the last business address known to the party giving notice.

13.4. RIGHTS AND REMEDIES

13.4.1. Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights and remedies otherwise imposed or available by law.

13.4.2. No action or failure to act by the Owner, Architect/Engineer or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach thereunder, except as may be specifically agreed in writing.

13.5. TESTS AND INSPECTIONS

13.5.1. Tests, inspections and approvals of portions of the Work required by the Contract Documents or by laws, ordinances, rules, regulations or orders of public authorities having jurisdiction shall be made at an appropriate time. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections and approvals. The Contractor shall give the Architect/Engineer timely notice of when and where tests and inspections are to be made so that the Architect/Engineer may be present for such procedures. The Owner shall bear costs of tests, inspections or approvals which do not become requirements until after bids are received or negotiations concluded.

13.5.2. If the Architect/Engineer, Owner or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection or approval not included under Subparagraph 13.5.1, the Architect/Engineer will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection or approval by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Architect/Engineer of when and where tests and inspections are to be made so that the Architect/Engineer may be present for such procedures. Such costs, except as provided in Subparagraph 13.5.3 shall be at the Owner's expense.

13.5.3. If such procedures for testing, inspection or approval under Subparagraphs 13.5.1 and 13.5.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure including those of repeated procedures and compensation for the Architect/Engineer's services and expenses shall be at the Contractor's expense.

13.5.4. Required certificates of testing, inspection or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Architect/Engineer.

13.5.5. If the Architect/Engineer is to observe tests, inspections or approvals required by the Contract Documents, the Architect/Engineer will do so promptly and, where practicable, at the normal place of testing.

13.5.6. Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

13.6. INTEREST

13.6.1. Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at such rate as the parties may agree upon in writing or, in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.

13.7. COMMENCEMENT OF STATUTORY LIMITATION PERIOD

13.7.1. As between the Owner and Contractor:

13.7.1.1. **Before Substantial Completion.** As to acts or failures to act occurring prior to the relevant date of Substantial Completion, any applicable statute of limitations shall commence to run and any alleged cause of action shall be deemed to have accrued in any and all events not later than such date of Substantial Completion;

13.7.1.2. **Between Substantial Completion and Final Certificate for Payment.** As to acts or failures to act occurring subsequent to the relevant date of Substantial Completion and prior to issuance of the final Certificate for Payment, any applicable statute of limitations shall commence to run and any alleged cause of action shall be deemed to have accrued in any and all events not later than the date of issuance of the final Certificate for Payment; and,

13.7.1.3. **After Final Payment.** As to acts or failures to act occurring after the relevant date of issuance of the final Certificate for Payment, any applicable statute of limitations shall commence to run and any alleged cause of action shall be deemed to have accrued in any and all events not later than the date of any act or failure to act by the Contractor pursuant to any Warranty provided under Paragraph 3.5, the date of any correction of the Work or failure to correct the Work by the Contractor under Paragraph 12.2, or the date of actual commission of any other act or failure to perform any duty or obligation by the Contractor or Owner, whichever occurs last.

13.8. PAYROLL AND BASIC RECORDS

13.8.1. Payrolls and basic records pertaining to the project shall be kept on a generally recognized accounting basis and shall be available to the Owner, Legislative Auditor, the Legislative Fiscal Analyst or his authorized representative at mutually convenient times. Accounting records shall be kept by the Contractor for a period of three years after the date of the Owner's Final Acceptance of the Project.

14. ARTICLE 14 – TERMINATION OR SUSPENSION OF THE CONTRACT

14.1. TERMINATION BY THE CONTRACTOR

14.1.1. The Contractor may terminate the Contract if the Work is stopped for a period of 30 consecutive days through no act or fault of the Contractor or a Subcontractor, Sub-subcontractor or their agents or employees or any other persons or entities performing portions of the Work under direct or indirect contract with the Contractor, for any of the following reasons:

14.1.1.1. issuance of an order of a court or other public authority having jurisdiction which requires all Work to be stopped; or,

14.1.1.2. an act of government, such as a declaration of national emergency which requires all Work to be stopped.

14.1.2. The Contractor may terminate the Contract if, through no act or fault of the Contractor or a Subcontractor, Sub-subcontractor or their agents or employees or any other persons or entities performing portions of the Work under direct or indirect contract with the Contractor, repeated suspensions, delays or interruptions of the entire Work by the Owner as described in Paragraph 14.3 constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less.

14.1.3. If one of the reasons described in Subparagraph 14.1.1 or 14.1.2 exists, the Contractor may, upon seven days' written notice to the Owner and Architect/Engineer, terminate the Contract and 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 and profit but not damages.

14.1.4. If the Work is stopped for a period of 60 consecutive days through no act or fault of the Contractor or a Subcontractor or their agents or employees or any other persons performing portions of the Work under contract with the Contractor because the Owner has persistently failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven additional days' written notice to the Owner and the Architect/Engineer, terminate the Contract and recover from the Owner as provided in Subparagraph 14.1.3.

14.2. TERMINATION BY THE OWNER FOR CAUSE

14.2.1. The Owner may terminate the Contract if the Contractor:

- 14.2.1.1. persistently or repeatedly refuses or fails to supply enough properly skilled workers or proper materials;
- 14.2.1.2. fails to make payment to Subcontractors for materials or labor in accordance with the respective agreements between the Contractor and the Subcontractors;
- 14.2.1.3. persistently disregards laws, ordinances, or rules, regulations or orders of a public authority having jurisdiction; or,
- 14.2.1.4. otherwise is guilty of any breach of a provision of the Contract Documents.

14.2.2. When any of the above reasons exist, the Owner, upon certification by the Architect/Engineer that sufficient cause exists to justify such action, may without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven days' written notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

- 14.2.2.1. take possession of the site and of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;
- 14.2.2.2. accept assignment of subcontracts pursuant to Paragraph 5.4; and,
- 14.2.2.3. finish the Work by whatever reasonable method the Owner may deem expedient. Upon request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

14.2.3. When the Owner terminates the Contract for one of the reasons stated in Subparagraph 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

14.2.4. If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Architect/Engineer's services and expenses made necessary thereby, and other damages incurred by the Owner and not expressly waived, such excess shall be paid to the Contractor. If such costs and damages exceed the unpaid balance, the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall be certified by the Architect/Engineer, upon application, and this obligation for payment shall survive termination of the Contract.

14.3. SUSPENSION BY THE OWNER FOR CONVENIENCE

14.3.1. The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work in whole or in part for such period of time as the Owner may determine.

14.3.2. The Contract Sum and Contract Time shall be adjusted for increases in the cost and time caused by suspension, delay or interruption as described in Subparagraph 14.3.1. Adjustment of the Contract Sum shall include profit. No adjustment shall be made to the extent:

- 14.3.2.1. that performance is, was or would have been so suspended, delayed or interrupted by another cause for which the Contractor is responsible; or,
- 14.3.2.2. that an equitable adjustment is made or denied under another provision of the Contract.

14.4. TERMINATION BY THE OWNER FOR CONVENIENCE

14.4.1. The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause.

14.4.2. Upon receipt of written notice from the Owner of such termination for the Owner's convenience, the Contractor shall:

14.4.2.1. cease operations as directed by the Owner in the notice;

14.4.2.2. take actions necessary, or that the Owner may direct, for the protection and preservation of the Work, and;

14.4.2.3. except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

14.4.3. In case of such termination for the Owner's convenience, the Contractor shall be entitled to receive payment for Work executed, and costs incurred by reason of such termination, along with reasonable overhead and profit on the Work not executed. The Contractor shall provide a full and complete itemized accounting of all costs.

15. EQUAL OPPORTUNITY

15.1. The Contractor and all Sub-contractors shall not discriminate against any employee or applicant for employment because of race, color, sex, pregnancy, childbirth or medical conditions related to pregnancy or childbirth, political or religious affiliation or ideas, culture, creed, social origin or condition, genetic information, sexual orientation, gender identity or expression, national origin, ancestry, age, disability, military service or veteran status, or marital status, or physical or mental disability and shall comply with all Federal and State laws concerning fair labor standards and hiring practices. The Contractor shall ensure that applicants are employed, and that employees are treated during employment, without regard to race, color, sex, pregnancy, childbirth or medical conditions related to pregnancy or childbirth, political or religious affiliation or ideas, culture, creed, social origin or condition, genetic information, sexual orientation, gender identity or expression, national origin, ancestry, age, disability, military service or veteran status, or marital status, or physical or mental disability.

15.2. 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.

15.3. The Contractor and all Sub-contractors 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, color, sex, pregnancy, childbirth or medical conditions related to pregnancy or childbirth, political or religious affiliation or ideas, culture, creed, social origin or condition, genetic information, sexual orientation, gender identity or expression, national origin, ancestry, age, disability, military service or veteran status, or marital status, or physical or mental disability..

[END OF GENERAL CONDITIONS]

SUPPLEMENTAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION

(REVISED MARCH 1, 2016)

FOR STATE OF MONTANA GENERAL CONDITIONS

ARTICLE 1 – GENERAL PROVISIONS

1.1 BASIC DEFINITIONS

1.1.3 SPECIFICATIONS

1.1.3.1 ADD: “Approved”: When used to convey Architect’s/Engineer’s action on Contractor’s submittals, applications, and requests, “approved” is limited to Architect’s/Engineer’s duties and responsibilities as stated in the Conditions of the Contract.

1.1.3.2 ADD: “Directed”: A command or instruction by Architect/Engineer. Other terms including “requested,” “authorized,” “selected,” “required,” and “permitted” have the same meaning as “directed.”

1.1.3.3 ADD: “Indicated”: Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including “shown,” “noted,” “scheduled,” and “specified” have the same meaning as “indicated.”

1.1.3.4 ADD: “Regulations”: Laws ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

1.1.3.5 ADD: “Furnish”: Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

1.1.3.6 ADD: “Install”: Operations at Project site including unloading, temporarily shoring, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

1.1.3.7 ADD: “Provide”: Furnish and install, complete and ready for the intended use.

1.1.3.8 ADD: “Project site”: Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land or portion of the building on which the Project is to be built.

1.6.1 Insert in the sixth line: “All documents which constitute the instruments of service are the property of the Owner.” In lieu of the phrase “Unless otherwise indicated, the Architect/Engineer and the Architect/Engineer’s consultants shall be deemed the authors of them... except as defined in the Owner’s Contract with the Architect/Engineer.”

ARTICLE 2 – THE OWNER

2.1 THE STATE OF MONTANA

2.1.1.1 ADD: The State of Montana includes its officers, elected and approved officials, employees and volunteers, and political subdivisions thereof. The State of Montana and Montana State University are synonymous throughout the contract documents.

ARTICLE 3 – THE CONTRACTOR

3.3 SUPERVISION AND CONSTRUCTION PROCEDURES

3.3.6 ADD: PRODUCT DELIVERY, STORAGE AND HANDLING

3.3.6.1 ADD: Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer’s written instructions.

3.3.6.2 ADD: DELIVERY AND HANDLING:

3.3.6.2.1 ADD: Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.

3.3.6.2.2 ADD: Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.

3.3.6.2.3 ADD: Deliver products to Project site in an undamaged condition in manufacturer’s original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.

3.3.6.2.4 ADD: Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and property protected.

3.3.6.3 ADD: STORAGE

3.3.6.3.1 ADD: Store products to allow for inspection and measurement of quantity or counting of units

3.3.6.3.2 ADD: Store materials in a manner that will not endanger Project structure.

3.3.6.3.3 ADD: Store products that are subject to damage by the elements under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.

3.3.6.3.4 ADD: Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.

3.3.6.3.5 ADD: Comply with product manufacturer’s written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.

3.3.6.3.6 ADD: Protect stored products from damage and liquids from freezing.

3.10 CONSTRUCTION SCHEDULES

3.10.1.1 ADD: A pre-construction meeting will be held at a time mutually agreed upon by the Owner, Architect/Engineer and Contractor at Campus Planning, Design and Construction, Montana State University, Bozeman, Montana. The contractor shall confirm the Contractor’s Construction Schedule for the Work. Coordination of operating requirements of the affected buildings, and surrounds, schedule of activities and Owner requirements will be discussed, as well as the order in which the Contractor intends to pursue the work. This schedule will be reviewed and must be mutually agreed upon by the Architect, Contractor and Owner.

3.11 DOCUMENTATION AND AS-BUILT CONDITIONS AT THE SITE

3.11.4 ADD: The contractor shall maintain at the site two (2) construction reference sets of all specifications, drawings, approved shop drawings, change orders and other modifications, addenda, schedules and instructions, in good order.

3.11.4.1 ADD: The record drawings shall be two (2) sets of black (or blue) and white prints of the drawings on which the contractor must record all “red line” changes during the course of construction and will include references to change order numbers, field directives, etc., and their dates. This record set shall be maintained separate and apart from documents used for construction reference. This set will be available for review by the project consultant, architect, engineer and MSU project manager at all times.

3.11.4.2 ADD: All as-built conditions shall be kept current and the contractor shall not permanently conceal or cover any work until all required information has been recorded.

3.11.4.3 ADD: All survey and exterior underground utilities shall be recorded using the spatial reference, Montana State Plane, NAD 83, CORS 96, Lambert Conformal Conic. The National Geodetic Survey publishes NAD 83

coordinates in the metric system (i.e., meters). The conversion factor that should be used to convert between English and metric systems is the international conversion factor of 1 ft. = 0.3048 m. coordinate system.

3.11.4.4 ADD: In marking any as-built conditions, the contractor shall ensure that such drawings indicate by measured dimension to building corners or other permanent monuments the exact locations of all piping, conduit or utilities concealed in concrete slabs, behind walls or ceilings or underground. Record drawings shall be made to scale and shall also include exact locations of valves, pull boxes and similar items as required for maintenance or repair service.

3.11.4.5 ADD: The contractor shall prepare and maintain a binder with all project warranty information. This will be provided to the project consultant, architect or engineer at final acceptance.

3.12.1 DEFINITIONS:

3.12.1.4 ADD: Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term “product” includes the terms “material,” “equipment,” “system,” and terms of similar intent.

3.12.1.5 ADD: Named Products: Items identified by manufacturer’s product name, including make or model number or other designation shown or listed in manufacturer’s published product literature that is current as of date of the Contract Documents.

3.12.1.6 ADD: New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.

3.12.1.7 ADD: Comparable Products: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

3.12.1.8 ADD: Basis-of-Design Product Specification: A specification in which a specific manufacturer’s product is named and accompanied by the words “basis-of-design product,” including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specifications.

3.13. USE OF SITE

3.13.3 ADD: MSU BOZEMAN Vehicle Regulations state:

“All students, faculty, staff, and visitors must register any motor vehicle they park on the University campus, for any reason. A visitor is anyone not defined as student, staff or faculty.”

All Contractor and Contractor employees shall comply with Montana State University parking regulations. MSU parking permits can be purchased at the Huffman Building at Seventh Avenue and Kagy Boulevard. Contractor should call University Police at 994-2121 for permit information. Violators of MSU Bozeman Vehicle Regulations may be ticketed and towed.

Unless otherwise indicated on the drawings, all Contractor and Contractor employee vehicles on campus shall be parked in designated parking lots. If allowed on the drawings, vehicles to a maximum number stated, may be parked in project site areas designated and shall only be Contractor vehicles with company signs clearly visible. No personal vehicles shall be parked at the project site in any case. If a driver of a vehicle not allowed to be parked at the project site must unload equipment, tools, or materials, the vehicle must be immediately thereafter moved to a designated lot or leave campus. Vehicles parked in the project site, other than those allowed on the drawings, may be ticketed and towed.

Access to the project site shall be only by the route designated on the drawings. In cases where a different route must be used for a specific purpose, permission must be obtained from MSU Facilities Services. In no case will vehicles be used on the Centennial Mall paving. Access routes are for delivery of equipment, tools, and not for parking.

Site staging areas for materials and equipment if permitted, will be designated on the drawings if permitted. If not designated, staging is intended to be in the construction area boundaries. Staged materials and equipment must be secured on the ground surface or in trailers. Site staging areas shall be fenced.

3.13.4 ADD: The Contractor shall coordinate his operations with the Owner in order that the Owner will have maximum use of existing facilities surrounding the area of the Work, as agreed upon, at all times during normal working hours. Contractor further agrees to coordinate his operations so as to avoid interference with the Owner's normal operations to as great an extent as possible.

3.13.5 ADD: By acceptance of MSU Building Keys the Contractor agrees with the following: University keys are the property of Montana State University. Fabricating, duplicating or modifying University keys is prohibited. Doors must remain locked at all times. The use of these keys to allow unauthorized persons to enter the above areas is prohibited. Loss of any key must be reported immediately to the Director, Office of Facilities Services and University Police, if the loss of keys results in re-keying costs, these costs will be charged to the Contractor. **See attached Estimated Re-Keying Costs per Building.**

3.13.6 ADD: The Montana Legislature decreed that the "right to breath smoke-free air has priority over the desire to smoke" (MCA 20-40-102). It is the policy of MSU to promote the health, wellness and safety of all employees, students, guests, visitors, and contractors while on campus. Therefore, the campus will be free of tobacco-use effective August 1, 2012. The use of tobacco (including cigarettes, cigars, pipes, smokeless tobacco and all other tobacco products) by students, faculty, staff, guests, visitors, and contractors is prohibited on all properties owned or leased by MSU.

Littering any university property, whether owned or leased, with the remains of tobacco products is prohibited. All university employees, students, visitors, guests, and contractors are required to comply with this policy, which shall remain in effect at all times. Refusal to comply with this policy may be cause for disciplinary action in accordance with employee and student conduct policies. Refusal to comply with the policy by visitors, guests and contractors may be grounds for removal from campus. (http://www2montana.edu/policy/smoking_facilities/)

3.13.7 ADD: The Contractor may use the University's toilet facilities only as directed by the Owner.

ARTICLE 4 – ADMINISTRATION OF THE CONSTRUCTION CONTRACT

4.6. ARBITRATION

4.6.3 Insert in the second line "the Eighteenth Judicial District, Gallatin County" in lieu of "First Judicial District, Lewis & Clark County."

4.6.11 ADD: In responding to a claim brought by a Contractor, the Owner shall have a minimum of forty-five (45) days in which to respond to a revised claim prior to the arbitration hearing.

ARTICLE 7 – CHANGES IN WORK

7.2 CHANGE ORDERS

7.2.2.1 Insert the word "maximum" before "5%" and insert the word "maximum" before "10%".

7.2.2.4 ADD: Total Change Order markup shall not exceed (cost of the work) x 1.15.

7.2.3.1 Insert at the beginning of the first sentence the word "Itemized".

7.2.3.2 Insert at the beginning of the first sentence the word "Itemized".

7.2.3.3 Insert at the beginning of the first sentence the word "Itemized".

7.2.3.4 ADD: The Contractor shall provide a complete description summarizing all work involved.

ARTICLE 8 - TIME

8.1. DEFINITIONS

8.1.8.1 ADD: The Owner will issue a written Notice to Proceed on satisfactory receipt of the signed Contract and all required bonds, insurance and other required submittals. Work commenced before receipt of the Notice to Proceed will be entirely at the Contractor's risk.

8.2. PROGRESS AND COMPLETION

8.2.5 ADD: Completion of the work within the stated time and/or by the date stated on the Notice to Proceed is of the essence of this Contract and failure to complete, without approved time extension, may be considered default of the Contract. At the time for completion as stated on the Notice to Proceed or as extended by approved change order, if the work is not substantially complete, the Owner may notify the Contractor and the Contractor's surety company in writing of the recourse the Owner intends to take, within the Contract, to assess liquidated damages and /or cause the work to be completed.

8.3. DELAYS AND EXTENSIONS OF TIME

8.3.4 ADD: By the act of signing the Contract, the Contractor signifies that he/she and all subcontractors can perform the work within the stated schedule and that subcontractors, manufacturers, suppliers, and deliverers are known to be able to support the schedule. Time extension may be granted for unforeseen conditions or events out of the Contractor's control causing delay in delivery of materials or causing delay in the Contractor's ability to perform the work within the Contract Documents. The Contractor is expected to take all possible measures and bear all reasonable costs in order to anticipate, control, counteract, and expedite such delay-causing conditions, including finding alternative sources of materials, equipment, shipping, and labor. Notification of any claim for schedule delay must be made in writing to the Owner within one week of the causing event or of first knowledge of a known delay causing condition with supporting documentation as required by the Owner. The Owner will respond in writing within one week to claims of delay. No claims of delay will be entertained after the date of completion as stated on the Notice to Proceed or as extended by previously approved delay claims.

ARTICLE 9 – PAYMENTS AND COMPLETION

9.3. APPLICATIONS FOR PAYMENT

9.3.7.2.1. Insert in the first line "Schedule of Values" in lieu of "Schedule of Amounts for Contract Payment".

9.3.7.2.3 ADD: Subcontractor's List: The Contractor shall list all subcontractors doing work in excess of \$5,000.

9.8. SUBSTANTIAL COMPLETION

9.8.4.1 ADD: Prior to the inspection, the Contractor shall complete the final clean-up of the project site which, unless otherwise stated in the Contract Documents, shall consist of:

9.8.4.1.1 Removal of all debris and waste. All construction debris and waste shall be removed from the campus grounds. Use of the University trash containers will not be permitted.

9.8.4.1.2 Removal of all stains, smears, marks of any kind from surfaces including existing surfaces if said damage is the result of the work.

9.8.4.1.3 Removal of all temporary structures and barricades.

9.10. FINAL COMPLETION AND FINAL PAYMENT

9.10.2.4 Insert in the first line after the word "(Form 103)": "for contracts greater than or equal to \$25,000"

ARTICLE 10 – PROTECTIONS OF PERSONS AND PROPERTY

10.1. SAFETY

10.1.2 Insert in the second line before the word "safeguards": "and as approved by Owner,"

10.1.2.1 ADD: The Contractor recognizes that the Work will be conducted in and around buildings and areas that are occupied and will continue to function for the purposes of the University. The Contractor shall conduct a project safety meeting prior to the start of the Work, with the Owner's representative and all others that the Owner's representative deems necessary. The purpose of the meeting shall be to produce project specific rules and guidelines pertaining to but not restricted to: safety of persons in and around the area of the Work including type and location of fencing, guards, signage, etc.; closing of existing campus circulation routes and designation of alternate routes, including creation of temporary routes of access as required; creation and location of temporary signage as required to

maintain accessible routes for handicapped access to and around the site of the Work. The Contractor shall be solely responsible for implementing all required means and methods for site safety and security that may be agreed upon in this meeting.

10.1.2.2 ADD: Contractor shall notify Owner any time his operations will disrupt use of and access to existing accessible routes. Contractor is solely responsible for maintaining existing accessible routes in the area of the project with the exception of temporary interruptions lasting one day or less. Contractor is responsible for erecting signage identifying temporary re-routing of accessible routes. Such re-routing shall be coordinated with Owner in advance.

10.3. UTILITIES

10.3.1 ADD: Underground Utilities: Buried utilities, including, but not limited to, electricity, gas, steam, air, water, telephone, sewer, irrigation, broadband coaxial computer cable, and fiber optic cables are very vulnerable and damage could result in loss of service. The telephone, broadband and fiber optic cables are especially sensitive and the slightest damage to these components will result in disruption of the operations of the campus.

10.3.2 ADD: "One Call" must be notified by phone and in writing at least 72 hours (3 business days) prior to digging to arrange and assist in the location of buried utilities in the field. (Dial 811). The Contractor shall mark the boundary of the work area. The boundary area shall be indicated with white paint and white flags. In winter, pink paint and flags will be accepted.

10.3.3 ADD: After buried utilities have been located, the Contractor shall be responsible for any utilities damaged while digging. Such responsibility shall include all necessary care including hand digging. Contractor's responsibility shall also include maintaining markings after initial locate. The area for such responsibility, unless otherwise indicated, shall extend 24 inches to either side of the marked center line of a buried utility line. In cases of multiple or overlapping utilities or inconclusive electronic locating signals, MSU Project Manager may specifically indicate a wider area for Contractor's responsibility.

10.3.4 ADD: The Contractor's responsibility shall include repair or replacement of damaged utilities. In the event of damage to the 15 KV electrical distribution system, the broadband or fiber optic cables, repair will consist of replacement from termination to termination. Facilities Services and the MSU Information Technology Center will verify repair and recertification. The Contractor will also be responsible for all costs associated with reterminations and recertification.

10.3.5 ADD: Any buried utilities exposed by the operations of the Contractor shall be marked on the plans and adequately protected by the Contractor. If any buried utilities not located are exposed, the Contractor shall immediately contact Facilities Services at the numbers above. If, after exposing an unlocated buried utility, the Contractor continues digging without notifying Facilities Services and further damages the utility, the Contractor will be responsible.

10.3.6 ADD: Damage to irrigation systems during seasons of no irrigation that are not immediately and adequately repaired and tested will require the Contractor to return when the system is in service to complete the repair.

10.3.7 ADD: In the event of a planned interruption of any existing utility service, the Contractor shall make arrangements with Facilities Services at least 72 hours (3 business days) in advance. Shutdowns of the broadband or fiber optic cables will normally require 5 working days notice to Facilities Services and the Information Technology Center. The Contractor shall bear all costs associated with the interruptions and restorations of service.

10.3.8 ADD: The Owner allows the contractor to use the Owner's utilities (water, heat, electricity) services without charge for procedures necessary for the completion of the work.

ARTICLE 11 - INSURANCE AND BONDS

11.4. COMMERCIAL GENERAL LIABILITY INSURANCE

11.4.1.3. Insert in the first line after "State of Montana": ", Montana State University".

11.7. PERFORMANCE BOND AND LABOR & MATERIAL PAYMENT BOND (BOTH ARE REQUIRED ON THIS PROJECT)

11.7.1. Insert in the first line at the beginning of the sentence "For contracts equal to or greater than \$25,000".

11.8. CANCELLATION

11.8 ADD All Certificates shall contain a provision that coverage provided by the policies will not be cancelled without at least thirty (30) days prior notice to the Owner.

ARTICLE 13 – MISCELLANEOUS PROVISIONS

13.1. GOVERNING LAW

13.1.1. Insert in the second line “The Eighteenth Judicial District, Gallatin County” in lieu of “First Judicial District, Lewis and Clark County”.

END OF SUPPLEMENTARY GENERAL CONDITIONS

Cost Estimate to Re-key Buildings

Building	Core #	Cut keys	Budget
AJM Johnson	112	448	\$13,000.00
Animal BioScience	109	436	\$13,000.00
ARC	122	488	\$14,000.00
Athletics (Fieldhouse etc.)	500	2,000	\$52,000.00
Cheever Hall	136	544	\$18,000.00
Chem Building	229	916	\$30,000.00
Chem Modular	16	64	\$3,000.00
Cobleigh Hall	380	1,520	\$41,000.00
Cooley Lab	99	396	\$12,000.00
Creative Arts Complex	368	1,472	\$50,000.00
Culbertson Hall	171	684	\$23,000.00
Haynes Hall	113	452	\$16,000.00
Howard Hall	119	476	\$16,000.00
Huffman	39	156	\$6,000.00
EPS	408	1,632	\$45,000.00
EPS Complex	928	3,712	\$106,000.00
Gaines Hall	175	700	\$23,000.00
Grad Art	6	24	\$2,000.00
Hamilton Hall	99	396	\$16,000.00
Heat Plant	17	68	\$3,000.00
Herrick Hall	118	472	\$16,000.00
Kellog Center	35	140	\$5,000.00
Leon Johnson Hall	313	1,252	\$37,000.00
Lewis Hall	163	652	\$21,000.00
Linfield Hall	295	1,180	\$34,000.00
Marga Hosaeus	134	536	\$18,000.00
Marsh Lab	187	748	\$24,000.00
McCall Hall	52	208	\$9,000.00
Molecular Bean	5	20	\$2,000.00
Montana Hall	156	624	\$22,000.00
Museum of the Rockies	166	664	\$25,000.00
OutDoor Rec	16	64	\$3,000.00
Plant BioScience	112	448	\$16,000.00
Plant Growth	152	608	\$20,000.00
Reid Hall	302	1,208	\$36,000.00
Renne Library	255	1,020	\$32,000.00
Roberts Hall	140	560	\$20,000.00
Romney	98	392	\$15,000.00
Swingle Health Center	137	548	\$18,000.00
Taylor Hall	56	224	\$10,000.00
Traphagen Hall	148	592	\$21,000.00
Univ. Record Storage	9	36	\$2,000.00
VisComm (Black Box)	144	576	\$21,000.00
Wilson Hall	325	1,300	\$38,000.00
Mech Room	501	2,004	\$30,000.00

PROJECT CLOSEOUT CHECKLIST

PROJECT TITLE: _____ PPA No. _____
 CONTRACTOR: _____ DATE: _____
 CONSULTANT _____

*** In absence of a Consultant, responsibilities will be determined at Pre-construction meeting*

To be submitted with Application of Final Payment

Contract Requirements	Date PM Verified	Date Completed	Required Documentation:
			Final application for payment (all contracts)
			Certificate of Substantial Completion - MSU Form 107 (over \$25K)
			Certificate of Final Acceptance - MSU Form118 (over \$25K)
			Consent of Surety to final payment MSU Form103 (if over \$25K)

MSU PM			Verification of All Change Orders & Final Amounts with Contract amounts
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*Contractor to submit all deliverables to the Consultant
To be submitted with Application of Final Payment*

Contractor Requirements	Date PM Verified	Date Completed	Required Deliverables:
			Final walk through and instructions to Owner
			As-built "red lined" drawings (PDF Color Scan of Redlined Construction Set)
			Complete set of project shop drawings/Product Data (3Sets)
			Demonstration & Training
			City of Bozeman Building Permits: <input type="checkbox"/> Fire Suppression test & Certificate <input type="checkbox"/> Fire Alarm test & Certificate <input type="checkbox"/> Elevator Inspection <input type="checkbox"/> Plumbing & HVAC test & Inspection <input type="checkbox"/> Electrical Inspection <input type="checkbox"/> Temporary certificate of occupancy <input type="checkbox"/> Final certificate of occupancy
			Final project inspection
			Notification of completion of punch list
			Copy of warranty Binder

Contractor Signature _____ Consultant Signature _____

Submit at Record Document Stage/Consultant shall submit Contractor Deliverables to Owner

Consultant Requirements	Date PM Verified	Date Completed	Required Deliverables:
			Operation & Maintenance Manuals: including warranties or guarantees for all equipment (2 copies – project, trades, building file, support manager: PDF & Paper) <input type="checkbox"/> HVAC <input type="checkbox"/> Plumbing <input type="checkbox"/> Electrical <input type="checkbox"/> Elevator <input type="checkbox"/> Fire Alarm <input type="checkbox"/> Roof <input type="checkbox"/> Project Manual (Divisions 1-13)

Consultant Signature _____ Project Manager _____



SUBSTITUTION REQUEST (PRIOR APPROVAL)

Project Title: _____

PPA No: __ - ____

Location: _____

Owner: MONTANA STATE UNIVERSITY Bidder (Sub-): _____

This request is submitted for the approval of the Architect. Bidder / Sub-Bidder shall submit one request in accordance with Bidders' Instructions and Information for each proposed substitution. All blanks are to be completed.

The material, system, or equipment defined by this Substitution Request is proposed as a replacement for the material, system, or equipment originally specified and defined as follows:

SECTION PARAGRAPH SPECIFIED MATERIAL, SYSTEM, OR EQUIPMENT

PROPOSED SUBSTITUTION: The material, system, or equipment being proposed is defined as follows:

- What are the differences between the specified material, system, or equipment and the proposed substitution?
Does the proposed substitution require dimensional changes on the Construction Drawings? (Y/N)
Does the proposed substitution require changes to the Work of other trades? (Y/N)
Is the warranty for the proposed substitution comparable with that of the specified product? (Y/N)

By signing and submitting this request, the Bidder / Sub-Bidder represents that the function, appearance, and quality of the proposed substitution are equivalent or superior to the specified material, system, or equipment.

By signing and submitting this request, the Bidder / Sub-Bidder agrees to pay all costs, including architectural and engineering fees, associated with the incorporation of the proposed substitution into the Project.

SUBMITTED BY (BIDDER / SUB-BIDDER) AUTHORIZED AGENT DATE

Received: _____
DATE

Architect's Action: [] Rejected

[] Rejected - For reasons as follows:

[] Approved

[] Approved as noted:

REVIEWED BY (ARCHITECT) AUTHORIZED AGENT DATE



CAMPUS PLANNING, DESIGN & CONSTRUCTION

Sixth Avenue and Grant Street
PO Box 172760 • Bozeman, Montana 59717-2760
Phone: (406) 994-5413 • Fax: (406) 994-5665

SCHEDULE OF VALUES

Project Title: _____ PPA No.: _____
Location: _____ Date: _____
Contractor: _____
Address: _____

Table with 6 columns: DIV. NO., DESCRIPTION, LABOR COSTS, MATERIAL COSTS, OTHER COSTS, TOTAL ITEM COST. Includes rows for itemized costs and summary rows for 'TOTAL COST THIS SHEET', 'TOTAL COST - ADDITIONAL SHEETS', and 'TOTAL PROJECT COST'.

This Schedule of Values is a statement made by the Contractor to the Architect/Engineer and Owner that allocates the contract sum among the various portions of the Work and shall form the basis for review of the Contractor's Payment Requests.

Submitted by: _____ (Company/Contractor) _____ (Name) _____ (Date)
Reviewed by: _____ (Architect/Engineer) _____ (Name) _____ (Date)
Approved by: Montana State University _____ (Name) _____ (Date)
Campus Planning, Design & Construction

STANDARD FORM INSTRUCTIONS

To simplify the form and request for payment process, formulas have been inserted in the form. Fields shaded in light blue are formula fields and cannot be manipulated. Please start by completing the top of Page 1 along with the RED outlined fields, then move to Page 2 inserting the necessary detail. **Formulas will pull the detail from Page 2 into Page 1 to correctly calculate payment due.** Don't forget to check your retainage calculation for each request submitted. Retainage is calculated at 5%, which is the default contractual retainage. [Please see the instructions below if you are working under an MSU Bozeman General Services Contract.]

SUBMISSION

Periodic Estimates for Partial Payment (Form 101) should be submitted with a valid signature at the bottom of Page 1.

With the exception of Final Requests for payment, Faxed or Scanned/Emailed requests for payment are acceptable with a valid signature and date. Faxed Requests should be sent to 406-994-6572 Attn: Accounting. Emailed requests should be sent to ara.meskimen@montana.edu.

CONSULTANT APPROVAL

If there is an Architectural Firm (Consultant) assigned to your project their approval is required prior to submitting the request for payment to MSU. Please submit the Periodic Estimate for Partial Payment (Form 101) to the consultant on the project directly, they will route the request for payment to MSU once they have approved it.

COMPLETE BOTH PAGES

Please complete BOTH pages of the Periodic Estimate for Partial Payment (Form 101). Because both pages are contract documents, **your request can be declined if both pages are not completed.** Also, your amount due is calculated from the detail on Page 2, it will not calculate appropriately without Page 2 completed. (Use the tabs at the bottom of Excel to move between the instructions and both pages)

FINAL REQUESTS

Final Requests for payment need to be submitted with an original Notorized and Signed Affidavit of Completion (Form 108) Retainage will be held on Final Requests received without an Affidavit of Completion attached or on file.

RETAINAGE CALCULATION

The retainage field auto calculates the default contract retainage amount of 5%. This field can be overwritten in order for the contractor to request no retainage holding or a reduced retainage holding amount. Please keep in mind that MSU Bozeman reserves the right to make changes to the submitted Periodic Estimate For Partial Payment (Form 101) in keeping with the signed contractual agreement between MSU Bozeman and the contractor.

GENERAL SERVICE CONTRACT INSTRUCTIONS

If you are a contractor working under an MSU Bozeman issued **General Services** contract. Please **request the electronic version of the GENERAL SERVICES pay request form.**

If you have questions on the [Pay Request Form](#) or need additional information regarding the usage of this form:
Please Contact:

Ara Meskimen | MSU Bozeman
ara.meskimen@montana.edu
406-994-5461

If you have questions on [Change Orders, Addendums, Contracts, or other Contract Documents](#) related to your work on campus:
Please Contact:

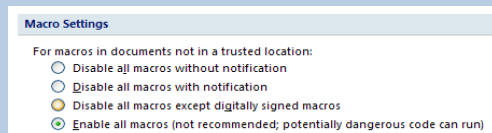
Your Project Manager OR

Rebecca Barney | MSU Bozeman
Rebecca.Barney@montana.edu
406-994-5287

HINTS:

Please note: the Macro Settings for the user computer need to be set at "Enable" in order to run the **PRINT** and **RESET FORM** macros.

That can be done by entering the Trust Center for Microsoft Excel and selecting Enable Macros.



*(Trust Center is on Windows XP and newer versions)

*(Older versions have the "Enable Macros" setting, however, it is under Security settings)

If you need additional help adjusting these settings do a search under Microsoft Excel Help for "Enable Macros", there you can get step by step instructions for adjusting your macro settings.



PERIODIC ESTIMATE FOR PARTIAL PAYMENT

PPA No.: _____ Date: _____
 Period From: _____ To: _____
 Pay Estimate No.: _____

Project Title: _____
 Location: Montana State University

Contractor: _____
 Address: _____
 Phone: _____

RETAINAGE ADJUSTMENT	
1. Total Retainage to Date:	
2. Less Securities Deposited:	-
3. Retainage Withheld (1 - 2)	-

CONTRACT AMOUNT STATUS	
1. Original Contract Amount:	
2. Net +/- by Change Order: [Pulls from Change Order Summary]	-
3. Contract Amount to Date:	-

CHANGE ORDER SUMMARY			
No.	Date Approved	Additions	Deductions
TOTALS:		-	-
NET TOTAL:		-	-

CONTRACT STATUS	
1. Work in Place (from next page): [Column D + E Total - Page 2]	
2. Total Work & Stored Material: [Column G Total - Page 2]	
3. Retainage Withheld:	5.0%
4. Total Earned Less Retainage:	-
5. Less Previous Payments (+ 1 % Tax):	-
6. Amount Due This Payment:	-
7. Less 1% State Contractor's Tax: [Contracts > 4999.99]	-
8. Payment Due Contractor:	-

I hereby certify that this submitted request for payment is correct, true and just in all respects and that payment or credit has not previously been received. I further warrant and certify by submission of this request that all previous work for which payment has been received is free and clear of all liens, disputes, claims, security interests, encumbrances, or causes of action of any type or kind in favor of the contractor, subcontractors, material suppliers, or other persons or entities and do hereby release the Owner from such.

Submitted by: _____

 (Name) Date: _____

Reviewed by: _____
 (Consultant)

 (Name) Date: _____

Approved by: **State of Montana, Montana State University**
Facilities Planning, Design and Construction

 (Name) Date: _____



CAMPUS PLANNING, DESIGN & CONSTRUCTION

Sixth Avenue and Grant Street • PO Box 172760 • Bozeman, Montana 59717-2760

Phone: (406) 994-5413 • Fax: (406) 994-5665

ACKNOWLEDGEMENT OF SUBCONTRACTORS

Project Title: _____ PPA NO. _____
Location: _____ Date: _____
Contractor: _____
Address: _____

TO: MONTANA STATE UNIVERSITY
CAMPUS PLANNING, DESIGN & CONSTRUCTION
6TH AND GRANT STREET, PO BOX 172760
BOZEMAN, MONTANA 59717-2760

Listed below are the principal subcontractors proposed on this project. All subcontracts exceeding \$5,000 are to be listed.

The Contractor certifies that these subcontractors:

- 1. Have been advised of the labor standards and provisions applicable to this project.
2. That all provisions incorporated in the Contract between the Owner and the undersigned contractor will be incorporated in the contracts between the Contractor and any Subcontractors.
3. Are competent to accomplish the work subcontracted to them.

Table with 3 columns: NAME AND ADDRESS OF SUBCONTRACTORS, REGISTRATION NO., TYPE OF WORK. Contains 7 empty rows.

Submitted by: _____ (Company/Contractor) _____ (Name) _____ (Date)

Reviewed by: _____ (Architect/Engineer) _____ (Name) _____ (Date)

Acknowledged by: Montana State University _____ (Name) _____ (Date)
Campus Planning, Design & Construction



CONSENT OF SURETY

Project:
Location: Montana State University
PPA No.

TO: Montana State University
Campus Planning, Design & Construction
6TH & Grant, PO Box 172760
Bozeman, Montana 59717-2760

Contractor: Contract Date:

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

on bond of (here insert name and address of Contractor)
,Surety Company,
,Contractor,

hereby approves of the final payment to the Contractor, and agrees that final payment to the Contractor shall not
relieve the Surety Company of any of its obligations to State of Montana, Owner, as set forth in the said Surety
Company's bond. The Surety agrees to be bound to the warranty period under the same conditions as the
Contractor. The warranty is defined as commencing with Substantial Completion (or with each Substantial
Completion if there is more than one) of the Project, or any portion thereof, and continuing for one (1) calendar year
from the date of Final Acceptance of the entire project unless otherwise modified in writing as part of the Substantial
Completion or Final Acceptance.

IN WITNESS WHEREOF,

the Surety Company has hereunto set its hand this Day of ,

Surety Company

Signature of Authorized Representative

Attest:
(Seal)

Title



CONTRACT CHANGE ORDER

Project Name: _____	PPA No.: _____
Location: Montana State University, Bozeman, Montana	Chg. Order No.: _____
Contractor: _____	Date: _____
Address: _____	Phone: _____
_____ The Contractor is hereby directed to make the following changes in the Contract:	

Item No.	DESCRIPTION /UNIT/BREAKDOWN/UNIT COSTS <small>(Indicate Critical Path Schedule impact for each Item)</small>	(Indicate Add or Deduct)	COST
	SUBTOTAL (Labor & Materials) =		\$0.00
	(All contractor proposals will show break out of O&P) Overhead & Profit @ _____ =		
	TOTAL COST (This Change Order Only) =		\$0.00

Change In Contract Duration/Time By This Change Order: (No Change) (Increase) (Decrease) BY _____ CALENDAR DAYS
 NEW CONTRACT COMPLETION DATE: _____

CONTRACT STATUS

1. Original Contract Amount	
2. Net Change by Previous Change Order(s)	
3. Current Contract Amount (1+2)	\$0.00
4. This Change Order Total Amount	\$0.00
5. New Contract Amount (3+4)	\$0.00
6. Total Cost of All Change Orders to Date (2+4)	\$0.00

JUSTIFICATION FOR CHANGE(S) (To be completed by Architect/Engineer):

Describe the details which mandate the change(s).

JUSTIFICATION FOR COST ADJUSTMENT (To be completed by Architect/Engineer):

Describe the basis used to calculate the cost adjustment.

JUSTIFICATION FOR SCHEDULE ADJUSTMENT (To be completed by Architect/Engineer):

Describe the impact of adjustment(s) to the critical path.

APPROVALS

By signature on this change order, the Contractor certifies that this change order is complete and includes all direct costs, indirect costs and consequential items (including additional time, if any) and is free and clear of any and all claims or disputes (including, but not limited to, additional costs, additional time, disruptions, and impacts) in favor of the Contractor, subcontractors, material suppliers, or other persons or entities concerning this change order and on all previously contracted Work and does hereby release the Owner from such.

Approved by Contractor:

(Company) (Signature)

Recommended by Architect/Engineer:

(Company) (Signature)

Surety Consent: SURETY CONSENT IS REQUIRED IF THE TOTAL AMOUNT OF ALL CHANGE ORDERS (LINE 6) EXCEEDS 10% OF THE ORIGINAL CONTRACT AMOUNT.

The Surety consents to this Contract Change Order and agrees that its bond or bonds shall apply and extend to the Contract as modified or amended per this Change Order. The principal and the Surety further agree that on or after execution of this consent, the penalty of the applicable Performance Bond and Labor & Material Bond is increased by:

(____)

By One Hundred Percent (100%) of ALL Change Orders

Countersigned by Resident Agent:

Surety:

Recommended by: CPDC Project Manager:

(Signature) Date:

Accepted by:

(Signature) MSU Campus Planning, Design, & Construction Date:



CONTRACTOR'S AFFIDAVIT OF COMPLETION
PAYMENT OF DEBTS AND CLAIMS, AND RELEASE OF LIENS

Project Name:
Location: Montana State University
PPA No.:

I CERTIFY to the best of my knowledge and belief that all work has been performed and materials supplied in strict accordance with the terms and conditions of the corresponding contract documents between the STATE OF MONTANA, acting by and through its DIRECTOR, MONTANA STATE UNIVERSITY, CAMPUS PLANNING, DESIGN & CONSTRUCTION, hereinafter called the Owner, and, hereinafter called the CONTRACTOR, for the above referenced project.

I further certify and declare that all bills for materials, supplies, utilities and for all other things furnished or caused to be furnished by the CONTRACTOR and used in the execution of the contract will be fully paid upon receipt of Final Payment and that there are no unpaid obligations, liens, claims, security interests, encumbrances, liabilities and/or demands of State Agencies, subcontractors, material men, mechanics, laborers or any others resulting from or arising out of any work done, caused to be done or ordered to be done by the CONTRACTOR under the contract.

In consideration of the prior and final payments made and all payments made for authorized changes, the CONTRACTOR releases and forever discharges the OWNER from any and all obligations, liens, claims, security interests, encumbrances and/or liabilities arising by virtue of the contract and authorized changes between the parties, either verbal or in writing, and any and all claims and demands of every kind and character whatsoever against the OWNER, arising out of or in any way relating to the contract and authorized changes.

I further certify and agree that the warranty period is defined as commencing with Substantial Completion (or with each Substantial Completion if there is more than one) of the Project, or any portion thereof, and continuing for one (1) calendar year from the date of Final Acceptance of the entire project unless otherwise modified in writing as part of the Substantial Completion or Final Acceptance.

This statement is made for the purpose of inducing the OWNER to make FINAL PAYMENT under the terms of the contract, relying on the truth and statements contained herein.

(Seal)

CONTRACTOR

Four horizontal lines for signature and title.

(Signature)

(Title)

State of Montana
County of

Subscribed and sworn to me this Day of,

(Seal)

NOTARY

Notary Public for the State of Montana
My Commission Expires:



CERTIFICATE OF SUBSTANTIAL COMPLETION

Project Name: _____ PPA No. _____

Project Address: Montana State University - Bozeman Campus Date: _____

TO: Montana State University
 Campus Planning, Design & Construction
 6th & Grant, PO Box 172760
 Bozeman, Montana 59717-2760

Architect/Engineer: _____

Contractor: _____ Contract Date: _____
 _____ Contract Amount: _____

PROJECT OR DESIGNATED PORTION SHALL INCLUDE:

The work performed under this Contract has been reviewed and found to be substantially complete. The Date of Substantial Completion of the Project or portion thereof designated above, which is also the date of commencement of applicable warranties required by the Contract Documents, except as stated below is hereby established as: _____

BASIC PROJECT INFORMATION <small>(required by Risk & Tort Defense Division)</small>	NEW	REMODEL/RENOVATION
Total Square Footage		
General Construction Material <small>(e.g. masonry, metal panel, wood, etc.)</small>		
Total Construction Cost		
Fire Sprinklers Installed (yes/no)		
Estimated Date of Occupancy <small>(if different from date of Substantial)</small>		
Building Usage:		
Additional Comments:		

Definition of Date of Substantial Completion

The Date of Substantial Completion of the Work or designated portion thereof is the Date certified by the Architect/Engineer when construction is sufficiently complete, in accordance with the Contract Documents, so the Owner can occupy or utilize the Work or designated portion thereof for the use for which it is intended, as expressed in the Contract Documents.

A list of items to be completed or corrected, prepared by the Contractor and verified and amended by the Architect/Engineer, is attached hereto. The failure to include any items on such list does not alter the responsibility of the Contractor to complete all the Work in accordance with the Contract Documents. The warranty period is defined as commencing with Substantial Completion (or with each Substantial Completion if there is more than one) of the Project, or any portion thereof, and continuing for one (1) calendar year from the date of Final Acceptance of the entire project unless otherwise modified in writing as part of the Substantial Completion or Final Acceptance.

Architect/Engineer By Date

The Contractor will complete or correct the Work on the list of items attached hereto within _____ days from the above Date of Substantial Completion.

Contractor By Date

The Owner accepts the Work or designated portion thereof as substantially complete and will assume full possession thereof at _____ (time) on (date).

**Montana State University
Campus Planning, Design & Construction**

Owner By Date

The responsibilities of the Owner and the Contractor for security, maintenance, heat, utilities, damage to the Work and insurance will be as follows (use attachments as necessary):



CONSTRUCTION CHANGE DIRECTIVE

Project Name:
Location: Montana State University
Contractor:

PPA No.:

Date:

Change Directive No.: CCD-

Owner: Montana State University
Campus Planning, Design & Construction
6TH & Grant, PO Box 172760
Bozeman, Montana 59717-2760

Architect/Engineer:

The Contractor is directed to proceed as described below. Proceed with this Work promptly. Costs for the Work (if any) involved and change in Contract Time (if any) will be included in a subsequent Change Order.

Description:

Attachments: (insert listing of documents that support description)

The following is based on information provided by the Contractor:

- Change in Contract Sum options: Lump Sum, Unit Price, Estimated Not To Exceed, Fixed, Estimated, Maximum. Change in Contract Time options: of ___ Calendar Days.

Issued by Arch/Eng.: By: Date:
Accepted by Owner: Montana State University By: Date:
Accepted by Contractor: By: Date:



CAMPUS PLANNING, DESIGN & CONSTRUCTION

Sixth Avenue and Grant Street
PO Box 172760 • Bozeman, Montana 59717-2760
Phone: (406) 994-5413 • Fax: (406) 994-5665

REQUEST FOR INFORMATION

Project Title: _____
Location: Montana State University

PPA No.: _____
RFI No.: _____
Date: _____

To: _____

Attention: _____

From: _____

Attention: _____

Trades Affected: _____

In order to expedite the Work and avoid or minimize delays in the Work the following information is requested. Please return a response by: _____ Date Sent: _____ Date Received: _____

Information Requested:

Response:

Response Date: _____ Respondent: _____

- Cost Impact
Schedule Impact

This RFI is for clarification only. The contractor shall document the Owner's Representative within 48 hours if he/she feels the response to this RFI constitutes additional work.

- Distribution: Owner, Architect, Engineer, Agency, Contractor, Other



CAMPUS PLANNING, DESIGN & CONSTRUCTION

Sixth Avenue and Grant Street
PO Box 172760 • Bozeman, Montana 59717-2760
Phone: (406) 994-5413 • Fax: (406) 994-5665

PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS, that we:

(Contractor), hereinafter called the Principal, and

(Surety), a corporation licensed to do business as a surety under the laws of the State of Montana, hereinafter called Surety, are held and firmly bound unto the State of Montana in the full and just sum of:

Alpha Notation _____ DOLLARS (\$) _____ Numeric Notation

to be paid to the State of Montana or its assigns, to which payment we bind ourselves, heirs, executors, administrators, successors and assigns, jointly, severally, firmly by this bond.

WHEREAS, the Principal has entered into a contract with State of Montana, acting by and through its Director, Montana State University, Campus Planning, Design & Construction dated _____ and whereas it is one of the conditions of the award of the contract pursuant to statutes that this bond be executed for the Project entitled:

Project Title: _____
Montana State University
PPA No.: ___-_____

NOW, THEREFORE, the conditions of this obligation are such that if the above Principal as Contractor shall promptly and faithfully perform all of the provisions of the contract, and all obligations thereunder including the specifications, and any alterations provided for, and shall in a manner satisfactory to the State of Montana, complete the work contracted for including any alterations, and shall save harmless the State of Montana from any expense incurred through the failure of the Contractor to complete the work as specified, then this obligation shall be void; otherwise it shall remain in full force and effect.

The surety hereby waives notice of any extension of time and any alterations made in the terms of the contract, unless the cumulative cost of such alterations cause the total project cost to exceed the original contract sum by more than 10%.

FOR STATE USE ONLY:
Surety is licensed in MT: [] Yes [] No
Date verified: _____
Verified by: _____
Montana State University
State of Montana

Contractor: _____
(signature)

(print name)

(date)
Surety: _____
(print name)

(date)
By: _____
(Attorney-in-Fact, seal & signature)

(Agency)

(Street Address)

(Address)

(Phone/Fax)



CAMPUS PLANNING, DESIGN & CONSTRUCTION

Sixth Avenue and Grant Street
PO Box 172760 • Bozeman, Montana 59717-2760
Phone: (406) 994-5413 • Fax: (406) 994-5665

LABOR & MATERIAL PAYMENT BOND

KNOW ALL MEN BY THESE PRESENTS, that we:

(Contractor), hereinafter called the Principal, and

(Surety), a corporation licensed to do business as a surety under the laws of the State of Montana, hereinafter called Surety, are held and firmly bound unto the State of Montana in the full and just sum of:

Alpha Notation DOLLARS (\$) Numeric Notation

to be paid to the State of Montana or its assigns, to which payment we bind ourselves, heirs, executors, administrators, successors and assigns, jointly, severally, firmly by this bond.

WHEREAS, the Principal has entered into a contract with State of Montana, acting by and through its Director, Montana State University, Campus Planning, Design & Construction dated and whereas it is one of the conditions of the award of the contract pursuant to statutes that this bond be executed for the Project entitled:

Project Title:
Montana State University
PPA No.: -

NOW, THEREFORE, the conditions of this obligation are such that if the above Principal as Contractor shall duly and promptly pay all laborers, mechanics, subcontractors and material men who perform work or furnish material under the contract and all persons who shall supply him or the subcontractor with materials, services, bonds and insurance for the carrying on of the work, then this obligation shall be void; otherwise it shall remain in full force and effect and shall save harmless the State of Montana from any expense incurred through the failure of the Contractor to comply.

The surety hereby waives notice of any extension of time and any alterations made in the terms of the contract, unless the cumulative cost of such alterations cause the total project cost to exceed the original contract sum by more than 10%.

FOR STATE USE ONLY:
Surety is licensed in MT: Yes No
Date verified:
Verified by:
Montana State University
State of Montana

Contractor: (signature) (print name) (date)
Surety: (print name) (date)
By: (Attorney-in-Fact, seal & signature) (Agency) (Street Address) (Address)



CERTIFICATE OF FINAL ACCEPTANCE

Project Title: _____ PPA NO.: ____-____
 Location: Montana State University Date: _____

To: Montana State University
 Campus Planning, Design & Construction
 PO Box 172760
 Bozeman, Montana 59717-2760

Architect/Engineer: _____

Contractor: _____ Contract Date: _____
 _____ Contract Amount: _____

The Work performed under this Contract has been reviewed and found to be complete and has reached Final Acceptance. The Date of Final Acceptance of the Work is defined as the Date Certified by the Architect/Engineer upon which the Work is fully complete in all aspects, **and** which the Owner accepts the Contractor's work as complete. The Date of Final Acceptance of the Project, or portion thereof designated above, is also the basis for commencement of the DURATION of applicable warranties required by the Contract Documents. The Warranty Period is defined in the Contract Documents as commencing with Substantial Completion(s) and continuing for one (1) calendar year from the Date of Final Acceptance. This date shall correspond to the date of the Architect/Engineer's approval on the final pay application unless otherwise agreed upon in writing. In the event of a disparity between the date of the Architect/Engineer's approval and this form, if no other written agreement exists as to the date of final acceptance, this form shall constitute such agreement and it shall govern as the date of Final Acceptance.

Date of Substantial Completion:	Date of Final Acceptance:	Date of Warranty Expiration:

Notes:

 Architect/Engineer By _____ Date _____

 Contractor By _____ Date _____

State of Montana
Montana State University
Campus Planning, Design & Construction

 Owner By _____ Date _____

**MONTANA
PREVAILING WAGE RATES FOR BUILDING CONSTRUCTION SERVICES 2019**

Effective: January 26, 2019

**Steve Bullock, Governor
State of Montana**

**Galen Hollenbaugh, Commissioner
Department of Labor and Industry**

To obtain copies of prevailing wage rate schedules, or for information relating to public works projects and payment of prevailing wage rates, visit ERD at www.mtwagehourbopa.com or contact:

Employment Relations Division
Montana Department of Labor and Industry
P. O. Box 201503
Helena, MT 59620-1503
Phone 406-444-5600
TDD 406-444-5549

The Labor Standards Bureau welcomes questions, comments, and suggestions from the public. In addition, we'll do our best to provide information in an accessible format, upon request, in compliance with the Americans with Disabilities Act.

MONTANA PREVAILING WAGE REQUIREMENTS

The Commissioner of the Department of Labor and Industry, in accordance with Sections 18-2-401 and 18-2-402 of the Montana Code Annotated (MCA), has determined the standard prevailing rate of wages for the occupations listed in this publication.

The wages specified herein control the prevailing rate of wages for the purposes of Section 18-2-401, et seq., MCA. It is required each employer pay (as a minimum) the rate of wages, including fringe benefits, travel allowance, zone pay and per diem applicable to the district in which the work is being performed as provided in the attached wage determinations.

All Montana Prevailing Wage Rates are available on the internet at www.mtwagehourbopa.com or by contacting the Labor Standards Bureau at (406) 444-5600 or TDD (406) 444-5549.

In addition, this publication provides general information concerning compliance with Montana's Prevailing Wage Law and the payment of prevailing wages. For detailed compliance information relating to public works contracts and payment of prevailing wage rates, please consult the regulations on the internet at www.mtwagehourbopa.com or contact the Labor Standards Bureau at (406) 444-5600 or TDD (406) 444-5549.

GALEN HOLLENBAUGH
Commissioner
Department of Labor and Industry
State of Montana

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A. Date of Publication January 26, 2019

B. Definition of Building Construction

For the purposes of Prevailing Wage, the Commissioner of Labor and Industry has determined that building construction occupations are defined to be those performed by a person engaged in a recognized trade or craft, or any skilled, semi-skilled, or unskilled manual labor related to the construction, alteration, or repair of a public building or facility, and does not include engineering, superintendence, management, office or clerical work.

The Administrative Rules of Montana (ARM), 24.17.501(2) – 2(a), states *“Building construction projects generally are the constructions of sheltered enclosures with walk-in access for housing persons, machinery, equipment, or supplies. It includes all construction of such structures, incidental installation of utilities and equipment, both above and below grade level, as well as incidental grading, utilities and paving.”*

Examples of building construction include, but are not limited to, alterations and additions to buildings, apartment buildings (5 stories and above), arenas (closed), auditoriums, automobile parking garages, banks and financial buildings, barracks, churches, city halls, civic centers, commercial buildings, court houses, detention facilities, dormitories, farm buildings, fire stations, hospitals, hotels, industrial buildings, institutional buildings, libraries, mausoleums, motels, museums, nursing and convalescent facilities, office buildings, out-patient clinics, passenger and freight terminal buildings, police stations, post offices, power plants, prefabricated buildings, remodeling buildings, renovating buildings, repairing buildings, restaurants, schools, service stations, shopping centers, stores, subway stations, theaters, warehouses, water and sewage treatment plants (buildings only), etc.”

C. Definition of Public Works Contract

Section 18-2-401(11)(a), MCA defines “public works contract” as *“...a contract for construction services let by the state, county, municipality, school district, or political subdivision or for nonconstruction services let by the state, county, municipality, or political subdivision in which the total cost of the contract is in excess of \$25,000...”*.

D. Prevailing Wage Schedule

This publication covers only Building Construction occupations and rates. These rates will remain in effect until superseded by a more current publication. Current prevailing wage rate schedules for Heavy Construction, Highway Construction, and Nonconstruction Services occupations can be found on the internet at www.mtwagehoubopa.com or by contacting the Labor Standards Bureau at (406) 444-5600 or TDD (406) 444-5549.

E. Rates to Use for Projects

ARM, 24.17.127(1)(c), states *“The wage rates applicable to a particular public works project are those in effect at the time the bid specifications are advertised.”*

F. Wage Rate Adjustments for Multiyear Contracts

Section 18-2-417, MCA states:

“(1) Any public works contract that by the terms of the original contract calls for more than 30 months to fully perform must include a provision to adjust, as provided in subsection (2), the standard prevailing rate of wages to be paid to the workers performing the contract.

(2) The standard prevailing rate of wages paid to workers under a contract subject to this section must be adjusted 12 months after the date of the award of the public works contract. The amount of the adjustment must be a 3% increase. The adjustment must be made and applied every 12 months for the term of the contract.

(3) Any increase in the standard rate of prevailing wages for workers under this section is the sole responsibility of the contractor and any subcontractors and not the contracting agency.”

G. Fringe Benefits

Section 18-2-412, MCA states:

“(1) To fulfill the obligation...a contractor or subcontractor may:

(a) pay the amount of fringe benefits and the basic hourly rate of pay that is part of the standard prevailing rate of wages directly to the worker or employee in cash;

(b) make an irrevocable contribution to a trustee or a third person pursuant to a fringe benefit fund, plan, or program that meets the requirements of the Employee Retirement Income Security Act of 1974 or that is a bona fide program approved by the U. S. department of labor; or

(c) make payments using any combination of methods set forth in subsections (1)(a) and (1)(b) so that the aggregate of payments and contributions is not less than the standard prevailing rate of wages, including fringe benefits and travel allowances, applicable to the district for the particular type of work being performed.

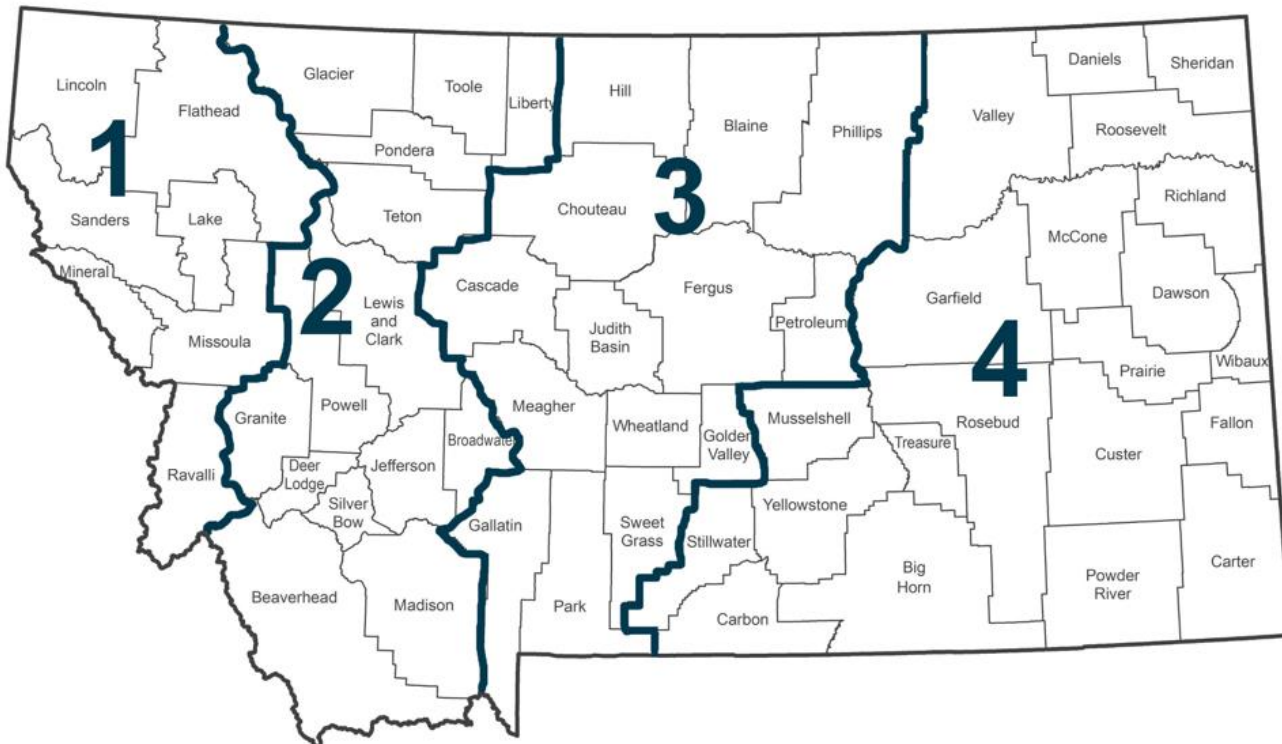
(2) The fringe benefit fund, plan, or program described in subsection (1)(b) must provide benefits to workers or employees for health care, pensions on retirement or death, life insurance, disability and sickness insurance, or bona fide programs that meet the requirements of the Employee Retirement Income Security Act of 1974 or that are approved by the U. S. department of labor.”

Fringe benefits are paid for all hours worked (straight time and overtime hours). However, fringe benefits are not to be considered a part of the hourly rate of pay for calculating overtime, unless there is a collectively bargained agreement in effect that specifies otherwise.

H. Prevailing Wage Districts

Montana counties are aggregated into 4 districts for the purpose of prevailing wage. The prevailing wage districts are composed of the following counties:

Montana Prevailing Wage Districts



I. Dispatch City

ARM, 24.17.103(11), defines dispatch city as “...*the courthouse in the city from the following list which is closest to the center of the job: Billings, Bozeman, Butte, Great Falls, Helena, Kalispell, and Missoula.*” A dispatch city shall be considered the point of origin only for jobs within the counties identified in that district (as shown below):

District 1 – Kalispell and Missoula: includes Flathead, Lake, Lincoln, Mineral, Missoula, Ravalli, and Sanders;

District 2 – Butte and Helena: includes Beaverhead, Broadwater, Deer Lodge, Glacier, Granite, Jefferson, Lewis and Clark, Liberty, Madison, Pondera, Powell, Silver Bow, Teton, and Toole;

District 3 – Bozeman and Great Falls: includes Blaine, Cascade, Chouteau, Fergus, Gallatin, Golden Valley, Hill, Judith Basin, Meagher, Park, Petroleum, Phillips, Sweet Grass, and Wheatland;

District 4 – Billings: includes Big Horn, Carbon, Carter, Custer, Daniels, Dawson, Fallon, Garfield, McCone, Musselshell, Powder River, Prairie, Richland, Roosevelt, Rosebud, Sheridan, Stillwater, Treasure, Valley, Wibaux, and Yellowstone.

J. Zone Pay

Zone pay is not travel pay. ARM, 24.17.103(24), defines zone pay as “...*an amount added to the base pay; the combined sum then becomes the new base wage rate to be paid for all hours worked on the project. Zone pay must be determined by measuring the road miles one way over the shortest practical maintained route from the dispatch city to the center of the job.*” See section I above for a list of dispatch cities.

K. Computing Travel Benefits

ARM, 24.17.103(22), states “ ‘*Travel pay, ’ also referred to as ‘travel allowance, ’ is and must be paid for travel both to and from the job site, except those with special provisions listed under the classification. The rate is determined by measuring the road miles one direction over the shortest practical maintained route from the dispatch city or the employee's home, whichever is closer, to the center of the job.*” See section I above for a list of dispatch cities.

L. Per Diem

ARM, 24.17.103(18), states “ ‘*Per diem ’ typically covers costs associated with board and lodging expenses. Per diem is paid when an employee is required to work at a location outside the daily commuting distance and is required to stay at that location overnight or longer.*”

M. Apprentices

Wage rates for apprentices registered in approved federal or state apprenticeship programs are contained in those programs. Additionally, Section 18-2-416(2), MCA states “...*The full amount of any applicable fringe benefits must be paid to the apprentice while the apprentice is working on the public works contract.*” Apprentices not registered in approved federal or state apprenticeship programs will be paid the appropriate journey level prevailing wage rate when working on a public works contract.

N. Posting Notice of Prevailing Wages

Section 18-2-406, MCA provides that contractors, subcontractors and employers who are “...*performing work or providing construction services under public works contracts, as provided in this part, shall post in a prominent and accessible site on the project or staging area, not later than the first day of work and continuing for the entire duration of the project, a legible statement of all wages and fringe benefits to be paid to the employees.*”

O. Employment Preference

Sections 18-2-403 and 18-2-409, MCA requires contractors to give preference to the employment of bona fide Montana residents in the performance of work on public works contracts.

P. Projects of a Mixed Nature

Section 18-2-408, MCA states:

“(1) The contracting agency shall determine, based on the preponderance of labor hours to be worked, whether the public works construction services project is classified as a highway construction project, a heavy construction project, or a building construction project.

(2) Once the project has been classified, employees in each trade classification who are working on that project must be paid at the rate for that project classification”

Q. Occupations Definitions

You can find definitions for these occupations on the following Bureau of Labor Statistics website:

http://www.bls.gov/oes/current/oes_stru.htm

R. Welder Rates

Welders receive the rate prescribed for the craft performing an operation to which welding is incidental.

S. Foreman Rates

Rates are no longer set for foremen. However, if a foreman performs journey level work, the foreman must be paid at least the journey level rate.

WAGE RATES

BOILERMAKERS

	Wage	Benefit
District 1	\$32.19	\$30.61
District 2	\$32.19	\$30.61
District 3	\$32.19	\$30.61
District 4	\$32.19	\$30.61

Duties Include:

Construct, assemble, maintain, and repair stationary steam boilers, boiler house auxiliaries, process vessels, and pressure vessels.

Travel:

All Districts

0-120 mi. free zone

>120 mi. federal mileage rate/mi.

Special Provision:

Travel is paid only at the beginning and end of the job.

Per Diem:

All Districts

0-70 mi. free zone

>70-120 mi. \$65.00/day

>120 mi. \$80.00/day

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BRICK, BLOCK, AND STONE MASONS

	Wage	Benefit
District 1	\$28.71	\$14.79
District 2	\$28.71	\$14.79
District 3	\$28.71	\$14.79
District 4	\$28.71	\$14.79

Travel:

All Districts

0-45 mi. free zone

>45-60 mi. \$32.50/day

>60-90 mi. \$62.00/day

>90 mi. \$75.00/day

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CARPENTERS

	Wage	Benefit
District 1	\$23.00	\$13.07
District 2	\$23.00	\$13.36
District 3	\$23.23	\$13.07
District 4	\$23.00	\$13.07

Duties Include:

Install roll and batt insulation, and hardwood floors.

Zone Pay:

All Districts

0-30 mi. free zone

>30-60 mi. base pay + \$4.00/hr.

>60 mi. base pay + \$6.00/hr.

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CEMENT MASONS AND CONCRETE FINISHERS

	Wage	Benefit
District 1	\$22.21	\$12.18
District 2	\$22.21	\$12.18
District 3	\$21.80	\$12.18
District 4	\$22.21	\$12.18

Duties Include:

Smooth and finish surfaces of poured concrete, such as floors, walks, sidewalks, or curbs. Align forms for sidewalks, curbs, or gutters.

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Zone Pay:

All Districts

0-30 mi. free zone

>30-60 mi. base pay + \$2.95/hr.

>60 mi. base pay + \$4.75/hr.

CONSTRUCTION EQUIPMENT OPERATORS GROUP 1

	Wage	Benefit
District 1	\$27.41	\$13.25
District 2	\$27.41	\$13.25
District 3	\$27.41	\$13.25
District 4	\$27.41	\$13.25

This group includes but is not limited to:

Air Compressor; Auto Fine Grader; Belt Finishing; Boring Machine (Small); Cement Silo; Crane, A-Frame Truck Crane; Crusher Conveyor; DW-10, 15, and 20 Tractor Roller; Farm Tractor; Forklift; Form Grader; Front-End Loader, under 1 cu. yd; Oiler, Heavy Duty Drills; Herman Nelson Heater; Mucking Machine; Oiler, All Except Cranes/Shovels; Pumpman.

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Zone Pay:

All Districts

0-30 mi. free zone

>30-60 mi. base pay + \$3.50/hr.

>60 mi. base pay + \$5.50/hr.

CONSTRUCTION EQUIPMENT OPERATORS GROUP 2

	Wage	Benefit
District 1	\$28.20	\$13.25
District 2	\$28.20	\$13.25
District 3	\$28.20	\$13.25
District 4	\$28.20	\$13.25

Zone Pay:
All Districts
 0-30 mi. free zone
 >30-60 mi. base pay + \$3.50/hr.
 >60 mi. base pay + \$5.50/hr.

This group includes but is not limited to:

Air Doctor; Backhoe\Excavator\Shovel, up to and incl. 3 cu. yds; Bit Grinder; Bituminous Paving Travel Plant; Boring Machine, Large; Broom, Self-Propelled; Concrete Travel Batcher; Concrete Float & Spreader; Concrete Bucket Dispatcher; Concrete Finish Machine; Concrete Conveyor; Distributor; Dozer, Rubber-Tired, Push, & Side Boom; Elevating Grader\Gradall; Field Equipment Serviceman; Front-End Loader, 1 cu. yd up to and incl. 5 cu. yds; Grade Setter; Gravel Conveyor; Heavy Duty Drills, All Types; Hoist\Tugger, All; Hydralift Forklifts & Similar; Industrial Locomotive; Motor Patrol (except finish); Mountain Skidder; Oiler, Cranes\Shovels; Pavement Breaker, EMSCO; Power Saw, Self-Propelled; Pugmill; Pumpcrete\Grout Machine; Punch Truck; Roller, other than Asphalt; Roller, Sheepsfoot (Self-Propelled); Roller, 25 tons and over; Ross Carrier; Rotomill, under 6 ft; Trenching Machine; Washing /Screening Plant.

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CONSTRUCTION EQUIPMENT OPERATORS GROUP 3

	Wage	Benefit
District 1	\$28.95	\$13.25
District 2	\$28.95	\$13.25
District 3	\$28.95	\$13.25
District 4	\$28.95	\$13.25

Zone Pay:
All Districts
 0-30 mi. free zone
 >30-60 mi. base pay + \$3.50/hr.
 >60 mi. base pay + \$5.50/hr.

This group includes but is not limited to:

Asphalt Paving Machine; Asphalt Screed; Backhoe\Excavator\Shovel, over 3 cu. yds; Cableway Highline; Concrete Batch Plant; Concrete Curing Machine; Concrete Pump; Cranes, Creter; Cranes, Electric Overhead; Cranes, 24 tons and under; Curb Machine\Slip Form Paver; Finish Dozer; Front-End Loader, over 5 cu. yds; Mechanic\Welder; Pioneer Dozer; Roller Asphalt (Breakdown & Finish); Rotomill, over 6 ft; Scraper, Single, Twin, or Pulling Belly-Dump; YO-YO Cat.

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CONSTRUCTION EQUIPMENT OPERATORS GROUP 4

	Wage	Benefit
District 1	\$29.95	\$13.25
District 2	\$29.95	\$13.25
District 3	\$29.95	\$13.25
District 4	\$29.95	\$13.25

Zone Pay:
All Districts
0-30 mi. free zone
>30-60 mi. base pay + \$3.50/hr.
>60 mi. base pay + \$5.50/hr.

This group includes but is not limited to:

Asphalt\Hot Plant Operator; Cranes, 25 tons up to and incl. 44 tons; Crusher Operator; Finish Motor Patrol; Finish Scraper.

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CONSTRUCTION EQUIPMENT OPERATORS GROUP 5

	Wage	Benefit
District 1	\$30.95	\$13.25
District 2	\$30.95	\$13.25
District 3	\$30.95	\$13.25
District 4	\$30.95	\$13.25

Zone Pay:
All Districts
0-30 mi. free zone
>30-60 mi. base pay + \$3.50/hr.
>60 mi. base pay + \$5.50/hr.

This group includes but is not limited to:

Cranes, 45 tons up to and incl. 74 tons.

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CONSTRUCTION EQUIPMENT OPERATORS GROUP 6

	Wage	Benefit
District 1	\$31.95	\$13.25
District 2	\$31.95	\$13.25
District 3	\$31.95	\$13.25
District 4	\$31.95	\$13.25

Zone Pay:
All Districts
0-30 mi. free zone
>30-60 mi. base pay + \$3.50/hr.
>60 mi. base pay + \$5.50/hr.

This group includes but is not limited to:

Cranes, 75 tons up to and incl. 149 tons; Cranes, Whirley (All).

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CONSTRUCTION EQUIPMENT OPERATORS GROUP 7

	Wage	Benefit
District 1	\$32.95	\$13.25
District 2	\$32.95	\$13.25
District 3	\$32.95	\$13.25
District 4	\$32.95	\$13.25

Zone Pay:
All Districts
0-30 mi. free zone
>30-60 mi. base pay + \$3.50/hr.
>60 mi. base pay + \$5.50/hr.

This group includes but is not limited to:

Cranes, 150 tons up to and incl. 250 tons; Cranes, over 250 tons—add \$1.00 for every 100 tons over 250 tons; Crane, Tower (All); Crane Stiff-Leg or Derrick; Helicopter Hoist.

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CONSTRUCTION LABORERS GROUP 1/FLAG PERSON FOR TRAFFIC CONTROL

	Wage	Benefit
District 1	\$19.90	\$9.22
District 2	\$19.90	\$9.22
District 3	\$19.90	\$9.22
District 4	\$19.90	\$9.22

Zone Pay:
All Districts
0-15 mi. free zone
>15-30 mi. base pay + \$0.65/hr.
>30-50 mi. base pay + \$0.85/hr.
>50 mi. base pay + \$1.25/hr.

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CONSTRUCTION LABORERS GROUP 2

	Wage	Benefit
District 1	\$19.11	\$6.92
District 2	\$22.35	\$9.22
District 3	\$22.67	\$5.18
District 4	\$20.87	\$4.93

Zone Pay:
All Districts
0-15 mi. free zone
>15-30 mi. base pay + \$0.65/hr.
>30-50 mi. base pay + \$0.85/hr.
>50 mi. base pay + \$1.25/hr.

This group includes but is not limited to:

General Labor; Asbestos Removal; Burning Bar; Bucket Man; Carpenter Tender; Caisson Worker; Cement Mason Tender; Cement Handler (dry); Chuck Tender; Choker Setter; Concrete Worker; Curb Machine-lay Down; Crusher and Batch Worker; Heater Tender; Fence Erector; Landscape Laborer; Landscaper; Lawn Sprinkler Installer; Pipe Wrapper; Pot Tender; Powderman Tender; Rail and Truck Loaders and Unloaders; Riprapper; Sign Erection; Guardrail and Jersey Rail; Spike Driver; Stake Jumper; Signalman; Tail Hoseman; Tool Checker and Houseman and Traffic Control Worker.

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CONSTRUCTION LABORERS GROUP 3

	Wage	Benefit
District 1	\$20.90	\$9.22
District 2	\$20.90	\$9.22
District 3	\$20.90	\$9.22
District 4	\$20.90	\$9.22

This group includes but is not limited to:

Concrete Vibrator; Dumpman (Grademan); Equipment Handler; Geotextile and Liners; High-Pressure Nozzleman; Jackhammer (Pavement Breaker) Non-Riding Rollers; Pipelayer; Posthole Digger (Power); Power Driven Wheelbarrow; Rigger; Sandblaster; Sod Cutter-Power and Tamper.

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Zone Pay:

All Districts

0-15 mi. free zone
>15-30 mi. base pay + \$0.65/hr.
>30-50 mi. base pay + \$0.85/hr.
>50 mi. base pay + \$1.25/hr.

CONSTRUCTION LABORERS GROUP 4

	Wage	Benefit
District 1	\$22.44	\$9.67
District 2	\$22.44	\$9.67
District 3	\$22.44	\$9.67
District 4	\$22.44	\$9.67

This group includes but is not limited to:

Hod Carrier***; Water Well Laborer; Blaster; Wagon Driller; Asphalt Raker; Cutting Torch; Grade Setter; High-Scaler; Power Saws (Faller & Concrete) Powderman; Rock & Core Drill; Track or Truck Mounted Wagon Drill and Welder incl. Air Arc.

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Zone Pay:

All Districts

0-15 mi. free zone
>15-30 mi. base pay + \$0.65/hr.
>30-50 mi. base pay + \$0.85/hr.
>50 mi. base pay + \$1.25/hr.

DRYWALL APPLICATORS

	Wage	Benefit
District 1	\$23.00	\$13.07
District 2	\$23.00	\$13.36
District 3	\$23.00	\$13.07
District 4	\$23.00	\$13.07

Duties Include:

Drywall and ceiling tile installation.

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Zone Pay:

All Districts

0-30 mi. free zone
>30-60 mi. base pay + \$4.00/hr.
>60 mi. base pay + \$6.00/hr.

ELECTRICIANS: INCLUDING BUILDING AUTOMATION CONTROL

	Wage	Benefit
District 1	\$30.51	\$14.17
District 2	\$30.38	\$13.77
District 3	\$31.05	\$13.15
District 4	\$33.58	\$13.93

Duties Include:

Electrical wiring; equipment and fixtures; street lights; electrical control systems. Installation and/or adjusting of building automation controls also during testing and balancing, commissioning and retro-commissioning.

Travel:

District 1

No mileage due when traveling in employer's vehicle.

The following travel allowance is applicable when traveling in employee's vehicle:

- 0-10 mi. free zone
- >10-45 mi. \$0.585/mi. in excess of the free zone.
- >45 mi. \$75.00/day

Districts 2 & 3

No mileage due when traveling in employer's vehicle.

The following travel allowance is applicable when traveling in employee's vehicle:

- 0-08 mi. free zone
- >08-50 mi. federal mileage rate/mi. in excess of the free zone.
- >50 mi. \$66.00/day

District 4

No mileage due when traveling in employer's vehicle.

The following travel allowance is applicable when traveling in employee's vehicle:

- 0-18 mi. free zone
- >18-60 mi. federal mileage rate/mi.
- >60 mi. \$75.00/day

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ELEVATOR CONSTRUCTORS

	Wage	Benefit
District 1	\$52.41	\$33.00
District 2	\$52.41	\$33.00
District 3	\$52.41	\$33.00
District 4	\$52.41	\$33.00

Travel:

All Districts

- 0-15 mi. free zone
- >15-25 mi. \$42.01/day
- >25-35 mi. \$84.01/day
- >35 mi. \$84.90/day or cost of receipts for hotel and meals, whichever is greater.

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FLOOR LAYERS (EXCEPT CARPET, WOOD, AND HARD TILES)

No Rate Established

Apply blocks, strips, or sheets of shock-absorbing, sound-deadening, or decorative coverings to floors.

Travel and Per Diem:

All Districts

No travel or per diem established

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GLAZIERS

	Wage	Benefit
District 1	\$18.48	\$2.74
District 2	\$18.01	\$2.50
District 3	\$18.82	\$2.82
District 4	\$19.81	\$3.02

Travel and Per Diem:

All Districts

No travel or per diem established.

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HEATING AND AIR CONDITIONING

	Wage	Benefit
District 1	\$29.62	\$18.00
District 2	\$29.62	\$18.00
District 3	\$29.62	\$18.00
District 4	\$29.62	\$18.00

Duties Include:

Testing and balancing, commissioning and retro-commissioning of all air-handling equipment and duct work.

Travel:

All Districts

0-50 mi. free zone

>50 mi.

- \$0.25/mi. in employer vehicle.
- \$0.65/mi. in employee vehicle.

Per Diem:

All Districts

\$70/day

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INSULATION WORKERS - MECHANICAL (HEAT AND FROST)

	Wage	Benefit
District 1	\$31.17	\$19.47
District 2	\$31.17	\$19.47
District 3	\$31.17	\$19.47
District 4	\$31.17	\$19.47

Duties Include:

Insulate pipes, ductwork or other mechanical systems.

Travel:

All Districts

0-30 mi. free zone

>30-40 mi. \$20.00/day

>40-50 mi. \$30.00/day

>50-60 mi. \$40.00/day

>60 mi. \$45.00/day plus

- \$0.56/mi. if transportation is not provided.
- \$0.20/mi. if in company vehicle.

>60 mi. \$86.00/day on jobs requiring an overnight stay plus

- \$0.56/mi. if transportation is not provided.
- \$0.20/mi. if in company vehicle.

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IRONWORKERS - STRUCTURAL STEEL AND REBAR PLACERS

	Wage	Benefit
District 1	\$27.75	\$25.45
District 2	\$27.25	\$22.14
District 3	\$27.25	\$22.14
District 4	\$27.25	\$22.14

Duties Include:

Structural steel erection; assemble prefabricated metal buildings; cut, bend, tie, and place rebar; energy producing windmill type towers; metal bleacher seating; handrail fabrication and ornamental steel.

Travel:

District 1

0-45 mi. free zone

>45-60 mi. \$40.00/day

>60-100 mi. \$65.00/day

>100 mi. \$85.00/day

Special Provision:

When the employer provides transportation, travel will not be paid. However, when an employee is required to travel over 70 miles one way, the employee may elect to receive the travel pay in lieu of the transportation.

Districts 2, 3 & 4

0-45 mi. free zone

>45-85 mi. \$60.00/day

>85 mi. \$90.00/day

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MILLWRIGHTS

	Wage	Benefit
District 1	\$33.00	\$13.07
District 2	\$33.00	\$13.36
District 3	\$33.00	\$13.07
District 4	\$33.00	\$13.07

Zone Pay:

All Districts

0-30 mi. free zone

>30-60 mi. base pay + \$4.00/hr.

>60 mi. base pay + \$6.00/hr.

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PAINTERS: INCLUDING PAPERHANGERS

	Wage	Benefit
District 1	\$19.66	\$6.98
District 2	\$21.42	\$6.81
District 3	\$23.47	\$6.29
District 4	\$19.28	\$5.84

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Travel and Per Diem:

All Districts

No travel or per diem established.

PILE BUCKS

	Wage	Benefit
District 1	\$30.00	\$13.07
District 2	\$30.00	\$13.36
District 3	\$30.00	\$13.07
District 4	\$30.00	\$13.07

Duties Include:

Set up crane; set up hammer; weld tips on piles; set leads; insure piles are driven straight with the use of level or plum bob. Give direction to crane operator as to speed and direction of swing. Cut piles to grade.

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Zone Pay:

All Districts

0-30 mi. free zone

>30-60 mi. base pay + \$4.00/hr.

>60 mi. base pay + \$6.00/hr.

PLASTERERS

	Wage	Benefit
District 1	\$22.21	\$12.18
District 2	\$22.21	\$12.18
District 3	\$21.80	\$12.18
District 4	\$22.21	\$12.18

Duties Include:

All materials beyond the substrate, such as a moisture barrier, any type of drainage installation between the moisture barrier and insulation or EPS board, the attachment of the EPS board, installation of fiberglass mesh embedded in the base coat, any water-resistant coat that is applied on top of the insulation to serve as a weather barrier, and the application of the finish coat.

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Zone Pay:

All Districts

0-30 mi. free zone

>30-60 mi. base pay + \$2.95/hr.

>60 mi. base pay + \$4.75/hr

PLUMBERS, PIPEFITTERS, AND STEAMFITTERS

	Wage	Benefit
District 1	\$29.88	\$13.56
District 2	\$30.00	\$16.00
District 3	\$30.00	\$16.00
District 4	\$32.31	\$18.36

Duties Include:

Assemble, install, alter, and repair pipe-lines or pipe systems that carry water, steam, air, other liquids or gases. Testing of piping systems, commissioning and retro-commissioning. Workers in this occupation may also install heating and cooling equipment and mechanical control systems.

Travel:

District 1

0-30 mi. free zone
>30-50 mi. \$25.00/day
>50-75 mi. \$40.00/day
>75 mi. \$75.00/day

Special Provision

If transportation is not provided, mileage at \$0.35/mi. with a separate free zone of 20 miles is added to the amounts above. However, if the employee is traveling more than 75 miles/day, only subsistence is required.

Districts 2 & 3

0-40 mi. free zone
>40-80 mi. \$30.00/day
>80 mi. \$60.00/day

Special Provision:

If employer provides transportation, travel pay will be ½ of the amounts listed above unless the employee stays overnight. If the employee chooses to stay overnight, the employee will receive the full amount of travel listed above even if the employer furnishes transportation.

District 4

0-70 free zone
>70 mi.

- On jobs when employees do not work consecutive days: \$0.55/mi. if employer doesn't provide transportation. Not to exceed two trips.
- On jobs when employees work any number of consecutive days: \$100.00/day.

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ROOFERS

	Wage	Benefit
District 1	\$20.23	\$8.63
District 2	\$16.00	\$9.08
District 3	\$19.33	\$4.52
District 4	\$19.45	\$4.31

Duties Include:

Metal roofing.

Travel:

District 1

0-50 mi. free zone
>50 mi. \$0.35/mi.

District 2 and 3

0-25 mi. free zone
>25 mi. \$0.35/mi only when employer doesn't provide transportation.

District 4

0-30 mi. free zone
>30 mi. \$0.25/mi only when employer doesn't provide transportation.

Per Diem:

District 1

\$60.00/day

District 2 and 3

Employer pays for room + \$25.00/day.

District 4

Employer pays for room + \$25.00/day.

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SHEET METAL WORKERS

	Wage	Benefit
District 1	\$29.62	\$18.00
District 2	\$29.62	\$18.00
District 3	\$29.62	\$18.00
District 4	\$29.62	\$18.00

Duties Include:

Testing and balancing, commissioning and retro-commissioning of all air-handling equipment and duct work. Manufacture, fabrication, assembling, installation, dismantling, and alteration of all HVAC systems, air veyer systems, and exhaust systems. All lagging over insulation and all duct lining.

Travel:

All Districts

0-50 mi. free zone
>50 mi.

- \$0.25/mi. in employer vehicle
- \$0.65/mi. in employee vehicle

Per Diem:

All Districts

\$70.00/day

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SOLAR PHOTOVOLTAIC INSTALLERS

	Wage	Benefit
District 1	\$30.51	\$14.17
District 2	\$31.05	\$14.56
District 3	\$31.05	\$13.15
District 4	\$33.58	\$13.93

Travel:

District 1

No mileage due when traveling in employer's vehicle.

The following travel allowance is applicable when traveling in employee's vehicle:

- 0-10 mi. free zone
- >10-45 mi. \$0.585/mi. in excess of the free zone.
- >45 mi. \$75.00/day

Districts 2 & 3

No mileage due when traveling in employer's vehicle.

The following travel allowance is applicable when traveling in employee's vehicle:

- 0-08 mi. free zone
- >08-50 mi. federal mileage rate/mi. in excess of the free zone.
- >50 mi. \$66.00/day

District 4

No mileage due when traveling in employer's vehicle.

The following travel allowance is applicable when traveling in employee's vehicle:

- 0-18 mi. free zone
- >18-60 mi. federal mileage rate/mi.
- >60 mi. \$75.00/day

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SPRINKLER FITTERS

	Wage	Benefit
District 1	\$34.35	\$20.44
District 2	\$34.35	\$20.44
District 3	\$29.90	\$20.44
District 4	\$34.35	\$20.44

Duties Include:

Duties Include but not limited to any and all fire protection systems: Installation, dismantling, inspection, testing, maintenance, repairs, adjustments, and corrections of all fire protection and fire control systems, including both overhead and underground water mains, all piping, fire hydrants, standpipes, air lines, tanks, and pumps used in connection with sprinkler and alarm systems.

Travel:

All Districts

- 0-60 mi. free zone
- >60-80 mi. \$19.00/day
- >80-100 mi. \$29.00/day
- >100 mi. \$100.00/day

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TAPERS

	Wage	Benefit
District 1	\$19.66	\$6.98
District 2	\$21.42	\$6.81
District 3	\$23.47	\$6.29
District 4	\$19.28	\$5.84

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Travel and Per Diem:

All Districts

No travel or per diem established.

TELECOMMUNICATIONS EQUIPMENT INSTALLERS

	Wage	Benefit
District 1	\$27.23	\$9.58
District 2	\$23.62	\$6.96
District 3	\$23.57	\$7.85
District 4	\$23.47	\$7.25

Duties Include:

Install voice; sound; vision and data systems. This occupation includes burglar alarms, fire alarms, fiber optic systems, and video systems for security or entertainment.

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Travel:

All Districts

The federal mileage rate/mi. in effect when travel occurs if using own vehicle.

Per Diem:

All Districts

Employer pays for meals and lodging up to \$75.00/day. When jobsite is located in Big Sky, West Yellowstone, and Gardiner, lodging and meals will be provided by the employer for all actual and reasonable expenses incurred.

TILE, TERRAZZO AND MARBLE FINISHERS

No Rate Established

Duties Include:

Finish work on hard tile, marble, and wood tile to floors, ceilings, and roof decks.

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Travel:

All Districts

0-60 mi. free zone
>60-75 mi. \$30.00/day
>75-215 mi. \$65.00/day
>215 mi. \$80.00/day

TILE, TERRAZZO AND MARBLE SETTERS

No Rate Established

Duties Include:

Apply hard tile, marble, and wood tile to floors, ceilings, and roof decks.

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Travel:

All Districts

0-60 mi. free zone
>60-75 mi. \$30.00/day
>75-215 mi. \$65.00/day
>215 mi. \$80.00/day

TRUCK DRIVERS

No Rate Established

This group includes but is not limited to:

Combination Truck & Concrete Mixer; Distributor Driver;
Dry Batch Trucks; Dump Trucks & Similar Equipment;
Flat Trucks; Lowboys, Four-Wheel Trailers, Float
Semitrailer; Powder Truck Driver (Bulk Unloader Type);
Servicemen; Service Truck Drivers, Fuel Truck Drivers,
Tiremen; Trucks with Power Equipment; Truck
Mechanic; Water Tank Drivers, Petroleum Product
Drivers.

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**SECTION 011000
SUMMARY**

1.1 PART 1 - GENERAL

A. Related Documents

1. Drawings and general provisions of Contract, including General Conditions, Supplemental Conditions and other Division 1 Specification Sections, apply to this Section.

B. Project Description

1. Recently Montana State University lost two of their recreational and gym facilities, due to a 100-year snow event. Until these facilities can be replaced, the University will install temporary recreational space on campus. Two temporary, air supported, dome shaped structures have been chosen to house MSU's temporary recreational and athletic needs. The structures will be placed east of the Fieldhouse and Tennis Center, and south of the Parking Garage. Upon removal of the dome structures, the existing exterior tennis courts will return to their previous exterior use.

C. Site Information

1. Scope of work includes, but is not necessarily limited to, provide and install all necessary work for two temporary air supported structures, including foundations, utilities and exterior flatwork access paths.

D. Contracts

1. Contracts shall be under one General Contract and shall include, but not be limited to, all labor, materials, and supervision necessary to furnish and install the Work.

E. Work Sequence

1. The work will be conducted in one phase to provide the least possible interference to the activities of the Owner's personnel and activities.
2. The Contractor will have access to the site from the date of receipt of the contract.

F. Contractor Use of Premises

1. Work on this contract is expected to be done during regular working hours Monday through Friday. Any variation from this will require prior approval of the Consultant and Owner.
2. All work must be coordinated with MSU at all times and MSU must be informed about any work impacting campus operations 72 hours or 3 working days in advance of work being conducted and shall require MSU approval.
3. General: Limit use of the premises to construction activities in areas indicated; allow for Owner/MSU occupancy and use by the public. Confine operations to areas within contract limits indicated. Portions of the site beyond areas in which construction operations are indicated are not to be disturbed.
4. Contractor shall conduct all his work in such a manner as to minimize the inconvenience and disruption of MSU's daily schedule.

5. Confine operations at the site to the areas permitted under the Contract. Portions of the site beyond areas on which work is indicated are not to be disturbed. Conform to site rules and regulations affecting the work while engaged in project construction.
6. Do not unreasonably encumber the site with materials or equipment. Confine stockpiling of materials to the areas designated on the drawings. If additional storage is necessary, obtain and pay for such storage off-site.
7. Contractor shall establish a staging area for storage of materials and equipment.
8. The Contractor is to coordinate with MSU for the location of the job site trailer office.
9. Keep driveways and entrances serving the premises clear and available to MSU and MSU's employees, staff and visitors at all times, unless otherwise agreed by MSU. Do not use these areas for parking or storage of materials. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on site.

G. Parking and Site Access

(See also Supplemental Conditions of the Contract for Construction.)

1. MSU Bozeman Vehicle Regulations state: "All students, faculty, staff, and visitors must register any motor vehicle they park on the University campus, for any reason. A visitor is anyone not defined as student, staff or faculty."
2. All Contractor and Contractor employees shall comply with Montana State University parking regulations. MSU parking permits can be purchased at the University Police Office located in the Huffman Building at Seventh Avenue and Kagy Boulevard. Violators of MSU Bozeman Vehicle Regulations may be ticketed and towed.
3. A maximum of three (3) Contractor Permits (or as agreed with MSU) will be made available to the Contractor for parking of essential vehicles within the designated parking lot (as designated on the Cover Sheet of the Contract Documents). Essential vehicles are vehicles used for delivery of equipment and tools required to be parked in close proximity to the construction area. All allowed vehicles only to be parked on hard surfaced areas within the Staging Area. All other Contractor and Contractor employee vehicles on campus shall be parked in designated parking lots to be agreed with MSU. No personal vehicles shall be parked at the project site in any event. If a driver of a vehicle not allowed to be parked at the project site must unload equipment, tools, or materials, the vehicle must be immediately thereafter move to a designated lot or leave campus.
4. Access and egress to and from the project site shall be via the staging area in Gatton Parking Lot only. In cases where a different route must be used for a specific purpose, permission must be obtained from MSU. Access routes are for delivery of equipment, tools, and materials and not for parking.
5. The site Staging Areas for materials and equipment are designated on the Cover Sheet of the Contract Documents. Staged materials and equipment must be secured on the ground surface or in trailers. Site staging areas shall be fenced in accordance with the Contract Documents. Vehicles in addition to those allowed to be parked may not be used for staging of equipment, tools, or materials.

H. Owner Occupancy

1. Full Owner/MSU Occupancy: The Owner/MSU will occupy the site during the entire construction period. Cooperate with MSU during construction operations

to minimize conflicts and facilitate MSU usage. Perform the work so as not to interfere with MSU's operations.

I. Safety Requirements

1. General: The safety measures required by the Contract Documents are not meant to be inclusive. The Contractor shall be solely responsible for safety on a 24-hours-per-day, 7 days-per-week basis and shall take whatever additional measures are necessary to insure the health and safety of the buildings' occupants, or pedestrians at or near the construction site and access routes and of all other persons in all areas affected by the Contractor's activities. Prior to the start of construction, the Contractor is to submit to the Consultant, a detailed written plan specifying the safety procedures that will be followed. Include (but not by way of limitation) the following: Verbiage, size and locations of warning signs; construction sequence as related to safety; use of barricades (type and location); employee policies as related to safety; and delivery of materials as related to safety. Revise the safety plan as required during construction and resubmit to the Owner.
2. All application, material handling, and associated equipment shall conform to and be operated in conformance with OSHA safety requirements.
3. Comply with Federal, State, local, and the Owner's fire, health and safety requirements.
4. Advise MSU whenever work is expected to be hazardous or inconvenient (including objectionable odors) to MSU's employees, students, visitors or the building occupants.
5. Construction materials or equipment shall be placed so as not to endanger the work or prevent free access to all emergency devices or utility disconnects.
6. Maintain the proper rated fire extinguishers within easy access where power tools, sanding or other equipment is being used.
7. The Contractor shall erect and maintain, as required by law, conditions and progress of the work, warning signs, barricades and other reasonable safeguards for safety and protection.

J. Existing Premises Condition

1. The Contractor is responsible for adequately documenting in photos the existing condition of the premises, to include external road surfaces, curbing and landscaped areas, specifically the cleanliness of areas. Any damage to the premises which is found after construction and is not so documented will be the responsibility of the Contractor to repair or replace.

K. Discrepancies in the Documents

1. The Contractor shall bring any discrepancies between any portions of the drawings and specifications to the attention of the Owner and the Consultant in writing. The Owner and Consultant shall review the discrepancy and clarify the intent desired in the Contract Documents. Unless specifically directed otherwise, the Contractor shall be obligated to provide the greater quantity or quality without any change in contract sum or time.

END OF SECTION 011000

**SECTION 012000
PRICE AND PAYMENT PROCEDURES**

1.1 GENERAL

A. Related Documents

1. Drawings and general provisions of Contract, including General Conditions, Supplemental Conditions and other Division 1 Specification Sections, apply to this Section.

B. Summary

1. This Section specified administrative and procedural requirements governing the Contractor's Applications for Payment.
2. The Contractor's Construction Schedule and Submittal Schedule are included in Section "Submittals".

C. Schedule of Values

1. Coordinate preparation of the Schedule of Values, Form 100, with preparation of the Contractor's Construction Schedule.
2. Each prime Contractor shall coordinate preparation of its Schedule of Values for its part of the work with preparation of the Contractor's Construction Schedule.
3. Correlate line items in the Schedule of Values with other required administrative schedules and forms, including:
 - a. Contractor's construction schedule
 - b. Application for Payment form
 - c. List of subcontractors
 - d. Schedule of allowances
 - e. Schedule of alternates
 - f. List of products
 - g. List of principal suppliers and fabricators
 - h. Schedule of submittals
 - i. Submit the Schedule of Values to the Architect at the earliest feasible date, but in no case later than seven (7) days before the date scheduled for submittal of the initial Application for Payment.
 - j. Sub-Schedules: Where the work is separated into phases that require separately phased payments, provide sub-schedules showing values correlated with each phase of payment.
4. Format and Content: Use the Project Manual Table of Contents as a guide to establish the format for the Schedule of Values.
 - a. Identification: Include the following project identification on the Schedule of Values:
 - 1) Project name
 - 2) Name of the Architect
 - 3) Project number (PPA No.)
 - 4) Contractor's name and address
 - 5) Date of submittal

- b. Arrange the Schedule of Values in a tabular form with separate columns to indicate the following for each item listed:
 - 1) Generic name
 - 2) Related specification section
 - 3) Name of subcontractor
 - 4) Name of manufacturer or fabricator
 - 5) Name of supplier
 - 6) Change Orders (numbers) that have affected value
 - 7) Dollar value
 - a) Percentage of Contract Sum in the nearest one-hundredth percent, adjusted to total 100%
 - c. Provide a breakdown of the Contract Sum in sufficient detail to facilitate continued evaluation of Applications for Payment and progress reports. Break principal subcontract amounts down into several line items.
 - d. Round amounts off to the nearest whole dollar; the total shall equal the Contract Sum.
 - e. For each part of the work where an Application for Payment may include materials or equipment, purchased or fabricated and stored, but not yet installed, provide separate line items on the Schedule of Values for initial cost of the materials, for each subsequent stage of completion, and for total installed value of that art of the work.
5. Margins of Cost: Show line items for indirect costs, and margins on actual costs, only to the extent that such items will be listed individually in Applications for Payment. Each item in the Schedule of Values and Applications for Payment shall be complete including its total cost and proportionate share of general overhead and profit margin.
- a. At the Contractor's option, temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown as separate line items in the Schedule of Values or distributed as general overhead expense.
6. Schedule Updating: Update and resubmit the Schedule of Values when Change Orders or Construction Change Directives result in a change in the Contract Sum.

D. Applications for Payment

- 1. Each Application for Payment shall be consistent with previous applications and payments as certified by the Architect and paid for by the Owner. The initial Application for Payment, the Application for Payment at time of Substantial Completion, and the final Application for Payment involve additional requirements.
- 2. Payment Application Times: Each progress payment date is as indicated in the Agreement. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.
- 3. Payment Application Forms: Use Montana Form 101 as the form for Application for Payment.
- 4. Application Preparation: Complete every entry on the form, including notarization and execution by person authorized to sign legal documents on behalf of the Owner. Incomplete applications will be returned without action.

- a. Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions have been made.
 - b. Include amounts of Change Orders and Construction Change Directives issued prior to the last day of the construction period covered by the application.
5. Transmittal: Submit one (1) executed copy of each Application for Payment to the Architect by means ensuring receipt within 24 hours, including waivers of lien and similar attachments, when required.
- a. Transmit each copy with a transmittal form listing attachments, and recording appropriate information related to the application in a manner acceptable to the Architect.
6. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of the first Application for Payment include the following:
- a. List of subcontractors
 - b. Schedule of Values
 - 1) Contractor's Construction Schedule (preliminary if not final)
 - c. Copies of building permits
 - 1) Copies of authorizations and licenses from governing authorities for performance of the work
 - d. Certificates of insurance and insurance policies (submitted with Contract)
 - e. Performance and payment bonds (submitted with Contract if required)
7. Application for Payment at Substantial Completion: Following issuance of the Certificate of Substantial Completion, submit an Application for Payment; this application shall reflect any Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the work.
8. Administrative actions and submittals that shall proceed or coincide with this application include:
- a. Occupancy permits and similar approvals
 - b. Warranties (guarantees) and maintenance agreements
 - c. Test/adjust/balance records
 - d. Maintenance instructions
 - e. Meter readings
 - f. Start-up performance reports
 - 1) Change-over information related to Owner's occupancy, use, operation and maintenance.
 - g. Final cleaning
 - 1) Application for reduction of retainage, and consent of surety

9. Final Payment Application: Administrative actions and submittals which must precede or coincide with submittal of the final Application for Payment include the following:
- a. Completion of project closeout requirements
 - 1) Completion of items specified for completion after Substantial Completion
 - b. Assurance that unsettled claims will be settled
 - 1) Assurance that work not complete and accepted will be completed without undue delay
 - 2) Transmittal of required project construction records to Owner

END OF SECTION 01200

**SECTION 012300
ALTERNATES**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions, Supplemental Conditions and other Division 1 Specification Sections, apply to this section. See also *Instructions to Bidders 10.3 Award of Bids*.

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for alternates.

1.3 DEFINITIONS

- A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the Bidding Requirements that may be added to or deducted from the Base Bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
 - 1. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.4 PROCEDURES

- A. Coordination: Modify or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
 - 1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.
- B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated modifications to alternates.
- C. Execute accepted alternates under the same conditions as other work of the Contract.
- D. Schedule: A Schedule of Alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. Description of Alternates

Add Alternate #1: This alternate is to have the Air-Supported Fabric Structures to include (1) 50-tonne bottom discharge recirc unit Model #TCH60DBE to the 162' x 242' structure and provide (1) 30-tonne bottom discharge recirc unit Model #TCH36DBE to the 130'-8" x 162' structure, as identified by the Basis of Design Manufacturer in Specification Section 133113 Air-Supported Fabric Structures, and all associated items required to include this into the mechanical system of the structures.

END OF SECTION

**SECTION 012500
SUBSTITUTION PROCEDURES**

PART 1 - GENERAL

- A. Related Documents
 - 1. Drawings and general provisions of Contract, including General Conditions, Supplemental Conditions and *Instructions to Bidders*.

- B. Substitution Procedures
 - 1. Substitutions include changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by the Contractor.
 - 2. Substitution Requests: Submit three copies of each request on MSU Substitution Request Form 099 for each consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - a. Submit requests in accordance with *Instructions to Bidders*.
 - b. Identify product to be replaced and show compliance with requirements for substitutions. Include a detailed comparison of significant qualities of proposed substitution with those of the Work specified, a list of changes needed to other parts of the Work required to accommodate proposed substitution, and any proposed changes in the Contract Sum or the Contract Time should the substitution be accepted.

- C. Architect will review proposed substitutions and notify Contractor of their acceptance or rejection. If necessary, Architect will request additional information or documentation of evaluation.
 - 1. Architect will notify Contractor of acceptance or rejection of proposed substitution within 10 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.

- D. Do not submit unapproved substitutions on Shop Drawings or other submittals.

END OF SECTION 012500

SECTION 013000

SUBMITTALS

1.1 GENERAL

A. Related Documents

1. Drawings and general provisions of Contract, including General Conditions, Supplemental Conditions and other Division 1 Specification Sections, apply to this Section.

B. Summary

1. This Section specifies administrative and procedural requirements for submittals required for performance of the work, including:
 - a. Contractor's construction schedule
 - b. Submittal schedule
 - c. Daily construction reports
 - d. Shop Drawings
 - e. Product data
 - f. Samples

Note: All Submittals are to be both print and electronic.

2. Administrative Submittals: Refer to other Division 1 Sections and other Contract Documents for requirements for administrative submittals. Such submittals include, but are not limited to:
 - a. Permits
 - b. Applications for Payment
 - c. Performance and payment bonds
 - d. Insurance certificates
 - e. List of Subcontractors

3. The Schedule of Values submitted is included in Section "Applications for Payment".
4. Inspection and test reports are included in Section "Quality Requirements".
5. Unless otherwise instructed by the Owner all submittals shall be directed to Architect/Engineer Consultant of Record. The Contractor's construction schedule, submittal schedule and daily construction reports shall be directed to the Consultant's representative, the State of Montana's representative and MSU's representative. Shop drawings, product data and samples shall be directed to the Consultant's representative.

C. Submittal Procedures

1. Coordination: Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.
 - a. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals and related activities that require sequential activity.

- b. Coordinate transmittal of different types of submittals for related elements of the work so processing will not be delayed by the need to review submittals concurrently for coordination.
 - 1) The Consultant reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
 - c. Processing: Allow sufficient review time so that installation will not be delayed as a result of the time required to process submittals, including time for resubmittals.
 - 1) Allow two (2) weeks for initial review. Allow additional time if processing must be delayed to permit coordination with subsequent submittals. The Consultant will promptly advise the Contractor when a submittal being processed must be delayed for coordination.
 - 2) If an intermediate submittal is necessary, process the same as the initial submittal.
 - 3) Allow two (2) weeks for reprocessing each submittal.
 - 4) No extension of contract time will be authorized because of failure to transmit submittals to the Consultant sufficiently in advance of the work to permit processing.
2. Submittal Preparation: Place a permanent label or title block on each submittal for identification. Indicate the name of the entity that prepared each submittal on the label or title block.
- a. Provide a space approximately 4" x 5" on the label or beside the title block on Shop Drawings to record the Contractor's review and approval markings and the action taken.
 - b. Include the following information on the label for processing and recording action taken.
 - 1) Project name and PPA Number
 - 2) Date
 - 3) Name and address of Consultant
 - 4) Name and address of Contractor
 - 5) Name and address of Subcontractor
 - 6) Name and address of supplier
 - 7) Name of manufacturer
 - a) Number and title of appropriate Specification Section
 - b) Drawing number and detail references, as appropriate
3. Submittal Transmittal: Package each submittal appropriately for transmittal and handling. Transmit each submittal from Contractor to Consultant using a transmittal form. Submittals received from sources other than the Contractor will be returned without action.
- a. On the transmittal record relevant information and requests for data. On the form, or separate sheet, record deviations from Contract Document requirements, including minor variations and limitations. Include

Contractor's certification that information complies with Contract Documents requirements.

- b. Transmittal Form: Contractor's standard form.

D. Contractor's Construction Schedule

1. Bar-Chart Schedule: Prepare a fully developed, horizontal bar-chart type Contractor's construction schedule. Submit both in print and electronically within thirty (30) days of the date established for "Commencement of the Work".
 - a. Provide a separate time bar for each significant construction activity. Provide a continuous vertical line to identify the first working day of each week. Use the same breakdown of units of the work as indicated in the "Schedule of Values".
 - b. Within each time bar indicate estimated completion percentage in 10 percent increments. As work progresses, place a contrasting mark in each bar to indicate actual completion.
 - c. Prepare the schedule on a sheet, or series of sheets, of stable transparency, or other reproducible media, of sufficient width to show data for the entire construction period.
 - d. Secure time commitments for performing critical elements of the work from parties involved. Coordinate each element on the schedule with other construction activities; include minor elements involved in the sequence of the work. Show each activity in proper sequence. Indicate graphically sequences necessary for completion of related portions of the work.
 - e. Coordinate the Contractor's construction schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other schedules.
 - f. Indicate completion in advance of the date established for Substantial Completion. Indicate Substantial Completion on the schedule to allow time for the Consultant's procedures necessary for certification of Substantial Completion.
2. Work Stages: Indicate important stages of construction for each major portion of the Work, including testing and installation.
3. Area Separations: Provide a separate time bar to identify each major construction area for each major portion of the work. Indicate where each element in an area must be sequenced or integrated with other activities.
4. Cost Correlation: At the head of the schedule, provide a two (2) item cost correlation line, indicating "pre-calculated" and "actual" costs. On the line show dollar-volume of work performed as of the dates used for preparation of payment requests.
 - a. Refer to Section "Price and Payment Procedures" for cost reporting and payment procedures.
5. Distribution: Following response to the initial submittal, print and distribute copies to the Consultant, Owner, subcontractors, and other parties required to comply with scheduled dates. Transmit electronically and post copies in the project meeting room and temporary field office.
 - a. When revisions are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have

completed their assigned portion of the work and are no longer involved in construction activities.

6. Schedule Updating: Revise the schedule after each meeting or activity, where revisions have been recognized or made. Issue the updated schedule electronically and in print concurrently with report of each meeting.

E. Submittal Schedule

1. After development and acceptance of the Contractor's construction schedule, prepare a complete schedule of submittals. Submit the schedule within ten (10) days of the date required for establishment of the Contractor's construction schedule.
 - a. Coordinate submittal schedule with the list of subcontracts, schedule of values and the list of products, as well as the Contractor's construction schedule.
 - b. Prepare the schedule in chronological order; include submittals required during the first thirty (30) or sixty (60) days of construction. Provide the following information:
 - 1) Scheduled date for the first submittal
 - 2) Related section number
 - 3) Submittal category
 - 4) Name of subcontractor
 - 5) Description of the part of the work covered
 - 6) Scheduled date for resubmittal
 - a) Scheduled date the Consultant's final release or approval
2. Distribution: Following response to initial submittal, print and distribute copies to the Consultant, Owner, subcontractors, and other parties required to comply with submittal dates indicated. Post copies in the project meeting room and field office.
 - a. When revisions are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the work and are no longer involved in construction activities.
3. Schedule Updating: Revise the schedule after each meeting or activity, where revisions have been recognized or made. Issue the updated schedule concurrently with report of each meeting.

F. Daily Construction Reports

1. Prepare a daily construction report, recording the following information concerning events at the site; and submit duplicate copies to the Consultant at weekly intervals:
 - a. List of subcontractors at the site
 - b. Approximate count of personnel at the site
 - c. High and low temperatures, general weather conditions
 - d. Accidents and unusual events
 - e. Meetings and significant decisions

- f. Stoppages, delays, shortages, losses
- g. Meter readings and similar recordings
- h. Emergency procedures
- i. Orders and requests of governing authorities
- j. Change Orders received, implemented
- k. Services connected, disconnected
- l. Equipment or system tests and start-ups
- m. Partial completions, occupancies
- n. Substantial Completions authorized

G. Shop Drawings

1. Submit newly prepared information, drawn to accurate scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the project is not considered Shop Drawings.
2. Shop Drawings include fabrication and installation drawings, setting diagrams, schedules, patterns, templates, and similar drawings. Include the following information:
 - a. Dimensions
 - b. Identification of products and materials included
 - c. Compliance with specified standards
 - d. Notation of coordination requirements
 - e. Notation of dimensions established by field measurement
 - f. Sheet Size: Except for templates, patterns and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2" x 11", but no larger than 36" x 48".
 - g. Submittal: Submit electronically and in print for the Consultant's review; Consultant's comments will be returned electronically.
 - 1) One (1) of the prints returned shall be marked-up and maintained as a "Record Document".
 - k. Do not use Shop Drawings without an appropriate final stamp indicating action taken in connection with construction.
3. Coordination drawings are a special type of Shop Drawing that show the relationship and integration of different construction elements that require careful coordination during fabrication or installation to fit in the space provided or function as intended.
 - a. Preparation of coordination drawings is specified in section "Project Coordination" and may include components previously shown in detail on Shop Drawings or Product Data.
 - b. Submit coordination drawings for integration of different construction elements. Show sequences and relationships of separate components to avoid conflicts in use of space.

H. Product Data

1. Collect Product Data into a single submittal for each element of construction or system. Product Data includes printed information such as manufacturer's

installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams, and performance curves. Where Product Data must be specially prepared because standard printed data is not suitable for use, submit as "Shop Drawings".

- a. Mark each copy to show applicable choices and options. Where printed Product Data includes information on several products, some of which are not required, mark copies to indicate the applicable information. Include the following information:
 - 1) Manufacturer's printed recommendations
 - a) Compliance with recognized trade association standards
 - b) Compliance with recognized testing agency standards
 - 2) Application of testing agency labels and seals
 - a) Notation of dimensions verified by field measurement
 - 3) Notation of coordination requirements
- b. Do not submit Product Data until compliance with requirements of the Contract Documents has been confirmed.
- c. Preliminary Submittal: Submit a preliminary single-copy of Product Data where selection of options is required.
- d. Submittals: Submit two (2) copies of each required submittal; submit four (4) copies where required for maintenance manuals. The Consultant will retain one (1), and will return the other marked with action taken and corrections or modifications required.
 - 1) Unless non-compliance with Contract Document provisions is observed, the submittal may serve as the final submittal.
- e. Distribution: Furnish copies of final submittal to installers, subcontractors, suppliers, manufacturers, fabricators, and others required for performance of construction activities. Show distribution on transmittal forms.
 - 1) Do not proceed with installation until an applicable copy of Product Data applicable is in the installer's possession.
 - 2) Do not permit use of unmarked copies of Product Data in connection with construction.

I. Samples

1. Submit full-size, fully fabricated samples cured and finished as specified and physically identical with the material or product proposed. Samples include partial sections of manufactured or fabricated components, cuts or containers of materials, color range sets, and swatches showing color, texture, and pattern.
 - a. Mount, display, or package samples in the manner specified to facilitate review of qualities indicated. Prepare samples to match the Consultant's sample. Include the following:
 - 1) Generic description of the sample
 - 2) Sample source
 - 3) Product name or name of manufacturer

- 4) Compliance with recognized standards
 - 5) Availability and delivery time
2. Submit samples for review of kind, color, pattern, and texture, for a final check of these characteristics with other elements, and for a comparison of these characteristics between the final submittal and the actual component as delivered and installed.
 - a. Where variation in color, pattern, texture, or other characteristics are inherent in the material or product represented, submit multiple units (not less than three (3)), that show approximate limits of the variations.
 - b. Refer to other specification sections for requirements for samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation and similar construction characteristics.
 - c. Refer to other sections for samples to be returned to the Contractor for incorporation in the work. Such samples must be undamaged at time of use. On the transmittal, indicate special requests regarding disposition of sample submittals.
3. Preliminary Submittals: Where samples are for selection of color, pattern, texture, or similar characteristics from a range of standard choices, submit a full set of choices for the material or product.
 - a. Preliminary submittals will be reviewed and returned with the Consultant's mark indicating selection and other action.
4. Submittals: Except for samples illustrating assembly details, workmanship, fabrication techniques, connections, operation and similar characteristics, submit three (3) sets; one (1) will be returned marked with the action taken.
 - a. Maintain sets of samples, as returned, at the project site, for quality comparisons throughout the course of construction.
 - 1) Unless non-compliance with Contract Document provisions is observed, the submittal may serve as the final submittal.
 - 2) Sample sets may be used to obtain final acceptance of the construction associated with each set.
5. Distribution of Samples: Prepare and distribute additional sets to subcontractors, manufacturers, fabricators, suppliers, installers, and others as required for performance of the work. Show distribution on transmittal forms.
 - a. Field samples specified in individual sections are special types of samples. Field samples are full-size examples erected on site to illustrate finishes, coatings, or finish materials and to establish the standard by which the work will be judged.
 - 1) Comply with submittal requirements to the fullest extent possible. Process transmittal forms to provide a record of activity.

J. Consultant's Action

1. Except for submittals for record, information, or similar purposes, where action and return is required or requested, the Consultant will review each submittal, mark to indicate action taken, and return promptly. Compliance with specified characteristics is the Contractor's responsibility.
2. Action Stamp: The Consultant will stamp each submittal with a uniform, self-explanatory action stamp. The stamp will be appropriately marked, as follows, to indicate the action taken:
 - a. Final-But-Restricted Release: When submittals are marked "Make Corrections Noted", that part of the work covered by the submittal may proceed provided it complies with notations or corrections on the submittal and requirements of the Contract Documents; final acceptance will depend on that compliance.
 - b. Returned for Resubmittal: When submittal is marked "Revise and Resubmit", do not proceed with that part of the work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal in accordance with the notations; resubmit without delay. Repeat if necessary to obtain a different action mark.
 - 1) Do not permit submittals marked "Revise and Resubmit" to be used at the project site, or elsewhere where work is in progress.
 - c. Other Action: Where a submittal is primarily for information or record purposes, special processing or other activity, the submittal will be returned, marked "Action not Required".

END OF SECTION 013000

SECTION 013100
PROJECT COORDINATION

1.1 GENERAL

- A. Related Documents
 - 1. Drawings and general provisions of Contract, including General Conditions and Supplemental Conditions and other Division 1 Specification Sections, apply to this Section.

- B. Summary
 - 1. This section specifies administrative and supervisor requirements necessary for project coordination including, but not necessarily limited to:
 - a. Coordination
 - b. Administrative and supervisory personnel
 - c. General installation provisions
 - d. Cleaning and protection
 - 2. Field Engineering is included in Section "Field Engineering".
 - 3. Progress meetings, coordination meetings and pre-installation conferences are included in Section "Project Meetings".
 - 4. Requirements for Contractor's Construction Schedule are included in Section "Submittals".

- C. Coordination
 - 1. Coordination: Coordinate construction activities included under various sections of these specifications to assure efficient and orderly installation of each part of the work. Coordinate construction operations included under different sections of the specifications that are dependent upon each other for proper installation, connection, and operation.
 - a. Provide access to work at all times for inspections by Owner and authorized representatives.
 - b. Provide safe working conditions and protection of completed work.
 - c. Provide barricades and signs.
 - d. Where installation of one part of the work is dependent on installation of other components, either before or after its own installation, schedule construction activities in the sequence required to obtain the best results.
 - e. Where availability of space is limited, coordinate installation of different components to assure maximum accessibility for required maintenance, service and repair.
 - f. Make adequate provisions to accommodate items scheduled for later installation.
 - g. Where necessary, prepare memoranda for distribution to each party involved outlining special procedures required for coordination. Include such items as required notices, reports, and attendance at meetings.
 - 1) Prepare similar memoranda for the Owner and separate Contractors where coordination of their work is required.
 - 2. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and ensure orderly progress of the work. Such administrative activities include, but are not limited to, the following:

- a. Notify Facilities Services or Campus Planning, Design and Construction of any expected disruptions in service or changes in construction schedule at least 72 hours (3 working days) in advance.
 - b. Preparation of schedules.
 - c. Installation and removal of temporary facilities.
 - d. Delivery and processing of submittals.
 - e. Progress meetings.
 - f. Project close-out activities.
3. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.
- a. Salvage materials and equipment involved in performance of, but not actually incorporated in, the work. Refer to other sections for disposition of salvaged materials that are designated as Owner's property.
- D. Submittals
- 1. Coordinated Drawings: Prepare and submit coordination drawings where close and careful coordination is required for installation of products and materials fabricated off-site by separate entities, and where limited space availability necessitates maximum utilization of space for efficient installation of different components.
 - a. Show the interrelationship of components shown on separate shop drawings.
 - b. Indicate required installation sequences.
 - c. Comply with requirements contained in Section "Submittals".
 - d. Section "Basic Electrical Requirements" for specific coordination drawing requirements for mechanical and electrical installations.
 - 2. Staff Names: Within 15 days of Notice to Proceed, submit a list of the Contractor's principal staff assignments, including the Superintendent and other personnel in attendance at the site; identify individuals, their duties and responsibilities; list their addresses and telephone numbers. Post copies of the list in the project meeting room, the temporary field office, and each temporary telephone.

1.2 PROJECT MEETINGS

- A. Related Documents
- 1. Drawings and general provisions of the Contract, including General and Supplementary General Conditions and other Division 1 Specification Sections, apply to this Section.
- B. Summary
- 1. This section specifies administrative and procedural requirements for project meetings including but not limited to:
 - a. Pre-construction conference
 - b. Pre-installment conferences
 - c. Coordination meetings
 - d. Progress meetings
- C. Pre-construction Conference
- 1. Schedule a pre-construction conference and organizational meeting.
 - a. Hold meeting at the project site or other convenient location and prior to commencement of construction activities, including the moving of

equipment on to the site. Conduct the meeting to review responsibilities and personnel assignments.

2. Attendees: The Owner, Consultant and their consultants, the Contractor and its superintendent, major subcontractors, manufacturers, suppliers and other concerned parties shall each be represented at the conference by persons familiar with and authorized to conclude matters relating to the work. Both the Contractor and the Contractor's job foremen shall attend the meeting, along with all subcontractors.
3. Agenda: Discuss items of significance that could affect progress including such topics as:
 - a. Tentative construction schedule
 - b. Critical work sequencing
 - c. Designation of responsible personnel
 - d. Procedures for processing field decisions and Change Orders
 - e. Procedures for processing Applications for Payment
 - f. Distribution of Contract Documents
 - g. Submittal of Shop Drawings, Product Data and Samples
 - h. Preparation of record documents
 - i. Use of the premises
 - j. Office, work and storage areas
 - k. Equipment deliveries and priorities
 - l. Safety procedures
 - m. First aid
 - n. Security
 - o. Housekeeping
 - p. Working hours

D. Pre-Installation Conferences

1. Conduct a pre-installation conference at the site before each construction activity that requires coordination with other construction. The Installer and representatives of manufacturers and fabricators involved in or affected by the installation, and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise the Consultant of scheduled meeting dates.
2. Review the progress of other construction activities and preparations for the particular activity under consideration at each pre-installation conference, including requirements for:
 - a. Contract Documents
 - b. Options
 - c. Related Change Orders
 - d. Purchases
 - e. Deliveries
 - f. Shop Drawings, Product Data and quality control samples
 - g. Possible conflicts
 - h. Compatibility problems
 - i. Time schedules
 - j. Weather limitations
 - k. Manufacturer's recommendations
 - l. Compatibility of materials
 - m. Acceptability of substrates
 - n. Temporary facilities
 - o. Space and access limitations
 - p. Governing regulations

- q. Safety
 - r. Inspection and testing requirements
 - s. Required performance results
 - t. Recording requirements
 - u. Protection
3. The Consultant will record significant discussions and agreements and disagreements of each conference, along with the approved schedule. Distribute the record of the meeting to everyone concerned, promptly, including the Owner and Consultant.
 4. Do not proceed if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of work and reconvene the conference at the earliest feasible date.
- E. Coordination Meeting
1. Conduct project coordination meetings at regularly scheduled times convenient for all parties involved. Project coordination meetings are in addition to specific meetings held for other purposes, such as regular progress meetings and special pre-installation meetings.
 2. Request representation at each meeting by every party currently involved in coordination or planning for the construction activities involved.
 3. The Consultant will record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.
- F. Progress Meetings
1. Conduct progress meetings at the project site at regularly scheduled intervals. Coordinate with the Owner and Consultant of scheduled meeting dates. Coordinate dates of meetings with preparation of the payment request.
 2. Attendees: In addition to representatives of the Owner and Consultant, each subcontractor, supplier, or other entity concerned with current progress or involved in planning, coordination or performance of future activities shall be represented at these meetings by persons familiar with the project and authorized to conclude matters relating to progress.
 3. Agenda: Visit job site to raise specific pending issues prior to meeting. Review and correct or approve minutes of the previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to the current status of the project.
 - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine where each activity is in relation to the Contractor's Construction Schedule, whether on time or ahead or behind schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the contract time.
 - b. Review the present and future needs of each entity present, including such items as:
 - 1) Interface requirements
 - 2) Time
 - 3) Sequences
 - 4) Deliveries
 - 5) Off-site fabrication problems
 - 6) Access
 - 7) Site utilization

- 8) Temporary facilities and services
 - 9) Hours of work
 - 10) Hazards and risks
 - 11) Housekeeping
 - 12) Quality and work standards
 - 13) Change Orders
 - 14) Documentation of information for payment requests
4. Reporting: The Consultant shall distribute printed and electronic copies of minutes of the meeting to each party present and to other parties who should have been present. Include a brief summary, in narrative form, of progress since the previous meeting and report.
- a. Schedule Updating: Revise the construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue the revised schedule concurrently with the report of each meeting.

1.3 PRODUCTS (NOT APPLICABLE)

1.4 EXECUTION

A. General Installation Provisions

1. Inspection of Conditions: Require the installer of each major component to inspect both the substrate and conditions under which work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.
2. Manufacturer's Instructions: Comply with manufacturer's installation instructions and recommendations, to the extent that those instructions and recommendations are more explicit or stringent than requirements contained in Contract Documents.
3. Inspect materials or equipment immediately upon delivery and again prior to installation. Reject damaged and defective items.
4. Provide attachment and connection devices and methods necessary for securing work. Secure work true to line and level. Allow for expansion and building movement.
5. Visual Effects: Provide uniform joint widths in exposed work. Arrange joints in exposed work to obtain the best visual effect. Refer questionable choices to the Consultant for final decision.
6. Recheck measurements, quantities and dimensions, before starting each installation.
7. Install each component during weather conditions and project status that will ensure the best possible results. Isolate each part of the completed construction from incompatible material as necessary to prevent deterioration.
8. Coordinate temporary enclosures with required inspections and tests, to minimize the necessity of uncovering completed construction for that purpose.
9. Mounting Heights: Where mounting heights are not indicated, install individual components at standard mounting heights recognized within the industry for the particular application indicated and in compliance with accessibility requirements. Refer questionable mounting height decisions to the Consultant for final decision.

B. Cleaning and Protection

1. During handling and installation, clean and protect construction in progress and adjoining materials in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

2. Clean and maintain completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
3. Limiting Exposures: Supervise construction activities to ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period. Where applicable, such exposures include, but are not limited to, the following:
 - a. Excessive static or dynamic loading
 - b. Excessive internal or external pressures
 - c. Excessively high or low temperatures
 - d. Thermal shock
 - e. Excessively high or low humidity
 - f. Air contamination or pollution
 - g. Water or ice
 - h. Solvents
 - i. Chemicals
 - j. Light
 - k. Radiation
 - l. Puncture
 - m. Abrasion
 - n. Heavy traffic
 - o. Soiling, staining and corrosion
 - p. Bacteria
 - q. Rodent and insect infestation
 - r. Combustion
 - s. Electrical current
 - t. High speed operation
 - u. Improper lubrication
 - v. Unusual wear or other misuse
 - w. Contact between incompatible materials
 - x. Destructive testing
 - y. Misalignment
 - z. Excessive weathering
 - aa. Unprotected storage
 - ab. Improper shipping or handling
 - ac. Theft
 - ad. Vandalism

END OF SECTION 013100

SECTION 014000
QUALITY REQUIREMENTS

1.1 GENERAL

A. RELATED DOCUMENTS

1. Drawings and general provisions of Contract, including General Conditions, Supplemental Conditions and other Division-1 Specification Sections, apply to this Section.

B. SUMMARY

1. This Section specifies administrative and procedural requirements for quality control services.
2. Quality control services include inspections and tests and related actions including reports, performed by independent agencies, governing authorities, and the Contractor. They do not include Contract enforcement activities performed by the Architect.
3. Inspection and testing services are required to verify compliance with requirements specified or indicated. These services do not relieve the Contractor of responsibility for compliance with Contract Document requirements.
4. Requirements of this Section relate to customized fabrication and installation procedures, not production of standard products.
 - a. Specific quality control requirements for individual construction activities are specified in the Sections that specify those activities. Those requirements, including inspections and tests, cover production of standard products as well as customized fabrication and installation procedures.
 - b. Inspections, test and related actions specified are not intended to limit the Contractor's quality control procedures that facilitate compliance with Contract Document requirements.
 - c. Requirements for the Contractor to provide quality control services required by the Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

C. RESPONSIBILITIES

1. Contractor Responsibilities: The Contractor shall provide inspections, tests and similar quality control services, specified in individual Specification Sections and required by governing authorities, except where they are specifically indicated to be the Owner's responsibility, or are provided by another identified entity; these services include those
 - a. Services specified to be performed by an independent agency and not by the Contractor. Costs for these services shall be included in the Contract Sum.
 - b. The Contractor shall employ and pay an independent agency, to perform specified quality control services.
 - c. The Owner will engage and pay for the services of an independent agency

to perform inspections and tests specified as the Owner's responsibility. Payment for these services will be made by the Owner.

- d. Where the Owner has engaged a testing agency or other entity for testing and inspection of a part of the Work, and the Contractor is also required to engage an entity for the same or related element, the Contractor shall not employ the entity engaged by the Owner, unless otherwise agreed in writing with the Owner.
2. Retesting: The Contractor is responsible for retesting where results of required inspections, tests or similar services provide unsatisfactory and do not indicate compliance with Contract Document requirements, regardless of whether the original test was the Contractor's responsibility.
 - a. Cost of retesting construction revised or replaced by the Contractor is the Contractor's responsibility, where required tests were performed on original construction.
 3. Associated Services: The Contractor shall cooperate with agencies performing required inspections, tests and similar services and provide reasonable auxiliary services as requested. Notify the agency sufficiently in advance of operations to permit assignment of personnel. Associated services required include but are not limited to:
 - a. Providing access to the Work and furnishing incidental labor and facilities necessary to facilitate inspections and tests.
 - b. Taking adequate quantities of representative samples of materials that require testing or assisting the agency in taking samples.
 - c. Providing facilities for storage and curing of test samples, and delivery of samples to testing laboratories.
 - d. Providing the agency with a preliminary design mix proposed for use for materials mixes that require control by the testing agency.
 - e. Security and protection of samples and test equipment at the Project site.
 4. Owner Responsibilities: The Owner will provide inspections, tests and similar quality control services specified to be performed by independent agencies and not by the Contractor, except where they are specifically indicated as the Contractor's responsibility or are provided by another identified entity. Costs for these services are not included in the Contract Sum.
 - a. The Owner will employ and pay for the services of an independent agency, testing laboratory or other qualified firm to perform services which are the Owner's responsibility.
 5. Duties of the Testing Agency: The independent testing agency engaged to perform inspections, sampling and testing of materials and construction specified in individual Specification Sections shall cooperate with the Architect and Contractor in performance of its duties, and shall provide qualified personnel to perform required inspections and tests.
 - a. The agency shall notify the Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.

- b. The agency is not authorized to release, revoke, alter or enlarge requirements of the Contract Documents, or approve or accept any portion of the Work.
 - c. The agency shall not perform any duties of the Contractor.
6. Coordination: The Contractor and each agency engaged to perform inspections, tests and similar services shall coordinate the sequence of activities to accommodate required services with a minimum of delay. In addition the Contractor and each agency shall coordinate activities to avoid the necessity of removing and replacing construction to accommodate inspections and tests. The Contractor is responsible for scheduling times for inspections, tests, taking samples and similar activities.

D. SUBMITTALS

- 1. The independent testing agency shall submit a certified written report and electronic copy of each inspection, test or similar service, to the Architect, in duplicate, unless the Contractor is responsible for the service. If the Contractor is responsible for the service, submit a certified written report of each inspection, test or similar service through the Contractor, in duplicate.
 - a. Submit additional copies of each written report directly to the governing authority, when the authority so directs.
 - b. Report Data: Written reports of each inspection, test or similar service shall include, but not be limited to:
 - 1) Date of issue
 - 2) Project title and number
 - 3) Name, address and telephone number of testing agency
 - 4) Dates and locations of samples and tests or inspections
 - 5) Names of individuals making the inspection or test
 - 6) Designation of the Work and test method
 - 7) Identification of product and Specification Section
 - 8) Complete inspection or test data
 - 9) Test results and in interpretations of test results
 - 10) Ambient conditions at the time of sample-taking and testing
 - 11) Comments or professional opinion as to whether inspected or tested Work complies with Contract Document requirements
 - 12) Name and signature of laboratory inspector
 - 13) Recommendations on retesting

E. QUALITY ASSURANCE

- 1. Qualification for Service Agencies: Engage inspection and testing service agencies, including independent testing laboratories, which are prequalified as complying with "Recommended Requirements for Independent Laboratory Qualification" by the American Council of Independent Laboratories, and which specialize in the types of inspections and tests to be performed.
- 2. Each independent inspection and testing agency engaged on the Project shall be authorized by authorities having jurisdiction to operate in the State of Montana.

1.2 PRODUCTS (NOT APPLICABLE)

1.3 EXECUTION

A. GENERAL

1. Upon completion of inspection, testing, sample-taking and similar services, repair damaged construction and restore substrates and finishes to eliminate deficiencies, including deficiencies in visual qualities of exposed finishes.
2. Protect construction exposed by or for quality control service activities, and protect repaired construction.
3. Repair and protection is the Contractor's responsibility, regardless of the assignment of responsibility for inspection, testing or similar services.

END OF SECTION 014000

SECTION 015000
TEMPORARY FACILITIES AND UTILITIES

1.1 GENERAL

A. RELATED DOCUMENTS

1. Drawings and general provisions of the Contract, including General Conditions and Supplemental Conditions and other Division-1 Specification Sections, apply to this Section.

B. SUMMARY

1. This Section specifies requirements for temporary services and facilities, including utilities, construction and support facilities, security and protection.
2. Temporary utilities required may include but are not limited to:
 - a. Telephone service
 - b. Electric Service
 - c. Water
 - d. Natural gas
 - e. Sewer
3. Temporary construction and support facilities required may include but are not limited to:
 - a. Field offices and storage sheds.
 - b. Sanitary facilities, including drinking water
 - c. Temporary Project identification signs and bulletin boards
 - d. Waste Disposal services
 - e. Construction aids and miscellaneous services and facilities
4. Security and protection facilities required include but are not limited to:
 - a. Temporary Security Fencing
 - b. Temporary fire protection
 - b. Barricades, warning signs, lights
 - c. Environmental protection

C. QUALITY ASSURANCE

1. Regulations: Comply with industry standards and applicable laws and regulations if authorities having jurisdiction, including but not limited to:
 - a. Building Code requirements
 - b. Health and safety regulations
 - c. Utility company regulations
 - d. Police, Fire Department and Rescue Squad rules
 - e. Environmental protection regulations
2. Standards: Comply with NFPA Code 241, "Building Construction and

Demolition Operations" and ANSI-A10 Series standards for "Safety Requirements for Construction and Demolition".

D. PROJECT CONDITIONS

1. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Take necessary fire prevention measures. Do not overload facilities, or permit them to interfere with progress. Do not allow hazardous dangerous or unsanitary conditions, or public nuisances to develop or persist on the site.

1.2 PRODUCTS

A. MATERIALS

1. General: Provide new materials; if acceptable to the Architect, undamaged previously used materials in serviceable condition may be used. Provide materials suitable for the use intended.
2. Water: Provide potable water approved by local health authorities.
3. Open-Mesh Fencing: Provide 11-gage, galvanized 2-inch, chain link fabric fencing 6-feet high with galvanized barbed wire top strand and galvanized steel pipe posts, 1 1/2" I.D. for line posts and 2-1/2" I.D. for corner posts.

B. EQUIPMENT

1. General: Provide new equipment; if acceptable to the Architect, undamaged, previously used equipment in serviceable condition may be used. Provide equipment suitable for use intended.
2. Water Hoses: Provide 3/4" heavy-duty, abrasion-resistant, flexible rubber hoses 100 ft. long, with pressure rating greater than the maximum pressure of the water distribution system; provide adjustable shut-off nozzles at hose discharge.
3. Electrical Outlets: Provide properly configured NEA polarized outlets to prevent insertion of 110-120 volt plugs into higher voltage outlets. Provide receptacle outlets equipped with ground-fault circuit interrupters, reset button and pilot light, for connection of power tools and equipment.
4. Electrical Power Cords: Provide grounded extension cords; use "hard-service" cords where exposed to abrasion and traffic. Provide waterproof connectors to connect separate lengths of electric cords, if single lengths will not reach areas where construction activities are in progress.
5. Lamps and Light Fixtures: Provide general service incandescent lamps of wattage required for adequate illumination. Provide guard cages or tempered glass enclosures, where exposed to breakage. Provide exterior fixtures where exposed to moisture.
6. Temporary Offices: Provide prefabricated or mobile units or similar job-built construction with lockable entrances, operable windows and serviceable finishes. Provide heated and air-conditioned units on foundations adequate for normal loading.
7. Temporary Toilet Units: Provide self-contained single-occupant toilet units of the chemical, aerated recirculation, or combustion type, properly vented and fully enclosed with a glass fiber reinforced polyester shell or similar nonabsorbent

material.

9. First Aid Supplies: Comply with governing regulations.
10. Fire Extinguishers: Provide hand-carried, portable UL-rated, class "A" fire extinguishers for temporary offices and similar spaces. In other locations provide hand carried, portable, UL-rated, class "ABC" dry chemical extinguishers, or a combination of extinguishers of NFPA recommended classes for the exposures.
 - a. Comply with NFPA 10 and 241 for classification, extinguishing agent and size required by location and class of fire exposure.

1.3 EXECUTION

A. INSTALLATION

1. Use qualified personnel for installation of temporary facilities. Locate facilities where they will serve the Project adequately and result in minimum interference with performance of the Work and Owner's operations. Relocate and modify facilities as required.
2. Provide each facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed, or are replaced by authorized use of completed permanent facilities.

B. TEMPORARY UTILITIES

1. Temporary Telephones: Provide temporary telephone service for all personnel engaged in construction activities, throughout the construction period. Provide cellular telephone, operational and on site at all times.

C. TEMPORARY CONSTRUCTION AND SUPPORT FACILITIES INSTALLATION

1. Locate field offices, storage sheds, sanitary facilities and other temporary construction and support facilities for easy access and minimal interruption to Owner's operations.
 - a. Maintain temporary construction and support facilities until near Substantial Completion. Remove prior to Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to the Owner.
2. Field Offices: The Contractor, at his option, shall provide insulated, weather tight temporary offices of sufficient size to accommodate required office personnel at the Project site. Keep the office clean and orderly for use for small progress meetings. Furnish and equip offices as follows:
 - a. Furnish with a desk and chairs, a 4-drawer file cabinet, plan table and plan rack and a 6-shelf bookcase.
 - b. Equip with a water cooler and private toilet complete with water closet, lavatory and mirror-medicine cabinet unit.
3. Storage and Fabrication Sheds: Install storage and fabrication sheds, sized, furnished and equipped to accommodate materials and equipment involved,

including temporary utility service. Sheds may be open shelters or fully enclosed spaces within the building or elsewhere on the site.

4. Sanitary facilities include temporary toilets, wash facilities and drinking water fixtures. Comply with regulations and health codes for the type, number, location, operation and maintenance of fixtures and facilities. Install where facilities will best serve the Project's needs.
 - a. Provide toilet tissue, paper towels, paper cups and similar disposable materials for each facility. Provide covered waste containers for used material.
5. Toilets: Install self-contained toilet units. Shield toilets to ensure privacy. Use of pit-type privies will not be permitted.
6. Wash Facilities: Install wash facilities supplied with potable water at convenient locations for personnel involved in handling materials that require wash-up for a healthy and sanitary condition. Dispose of drainage properly. Supply cleaning compounds appropriate for each condition.
 - a. Provide safety showers, eye-wash fountains and similar facilities for convenience, safety and sanitation of personnel.
7. Drinking Water Facilities: Provide containerized tap-dispenser bottled-water type drinking water units, including paper supply.
 - a. Where power is accessible, provide electric water coolers to maintain dispensed water temperature at 45 to 55 deg F (7 to 13 deg C).
8. Collection and Disposal of Waste: Collect waste from construction areas and elsewhere daily. Comply with requirements of NFPA 241 for removal of combustible waste material and debris. Enforce requirements strictly. Do not hold materials more than 7 days during normal weather or 3 days when the temperature is expected to rise above 80 deg. F (27 deg C). Handle hazardous, dangerous, or unsanitary waste materials separately from other waste by containerizing properly. Dispose of material in a lawful manner. Do not use University trash containers for any reason.

D. SECURITY AND PROTECTION FACILITIES INSTALLATION

1. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.
 - (a) Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.
2. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each work day.
3. Open-Mesh Fencing: Provide 11-gage, galvanized 2-inch, chain link fabric fencing 6-feet high with galvanized barbed wire top strand and galvanized steel

pipe posts, 1 1/2" I.D. for line posts and 2-1/2" I.D. for corner posts.

4. Barricades, Warning Signs and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
5. Do not remove temporary security and protection facilities until Substantial Completion, or longer as requested by the Architect.
6. Temporary Fire Protection: Install and maintain temporary fire protection facilities of the types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 10 "Standard for Portable Fire Extinguishers," and NFPA 241 "Standard for Safeguarding Construction, Alterations and Demolition Operations."
 - a. Locate fire extinguishers where convenient and effective for their intended purpose, but not less than one extinguisher on each floor at or near each usable stairwell.
 - b. Store combustible materials in containers in fire-safe locations.
 - c. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire protection facilities, stairways and other access routes for fighting fires. Prohibit smoking in hazardous fire exposure areas.
 - d. Provide supervision of welding operations, combustion type temporary heating units, and similar sources of fire ignition.
7. Environmental Protection: Provide protection, operate temporary facilities and conduct construction in ways and by methods that comply with environmental regulations, and minimize the possibility that air, waterways and subsoil might be contaminated or polluted, or that other undesirable effects might result. Avoid use of tools and equipment which produce harmful noise. Restrict use of noise making tools and equipment to hours that will minimize complaints from persons or firms near the site.

E. OPERATION, TERMINATION AND REMOVAL

1. Supervision: Enforce strict discipline in use of temporary facilities. Limit availability of temporary facilities to essential and intended uses to minimize waste and abuse.
2. Maintenance: Maintain facilities in good operating condition until removal. Protect from damage by freezing temperatures and similar elements.
3. Termination and Removal: Unless the Architect requests that it be maintained longer, remove each temporary facility when the need has ended, or when replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with the temporary facility. Repair damaged Work, clean exposed surfaces and replace construction that cannot be satisfactorily repaired.
 - a. Materials and facilities that constitute temporary facilities are property of the Contractor. The Owner reserves the right to take possession of Project identification signs.

SECTION 01 60 00 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the contract, including General and Supplemental Conditions and Division 1 Specification Sections, apply to this section.

1.2 SECTION REQUIREMENTS

- A. Provide products of same kind from a single source. The term "product" includes the terms "material," "equipment," "system," and similar terms.
- B. Deliver, store, and handle products according to manufacturer's written instructions, using means and methods that will prevent damage, deterioration, and loss, including theft.
 - 1. Inspect products at time of delivery for compliance with the Contract Documents and to ensure items are undamaged and properly protected.
- C. Product Substitutions: Reasonable and timely requests for substitutions will be considered. Substitutions include products and methods of construction differing from that required by the Contract Documents and proposed by Contractor after award of Contract. Substitutions only allowed for products when more than one manufacturer is indicated.
 - 1. Submit two (2) copies of each request for product substitution. Identify product to be replaced and provide complete documentation showing compliance of proposed substitution with applicable requirements. Include a full comparison with the specified product, a list of changes to other Work required to accommodate the substitution, and any proposed changes in Contract Sum or Contract Time should the substitution be accepted.
 - 2. Submit requests for product substitution in time to permit processing of request and subsequent Submittals, if any, sufficiently in advance of when materials are required in the Work. Do not submit unapproved substitutions on Shop Drawings or other submittals.
 - 3. Owner will review the proposed substitution and notify Contractor of its acceptance or rejection.

PART 2 - PRODUCTS

2.1 PRODUCT OPTIONS

- A. Provide products that comply with the Contract Documents, are undamaged, and are new at the time of installation.
 - 1. Provide products complete with accessories, trim, finish, and other devices and components needed for a complete installation and the intended use and effect.

B. Select products as follows:

1. Where only a single product or manufacturer is named, provide the item indicated. No substitutions will be permitted.
2. Where two or more products or manufacturers are named, provide one of the items indicated. No substitutions will be permitted.
3. Where products or manufacturers are specified by name, accompanied by the term "or equal," provide the named item or comply with provisions concerning "product substitutions" to obtain approval for use of an unnamed product or manufacturer.
4. Where a product is described with required characteristics, with or without naming a brand or trademark, provide a product that complies with those characteristics and other Contract requirements.
5. Where compliance with performance requirements is specified, provide products that comply and are recommended in writing by the manufacturer for the application.
6. Where compliance with codes, regulations, or standards, is specified, select a product that complies with the codes, regulations, or standards referenced.

C. Unless otherwise indicated, Owner will select color, pattern, and texture of each product from manufacturer's full range of options.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01 60 00

SECTION 173000 EXECUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

1. Drawings and general provisions of Contract, including General Conditions, Supplemental Conditions and other Division-1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:

1. Construction layout.
2. Installation of the Work.
3. Cutting and patching.
4. Coordination of Owner-installed products.
5. Progress cleaning.
6. Starting and adjusting.
7. Protection of installed construction.
8. Correction of the Work.

- B. Related Requirements:

1. Section 011000 "Summary" for limits on use of Project site.

1.3 QUALITY ASSURANCE

- A. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.

1. Structural Elements: When cutting and patching structural elements, notify Consultant of locations and details of cutting and await directions from Consultant before proceeding. Shore, brace, and support structural element during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection
2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or those results in increased maintenance or decreased operational life or safety.
3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.
4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Consultant's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Comply with requirements specified in other Sections.
 - 1. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Consultant for the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
 - 1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
 - 2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
 - 3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- B. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- B. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- C. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a written and email request for information to Consultant.

3.3 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings. If discrepancies are discovered, promptly notify Consultant by email and in writing.
 - 1. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
 - 2. Inform installers of lines and levels to which they must comply.
 - 3. Check the location, level and plumb, of every major element as the Work progresses.
 - 4. Notify Consultant when deviations from required lines and levels exceed allowable tolerances.
- B. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Consultant.

3.4 INSTALLATION

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
 - 1. Make vertical work plumb and make horizontal work level.
 - 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
 - 3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.
- F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.
- G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Consultant, and in compliance with accessibility requirements.
 2. Allow for building movement, including thermal expansion and contraction.
 3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
- J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.5 CUTTING AND PATCHING

- A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.
- C. Temporary Support: Provide temporary support of work to be cut.
- D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- E. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
 3. Concrete: Cut using a cutting machine, such as an abrasive saw or a diamond- core drill.
 4. Proceed with patching after construction operations requiring cutting are complete.
- F. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.
1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.

2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.
 3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
 4. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.
- G. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.6 PROGRESS CLEANING

- A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
 2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.
 3. Containerize hazardous and unsanitary waste materials separately from other waste.
 4. Mark containers appropriately and dispose of legally, according to regulations.
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
1. Remove liquid spills promptly.
 2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways.
1. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- H. Clean and provide maintenance on completed construction as frequently as necessary through

the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

- I. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.7 STARTING AND ADJUSTING

- A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- B. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.
- C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.8 PROTECTION OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
- B. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION 017300

**SECTION 017320
WASTE MANAGEMENT**

PART 1 - GENERAL

1.1 WASTE MANAGEMENT REQUIREMENTS

Owner requires that this project generate the least amount of trash and waste possible. Employ processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors.

Minimize trash/waste disposal in landfills; reuse, salvage, or recycle as much waste as economically feasible.

Required Recycling, Salvage, and Reuse: The following may not be disposed of in landfills or by incineration and shall be recycled:

Aluminum and plastic beverage containers.

Corrugated cardboard.

Wood pallets.

Clean dimensional wood: May be used as blocking or furring.

Land clearing debris, including brush, branches, logs, and stumps.

Metals, including packaging banding, metal studs, sheet metal, structural steel, piping, reinforcing bars, door frames, and other items made of steel, iron, galvanized steel, stainless steel, aluminum, copper, zinc, lead, brass, and bronze.

Methods of trash/waste disposal that are **not** acceptable are:

Burning on the project site.

Burying on the project site.

Dumping or burying on other property, public or private.

Other illegal dumping or burying.

Regulatory Requirements: Contractor is responsible for knowing and complying with regulatory requirements, including but not limited to Federal, State and local requirements, pertaining to legal disposal of all construction and demolition waste materials.

1.2 DEFINITIONS

Clean: Untreated and unpainted; not contaminated with oils, solvents, caulk, or the like.

Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction, remodeling, repair and demolition operations.

Hazardous: Exhibiting the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity or reactivity.

Non-hazardous: Exhibiting none of the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity, or reactivity.

Nontoxic: Neither immediately poisonous to humans nor poisonous after a long period of exposure.

Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.

Recycle: To remove a waste material from the project site to another site for remanufacture into a new product for reuse by others.

Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form. Recycling does not include burning, incinerating, or thermally destroying waste.

Return: To give back reusable items or unused products to vendors for credit.

**SECTION 017320
WASTE MANAGEMENT**

Reuse: To reuse a construction waste material in some manner on the project site.

Salvage: To remove a waste material from the project site to another site for resale or reuse by others.

Sediment: Soil and other debris that has been eroded and transported by storm or well production run-off water.

Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.

Toxic: Poisonous to humans either immediately or after a long period of exposure.

Trash: Any product or material unable to be reused, returned, recycled, or salvaged.

Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

1.3 WASTE MANAGEMENT PLAN IMPLEMENTATION

Manager: Designate an on-site person or persons responsible for instructing workers and overseeing and documenting results of the Waste Management Plan.

Communication: Distribute copies of the Waste Management Plan to job site foreman, each subcontractor, Owner, and the Architect.

Instruction: Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the project.

Meetings: Discuss trash/waste management goals and issues at project meetings, including the Pre-bid meeting, Pre-construction meeting and regular job-site meetings.

Facilities: Provide specific facilities for separation and storage of materials for recycling, salvage, reuse, return, and trash disposal, for use by all contractors and installers.

As a minimum, provide:

Separate area for storage of materials to be reused on-site, such as wood cut-offs for blocking.

Separate dumpsters for each category of recyclable.

Recycling bins at worker lunch area.

Provide containers as required.

Provide adequate space for pick-up and delivery and convenience to subcontractors.

Keep recycling and trash/waste bin areas neat and clean and clearly marked in order to avoid contamination of materials.

Hazardous Wastes: Separate, store, and dispose of hazardous wastes according to applicable regulations.

Recycling: Separate, store, protect, and handle at the site identified recyclable waste products in order to prevent contamination of materials and to maximize recyclability of identified materials. Arrange for timely pickups from the site or deliveries to recycling facility in order to prevent contamination of recyclable materials.

Reuse of Materials On-Site: Set aside, sort, and protect separated products in preparation for reuse.

Salvage: Set aside, sort, and protect products to be salvaged for reuse off-site.

END OF SECTION 017320

**SECTION 017400
WARRANTIES AND BONDS**

1.1 GENERAL

A. RELATED DOCUMENTS

1. Drawings and general provisions of Contract, including General and Supplemental Conditions and other Division-1 Specification Sections, apply to this Section.

B. SUMMARY

1. This Section specifies general administrative and procedural requirements for warranties and bonds required by the Contract Documents, including manufacturers standard warranties on products and special warranties.
 - a. Refer to the General Conditions for terms of the Contractor's special warranty of workmanship and materials.
 - b. General closeout requirements are included in Section "Project Closeout."
 - c. Specific requirements for warranties for the Work and products and installations that are specified to be warranted, are included in the individual Sections of Divisions-2 through -16.
 - d. Certifications and other commitments and agreements for continuing services to Owner are specified elsewhere in the Contract Documents.
2. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products, nor does it relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.

C. DEFINITIONS

1. Standard Product Warranties are preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.
2. Special Warranties are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for the Owner.

D. WARRANTY REQUIREMENTS

1. Related Damages and Losses: When correcting warranted Work that has failed, 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.
2. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.
3. Replacement Cost: Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with

requirements of Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has benefitted from use of the Work through a portion of its anticipated useful service life.

4. Owner's Recourse: Written warranties made to the Owner are in addition to implied warranties, and shall not limit the duties, obligations, rights and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the Owner can enforce such other duties, obligations, rights, or remedies.
 - a. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the Contract Documents.
5. The Owner reserves the right to refuse to accept Work for the Project where a special warranty, certification, or similar commitment is required on such Work or part of the Work, until evidence is presented that entities required to countersign such commitments are willing to do so.

E. SUBMITTALS

1. Submit written warranties to the Architect prior to the date certified for Substantial Completion. If the Architect's Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, or a designated portion of the Work, submit written warranties upon request of the Architect.
 - a. When a designated portion of the Work is completed and occupied or used by the Owner, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the Architect within fifteen days of completion of that designated portion of the Work.
2. When a special warranty is required to be executed by the Contractor, or the Contractor and a subcontractor, supplier or manufacturer, prepare a written document that contains appropriate items and identification, ready for execution by the required parties. Submit a draft to the Owner through the Architect for approval prior to final execution.
 - a. Refer to individual Sections of Divisions-2 through -16 for specific content requirements, and particular requirements for submittal of special warranties.
3. Forms of Submittal: At Final Completion compile two copies of each required warranty and bond properly executed by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the table of contents of the Project Manual.
1. Bind warranties and bonds in heavy-duty, commercial quality, durable 3-ring vinyl covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2" by 11" paper.
 - a. Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the tab to identify the product or installation. Provide a

typed description of the product or installation, including the name or the product, and the name, address and telephone number of the installer.

- b. Identify each binder on the front and the spine with the typed or printed title "WARRANTIES AND BONDS, the Project title or name, and the name of the Contractor.

2. When operating and maintenance manuals are required for warranted construction, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

1.2 PRODUCTS (NOT APPLICABLE)

1.3 EXECUTION

A. SCHEDULE OF WARRANTIES

1. Schedule: Provide warranties and bonds on products and installations as specified in the appropriate Sections.

END OF SECTION 017400

**SECTION 017700
PROJECT CLOSEOUT**

1.1 GENERAL

A. RELATED DOCUMENTS

1. Drawings and general provisions of Contract, including General and Supplemental Conditions and other Division-1 Specification Sections, apply to this Section.

B. SUMMARY

1. This Section specifies administrative and procedural requirements for project closeout, including but not limited to:
 - a. Inspection procedures
 - b. Project record document submittal
 - c. Operating and maintenance manual submittal
 - d. Submittal of warranties
 - e. Final cleaning
 - f. Closeout requirements for specific construction activities are included in the appropriate Sections in Divisions - 2 through - 33.

C. SUBSTANTIAL COMPLETION

1. Preliminary Procedures: Before requesting inspection for certification of Substantial Completion, complete the following. List exceptions in the request.
 - a. In the Application for Payment that coincides with, or first follows, the date Substantial Completion is claimed, show 100 percent completion for the portion of the Work claimed as substantially complete. Include supporting documentation for completion as indicated in these Contract Documents and a statement showing an accounting of changes to the Contract Sum.
 - 1) If 100 percent completion cannot be shown, include a list of incomplete items, the value of incomplete construction, and reasons the Work is not complete.
 - b. Advise Owner of pending insurance change-over requirements.
 - c. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications and similar documents.
 - d. Obtain and submit releases enabling the Owner unrestricted use of the Work and access to services and utilities; include occupancy permits, operating certificates and similar releases.
 - e. See the *Supplemental Conditions of the Contract for Construction* 3.11 for Documentation and As-Built Conditions, and the *Project Closeout Checklist: Contractor Requirements*. Submit maintenance manuals, final project photographs, damage or settlement survey, property survey, and similar final record information.
 - f. Deliver tools, spare parts, extra stock, and similar items.
 - h. Complete start-up testing of systems, and instruction of the Owner's operating and maintenance personnel. Discontinue or change over and remove temporary facilities from the site, along with construction tools, mock-ups, and similar elements.
 - i. Complete final clean up requirements, including touch-up painting. Touch-up and otherwise repair and restore marred exposed finishes.

2. Inspection Procedures: On receipt of a request for inspection, the Consultant will either proceed with inspection or advise the Contractor of unfilled requirements. The Consultant will prepare the Certificate of Substantial Completion following inspection, or advise the Contractor of construction that must be completed or corrected before the certificate will be issued.
 - a. The Consultant will repeat inspection when requested and assured that the Work has been substantially completed.
 - b. Results of the completed inspection will form the basis of requirements for final inspection.

D. FINAL ACCEPTANCE

1. Preliminary Procedures: Before requesting final inspection for certification of final acceptance and final payment, complete the following. List exceptions in the request.
 - a. Submit the final payment request with releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required.
 - b. Submit an updated final statement, accounting for final additional changes to the Contract Sum.
 - c. Submit a certified copy of the Consultant's final inspection list of items to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance, and the list has been endorsed and dated by the Consultant.
 - e. Submit consent of surety to final payment.
 - f. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
2. Re-inspection Procedure: The Consultant will re-inspect the Work upon receipt of notice that the Work, including inspection list items from earlier inspections, has been completed, except items whose completion has been delayed because of circumstances acceptable to the Consultant.
 - a. Upon completion of re-inspection, the Consultant will prepare a certificate of final acceptance, or advise the Contractor of Work that is incomplete or of obligations that have not been fulfilled but are required for final acceptance.
 - b. If necessary, re-inspection will be repeated.

E. RECORD DOCUMENT SUBMITTALS

1. **See also the *Supplemental Conditions of the Contract for Construction 3.11 for Documentation and As-Built Conditions, and the Project Closeout Checklist: Contractor Requirements.***
2. General: Do not use record documents (red-line markups) for construction purposes; protect from deterioration and loss in a secure, fire-resistive location; provide access to record documents for the Consultant's reference during normal working hours.
3. Record Drawings (Red-lined): Maintain two clean, undamaged sets of blue or black line white-prints of Contract Drawings and Shop Drawings. Mark the sets to show the red-line changes during the course of construction with actual installation where the installation varies substantially from the Work as originally shown. Mark whichever drawing is most capable of showing conditions fully and accurately; where Shop Drawings are used, record a cross-reference at the

corresponding location on the Contract Drawings. Give particular attention to concealed elements that would be difficult to measure and record at a later date.

- a. Mark record sets with red erasable pencil; use other colors to distinguish between variations in separate categories of the Work.
 - b. Mark new information that is important to the Owner, but was not shown on Contract Drawings or Shop Drawings.
 - c. Note related Change Order numbers where applicable.
 - d. Organize record drawing sheets into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates and other identification on the cover of each set.
4. Record Specifications: Maintain one complete copy of the Project Manual, including addenda, and one copy of other written construction documents such as Change Orders and modifications issued in printed form during construction. Mark these documents to show substantial variations in actual Work performed in comparison with the text of the Specifications and modifications. Give particular attention to substitutions, selection of options and similar information on elements that are concealed or cannot otherwise be readily discerned later by direct observation. Note related record drawing information and Product Data.
- a. Upon completion of the Work, submit record Specifications to the Consultant for the Owner's records.
5. Record Product Data: Maintain one copy of each Product Data submittal. Mark these documents to show significant variations in actual Work performed in comparison with information submitted. Include variations in products delivered to the site, and from the manufacturer's installation instructions and recommendations. Give particular attention to concealed products and portions of the Work which cannot otherwise be readily discerned later by direct observation. Note related Change Orders and mark up of record drawings and Specifications.
- a. Upon completion of mark-up, submit (3) complete sets of record Product Data to the Consultant for the Owner's records.
6. Record Sample Submitted: Immediately prior to the date or dates of Substantial Completion, the Contractor will meet at the site with the Consultant and the Owner's personnel to determine which of the submitted Samples that have been maintained during progress of the Work are to be transmitted to the Owner for record purposes. Comply with delivery to the Owner's Sample storage area
7. Miscellaneous Record Submittals: Refer to other Specification Sections for requirements of miscellaneous record-keeping and submittals in connection with actual performance of the Work. Immediately prior to the date or dates of Substantial Completion, complete miscellaneous records and place in good order, properly identified and bound or filed, ready for continued use and reference. Submit to the Consultant for the Owner's records.
8. Maintenance Manuals: Provide one (1) draft copy for review. Provide **two (2)** final paper copies and one electronic pdf file prior to final completion. Organize operating and maintenance data into suitable sets of manageable size. Bind properly indexed data in individual heavy-duty 3-inch, 3 ring vinyl-covered binders **MSU will supply specific binders. Contact CPDC at 406/994-5413.** Mark appropriate identification on front and spine of each binder. Include the following types of information; and others as specified in other Divisions:
- a. Emergency instructions
 - b. Spare parts list
 - c. Copies of warranties
 - d. Wiring diagrams

- e. Recommended "turn around" cycles
- f. Inspection procedures
- g. Shop Drawings and Product Data
- h. Fixture lamping schedule
- i. List of final color and material selections

F. WARRANTIES AND BONDS

1. SUMMARY

- a. This Section specifies general administrative and procedural requirements for warranties and bonds required by the Contract Documents, including manufacturer's standard warranties on products and special warranties.
 - 1) Refer to the General Conditions and Supplemental Conditions for terms of the Contractor's special warranty of workmanship and materials.
 - 2) General closeout requirements are included in Section "Project Closeout."
 - 3) Specific requirements for warranties for the Work and products and installations that are specified to be warranted, are included in the individual Sections of Divisions-2 through -16.
 - 4) Certifications and other commitments and agreements for continuing services to Owner are specified elsewhere in the Contract Documents.
- B. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products, nor does it relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.
- C. Separate Prime Contracts: Each prime Contractor is responsible for warranties related to its own Contract.

2. DEFINITIONS

- a. Standard Product Warranties are preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.
- b. Special Warranties are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for the Owner.

3. WARRANTY REQUIREMENTS

- a. Related Damages and Losses: When correcting warranted Work that has failed, 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.
- b. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.
- c. Replacement Cost: Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of Contract Documents. The Contractor is

responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has benefitted from use of the Work through a portion of its anticipated useful service life.

- d. Owner's Recourse: Written warranties made to the Owner are in addition to implied warranties, and shall not limit the duties, obligations, rights and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the Owner can enforce such other duties, obligations, rights, or remedies.
 - 1) Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the Contract Documents.
- e. The Owner reserves the right to refuse to accept Work for the Project where a special warranty, certification, or similar commitment is required on such Work or part of the Work, until evidence is presented that entities required to countersign such commitments are willing to do so.

4. SUBMITTALS

- a. Submit written warranties to the Consultant prior to the date certified for Substantial Completion. If the Consultant's Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, or a designated portion of the Work, submit written warranties upon request of the Consultant.
 - 1) When a designated portion of the Work is completed and occupied or used by the Owner, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the Consultant within fifteen days of completion of that designated portion of the Work.
- b. Forms of Submittal: At Final Completion compile two copies of each required warranty and bond properly executed by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the table of contents of the Project Manual.
- c. Bind warranties and bonds in heavy-duty, commercial quality, durable 3-ring vinyl covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2" by 11" paper.
 - 1) Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the tab to identify the product or installation. Provide a typed description of the product or installation, including the name or the product, and the name, address and telephone number of the installer.
 - 2) Identify each binder on the front and the spine with the typed or printed title "WARRANTIES AND BONDS, the Project title or name, and the name of the Contractor.
- e. When operating and maintenance manuals are required for warranted construction, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

1.2 EXECUTION

A. CLOSEOUT PROCEDURES

1. Functional Demonstration: Demonstrate proper operation of all systems to Consultants and Owners representative prior to request for substantial completion. Coordinate schedule with Consultant.
2. Operating and Maintenance Instructions: Provide two (2) duplicate training sessions for each MSU trade group responsible for systems installed under this project. Coordinate schedule with Owner. Arrange for each installer of equipment that requires regular maintenance to meet with the Owner's personnel to provide instruction in proper operation and maintenance. If installers are not experienced in procedures, provide instruction by manufacturer's representatives. Include a detailed review of the following items:
 - a. Maintenance manuals
 - b. Record documents
 - c. Spare parts and materials
 - d. Tools
 - e. Lubricants
 - f. Fuels
 - g. Identification systems
 - h. Control sequences
 - i. Hazards
 - j. Cleaning
 - k. Warranties and bonds
 - 1) Maintenance agreements and similar continuing commitments

END OF SECTION 017700

SECTION 017823
OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 A.RELATED DOCUMENTS

- A. General provisions of Contract, including General and Supplemental Conditions and other Division-1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

1. Operation and maintenance documentation directory.
2. Operation manuals for systems, subsystems, and equipment.
3. Product maintenance manuals.
4. Systems and equipment maintenance manuals.

1.3 CLOSEOUT SUBMITTALS

- A. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.

1. Architect will comment on whether content of operations and maintenance submittals are acceptable.
2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

- B. Format: Submit operations and maintenance manuals in the following format:

1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Architect.
 - a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
 - b. Enable inserted reviewer comments on draft submittals.
2. Two paper copies and one electronic pdf. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves. Architect will deliver two copies to the Owner. **For Final manuals MSU will supply specific binders. Contact CPDC at 406/994-5413.**

- C. Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect and Commissioning Authority will return copy with comments.

1. Correct or revise each manual to comply with Architect's and Commissioning Authority's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's and Commissioning Authority's comments and prior to commencing demonstration and training.

PART 2 - PRODUCTS

2.1 REQUIREMENTS FOR OPERATION, AND MAINTENANCE MANUALS

- A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information.
- B. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
 1. Title page.
 2. Table of contents.
 3. Manual contents.
- C. Title Page: Include the following information:
 1. Subject matter included in manual.
 2. Name and address of Project.
 3. Name and address of Owner.
 4. Date of submittal.
 5. Name and contact information for Contractor.
 6. Name and contact information for Construction Manager.
 7. Name and contact information for Architect.
 8. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
 9. Cross-reference to related systems in other operation and maintenance manuals.
- D. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
- E. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
- F. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
 1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
 2. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily

navigated file tree. Configure electronic manual to display bookmark panel on opening file.

- G. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.
1. Binders: **MSU will supply specific binders. Contact CPDC at 406/994-5413.** These binders are sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and oversize sheets will need to be folded to 8x11.5.
 - a. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents, and indicate Specification Section number on bottom of spine. Indicate volume number for multiple-volume sets.
 2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
 3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.
 4. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
 - a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
 - b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.2 OPERATION MANUALS

- A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
 2. Performance and design criteria if Contractor is delegated design responsibility.
 3. Operating standards.
 4. Operating procedures.
 5. Operating logs.
 6. Wiring diagrams.
 7. Control diagrams.
 8. Precautions against improper use.
 9. License requirements including inspection and renewal dates.
- B. Descriptions: Include the following:
1. Product name and model number. Use designations for products indicated on Contract Documents.
 2. Manufacturer's name.
 3. Equipment identification with serial number of each component.
 4. Equipment function.
 5. Operating characteristics.
 6. Limiting conditions.

7. Performance curves.
 8. Engineering data and tests.
 9. Complete nomenclature and number of replacement parts.
- C. Operating Procedures: Include the following, as applicable:
1. Startup procedures.
 2. Equipment or system break-in procedures.
 3. Routine and normal operating instructions.
 4. Regulation and control procedures.
 5. Instructions on stopping.
 6. Normal shutdown instructions.
 7. Seasonal and weekend operating instructions.
 8. Required sequences for electric or electronic systems.
 9. Special operating instructions and procedures.
- D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.
- E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.3 PRODUCT MAINTENANCE MANUALS

- A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.
- B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.
- C. Product Information: Include the following, as applicable:
1. Product name and model number.
 2. Manufacturer's name.
 3. Color, pattern, and texture.
 4. Material and chemical composition.
 5. Reordering information for specially manufactured products.
- D. Maintenance Procedures: Include manufacturer's written recommendations and the following:
1. Inspection procedures.
 2. Types of cleaning agents to be used and methods of cleaning.
 3. List of cleaning agents and methods of cleaning detrimental to product.
 4. Schedule for routine cleaning and maintenance.
 5. Repair instructions.
- E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

2.4 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

- A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.
- B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.
- C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
 - 1. Standard maintenance instructions and bulletins.
 - 2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
 - 3. Identification and nomenclature of parts and components.
 - 4. List of items recommended to be stocked as spare parts.
- D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
 - 1. Test and inspection instructions.
 - 2. Troubleshooting guide.
 - 3. Precautions against improper maintenance.
 - 4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 - 5. Aligning, adjusting, and checking instructions.
 - 6. Demonstration and training video recording, if available.
- E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
- F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
- H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

- A. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

- B. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
- C. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
- D. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.
 - 1. Do not use original project record documents as part of operation and maintenance manuals.
- E. Comply with Division 01 Section "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

PART 4 - MATERIAL AND FINISHES MAINTENANCE MANUAL

- A. General: Incorporate as part of the O & M Manuals. Material and finishes to the Architect/Engineer for approval and distribution. Provide one section for architectural products, including applied materials and finishes, and a second section for products designed for moisture protection and products exposed to the water.
 - 1. Refer to individual specification sections for additional requirements on the care and maintenance of materials and finishes
- B. Architectural Products, Applied Materials and Finishes: Provide complete manufacturers data and instructions on the care and maintenance of architectural products, including applied materials and finishes.
- C. Manufacturers Data: Provide complete information on architectural products, including but not limited to the following items, as applicable:
 - 1. Manufacturer's catalog number
 - 2. Size
 - 3. Material composition
 - 4. Color texture reordering information for specially manufactured products
 - 5. Manufacturer and supplier/installers contact information
 - 6. Warranty terms
- D. Care and Maintenance Instruction: Provide complete information on the care and maintenance of architectural products, including the manufacturer's recommendations for the types of cleaning agents to be used and the methods of cleaning. In addition, provide information regarding cleaning agents and methods which could prove detrimental to the product. Include the manufacturer's recommended schedule for cleaning and maintenance.

- E. **Manufacturer's Data:** Provide complete manufacturer's data giving detailed information including, but not limited to the following, as applicable:
1. Applicable standards
 2. Chemical composition
 3. Installation details
 4. Inspection procedures
 5. Maintenance information
 6. Repair procedures
- F. **Schedule:** Provide complete information in the materials and finishes manual on products specified in the following sections:
(To be determined with Owner)
- G. **Color Schedule:** Provide complete information on MSU CPDC provided electronic spreadsheet form, to include manufacturer's name and number, location, item and surface of all painted, stained or treated material, surface or piece of equipment.

END OF SECTION 017823

SECTION 017839
PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. See also General Conditions and Supplemental Conditions of the Contract for Construction.
- B. **See the *Supplemental Conditions of the Contract for Construction 3.11 for Documentation and As-Built Conditions, and the Project Closeout Checklist: Contractor Requirements***
- C. Section includes administrative and procedural requirements for project record documents, including the following:
 - 1. Record Drawings.
 - 2. Record Specifications.
 - 3. Record Product Data.
- D. Related Requirements:
 - 1. Division 01 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
 - 2. Divisions 02 through 33 Sections for specific requirements for project record documents of the Work in those Sections.

1.2 CLOSEOUT SUBMITTALS

- A. Record Drawings (Redline Markups): Comply with the following:
 - 1. Number of Copies: Submit one set(s) of marked-up record prints.
 - 2. Number of Copies: Submit copies of record Drawings as follows:
 - a. Submittal:
 - 1) Submit two for review paper-copy set(s) of marked-up record prints.
 - 2) Submit PDF electronic files of scanned record prints and one set(s) of file prints.
 - 3) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
 - b. Final Submittal:
 - 1) Submit one paper-copy set(s) of marked-up record prints.
 - 2) Submit PDF electronic files of scanned record prints and one set(s) of prints.
 - 3) Print each drawing, whether or not changes and additional information were recorded.
- B. Record Specifications: Submit one paper copy or annotated PDF electronic files of Project's Specifications, including addenda and contract modifications.
- C. Record Product Data: Submit one paper copy or annotated PDF electronic files and directories of each submittal.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

- A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised Drawings as modifications are issued.
1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
 - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
 - b. Record data as soon as possible after obtaining it.
 - c. Record and check the markup before enclosing concealed installations.
 2. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
 3. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
 4. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- B. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
1. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
 2. Format: Annotated PDF electronic file with comment function enabled.
 3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
 4. Identification: As follows:
 - a. Project name and PPA Number.
 - b. Date.
 - c. Designation "PROJECT RECORD DRAWINGS."
 - d. Name of Architect.
 - e. Name of Contractor.

2.2 RECORD SPECIFICATIONS

- A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
 3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.

4. Note related Change Orders, record Product Data, and record Drawings where applicable.
- B. Format: Submit record Specifications as annotated PDF electronic file, paper copy or scanned PDF electronic file(s) of marked-up paper copy of Specifications.

2.3 RECORD PRODUCT DATA

- A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
 3. Note related Change Orders, record Specifications, and record Drawings where applicable.
- B. Format: Submit record Product Data as annotated PDF electronic file, paper copy or scanned PDF electronic file(s) of marked-up paper copy of Product Data.

2.4 MISCELLANEOUS RECORD SUBMITTALS

- A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.
- B. Format: Submit miscellaneous record submittals as PDF electronic file, paper copy, or scanned PDF electronic file(s) of marked-up miscellaneous record submittals.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

- A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.
- B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's reference during normal working hours.

END OF SECTION 017839

**SECTION 017900
DEMONSTRATION AND TRAINING**

PART 1 - GENERAL

1.1 SUMMARY

1. System Demonstration:

- a. **General:**
 - i. The system demonstration is a functional test of systems to determine whether they are substantially complete and operating as specified. Systems are to be tested and confirmed to be operating properly by the contractor prior to the Demonstration.
 - ii. Where initial Demonstration Session uncovers substantial deficiencies that require more than one Demonstration Session, Contractor shall reimburse Owner for personnel costs associated with performing subsequent Sessions.
- b. **Systems to be Tested:**
 - i. All systems installed and/or provided under the project to have functional testing.
- c. **Attendance:**
 - i. The system demonstration is to be provided by trained representatives that are familiar with the systems, and can operate systems as required to test and verify proper function. The Engineer and Owner's representatives will be present to document performance and/or deficiencies. The General Contractor or others may attend if desired.
 - ii. Individual testing sessions (modules) shall be provided for each type or group of systems, separated roughly by trade group that will be performing maintenance on the system. MSU trades groups and systems typically involved in testing are:
 - (1) Electricians
 - (2) Heating Plant (Hydronic and steam heating systems, controls)
 - (3) Plumbers (Plumbing, gas-fired heating, process piping systems)
 - (4) Refrigeration (Refrigeration, chilled water, packaged cooling systems)
- d. **Schedule:**
 - i. Contractor to coordinate time requirements and dates with Owner and Engineer. Begin scheduling with sufficient time prior to desired Substantial Completion date to allow all parties to work into schedule, and for deficiencies to be completed prior to desired Substantial Completion date. Demonstration is to be provided prior to, and separate from, training.

2. Training:

- a. **General:**
 - i. The system training is intended to familiarize the Owner's operating and maintenance staff with all systems requiring maintenance. Training is to be provided after the systems are in place and operational, after issues noted during the Demonstration have been resolved, and before final acceptance.
- b. **Systems Requiring Training:**
 - i. All systems installed and/or provided under the project are to have training.
- c. **Attendance:**
 - i. Training is to be provided by trained representatives that are familiar with the system's operation and maintenance requirements. Individual training sessions (modules) shall be provided for each type or group of systems, separated roughly by trade group that will be performing maintenance on the system. MSU trades groups and systems typically requiring training are:
 - (1) Electricians

- (2) Heating Plant (Hydronic and steam heating systems, controls)
 - (3) Plumbers (Plumbing, gas-fired heating, process piping systems)
 - (4) Refrigeration (Refrigeration, chilled water, packaged cooling systems)
- d. Schedule:
- i. Duplicate training sessions are to be provided for each training module, so that Owner's operating personnel can be split into two groups during training. Duplicate training sessions to be scheduled during different weeks. Length of training sessions will be determined by scope of training, and as coordinated with Owner after draft copy of training documents have been reviewed.
- 2.1 PRODUCTS
- 1. Not applicable
- 3.1 EXECUTION
- 1. Demonstration:
 - a. Demonstration Program:
 - i. Engineer to develop a demonstration program to verify the proper operation of all required systems. Submit program to Owner and Contractor at least two weeks prior to Demonstration.
 - ii. Engineer to work with Contractor to generate methods to be used to verify sequences and modes of operation that cannot be verified directly.
 - iii. Engineer to provide at least one copy of all submittals, contract drawings, specifications, and changes related to systems to be demonstrated. Documents to be made available during Demonstration.
 - iv. Contractor to provide at least one copy of Operating and Maintenance Manuals to be used during demonstration, including specified sequences of operation for field-constructed systems, and operating sequences for all manufactured equipment.
 - b. Demonstration Session:
 - i. Verify that all systems are functional and ready to operate in all modes prior to demonstration.
 - ii. Assemble all program materials required for demonstration.
 - iii. Contractor to provide all equipment necessary for access to, and operation of, systems including tools, ladder, lighting, and diagnostic equipment.
 - iv. Verify operation of individual components within systems.
 - v. Verify controls of related components are coordinated.
 - vi. Verify all operating sequences, operating modes, and safety controls.
 - vii. Record all pressures, temperatures, and other relevant data available from installed devices.
 - viii. Where digital control systems are available, set-up trend reports of relevant parameters which will confirm proper operation of systems installed, modified, or affected by changes made during this project. Provide copies of reports to Engineer and Owner for review. Review, analyze, and discuss results, and provide follow-up reports as required to confirm proper operation.
 - 2. Training:
 - a. Training Documentation:
 - i. Contractor to submit draft copy of agenda and training documents to Owner for review at least two weeks prior to training date.
 - ii. Provide a copy of the following items for each person that will be attending the

training sessions. Coordinate required number with the Owner.

- (1) Training agenda.
- (2) Summary of new systems and existing systems affected by this project.
- (3) Summary of work performed under this project.
- (4) Control system drawings and sequences of operation.
- (5) List of important maintenance and trouble-shooting operations for all systems.

iii. Provide minimum of 2 copies of following items:

- (1) Contract documents including all drawings, specifications, addendums, and change orders.

b. Training Sessions:

- i. Assemble at location to be determined by the Owner.
- ii. Distribute training documentation as indicated above.
- iii. Provide classroom style training if required for orientation, discussion of new systems and existing systems affected by this project, and other issues appropriate for a classroom format.
- iv. Visit site and review locations, and perform detailed review of operation and maintenance requirements for current systems.

END OF SECTION 179000

IRRIGATION SYSTEM GUIDELINES

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

Drawings and general provisions of each Contract, including General Conditions and Supplementary Conditions, apply to work of this section.

1.02 DESCRIPTION

The work of this section consists of all items necessary to install the proposed irrigation system as indicated on the plans, and the protection and splicing required to maintain all parts of the existing irrigation system in operation, with the exception of those parts designated to be removed or abandoned. This includes required sleeves for pipe and wire, back-flow prevention devices, reconnections, and miscellaneous modifications to the existing irrigation distribution lines including, but not limited to:

- A. Automatic controller and remote control valves.
- B. Lawn and planting beds sprinkler system.
- C. Connection to proposed irrigation water source and power supply.

1.03 RELATED WORK DESCRIBED ELSEWHERE

- A. Site Clearing Section 02230
- B. Earthwork/Restoration Section 02301
- C. Landscaping Section 02905
- D. Lawns and Grass Section 02935

1.04 QUALITY ASSURANCE

A. Qualifications of Installer

Provide at least one person who shall be present at all times during execution of this portion of the work and who shall be thoroughly familiar with the type of materials of installation and who shall direct all work performed under this section. All work of this section and related work listed above shall be performed by the same CONTRACTOR.

B. Codes and Standards

1. In addition to complying with all pertinent codes and regulations, comply with the latest rules of the National Electrical Code for all electrical work and materials.
2. Comply with National Plumbing code at all connections to potable water systems.
3. Where provisions of pertinent codes and standards conflict with the requirements of this section of these Specifications, the more stringent provisions shall govern.

1.05 SUBMITTALS

A. Material List

Before any irrigation system materials are delivered to the job site, submit to the ENGINEER a complete list of all irrigation system materials to be furnished and installed.

1. Show manufacturer's name and catalog number for each item, furnish complete catalog cuts and technical data, and furnish the manufacturer's recommendations as to method of installation. Where materials proposed differ from those specified, furnish complete shop drawings and design calculations to demonstrate equivalent performance of the proposed installation.
2. Do not permit any irrigation system component to be brought onto the job site without prior approval by the ENGINEER. Provide one sample of each element of the system to the ENGINEER for approval (sprinkler heads, valves, couplings, etc.). These samples will be returned to the CONTRACTOR, and if approved, may be used in the project.

B. Shop Drawings

CONTRACTOR shall submit Five (5) copies of the proposed sprinkler layout in a schematic form to the ENGINEER for approval. Any modifications to these proposed drawings will be returned to the CONTRACTOR for the preparation of five (5) copies of the final revised layout. The material list will be coordinated with the final shop drawings by the CONTRACTOR. Show all sleeve locations.

C. Field Verification

CONTRACTOR shall field verify all dimensions, existing and proposed conditions, and as required to provide one complete and operable system. Proposed system shall be laid out above ground using locate flags to show location of all sprinkler heads, valves, and sleeve locations. This layout shall be signed off on by MSU Irrigation Manger before any excavation shall begin.

D. As-built Drawings

Provide a complete set of Mylar reproducible as-built shop drawings to the ENGINEER for approval prior to final payment.

1.06 PRODUCT HANDLING

A. Protection

Use all means necessary to protect irrigation system materials before, during, and after installation and to protect the installed work and materials of all other trades.

B. Replacements

In the event of damage, immediately make all repairs and replacements necessary to the approval of the ENGINEER and at no additional cost to the OWNER.

1.07 PERFORMANCE REQUIREMENTS

A. Minimum Requirements

The following shall be the minimum requirements of the system. They are not intended to limit the overall intent, which is to obtain a fully operational and completely automatic sprinkler system. Specific requirements of this project manual shall apply to all elements typically. Conflicts between the drawings and the project manual or between specific and general performance of material requirements shall be assumed to be the most expensive.

B. Project Zones

Refer to the drawings for the general zones to be served by this system.

1. Irrigation layout must be adaptable to the future modification of the system to smaller heads, more intense head arrays and minimal spraying over the sidewalks. This should be accomplished by running the laterals near sidewalk edges whenever possible, and by positioning the mains with this future intent.
2. CONTRACTOR will advise himself of all existing and proposed site conditions and related planting and grading as required to coordinate and schedule with the work of other contractors.
3. Heads shall be positioned to prevent damage from spraying on the building envelope and/or causing inside flooding in any and all cases.
4. Organize zones to allow walking across the area on dry sidewalk while the irrigation system is on.

PART 2 - MATERIALS

2.01 PIPE

A. Plastic Pipe

1. Plastic pipe 4" and under in diameter shall be rigid non-plasticized Schedule 40 PVC IPS solvent-welded conforming to ASTM D-1784 and D-2241 standard specifications for PVC plastic pipe. Plastic pipe 6" and larger in diameter shall be rigid non-plasticized Class 200 PVC IPS gasket fit conforming to ASTM D-1784 and D-2241 standard specifications for PVC plastic pipe. The pipe shall be homogeneous throughout and free from visible cracks, holes, foreign materials, blisters, deleterious material, wrinkles, and dents.
2. All pipes shall be continuously and permanently marked with the following information:

Manufacturer's name or trademark, size, schedule and type of pipe, working pressure at 73 deg. F and National Sanitation Foundation (N.S.F.) approval.
3. All main lines shall be a minimum of two inches (2") in diameter, unless otherwise noted.
4. All lateral lines shall be a minimum of one and one-half inches (1-½") in diameter, unless otherwise noted.
5. All plastic pipe fittings to be installed shall be molded fittings manufactured of the same material as the pipe, rated as a pressure fitting (no DWV fittings shall be allowed) and shall be suitable for solvent weld, slip joint ring-tight seal, or screwed connections. All pipe six inches (6") in diameter and above shall be Class 200 PVC IPS gasket end. All smaller pipes shall be Schedule 40 PVC IPS solvent-welded.
6. Slip fitting socket taper shall be so sized that a dry, unsoften pipe end, conforming to these specifications, can be inserted no more than halfway into the socket. Plastic saddle and flange fittings will not be permitted. Only schedule 80 pipe may be threaded.
7. When connection is plastic to metal, plastic male adapters shall be used. The male adapter shall be hand tightened, plus one turn with a strap wrench. Joint compound shall be Teflon Tape on Water Based Teflon Paste.
8. All mainline pipes shall be traceable via purple or blue-colored 14 gauge single strand direct burial wire attached to the pipe. The wire should be free from moving valve parts to prevent damage. The tracer wire shall surface at and be

secured to the controller. This is not necessary for lateral pipelines with irrigation heads attached.

B. Pipe Sleeves

Pipe sleeves shall be Schedule 40 PVC pipe, six-inch (6") diameter unless noted otherwise, or equal approved by ENGINEER.

1. Installation

Provide empty sleeves along all pathways as noted on the drawings or every 100 feet. Extend sleeves at least one foot (1') beyond pavement on both sides. Sleeves shall be installed 18 inches below finished grade. All sleeves shall be installed at a depth on line and grade with existing or proposed irrigation lines. Sleeves with excessive or shallow invert depth will be rejected. Cap ends of empty sleeves with duct tape.

2. Sleeve Location Marking

a. New Pavement

The location of each sleeve must be marked along both of the extreme edges of any new pavement installed over the sleeve. This shall be accomplished by pressing the end section of a two-inch (2") pipe into the uncured pavement surface to make an imprint.

b. Existing Pavement

For sleeves pushed under existing pavement, sleeve locations shall be marked along the extreme edges of the pavement on both sides where the sleeve emerges from under the pavement. Markings shall consist of scoring the surface of the existing pavement with a 2" O.D. core drill just enough to make the impression of a circle in the pavement surface.

2.02 RISERS/SWING JOINTS

A. Flexible Risers

Stationary Pop-up and Surface Sprinkler Heads shall be installed using "funny pipe" or four-piece swing joints. Sprinkler Heads with one-half inch (1/2") and/or three-quarter inch (3/4") inlets shall connect with "funny pipe" exclusively, in lengths no longer than two feet (2'). Sprinkler Heads with one-inch (1") inlets shall connect with four-piece swing joints only.

1. Installation with "funny pipe", which is one-half inch (1/2") low density, polyethylene pipe, rated 80 PSI at 100 deg. F, must use Teflon-taped barbed street

ells. Use of flexible pipe such as “funny pipe” is limited to connecting laterals to irrigation heads.

2. Four-piece swing joints shall consist of an assembly using three (3) one inch (1”) Marlex street elbows, with a 1” SCH 80 Nipple of required length to set head at grade.

B. HDPE Pipe

1. All HDPE pipe must be SDR11 manufactured in accordance with AWWA C901/C906, ASTM D2239, ASTM D2737, ASTM D3035, ASTM F714 and ANSI/NSF 14/16 listings.
2. All fusion welds must be done by a certified technician.
3. All fitting must be fusion welded using butt joints with mechanical fittings or electro fusion fittings designed for use with HDPE.
4. All HDPE pipe that is damaged to the point where 10% of the overall wall thickness is effected shall be repaired according to owners’ recommendation.

C. Rigid Risers

All risers for shrub spray heads, bubblers, etc., that are in shrub or flowerbed areas and planters, shall be schedule 80 PVC plastic pipe, unless otherwise specified or shown on the plans. The risers shall be of sufficient height so as not to cause any interruption of the stream from the sprinkler nozzle when the plant material has reached its optimum growth.

2.03 VALVES

A. Ball Valves

1. All manual ball valves, sizes 1-1/2” inches and smaller, shall be all bronze double with integral taper seats and with rising stem.
2. All valves 2” and larger shall be gate valves.
3. All ball valves shall be full port, with chromium or stainless ball with Teflon seats 150 PSI rated, Hammond, or approved equal.

B. Pressure Reducing Valves

Provide pressure-reducing valves on main lines only, Watts, Series U5, U5B ½” to 2” Standard Capacity, or approved equal.

C. Gate Valves

1. All manual gate valves, sizes four-inch (4”) and smaller, shall be made in the U.S.A., brass body, threaded, non-rising stem, full port, 200 PSI/13.8 bar non-

shock cold working pressure up to 180 deg. F./82 deg. C., NSF/ANSI 61-8 compliant: NIBCO model TI-8 or approved equal.

2. All gate valves of 6-inch (6") size or larger shall be at least 150 PSI rated, AWWA-C509 resilient wedge gate valve, made in the U.S.A., featuring non-rising stem, iron body, epoxy coated interior, mechanical joint with appropriate size gaskets for corresponding pipe as per drawing.

D. Quick-Coupler Valves

Provide Rain Bird #3 DNP Quick Coupler valves and one key per valve.

E. Automatic Remote Control Valves

Automatic control valves shall consist:

1. Rain Bird PESB Series, 24 volts, contamination resistant valve with a pressure operating range of 20-200 psi and a 0.25 to 200 g.p.m. flow range. Glass-filled nylon construction, one-piece solenoid with captured plunger, flow control handle adjusts, manual internal and external bleeds, nylon screen scrubber and purple flow control handles for easy identification of non-potable water systems or approved equal.

F. Back-Flow Preventers

Back-flow on potable systems only shall be Wilkins Model 720A or approved equal.

2.04 VALVE BOXES

All remote control valves, pressure regulating valves, manual control valves, zone shut-off valves, gate valves or globe valve filters and drains, unless otherwise indicated, shall be installed in a valve access box of proper size as required for easy access to the valve. Valve box to be Carson, with round, locking green cover ten inches (10") in diameter for quick coupler valves, and 10" x 15" standard for all others unless described otherwise in the contract drawings, or approved equal. All round valve boxes shall be supported underneath the bottom edges with two bricks (minimum). All rectangular valve boxes shall be supported underneath the bottom edges with three bricks (minimum). The base of the valve box should be at or below the body of the valve. The lid of the valve box should be flush or within 1" of turf grade.

2.05 AUTOMATIC IRRIGATION CONTROLLER

A. Controller Type

The automatic controller shall be 120 volt input, soft-wired, 26.5 volt output, with the

number of valve stations and in the type and model number indicated on the plans, and shall be a Rain Bird ESP SAT LS or ESP SAT LW. Wall or pedestal mount type must be pre-approved by the ENGINEER and OWNER for the site situation. Controller station size and quantity specified per drawing. Station wiring and timing schedule specified per drawing. All station wiring must be terminated in a Rain Bird ESPSATOB24 mounted in the pedestal or wall mounted wire trough. All controllers must be equipped with a Rain Bird RMK450NARR with a University licensed and authorized frequency, hooked to a Rain Bird Maxilink Ant 01 or Antenex Directional Yagi Model Y4503/Y4505 or University approved substitute. All MaxiCom components must be ordered and installed by a MaxiCom-certified installer.

B. Electrical Power

Power for the controllers shall be the responsibility of the sprinkler installer. Meet all electrical specifications for installation of controllers and power to the controllers. The controllers must be wired to the power source in the pedestal or wall via an Isobar Ultra 4 surge protector and a two-receptacle Ground Fault Interrupter (GFI) outlet. A pigtail that can reach from the controller to the outlet is required. Power source must be pre-approved by Owner prior to connection.

C. Sleeves

1. Provide minimum six inch (6") diameter sleeves under paved areas as necessary to run all control wiring and piping for sprinkler zones. Coordinate with concrete work prior to forms being set. All sleeves shall be installed at a depth on line and grade with existing or proposed irrigation lines. Sleeves with excessive or shallow invert depth will be rejected.
2. No sleeving shall be put in tunnel walls. All main lines fed from the tunnel shall be cored, and sized to fit link seals for that pipe size. Each mainline shall be sealed using 2 link seals, one on the inner wall and one on the outer wall. No fittings allowed within 3'-0" of outer tunnel wall.

D. Location

After pre-approval by the ENGINEER and OWNER, locate controllers on outside walls of buildings or on pedestals at locations that will maximize the view of the zones serviced by each controller. Verify locations with the ENGINEER to avoid compromising buildings systems and/or appearance concerns.

Pedestals controllers must be mounted to a concrete slab of dimensions 1.5' x 1.5' x 0.33'. Each pedestal slab shall have a minimum of 2 electrical sweep 90's poured into it. First; one 1" sweep shall hold 120V direct bury power wires, second, one 2" sweep shall hold valve control and flow meter wires- additional or larger sweeps shall

be installed as needed to avoid wire damage. Two bollards consisting of three inch (3") steel pipe filled with concrete and anchored in concrete shall be installed against the edge of the slab in front and in back of the controller. The bollards shall be primed and painted with a black, epoxy-based paint. The concrete at the top of the pipe must be domed and finished to a smooth, even surface, without concrete residue on the outside surface of the pipe.

E. Flow Meter

A MaxiCom-compatible flow meter must be installed at every point of connection. This may be either a Rain Bird Brass Insert Sensor (FS350B) for pipe three inches or larger, or a Rain Bird PVC Tee Sensor of the appropriate size: FS150P for 1-1/2" pipe, FS200P for 2" pipe, and FS300P for 3" pipe. The flow meter must be directly connected to the controller using PE43 communication cable (the blue/blue white wire pair must be used for the flow meter/pulse transmitter connection) and a PT 322 pulse transmitter. All splices using this type of cable must meet Rain Bird MaxiCom standards. Programming and hook up of the PT322 shall be completed by MSU Irrigation Employee.

F. Certified Installation

All MaxiCom components must be ordered and installed by a MaxiCom-certified installer.

2.06 IRRIGATION HEADS

A. Rotary Sprinklers

All rotary sprinkler heads shall be Model I-20R Series, manufactured by Hunter Industries, San Marcos, California; Rain Bird 5004+PCSAMRNP Series, manufactured by Rain Bird Sprinkler Mfg. Corp., Glendora California; Rain Bird 8005NP Series, manufactured by Rain Bird Sprinkler Mfg. Corp., Glendora California; or owner approved equivalent.

B. Spray Heads

All spray head sprinklers shall be Rain Bird Model Nos. 1800 series SAM with variable arc nozzles (VAN) or MPR nozzles, manufactured by Rain Bird Sprinkler Mfg. Corp., Glendora California or approved equal.

C. Bubblers

All bubbler zones must be controlled by a Rain Bird PESB Series Valve incorporating a Rain Bird PRS regulator. There must be a Rain Bird WYE Filter System installed directly downstream of the valve, located inside the valve box in a

manner that allows easy maintenance. The bubbler heads must be Rain Bird 1300A-F Series mounted on Rain Bird 1804 SAM Spray Bodies or approved equal.

D. Drip Irrigation

No drip irrigation systems are allowed at Montana State University.

2.07 CONTROL CABLE

A. Type

All electrical control and ground wire shall be Baron irrigation control cable or approved equal, 14-gauge unless otherwise indicated on the drawings. All wiring to be used for connecting the automatic remote control valve to the automatic controllers shall be Type "UF", 600 volt, solid copper, single conductor wire with PVC or polyethylene insulation and bear UL approval for direct underground burial feeder cable.

B. Insulation

Insulation shall be four-sixty-fourths inch (4/64") thick minimum covering of ICC-100 compound for positive waterproofing protection. All control or "hot" wires shall be red and all common or "ground" wires shall be white. A minimum of one black extra wire shall be included in the wiring run for every four (4) wires installed. All black extra wires shall be intact and usable from the controller to the end of each mainline run with slack wire available at each valve location.

C. Code Compliance

Verification of wire types and installation procedures shall be checked to conform to local codes.

D. Splices

All splices are to be completed within valve boxes using one-piece, jelly-filled, water-proof wire connectors with 20 expansion coils per splice, allowing work to be completed at ground level. All splices shall be located on as-built drawings.

E. Trench Installation

1. Tape and bundle all wiring at ten-foot (10') intervals.
2. Attach tracer wire to main line pipe only at ten-foot (10') intervals.
3. All 120 volt wiring shall be in conduit with marker tape installed in the ditch six inches (6") above the conduit.

4. All wiring under pavement and through sleeves shall be in conduit.
5. Tie a loose twenty-inch (20") loop in wiring at all changes in direction greater than 30 degrees. Untie all loops after making connections.

2.08 VAULTS

A. Water Service Connection

A vault shall be installed at domestic water service connection. Vault shall house domestic water back-flow preventers, blowout assembly and isolation valves. Vault must comply with applicable code(s).

B. Location

Review location of vault with ENGINEER prior to installation.

2.09 OTHER MATERIALS

A. Tools To Be Furnished

1. Supply as part of this contract the following tools:
 - a. Two keys for each automatic controller
 - b. Two quick-coupler keys, Rain Bird Model 33K with matching hose swivels.
2. The above equipment shall be turned over to the OWNER at the conclusion of the project. Before final inspection can occur, evidence that the OWNER has received materials must be shown to the ENGINEER.

B. Concrete

Provide and coordinate installation of all concrete thrust blocks. Refer to Division 3 for concrete requirements. Provide thrust blocks for all lines larger than 3-inch diameter, at all tees and ells.

C. Other Materials

All other materials not specifically described but required for a complete and proper irrigation system installation, shall be new, first quality of their respective kinds, and subject to the approval of the ENGINEER.

PART 3-EXECUTION

3.01 SURFACE CONDITIONS

A. Inspection

1. Prior to all work of this section, carefully inspect the installed work of all other trades and verify that such work is complete to the point where this installation may properly commence.
2. Verify that irrigation system may be installed in strict accordance with all pertinent codes and regulations, the original design, the referenced standards, and the manufacturer's recommendations.

B. Discrepancies

1. In the event of discrepancy, immediately notify the ENGINEER.
2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.02 FIELD MEASUREMENTS

Make all necessary measurements in the field to ensure precise fit of items in accordance with the original design.

3.03 TRENCHING AND BACKFILLING

A. General

1. Perform all trenching required for the installation of items where the trenching is not specifically described in other sections of these specifications.
2. Make all trenches in accordance with OSHA Requirements with sufficient width to provide free working space at both sides of the trench and around the installed item as required for gluing, joining, backfilling, and compacting while minimizing width of trenches.
3. The CONTRACTOR will be required to conduct his work so that trenches will remain open a minimum possible time.

B. Depth

1. Trench as required to provide the elevations shown on the Plans.
2. Trench to sufficient depth to give a minimum of eighteen inches (18") of fill above the top of the pipe measured from the adjacent finished grade under driveways and sidewalks.

3. All mainline and control cables shall have a minimum cover of eighteen inches (18") above the pipe or wire. All laterals shall have a minimum cover of twelve inches (12") above the pipe.
4. All sleeves shall be installed at a depth on line and grade with existing or proposed irrigation lines. Sleeves with excessive or shallow invert depth will be rejected.

C. Correction of Faulty Grades

Where trench excavation is inadvertently carried below proper elevations, backfill with material approved by the ENGINEER and then compact to provide a firm and unyielding sub grade to the approval of the ENGINEER and at no additional cost to the OWNER.

D. Trench Bracing

1. Properly support all trenches in strict accordance with all pertinent rules and regulations.
2. Brace, sheet, and support trench walls in such a manner that they will be safe and that the ground alongside the excavation will not slide or settle, and that all existing improvements of every kind will be fully protected from damage.
3. In the event of damage to such improvements, immediately make all repairs and replacements necessary to the approval of the ENGINEER and at no additional cost to the OWNER.
4. Arrange all bracing, sheeting, and shoring so as to not place stress on any portion of the completed work until the general construction thereof has proceeded far enough to proven, sufficient strength.

E. Removal of Trench Bracing

Exercise care in the driving and removal of sheeting, shoring, bracing, and timbering to prevent collapse or caving of the excavation faces being supported.

F. Grading and Stockpiling Trenched Material

1. Control the stockpiling of trenched material in a manner to prevent water from running into the excavation.
2. Do not obstruct surface drainage but provide means whereby storm and wastewater are diverted into existing gutters, other surface drains, or temporary drains.

G. Methods

1. All trench excavation shall be made by open cut. During excavation, material suitable for backfilling shall be piled in an orderly manner, a sufficient distance from the banks of the trench to avoid overloading, and to prevent slides or cave-ins. All material not required for backfill or not suitable for backfill shall be removed from the site by the CONTRACTOR. Banks of trenches shall be kept as nearly vertical as possible, and shall be properly sheeted and braced as may be necessary to prevent caving.
2. The CONTRACTOR shall provide, place, maintain, and remove all necessary barricades, warning signs, and other safety devices from the start to the finish of the project to prevent pedestrians from falling in open trenches.
3. Trench widths in paved streets or in areas where proximity to other structures requires vertical cuts, shall not be wider than is required for proper handling, jointing and bedding of the pipe.
4. The bottom of the trenches shall be accurately graded to line and grade, and provide uniform bearing and support for each section of the pipe on undisturbed soil, at every point along its entire length. Depressions for joints shall be dug after the trench bottom has been graded, and shall be only of such length, depth, and width as required for properly making the particular type joint. Care shall be taken not to excavate below the depths indicated.
5. Where rock occurs in trench excavation, the rock shall be removed to a depth of six inches (6") below the established grade line, and to a width of twelve inches (12") greater than the outside diameter of the pipe to be installed in the trench.
6. No water shall be permitted to rise or stand in trenches not yet backfilled until after the pipe has been placed, tested and covered with backfill for a depth of at least ten inches (10"). Any pipe having its alignment or grade changed as a result of a flooded trench shall be removed and re-laid after the trench is graded once again at no additional cost to the OWNER.

H. Pavement Removal

1. Where excavation of trenches requires the removal of pavement, the pavement shall be cut in a straight line along the edge of the excavation by use of a spade-bit air hammer, concrete saw or similar approved equipment to obtain straight, square and clean break. After backfilling and sub grade preparations are completed, the pavement section and surfacing shall be replaced.
2. Pavement replacement shall utilize the same materials and design as the original pavement.

3. Excess material, including rock, broken concrete, bituminous materials, debris, or other materials not suitable for backfill, shall be removed from the site and disposed of by the CONTRACTOR.

3.04 BORING

A. Locations

Boring shall be used to route pipe, wiring, or both under structures such as walks or curbs where trenching is impractical. Sleeves shall be installed in all bored holes.

B. Method

Boring shall be accomplished with a drill, auger, water jet, or any other instrument approved by the ENGINEER capable of producing a precise hole. Boring shall not disturb overlaying structures or cause settlement and damage to those structures.

3.05 SLEEVES

A. Locations

Sleeves shall be installed wherever routing of a pipe, wiring, or both crosses a paved area or passes through a bored hole.

B. Methods

1. Sleeves laid in open trenches shall be uniformly and evenly supported by undisturbed soil on the trench bottom. Backfill shall conform to standards hereinafter specified.
2. Sleeves installed in borings shall be forced through and shall have a snug fit throughout the length of the bored hole. Sleeves cracked or broken shall not be accepted.

3.06 BACKFILL

A. Material

Backfill material shall be free of clods, lumps of frozen material, or stones larger than one-inch (1") in their maximum dimension. The bedding and select material under, around and six inches (6") above the top of the pipe shall be placed by hand in maximum layers of six inches (6") and carefully compacted in a manner which will not displace the pipe. Compaction of the select backfill shall be at least ninety percent (90%) of the maximum density as determined by AASHTO T-180. Water settling will not be allowed.

B. Inspection

The trenches shall not be backfilled until inspection has been completed and the pipe installation, including the grade, alignment and jointing has been found to be in compliance with the requirements of the plans and specifications.

C. Around and Over the Pipe

1. Select backfill material consisting of sand, fine gravel or select earth, free of large lumps or rocks larger than three-quarters of an inch ($\frac{3}{4}$ ") shall be used in backfilling around and over the installed pipe.
2. The select material shall be obtained from the excavation material removed from the trench and shall be processed by screening, sifting, or selective sorting, so as to produce the type of backfill herein specified. The CONTRACTOR may at his option and expense provide an acceptable imported material.
3. This backfill material shall be carefully deposited around and over the pipe in layers not more than six inches (6") thick, loose measurement, unless otherwise permitted by the ENGINEER, wetted to optimum moisture content and uniformly compacted to at least ninety-five percent (95%) of the maximum density obtainable at optimum moisture content as determined by ASTM D698 (latest revision), until the pipe has a cover depth of at least one foot (1').

D. Remainder of Trench Backfill

1. The remaining depth of the trench shall be backfilled with excavation material removed from the trench, which shall be wetted or dried to near optimum moisture content.
2. This material shall be carefully deposited in layers not to exceed six inches (6") in compacted thickness and compacted to at least ninety-five percent (95%) of the maximum density as determined by ASTM D698 (latest revision). The method of compaction selected by the CONTRACTOR shall not cause damage of any nature to the installed pipe. Replace topsoil on trench fill and compact to eighty-five percent (85%) of maximum density at optimum moisture.
3. The use of water settlement for this portion of the trench backfilling is permissible if the specified density can be obtained and the backfill material is suitable for this type of trench compaction.

3.07 INSTALLATION OF PIPING

A. General

1. Layout the piping system in strict accordance with the Plans.
2. Where piping is shown on the Plans to be under paved areas but running parallel and adjacent to planted areas, the intention is to install the piping in the planted areas.

B. Line Clearance

1. All lines shall have a minimum clearance of four inches (4") from each other, and six inches (6") from lines of other trades, except through pipe sleeves.
2. Parallel lines shall not be installed directly over one another.

C. Inspection of Pipe and Fittings

Carefully inspect all pipe and fittings before installation, removing all dirt, scale, and butts and reaming as required; install all pipe with stamped markings oriented up to allow visual inspection and verification.

D. Plastic Pipe

1. Plastic pipe shall be installed in a manner so as to provide for expansion and contraction as recommended by the manufacturer.
2. All plastic pipe joints shall be solvent-weld joints or gasket fit joints. Only the solvent cement recommended by the pipe manufacturer shall be used and it must be a two-part system consisting of primer and cement. No single part cement system shall be used. All plastic pipe and fittings shall be installed as outlined and instructed by the pipe manufacturer and it shall be the CONTRACTOR's responsibility to make arrangements with the pipe manufacturer for any field assistance that may be necessary. The CONTRACTOR shall assume full responsibility for the correct installation.
3. All plastic (PVC) to metal joints shall be made with plastic threaded male adaptors into metal threaded female fittings.
4. The solvent-weld joints shall be made on dry pipe.
5. The solvent-weld joints shall be allowed to set at least 24 hours before pressure is applied to the system on PVC pipe.

E. Copper Pipe

Direct buried copper pipe connections shall be made using silver solder.

F. Thrust Blocks

Provide concrete thrust blocks for all pipes as shown on the plans. All thrust blocks shall bear directly on undisturbed earth. Center the pipe in the middle of the thrust block.

3.08 INSTALLATION OF EQUIPMENT

A. General

1. All fittings, valves, etc., shall be carefully placed in the trenches with concrete thrust blocks, placed where required.
2. All sprinklers, having adjustable nozzles, shall be adjusted for proper and adequate distribution of the water over the coverage pattern of the sprinkler.
3. All nozzles on stationary pop-up sprinklers or stationary spray heads shall be tightened after installation. All sprinklers having an adjusting screw, adjusting stem or adjusting friction collars shall be adjusted as required for the proper arc of coverage, radius, diameter and/or discharge.
4. All control wires shall be clearly labeled by station, using weatherproof material, at the controller and at the valve ends. Mark the underside of all valve box covers, indicating the valve controller station number. All markings shall be made in a neat and legible manner using white enamel paint.
5. All control or "hot" wires shall be red and all common or "ground" wires shall be white. A minimum of one black extra wire shall be included in the wiring run for every four (4) wires installed.

B. Sprinkler Heads

1. Install lawn sprinkler heads where indicated on the plans and in strict accordance with the manufacturer's recommendations and as necessary to provide complete uniform coverage and precipitation.
2. Upon completion of installation, reset all lawn sprinkler heads flush with grade and firmly anchored with soil.

C. Master Automatic Control Valves

A master automatic control valve shall be installed at the point of connection to the main for any remotely controlled portion of the irrigation system. In cases where there are multiple points of connection, a master valve shall be installed for each, with

no more than three points of connection allowed. Each master valve will have its own separate yellow “hot” wire.

3.09 TESTING AND INSPECTION

A. Covering or Enclosing Work Prior to Inspection

Do not allow or cause any of the work in this section to be covered up or enclosed until it has been inspected, tested, and approved by the OWNER’s Representative.

B. Flushing

Before backfilling the mainline, and with all control valves in place, but before lateral pipes are connected, completely flush and test the mainline and repair for all leaks; flush out each section of lateral pipe before sprinkler heads are attached. Complications due to this not being done during install will result in charges to the contractor.

C. Testing

1. Make all necessary provisions for thoroughly bleeding the line of air and debris.
2. After valves have been installed, test all live water lines hydrostatically for leaks at a pressure of one hundred fifty (150) psi for a period of two (2) hours, with all couplings exposed and with all pipe sections center loaded.
3. Furnish all necessary testing equipment and personnel.
4. Correct all leaks and retest until acceptance by the ENGINEER.

D. Final Inspection

1. Thoroughly clean, adjust, and balance all systems.
2. Demonstrate the entire system to the ENGINEER and OWNER, proving that all remote control valves are opening and closing on command, that all heads are properly adjusted for radius and arc of coverage, that all emitters are functioning, and that the installed system is workable, clean, and efficient.
3. Existing irrigation system(s) or portions of systems which have had their performance altered by any of the work related to this project shall be repaired or adjusted using materials and installation methods in accordance with this specification and in a manner to restore head-to-head sprinkler coverage, uniform precipitation rates, control zone integrity, and elimination of the spraying of water on building walls and sidewalks.

3.10 CLEANUP

Upon completion of the work, the entire site shall be cleared of all debris, and ground surfaces shall be finished to smooth, uniform slopes and shall present a neat and workmanlike appearance. Cleanup shall be considered an incidental item, and no additional payment shall be made for any cleanup item. All improvements or other obstructions removed during construction shall be replaced in a condition at least equal to their existing condition.

3.11 MAINTENANCE

- A. The CONTRACTOR shall, for a period of one (1) year after completion and final acceptance of the work, maintain and repair any trench or boring settlement which may occur, and shall make suitable repairs to any pavements, or other structures which may become damaged as a result of settlement. All such maintenance and repair shall be at the CONTRACTOR's expense.
- B. The CONTRACTOR shall inform the OWNER of the location and the nature of all damage done to the existing irrigation system not slated for demolition within eight hours of the occurrence of the damage.
- C. The CONTRACTOR shall maintain the existing and proposed irrigation system in operation during the construction period. Upon completion of the proposed irrigation work the CONTRACTOR shall balance and adjust the entire (new and existing) system.

3.12 AS-BUILT DRAWINGS, CHARTS AND EQUIPMENT MANUALS

A. Record Drawings

1. Accurately record on one set of black and white prints of the site plan all installed work including both pressure and non-pressure lines.
2. Upon completion of each increment of work, transfer all such information and dimensions to the print. The dimensions shall be recorded in a legible and workmanlike manner.
3. Dimension from two permanent points of reference (buildings, monuments, sidewalks, curbs, pavement, etc.). Locations shown on as-built drawings shall be kept day-to-day as the project is being installed. All dimensions noted on drawings shall be one-eighth-inch (1/8") in size (minimum).

4. Show locations and depths of the following items:

Point of connection

Routing of pressure lines (max. dimension=one hundred feet {100'} along lines)

Gate valves

Sprinkler control valves

Quick coupling valves

Routing of control wires

Sprinkler heads

Other related equipment

5. Maintain as-built drawings on site at all times.
6. Make all notes on drawings in pencil (no ball point pen).

B. Controller Charts

1. ENGINEER must approve as-built drawings before charts are prepared.
2. Provide one controller chart for each controller supplied showing the area covered by automatic controller, of the maximum size controller door will allow.
3. The chart is to be a reduced drawing of the actual as-built system.
4. Chart shall be black line print and different colored shading used to show area of coverage for each station.
5. When completed and approved, the chart shall be hermetically sealed between two pieces of plastic.
6. The chart shall be mounted using Velcro or equal type of semi-permanent fastening device.
7. These charts must be completed and approved prior to final acceptance of the irrigation system by the OWNER.

C. Operation and Maintenance Manuals

1. Prepare and deliver to the ENGINEER within ten calendar days prior to completion of construction, all required and necessary descriptive material in complete detail and sufficient quantity, properly prepared in two (2) individually bound copies of the operations and maintenance manual. The manual shall describe the material installed and shall be in sufficient detail to permit operating personnel to understand, operate and maintain all equipment. Spare parts lists and related manufacturer information shall be included for each equipment item installed. Each complete, bound manual shall include the following information:

- a. Index sheet stating CONTRACTOR's address and telephone number, duration of guarantees period, list of equipment with names and addresses of local manufacturer representatives.
 - b. Complete operating and maintenance instructions on all major equipment.
 - c. System start-up and shut down instructions.
2. In addition to the above maintenance manuals, provide the maintenance personnel with instructions for system operation and show written evidence to the OWNER at the conclusion of the project that this service has been rendered.

3.13 GUARANTEE

A. Warranty

1. The entire irrigation and water system shall be guaranteed to give satisfactory service for a period of one year from the date of acceptance by the OWNER.
2. Should any trouble develop within the time specified above due to inferior or faulty materials or workmanship, the trouble shall be corrected at no expense to the OWNER.
3. Any and all damages resulting from faulty materials or workmanship shall be repaired by the CONTRACTOR to the satisfaction of the OWNER, at no cost to the OWNER.

End

LANDSCAPE GUIDELINES

PART 1 - GENERAL

1.0 RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General conditions, Supplementary Conditions, apply to work of this section.

1.1 DESCRIPTION

- A. The work in this section includes landscape construction, protection of existing site and landscape conditions and landscape maintenance during construction.
- B. See drawings for extent of landscaping.

1.2 RELATED WORK DESCRIBED ELSEWHERE

- A. Section 01500 – Temporary Facilities and Controls
- B. Section 02210 – Tree Protection
- C. Section 02235 – Site Clearing
- D. Section 02300 - Earthwork
- E. Section 02810 - Irrigation System
- F. Section 02935 – Lawns and Grass

1.3 QUALITY ASSURANCE

- A. Comply with applicable Federal, state and local regulations governing landscape materials and work.
- B. Owner's representative reserves right to review and reject materials at growing site and as delivered to site.
- C. Observation at growing site does not preclude right of rejection at job site. Remove rejected materials from site immediately.
- D. Personnel: Employ only qualified personnel familiar with required work.

- E. Contractor's Responsibilities: Landscape Contractor to coordinate activities with all other trades. Landscape Contractor to also secure utility locates prior to commencing work involving excavation or digging.

1.4 REFERENCED STANDARDS

- A. *ANSI Z60.1: American Standard for Nursery Stock*, latest edition, American National Standards Institute.
- B. *Hortus Third: A Concise Dictionary of Plants Cultivated in the United States & Canada*, Staff of the L.H. Bailey Hortorium, Cornell University, 1999.
- C. *ASTM C33: Specification for Concrete Aggregate*, American Society of Testing Materials.
- D. Alex Shigo, *Tree Pruning*, Shigo & Tree Associates, LLC, 1989.
- E. *Guide for Plant Appraisal*, latest edition, Council of Tree and Landscape Appraisers.
- F. *Species Ratings and Appraisal Factors Guide*, latest edition, International Society of Arboriculture, Rocky Mountain Chapter.
- G. *ANSI A300: Standards for Tree Care Operations*, American National Standards Institute.
- H. Tree Planting Specifications, Dr. Delmar Gilman, University of Florida, <http://hort.ifas.ufl.edu/woody/summary-planting.shtml>, Copyright 2011, University of Florida
- I. Guideline Specifications for Nursery Tree Quality, Dr. Delmar Gilman, University of Florida, <http://search.ufl.edu/web/#gsc.tab=0&gsc.q=Guideline%20Specifications%20for%20nursery%20stock%20%20site%3Ahort.ifas.ufl.edu>, Copyright 2011, University of Florida.
- J. International Society of Arboriculture (ISA) Best Management Practices publications

1.5 SUBMITTALS

- A. File Certificates of Inspection of plant material by Federal, State and local authorities with Landscape Architect, if required.

- B. Submit within 30 days after award of contract, complete list of materials to be furnished under this section and confirmed sources for materials.
- C. Requests for substitutions shall be submitted in writing to the Landscape Architect prior to award of contract.
- D. Provide and pay for material testing. Submit the following materials certification and text report.
 - 1. Topsoil
 - a. pH factor
 - b. Mechanical analysis
 - c. Percentage of organic content
 - d. Recommendations on type and quantity of additives required to establish satisfactory pH factor and supply of nutrients to bring topsoil to satisfactory level for planting.
 - e. Identify source location of topsoil proposed for use on the project if imported from off-site.
 - 2. Organic Additives
 - a. Loss of weight by ignition
 - b. Moisture absorption capacity
 - c. Percentage of organic matter
 - d. pH factor
- E. Submit the following material samples, in a size within reason to evaluate material thoroughly:
 - 1. Mulch
 - 2. Erosion control fabric
 - 3. Edging

1.6 PRODUCT PREPARATION, DELIVERY, AND STORAGE

A. Preparation and Protection

1. Balled and Burlapped (B&B) Plants: Dig and prepare shipment in a manner that will not damage roots, branches, shape, and future development.
2. Container Grown Plants: Deliver plants in container sufficiently rigid to hold ball shape and protect root mass.
3. Use all means necessary to protect and maintain materials before, during and after installation and to protect the installed work and materials of all other trades.
4. All seed shall be delivered in the original bags certifying purity, germination, common, and botanical name for each species, and percent weed seed. Owner's representative shall inspect all seed prior to application. Untagged seed bags shall be rejected. Immediately make all replacements necessary to the approval of the Owner's representative and at no additional cost to the Owner.
5. Deliver all products, as specified, to site in original, sealed containers bearing manufacturer's guaranteed statement of analysis.

B. Delivery

1. Deliver packaged materials in sealed containers showing weight, analysis and name of manufacturer. Protect materials from deterioration during delivery and while stored on site.
2. Deliver only plant materials that can be planted in one day unless adequate storage and watering facilities are available on job site.
3. Protect root balls by heeling in with mulch if not planted within 24 hours of delivery.
4. Protect during delivery to prevent damage to roots at all times. Cover all materials during transport.
5. Notify Land Owner's representative of delivery schedule 48 hours in advance so plant material may be observed upon arrival at job site and can be inspected immediately after being unloaded at site.
6. Remove rejected plant material immediately from site.
7. Do not lift, move, adjust to plumb, or otherwise manipulate plants by trunk or stems. Avoid damage or stress by proper handling. Plant material dropped

on the ground, rather than gently placed into the storage area or planting bed, will be rejected.

C. Storage

1. Plant material shall be stored in a shady and secure location, and shall be watered regularly prior to planting to prevent drying out of the rootball.
2. Seed, fertilizer, herbicide, hydromulch, and tackifier shall be kept in dry storage away from contaminants, at a weatherproof location.

1.7 JOB CONDITIONS

A. Site and Plant Protection

1. Care must be exercised to minimize disturbance or compaction of areas adjacent to any project. Trees shall be protected as specified in the project manual. (Section 02210 – Tree Protection)
2. In order to prevent excessive soil compaction and destruction of soil structure, no site work will be performed in cases where equipment or traffic must pass over wet soils or if wet soils must be handled or manipulated in order for the work to progress. Wet soil is defined as any soil within 90 percent of field capacity (saturation).
3. Do not move equipment over existing landscape or newly placed structures without approval of the Owner or Owner's Representative.
4. Provide board roading as required to protect paving. Protect other improvements from damage, with protection boards, ramps and protective sheeting.

B. Planting Restrictions

1. Perform actual planting per referenced standards.
2. Owner's representative must approve all bedding plants and ground covers.
4. Plant materials must be installed with spacings that allow, at maturity, a maximum of 30 percent canopy overlap or inter-fingering. This does not apply to species of widely disparate mature sizes, such as between a large tree and understory shrubs, because their canopies do not grow together.

5. Trees that are medium and small at maturity must be planted no closer than fifteen feet to any building, sidewalk or paved surface unless otherwise indicated on the drawings. Trees that are large at maturity cannot be placed closer than 20 feet to any building, sidewalk or paved surface unless otherwise indicated on the drawings. Owner must approve exceptions to these requirements.

C. Utilities

1. Utility locates are required prior to digging and any construction activities.
2. Coordinate work with Owner, including irrigation manager, in order to prevent damage to underground sprinkler system.

1.8 WARRANTY

- A. Warranty plant material for one year after final acceptance. Replace dead or dying materials not in vigorous, thriving condition as soon as weather permits and on notification by Owner's representative. Replace plants, including trees, which in opinion of Owner's representative have partially died, thereby compromising shape, size or symmetry.
- B. Replace plants with same kind and size as originally planted, at no cost to Owner. Provide one-year warranty on replacement plants. Trees should be replaced at start of next planting or digging season. In such cases, remove dead trees immediately. Protect irrigation system and other piping conduit or other work during replacement. Repair damage immediately.
- C. Warranty excludes replacement of plants after final acceptance because of injury by storm, drought, drowning, hail, freeze, insects, or disease. Materials damaged by "Acts of God" prior to final acceptance are responsibility of Contractor.
- D. At end of warranty period, remove staking and guying materials from the site.

1.9 MAINTENANCE

- A. Water will be available on site. Provide necessary hoses and other watering equipment required to complete work.
- B. Maintain plantings and trees by watering, cultivating, weeding, spraying, cleaning, and replacing as necessary to keep landscape in a vigorous, healthy condition.
- C. Coordinate watering schedules with irrigation contractor or Owner's representative during installation and until final acceptance. Provide deep root watering to newly installed trees.

- D. Mowing: Mow newly planted grass area weekly after initial growth reaches two and one-half inches.
- E. Weeding: Remove weeds and foreign grasses in planted areas at least once per week. Herbicides may be used only when approved by the Owner's Representative.
- F. Fencing: Provide four (4') foot tall orange plastic snow fencing and metal tee fence post spaced at a maximum of eight (8') feet apart around all walks at seeded areas. Maintain until lawn is accepted.
- G. Tree Replacement

Trees removed during demolition or construction are to be replaced following consultation with Owner's Arborist or Owner's Representative. Appraised values of existing trees have been determined according to industry standards and will be provided by the Owner if applicable.

PART 2 – PRODUCTS

2.0 PLANTS

A. General

Plant quality must be equal to well formed No. 1 grade nursery stock. Listed plant heights are from tops of root balls to nominal tops of plants. Plants shall be specimen quality, typical of their species or variety.

B. Shrubs and Ground Covers

Plants shall be nursery grown, healthy and vigorous, of normal habit of growth for the species, free from disease, insect eggs, and larvae. Specified sizes are before pruning and measured with branches in normal position. Plants shall be well rooted and established in the container.

C. Ornamental and Shade Trees

Trees shall be healthy, vigorous, full-branched, well-shaped, trunk diameter, and height requirements as specified. Root balls shall be firm, neat and slightly tapered and well burlapped. Trees with loose or damaged root balls at time of planting shall be rejected. Root balls should meet the American Standard for Nursery Stock, Edition approved 1985 by American National Standards Institute, Inc. (Z6O.1) standard.

D. Special Requirements

Shade trees are to be procured a minimum of 30 days prior to scheduled installations. Trees to be shipped in enclosed truck or the branches/leaves protected by appropriate fabric during shipping. Trees are to be healed in at job site or at Contractor's holding facility and maintained until site is ready. Owner's representative will review trees at holding area prior to planting.

E. Collected Trees

Direct planting from the collection site is preferred. Coordinate with Owner for utility locates and scheduling of sidewalk closures or other logistical issues. If necessary, spray field grown trees immediately prior to digging with anti-desiccant. Insure adequate coverage to trunks, branches and foliage.

2.1 SOIL PREPARATION MATERIALS

A. Soil Amendments: Soil amendments are not to be used unless approved by Owner.

B. Topsoil

1. Friable, fertile, dark, loamy soil, free of clay lumps, stones and other extraneous material and reasonably free of weeds and foreign grasses, with a pH of 5.0 to 8.0.
2. Organic matter shall be four to 12 percent total dry weight.
3. Provide tests for certification.

C. Sharp Sand

Sharp sand shall be clean, washed and fine aggregate and shall meet ASTM C33 standards.

D. Peat Moss

Peat moss shall be commercially produced, sterilized, reed-sedge peat, equivalent to Martins Peat, Big Fork, Montana. Peat must have a pH between five and seven and organic matter content not less than 90 percent.

E. Fertilizer

1. Type A – as recommended by testing agency.
2. Type B – Scotts "Osmocote" at a 14-14-14 ratio, incorporated into the soil according to instructions on the bag.

2.2 MISCELLANEOUS MATERIALS

A. Edging

As indicated on drawings.

B. Mulch

1. Shredded, medium grade, Douglas fir bark with a chip size of one and one-half inch to two and one-half inch average, free of wood chips and sawdust, as manufactured by Model Log Homes, 75777 Gallatin Road, Gallatin Gateway, Montana, 59730 (or approved equal).
2. One and one-half inch round, native, washed, river rock.
3. Owner's representative approved equal.

C. Landscape Fabric

Heavy, professional grade, spun-bonded nylon landscape fabric with six-inch anchoring pins. Woven fabric is unacceptable.

D. Anti-Desiccant

1. Protective film emulsion for protection of plant surfaces during transport. Permeable to permit transpiration, as manufactured by Wilt Pruf, Inc., P.O. Box 4280, Greenwich, Connecticut, 06830. Mixed and applied in accordance with manufacturer's instructions.
2. Owner's representative approved equal.

E. Staking and Guying

1. Tie Wire: 12-gauge, galvanized wire
2. Metal posts: 8'-0" t-stakes
3. Nylon strap: three inches wide, 12 inches long white or black nylon strap with one 1/2" brass grommet in each end or Landscape Architect approved equivalent.

F. Drainage Fill

No drainage without Owner's written permission.

G. Native Topsoil

Refer to Montana Standard Specifications Subsections 203.80 Topsoil Salvaging and placing, 610.00 Topsoiling and 713.06 Topsoil Material.

H. Imported Topsoil

In the event sufficient quantities of native topsoil cannot be salvaged from the site, the Contractor shall provide imported topsoil to supplement the project requirements. The Contractor shall provide topsoil that meets or exceeds the quality of the native topsoil material available on site. Contractor shall provide source and analysis information to the Owner's Representative, for his approval, prior to delivery. The Contractor shall incorporate into the topsoil, amendments necessary to provide topsoil fertility and quality, equal to or exceeding the characteristics of the native topsoil.

PART 3 - EXECUTION

3.0 INSPECTION

Examine sub-grade and verify conditions under which work is to be performed. Notify General Contractor and Owner's representative of unsatisfactory conditions.

3.1 BED PREPARATION

- A. Scarify all sub-grade of bed areas to six inches, all areas.
- B. Contractor shall spread topsoil evenly throughout bed after thoroughly mixing soil, amendments and fertilizer together on site.
- C. Remove any debris and rocks larger than one inch.

3.2 SHRUB AND GROUND COVER PLANTING

- A. Provide one-foot deep top soil in all shrub beds.
- B. Place plants in a position on bed areas before removal from containers. Obtain approval from Owner's representative of plant layout in the field. Owner's representative reserves the right to shift locations of plants prior to planting.
- C. Remove all materials (burlap, twine, wire, etc.) from entire root ball on all B&B plants.

- D. Plant all plants as located, setting plants with the root flare even with the tops of bed grades. Backfill with native soil and compact soil carefully around each plant ball. Water thoroughly to eliminate air pockets. Carefully prune plants to remove dead or broken branches and hand-rake bed areas to smooth even surfaces.

3.3 TREE PLANTING

A. Ornamental Trees and Shrubs

1. Stake locations for approval by Owner's representative.
2. Plant in pits two times wider than ball for trees and shrubs.
3. Fill material should be the native soil removed from the hole. No planting mix or soil amendments should be used.
4. Glazed sides of mechanically dug holes should be roughened or scarified to allow root penetration.
5. Remove all materials (burlap, twine, wire, etc) from entire root ball.
6. Carefully settle by watering to prevent pockets.
7. Root collar shall not be planted below finish grade level.

B. Root Balls

1. Root balls shall be properly located in relationship to adjacent soil as required by referenced standards.
2. Balls set too deep or too shallow shall be carefully removed and replanted as required by the Owner's representative.

3.4 TREE MOVING AND TRANSPLANTING

- A. Tree moving and transplanting shall be done in accordance with standards outlined in *ANSI A300: Standards for Tree Care Operations*, American National Standards Institute.
- B. All tree moving and/or transplanting operations shall be coordinated with the Owner prior to commencement of work.
- C. All removal and receiving areas shall have a comprehensive utility locate done according to current standards prior to commencement of work.

3.5 PERENNIAL PLANTING

- A. Prepare planting beds as indicated on drawings. Provide one foot of thoroughly mixed and prepared soil consisting of 50 percent sand loam topsoil; 25 percent coarse pumice, 3/8 inch size; and 25 percent peat moss. Thoroughly mix in 20 pounds of Scott, Ortho or Lilly-Miller nitrogen fertilizer per cubic yard with formulation of 10-20-10.
- B. Replace existing soil with planting mix.
- C. Space plants as indicated on drawings. Obtain approval of plant layout from Owner's representative before planting. Owner's representative reserves the right to change the location of plants prior to planting.

3.6 LANDSCAPE FABRIC

After planting has been completed and approved by the Owner's representative, install landscape fabric across planting beds. Sheets of fabric should have a minimum six-inch overlap. At the bed margins, fabric should be installed under the bottom of the edging. Fabric lapping outside the edging should be trimmed to below grade and buried when the edging is backfilled. Fabric should be well anchored with 6 inch staples pounded flush with the grade. Plant openings must be large enough to allow for future growth.

3.7 TOP DRESSING

After landscape fabric has been installed and accepted by the Owner's representative, top dress bed areas with mulch, as indicated on drawings, a minimum of three inches deep. Fabric must not be exposed or protrude above the mulch or edging. Mulch should be clean, whether organic or mineral mulch, and should be free of debris and soil.

3.8 TREE WRAPPING

Tree wrapping will not be accepted.

3.9 PRUNING OF NEW TREES

- A. Follow referenced standards and prune material as directed by Owner's representative.
- B. Do not cut back terminal branches. Properly remove sucker growth from the base and badly broken or bruised branches. Thin native trees more heavily than nursery grown plants.

3.10 TREE SAUCERS

Form a four inch high saucer around each new tree for deep watering. Contractor is responsible for deep watering until final acceptance.

3.11 TREE GUYING AND STAKING

- A. Stake and guy trees immediately following planting operation. Take precautions during guying operation to prevent damage or injury to branches and roots. Orient all stakes within each cluster or row of trees in the same direction or as directed by Owner's representative.
- B. Trees of over one inch caliper must be staked with woven nylon straps and wire. Tension on ties should be adequate to support tree, but slack enough to permit movement and the development of reaction wood. Ties cannot be fastened tightly to trunks; free movement or slack equal to at least twice the caliper must be allowed.

3.12 PLANTING BED EDGING

Install edging per manufacturer's directions. Set edging as indicated in true lines as designed with top of edging one inch above finish grade.

3.13 CLEANUP

- A. Keep premises neat and orderly including organization of storage areas. Remove trash and debris from excavated planting areas, preparing beds, or planting plants from site daily as work progresses. Keep paved areas clean by sweeping or hosing.
- B. Repair all damage caused by landscape operations.

END

LAWNS AND GRASS GUIDELINES

PART 1 - GENERAL

1.0 RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General conditions, Supplementary Conditions, apply to work of this section.

1.1 DESCRIPTION

- A. Work in this section includes:
 - 1. Furnishing all plants, labor, equipment;
 - 2. Performing all operations to finish grade topsoil;
 - 3. Prepare seed and sod beds;
 - 4. Sod all lawn areas; and
 - 5. Maintenance and protection of all sodded and seeded areas.

- B. All areas within the contract limits, except surfaces occupied by paving and areas indicated to be undisturbed shall be hydroseeded or sodded as shown on Plans. Areas repaired due to Contractor damage shall be hydroseeded.

1.2 RELATED WORK DESCRIBED ELSEWHERE

- A. Section 02200 - Earthwork

- B. Section 02215 - Earthwork for Surface Restoration

- C. Section 02810 - Irrigation System

- D. Section 02900 - Landscaping

The Montana Department of Transportation Standard Specification for road and bridge construction, 1987 Edition, Section 610, roadside development shall govern the work as if bound herein. Where provisions of this section and the referenced standard conflict, this section shall govern.

1.3 QUALITY ASSURANCE

- A. Qualification of Workmen

Provide at least one person who shall be present at all times during execution of this portion of the work and who shall be thoroughly familiar with the type of materials being installed and the best methods for their installation and who shall direct all work performed under this section.

B. Contractor Qualifications

The Contractor shall have at least two (2) years of weed control spraying experience. Proof of experience will be required. The Contractor must have a valid Montana Commercial Herbicide Applicator's License.

C. Chemical Registration

All weed control chemicals must be registered with the Environmental Protection Agency and the State of Montana.

D. Equipment Requirements

The Contractor shall furnish, operate, and maintain suitable and adequate equipment necessary to perform the above operations in an approved and workman-like manner without delays. Spray nozzles shall be raindrop or similar drift control type.

E. Liability and Contractor's Responsibilities

Weather conditions must be such that no damage outside the sprayed area will occur and the Contractor will cease spraying whenever the application of spray could cause such damage.

The Contractor agrees to hold harmless the Owner and Landscape Architect and/or Engineer against any and all claims for damage arising from operations covered in this proposal.

F. Time of Application

Because of varied climatic conditions, it will be the Contractor's responsibility to coordinate spraying activities to achieve the best results. To avoid possible chemical exposure and general alarm among campus users, time of application must not coincide with other nearby outside campus activities. If nearby activity encroaches during spraying operations, spraying must cease immediately until people leave the area.

1.4 PRODUCT HANDLING

A. Protection

1. Use all means necessary to protect and maintain materials before, during, and after installation and to protect the installed work and materials of all other trades.
2. All seed shall be delivered in the original bags certifying purity, germination, common, and botanical name for each species, and percent weed seed. Owner shall inspect all seed prior to application. Untagged seed bags shall be rejected. Immediately make all replacements necessary to the approval of the Owner's Representative and at no additional cost to the Owner.
3. Deliver chemical fertilizers and herbicides, as specified, to site in original, sealed containers bearing manufacturer's guaranteed statement of analysis

B. Storage

Seed, fertilizer, herbicide, hydromulch, and tackifier shall be kept in dry storage away from contaminants, at a weatherproof location.

C. Notice to Proceed

The Contractor shall not proceed with seeding or sodding operations until the irrigation system has been tested and approved by the Owner's Representative.

D. Schedules

Install lawn seed mixes during the specified time periods. If special conditions exist that may warrant a variance in the specified plant dates or conditions, a written request shall be submitted to the Owner's Representative stating the special conditions and proposed variance.

The Contractor shall provide a weed control plan and schedule prior to bed preparation, for approval of the Owner's Representative.

E. Substitutions

Requests for substitutions shall be submitted in writing to the Owner's Representative prior to award of contract.

1.5 SPECIAL LANDSCAPE PROVISIONS

A. Water

Water will be available on site. Provide necessary hoses and other watering equipment required to complete work.

B. Maintenance

Until final acceptance, and until as approved stand of grass is achieved, maintain plantings by watering, cultivating, mowing, weeding, spraying, cleaning and replacing as necessary to keep lawns in a vigorous, healthy condition.

Watering: Water as necessary to keep top two inches of soil moist. Coordinate with Irrigation Contractor.

Mowing: Mow newly planted grass area weekly after initial growth reaches 2-½ inches.

Weeding: Remove weeds and foreign grasses in planted areas at least once per week. Herbicides may be used only when approved by the Owner's Representative.

Fencing: Provide four (4') foot tall orange plastic snow fencing and metal tee fence post spaced at a maximum of eight (8') feet apart around all walks at seeded and sodded areas. Maintain until lawn is accepted.

1.6 CONDITION OF SURFACES

Lawn areas will be left at ± 0.1 feet of finish grade as shown on plans.

1.7 ACCEPTANCE

The work will be accepted when a completed stand of grass at the three-leaf stage or beyond is achieved and all provisions of Section 3.5.C, "Performance" have been met as approved by the Owner and Owner's Representative.

PART 2 - MATERIALS

2.1 GRASS SEED

A. General

1. Seed shall be used only in areas where an irrigation system is absent or has been removed.
2. All seed shall be:
 - a. Free from noxious weed seeds, and re-cleaned;
 - b. Grade A recent crop seed;
 - c. Treated with appropriate fungicide;
 - d. Delivered to the site in sealed containers with dealer's guaranteed analysis.

B. Irrigated Grass Seed Mixture: Seed at the minimum rate of three (3) pounds per one thousand (1000) square feet (130 lbs./acre).

<u>Name of Grass</u>	<u>Proportion by Weight</u>	<u>Percent Purity</u>	<u>Percent Germination</u>
'Midnight' Kentucky bluegrass	25%	95%	85%
'Rugby II' Kentucky bluegrass	25%	95%	85%
'Ram I' Kentucky bluegrass	25%	95%	85%
'Delaware' Dwarf Peren. Rye Grass	25%	95%	85%

C. Non-irrigated Grass Seed Mixture: must be 'Kitty Hawk' turf-type tall fescue seeded at three (3) pounds per thousand (1000) square feet (130 lbs./acre).

2.2 SOD

A. General

1. Sod all areas where site is substantially disturbed.
2. Sod shall be from a commercial sod farm located in the Gallatin Valley.
3. Sod type, condition and source shall be approved by the Owner's Representative.

B. Sod Characteristics

Sod shall be well-established lawn turf grasses similar to the seed mix described in 2.1 B.

Sod shall be vigorous, well-rooted, healthy turf, well hydrated and possessing excellent color.

Sod shall be free from disease, insect pests, weeds, other grasses, stones, and any other harmful or deleterious matter.

C. Sod Handling

Cut sod in uniformly wide strips, uniformly 1-1/2 inches thick with clean cut edges.

Sod shall be rolled or folded prior to lifting. Handling of sod shall be done in a manner that will prevent tearing, breaking, drying, or any other damage.

Sod shall be installed in place on the site not more than 24 hours after cutting.

2.3 FERTILIZER

A. Soil Testing

1. Verify fertilization needs by sampling and testing soil prior to purchasing fertilizer. The test sample shall be obtained by sampling six different locations at the project site. Soil from sampled locations shall be mixed in equal parts to provide a compiled sample for testing.

Testing by an approved laboratory shall include:

- a. A test for soil pH,
- b. A test for electrical conductivity (EC),
- c. A test for the amount of nitrogen, phosphorus and potassium present (NPK),
- d. A test to determine the amount of organic matter present (OM).

2. Results of tests shall be reviewed by the Owner and Engineer prior to purchase of fertilizer. If tests results are typical for the general campus area, fertilization operations may commence as specified. If test results are not typical for the general campus area, Owner will provide modified formulation and application rate specifications by Change Order.

B. Formulation

1. Fertilizer shall be manufactured by Anderson ProTurf, or equal approved by the Owner. Application rates shall be in accordance with manufacturer recommendations. Fertilizer shall be complete, uniform in composition, dry and free flowing. The fertilizer shall be delivered to the site in the original waterproof containers, each bearing the manufacturer's statement of analysis.
2. Fertilizer to be spread on areas to be seeded shall be commercially prepared by Anderson ProTurf or an equal product pre-approved by the Owner. Fertilizer shall be a slow release, Poly-S urea, and shall contain the following percentages by weight:
 - 10% Nitrogen
 - 20% Phosphorus
 - 10% Potassium
 - 12% Sulfur
3. Grow - in Fertilizer shall be a slow-release, Poly-S urea, and shall be formulated as 25-3-4-Fe-2% and commercially prepared by Anderson ProTurf or equal approved by the Owner.

C. Special Protection

If stored at the site, protect fertilizer from the elements at all times.

2.4 Mulch

Wood cellulose fiber for hydromulch – Weyerhaeuser, Conweb, or approved equal.

2.5 Mulch Tackifier

Mulch tackifier must be natural, non-asphaltic, vegetable gum with gelling and hardening agents, Terra Tack or approved equal.

2.6 Water

Water shall be clean irrigation quality water.

2.7 Pre-Planting Herbicide

Roundup, provide compatible surfactant and drift control agents as required.

2.8 Post-Emergent Herbicide

"TRIMEC" 2,4-D.M.C.P.P. DICAMBA (BANVIL) manufactured by P.B.I. Gordon 816-421-4070 distributed by Wilbur Ellis Company (406)-248-1176 or West Chemical Agricultural Chemicals, Inc., (406)-252-3834, or other appropriate control which best fits the weed problem and necessary applications.

2.9 Native Topsoil

Refer to Montana Standard Specifications Subsections 203.80 Topsoil Salvaging and placing, 610.00 Topsoiling and 713.06 Topsoil Material.

2.10 Imported Topsoil

In the event sufficient quantities of native topsoil cannot be salvaged from the site, the Contractor shall provide imported topsoil to supplement the project requirements. The Contractor shall provide topsoil that meets or exceeds the quality of the native topsoil material available on site. Contractor shall provide source and analysis information to the Owner's Representative, for his approval, prior to delivery. The Contractor shall incorporate into the topsoil, amendments necessary to provide topsoil fertility and quality, equal to or exceeding the characteristics of the native topsoil.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

A. Inspection

Prior to all work of this section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.

Verify that seeding may be completed in accordance with the original design and the reference standards.

B. Discrepancies

1. In case of discrepancy, immediately notify the Owner's Representative.
2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.2 FINISHING

A. Topsoil Spreading

Contractor shall provide a 6" minimum compacted, depth of topsoil on all lawn areas. Topsoil shall be graded smoothly and evenly. Lawn area sub grade particularly on slopes shall be roughed and scarified 6" minimum depth to except and bind with the finish layer of topsoil. Topsoil shall be spread in a non-muddy, unfrozen condition. Surface finish shall be +/- 0.1 foot. Compaction of the topsoil layer shall be $\pm 85\%$ maximum dry density. Refer to Montana Department of Highways Standard Specifications Subsections 610.00 Topsoiling, 203.08 Topsoil Salvaging and Placing, 713.06 topsoil material.

B. Finish Grading

Grade lawn areas to finish grades, filling as needed or removing surplus dirt and floating areas to a smooth uniform grade. All lawn areas shall slope to drain minimum 2% slope. Where no grades are shown, surfaces shall have a smooth and continual grade between existing or fixed controls (such as walks, curbs, catch basins, and elevations at steps or building). Loosen and fine rake areas to receive seed or sod to break up lumps and produce a smooth, even grade, free from unsightly variations, ridges, or depressions. Remove stones one inch or larger, sticks, roots or other debris exposed during this operation. All finish grades shall meet the approval of the Owner's Representative before grass seed is sown or sod is placed.

C. Weed Control

1. Prior to application of seed or sod, the bed shall be roughed up to a depth of 1/8th inch.
2. Moisten the seedbed to a depth of 1" to promote germination of any seeds contained in the topsoil. If rhizomatous grasses, field bindweed (morning glory) or noxious weeds are evident, the Contractor shall be required to eliminate those undesirable plants prior to seeding or sodding, at the discretion and direction of the Owner's Representative.
3. Spray areas showing weed growth with approved herbicides, mow, and remove clippings prior to final grading. Seeding and sodding shall be executed 72 hours following Roundup application.

3.3 PLANTING

A. Preparation

1. Hydroseed bed preparation shall pertain to the preparation of the surface of the ground to receive the seed. The ground shall be hand or machine raked to remove all debris, clods, rocks, and other material larger than 1 inch, to a depth of 4 inches. Such debris, clods, rocks, and other material so removed shall be disposed of off the immediate property. Hydroseed bed preparation shall not commence until the moisture conditions make the ground area and soil friable.
2. If there has been a time lapse following the placement of the topsoil to allow it to become settled and compacted on the surface, the areas to be seeded shall be thoroughly worked to a depth of 3 to 4 inches so as to provide a surface of such condition that it will allow application of the seed in compliance with these specifications.
3. Hydroseed beds shall be permitted to settle or firmed by rolling before seeding.
4. Initial application of fertilizer shall be applied evenly at the rate of 600 lbs. of material per Acre prior to seeding and incorporate into the prepared seedbed ½" deep by light raking.

B. Sowing

1. Immediately prior to the application of the seed, the soil shall be loose to a depth of at least 1 inch and free from all material as specified. If soil is too loose or dry for good handling, it should be moistened and rolled lightly.
2. Hydroseed all irrigated areas as shown on the plans. Irrigated areas may be seeded any time between April 15 and June 1, and August 10 and September 10, provided the irrigation system is operational. Hydroseed all dry land areas as shown on the plans. Seed to overlap limits of irrigated lawn by one half the distance between sprinkler head and limits of coverage between April 1 and May 15, and September 20 and October 30.
3. Lawn grass shall be sown at 3 pounds per 1000 square feet, (130 lbs./acre) using approved methods that allow for the even precise hydroseeding and incorporation of the seed into the top ½-inch of the prepared seedbed. If seed can be drilled, reduce rate to 60 pounds per acre. A drill type seeder with spacing greater than 3½" is not acceptable. When seed is drilled and the surface is unduly loose, the seedbed shall be compacted by an agricultural roller, cultipacker, or compactor not more than 24 hours after seeding.

4. Apply tackifier on all slopes greater than 4 to 1 at a rate of 100 pounds per acre.
5. Seed and mulch shall be applied in separate and distinct operations except that a minimal amount of mulch may be added to the seed slurry as a visual aid during the seeding process. Mulch applied with seed shall not exceed of mulch for each five (5) gallons of water. This mulch shall be deducted from the total quantity to be applied. The application of the seed slurry shall be made with the equipment having a built-in agitation system and operating capacity sufficient to agitate, suspend, and homogeneously mix slurry containing water, seed, and mulch. The slurry shall be sprayed over the soil in a uniform coat. Wherever practical, the slurry shall be applied normal to the surface being treated to effectively drill the seed in to the seedbed. Hydromulch application shall follow seeding as soon as practical, with consideration for minimal soil erosion through washing. All seeded areas shall be mulched before work is terminated on any day.

C. Mulching

1. Mulch all hydroseeded areas. Topsoil or seed that washes out for reasons attributable to the Contractor's activities or failure to take proper precautions shall be replaced at the Contractor's expense.
2. All structures shall be protected from hydraulic application of mulch material. Any material deposited on walks, streets, inlets, or other structures, shall be removed.
1. Mulch shall not be applied in the presence of free surface water, but may be applied on damp ground.
2. Organic mulch shall be mixed with water at a rate of one pound of mulch (dry weight) to one gallon of water, hydraulically applied as per manufacturer's recommendations at a rate of 2000 pounds per acre.

D. Tackifier

Mulch tackifiers shall be mixed with water at a rate specifically by the manufacturer and shall be applied at a minimum rate of 40 pounds per acre.

3.4 SOD INSTALLATION

A. Preparation

Bed preparation shall be similar to that required for seedbed preparation.

B. Application

1. Sod may be placed at any time when the ground is not frozen.
2. A string or line of boards may be used as a guide for setting the first course of sod across the area. Each course is matched against the edge of this course, staggering successive courses. All work should be done on boards laid on top of the sod to avoid footprints or other injuries to the surface.
3. All sod is to be laid on topsoiled areas. The joints shall be butting.
4. Lay sod across slope.
5. Roll or lightly tamp, with suitable wooden or metal tamper, all new sod sufficiently to set or press sod into underlying soil.
6. Before sod is laid, apply fertilizer specified, at the rate of six (6) pounds per 1000 square feet.
7. After sod installation is completed, clean up and thoroughly moisten areas of newly laid sod.

3.5 STAKING AND FENCING

A. General

All newly sodded or seeded areas are to be fenced so as to prevent trampling by foot or vehicular traffic. Fencing shall be removed by Contractor when Owner has determined that the lawn area is successfully established, as dictated in this section.

B. Materials

1. Posts to be five-foot minimum, six foot maximum green steel t-posts.
2. Fencing to be four-foot Tenax in guardian orange, length variable. Color substitutions allowed only with the direction and approval of the Project Manager.

C. Performance

1. Staking shall not be performed without prior identification of underground utilities, including but not limited to irrigation.
2. Stakes shall be installed every 16 feet or less, using a t-post driver.

3. Fencing to be attached to posts with nylon fence ties, zip ties or flexible wire.

3.6 MAINTENANCE

A. General

Maintain original grades of all lawn areas after commencement of planting and during maintenance period until final acceptance of the job, but in no case less than forty-five (45) days.

B. Work Included

1. All irrigated areas shall be watered as required to establish a mature stand of grass.
2. All areas shall be watched closely so that they are not permitted to dry out or to form puddles of water, or to be washed by over-application.
3. Mow all seeded lawn at 2½" each time its height reaches 3½". Maintain through a minimum of three mowings to provide an even stand over the entire seeded area, until final inspection and acceptance.
4. Provide a "grow-in" fertilizer, as specified, for all irrigated lawns. Apply six weeks after seed germination. In the case of fall seeding, apply prior to May 1, the following year.
5. Apply post emergence herbicide per the manufacturer's recommendations and application rates, whenever and wherever weed growth jeopardizes or inhibits the development of a mature grass lawn. Apply herbicide in late spring or early summer. Apply only when mean high temperatures are between 60° and 85° F with wind velocities less than five (5) miles per hour. Prior to application, Contractor shall notify Owner, in writing, of the proposed schedule for applying herbicides. Written notice shall include the following items:
 - a. Date of proposed application
 - b. Specific area of proposed application
 - c. Proposed herbicide for application
 - d. Proposed concentration and application rate.

The application area must be signed with Owner-approved signs informing the public of the application and duration of restricted use.

C. Performance

1. Establish a dense lawn of permanent grasses, free from lumps and depressions. Any part failing to show uniform cover and grades free from lumps and depressions shall be redone, and such replacement shall continue until a dense lawn is established. Scattered bare spots will not be allowed. Adequate germination shall equate to 11 to 15 seedlings per square foot over 95 percent of area seeded for native grass areas.
2. Finish grades at the edges of sidewalks, curbs or other hard surface boundaries must be at a level such that the established turf surface will be one (1) inch below the plane of the hard surface for a minimum distance of six (6) feet from the edge.
3. Maintain entire lawn area until the above performance is achieved throughout the project.

D. Replacements

1. Any area that fails to produce an adequate stand of grass shall be re-sodded or reseeded by the Contractor at no additional expense to the Owner.
2. Replacements required because of vandalism or other causes beyond the control of the Contractor are not part of the Contract.
3. For acceptance, the established grass will be judged by the stand's fullness, health, maturity and number of weeds present. Determination and acceptance of grass areas shall be made by the Owner's Representative.

E. Extension of Maintenance Period

Continue the maintenance period at no additional cost to the Owner until all previously noted deficiencies have been corrected, at which time the final inspection shall be made.

3.7 CLEAN-UP

Keep premises neat and orderly including organization of storage areas. Remove trash and debris resulting from lawn preparation from site daily as work progresses. Leave paved areas in a broom clean condition by sweeping or hosing.

END

LAWNS AND GRASS

TREE PROTECTION GUIDELINES

PART 1 - GENERAL

1.0 RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General conditions, Supplementary Conditions, apply to work of this section.

1.1 DESCRIPTION

The work in this section includes protection, trimming and maintenance of existing trees, shrubs and groundcover that are affected by execution of the Contract Documents, whether temporary or permanent construction.

- A. The Contractor assumes responsibility for all coordination of work within the Critical Root Zone (CRZ) of protected trees.
- B. Plant protection applies to all trees to remain within the Limit of Work as well as those, which are adjacent to the Limit of work and could be affected by new construction. Work to include:
 - 1. Protection of existing trees and indicated vegetated areas.
 - 2. Watering of existing trees and vegetated areas to be protected.
 - 3. Maintenance of existing and newly installed tree and vegetation protection elements including but not limited to fencing, organic bark mulch, landscape fabric, cabling, and signage.
 - 4. Pruning of existing trees to be protected
 - 5. Removal of pruning debris and other excess material not used. On-site chipping and re-use of pruned material is encouraged.
- C. Contractor shall perform all tree protection installation and removal, and any necessary pruning work required for construction under the supervision of the Owner.

1.2 RELATED WORK DESCRIBED ELSEWHERE

- A. Section 01500 – Temporary Facilities and Controls
- B. Section 02235 – Site Clearing

- C. Section 02300 - Earthwork
- D. Section 02810 - Irrigation System
- E. Section 02900 - Landscaping
- F. Section 02935 – Lawns and Grass

1.3 DEFINITIONS

- A. **Tree Protection Zone:** Area surrounding individual trees or groups of trees to remain during construction, and defined by the drip line of individual trees or the perimeter drip line of groups of trees, unless otherwise indicated.
- B. **Drip Line:** The areas encompassing the base of the tree as delineated by an imagined vertical line drawn from the farthest extent of the branches to the ground.
- C. **Diameter at Breast Height (DBH):** Diameter at breast height as measured at four and one-half feet (4'-6") above the existing grade at the base of the tree.
- D. **Critical Root Zone (CRZ):** An area up to one and one-half the radius of the drip line of the tree.

1.4 REFERENCED STANDARDS

- A. *ANSI Z60.1: American Standard for Nursery Stock*, latest edition, American National Standards Institute.
- B. *Hortus Third: A Concise Dictionary of Plants Cultivated in the United States & Canada*, Staff of the L.H. Bailey Hortorium, Cornell University, 1999.
- C. *ASTM C33: Specification for Concrete Aggregate*, American Society of Testing Materials.
- D. Alex Shigo, *Tree Pruning*, Shigo & Tree Associates, LLC, 1989.
- E. *Guide for Plant Appraisal*, latest edition, Council of Tree and Landscape Appraisers.
- F. *Species Ratings and Appraisal Factors Guide*, latest edition, International Society of Arboriculture, Rocky Mountain Chapter.
- G. *ANSI A300: Standards for Tree Care Operations*, American National Standards Institute.

- H. International Society of Arboriculture Best Management Practices publications
- I. An Illustrated Guide to Pruning, 2nd Edition, Gilman, Delmar, 2002.

1.5 QUALITY ASSURANCE

- A. Tree Service Firm Qualifications: An experienced tree service firm with a minimum of five years of experience that has successfully completed tree protection and trimming work similar to that required for this project.
- B. Arborist Qualifications: An arborist certified by ISA or licensed in the jurisdiction where the project is located.
- C. Tree Pruning Standard: Comply with ANSI A300 (Part 1), “Tree, Shrub, and Other Woody Plant Maintenance – Standard Practices (Pruning).”
 - 1. Owner’s representative shall be notified 24 hours in advance of all pruning, thinning and tree protection work.
- D. Pre-Construction Conference: Conduct conference at project site to comply with requirements in ANSI A300 Division 1, Section “Project Management and Coordination.”
 - 1. Before tree protection and trimming operations begin, meet with representatives of authorities having jurisdiction, Owner’s Arborist, Landscape Architect, consultants, and other concerned entities to review tree protection and trimming procedures and responsibilities.

1.6 SUBMITTALS

- A. Product Data: For each type of product indicated below.
- B. Product samples:
 - 1. Tree protection area signage.
 - 2. Cabling materials.
 - 3. Landscape fabric.
 - 4. Organic bark mulch.
- C. Tree Pruning Schedule: Written schedule from arborist detailing scope and extent of pruning of trees to remain that are affected by construction.

- D. Tree Protection Plan: Contractor shall submit a tree protection plan that confirms that use of the tree protection fencing plan provided in the Contract Documents. Contractor shall notify the Owner of all work activities within the CRZ of trees to be protected, anticipated work methods, proposed tree and root avoidance techniques, and Arborist's on-site confirmation of CRZ for each tree.

1.7 JOB CONDITIONS

- A. Site Work Restrictions: In order to prevent excessive soil compaction and destruction of soil structure, no site work will be performed in cases where equipment or traffic must pass over wet soils or if wet soils must be handled or manipulated within the Tree Protection Zone in order for the work to progress. Wet soil is defined as any soil within 85 percent of field capacity (saturation).
- B. Utilities
 - 1. Utility locates are required prior to digging and any construction activities.
 - 2. Coordinate work with Owner, including irrigation manager, in order to prevent damage to underground sprinkler system.

1.8 MAINTENANCE

- A. Water will be available on site. Provide necessary hoses and other watering equipment required to complete work.
- B. Maintain existing plantings and trees by watering, cultivating, weeding, and spraying as necessary to keep landscape in a vigorous, healthy condition.
- C. Coordinate watering schedules with irrigation contractor during installation and until final acceptance. Provide deep root watering to newly installed trees.

PART 2 – PRODUCTS

2.0 MATERIALS

- A. Topsoil Depth: Natural or cultivated surface-soil layer containing composted organic matter and sand, silt and clay particles; friable, pervious, and black or darker shade of brown, gray or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than two inches in diameter; and free of weeds, roots and toxic and other non-soil materials.
- B. Filter Fabric: Manufacturer's standard, non-woven, pervious, geotextile fabric of polypropylene, nylon, or polyester fibers.

- C. Chain-Link Fence:
1. Fencing shall be galvanized chain link as specified below, six feet minimum height. Plastic fencing and wood stakes, or snow fencing are not acceptable.
 2. Includes posts, braces, supports and mesh that may be salvaged materials or other used material to form a minimum six foot high enclosure.
 3. Posts shall be a minimum diameter of 1-1/2-inch steel pipe.
 4. Mesh shall be two inches by two inches by 11 gauge minimum chain link fabric.
 5. Use of concrete or metal post piers is permitted.
- E. Signage: Provide weather resistant 8-1/2 inches by 11 inches fluorescent green or yellow signs that identify Tree Protection Zone and list restrictions.
- F. Cabling: Cabling materials shall meet the ANSI A300 standards for cabling of trees.
- G. Tree Tags: Rack track shaped aluminum engraved numbered tags.
- H. Organic Mulch: Shall be free from weed seed, sawdust and splinters and shall not contain resin, tannin, wood fiber or other compounds detrimental to plant life. Bagged mulch shall have moisture content not in excess of 22%. Bulk mulch shall have a size range of 1/2 inch to 1-1/4 inch with a maximum of 20% passing a 1/2 inch screen. Re-use of organic debris generated during the project is encouraged.
- I. Mycorrhizae Fungal Inoculants: “mycogrow gel” as manufactured by Fungi Perfecti, Olympia, WA, 1-800-780-9162, or approved alternate.
- J. Slow Release Fertilizer: Osmocote Plus, 15-9-12, or approved alternate.
- K. Anti-Desiccant: Protective film emulsion for protection of plant surfaces during transport. Permeable to permit transpiration, as manufactured by Wilt Pruf, Inc., P.O. Box 4280, Greenwich, Connecticut, 06830, or approved alternate. Mixed and applied in accordance with manufacturer’s instructions.
- L. Staking and Guying
1. Tie Wire: 12-gauge, galvanized wire
 2. Metal posts: 8’-0” t-stakes

TREE PROTECTION

3. Nylon strap: three inches wide, 12 inches long white or black nylon strap with one ½” brass grommet in each end or Landscape Architect approved equivalent.

PART 3 - EXECUTION

3.0 INSTALLATION OF TREE PROTECTION FENCING

- A. Prior to the start of any construction activity install temporary fencing at the designated tree protection zones to protect existing trees and vegetation to remain from construction damage. Maintain temporary fence and remove when construction (including irrigation and planting) is complete. Owner shall approve fence installation prior to mobilization of the site.
 1. Install chain-link fence according to ASTM F 567 and manufacturer’s written instructions. All fencing to be locked securely and only entered with owner’s permission and in consultation with the Owner’s Arborist.
 2. Place concrete or metal piers to minimize pedestrian and vehicle circulation and landscape impacts.
 3. Provide diagonal bracing to vertical posts at corners of enclosures and wherever needed to ensure rigidity of the fencing.
 4. If chain link fabric is used versus chain link panels the chain-link fabric shall be tight to grade at the bottom edge and stretched uniformly between posts. Top of fabric shall be a minimum of six feet above grade. Install fabric to form completely closed area around tree(s). Attach fabric to posts 12 inches on center with 11 gauge wire ties securely fastened, or with bolted ring clips and to top rail not over three feet on center.
- B. Fencing shall be installed as follows: In the vicinity of coniferous trees, fenced area shall include an area of a radius from the trunk equal to one and one-half times the radius of the drip line of the tree. In the vicinity of deciduous trees, fenced area shall include an area of a radius from the trunk equal to one and one-half times the radius of the drip line of the tree. For areas with shrubs plants, fenced area shall include the entire edge of the planted area.
- C. Area within tree protection fencing must be mulched with organic bark mulch to a depth of four inches.

- D. Attach orange flag strips 12 inches long at three feet on center along the fence, five feet above grade.
- E. Place tree protection signs at thirty-foot intervals along fence with a minimum of one sign if the fence is less than 30 feet in length.

3.1 FENCE MAINTENANCE AND REMOVAL

- A. Maintain fence in specified location and in good condition until completion of site operations and of delivery of equipment and material, except where directed otherwise in writing by Owner's representative.
- B. Fencing shall be immediately repaired when damaged.
- C. Remove protection fencing at Substantial Completion.

3.2 USE OF AREA WITHIN FENCE

- A. Do not use area within fence for operation, storage, vehicles, or foot traffic. Contractor shall notify Owner's representative 24 hours in advance of the need to move a tree protection fence or access inside of it.
- B. Do not alter grades within the required protective fence line except as directed during the fine grading operations at the conclusion of site development.
- C. Control soil moisture within the protected area. Prevent flooding, ponding, erosion, or excessive wetting of the soil and root systems caused by dewatering operations. Protect root areas from leachate, concrete, oil, fuel, lubricating oil, and from other contaminants.

3.3 USE OF AREA ADJACENT TO FENCE

- A. Do not store materials potentially harmful to tree roots within 20 feet of protected areas. Potentially harmful materials include, but are not limited to petroleum products, cement and concrete materials, cement additives, lime, paints coating, waterproofing agents, from coatings, detergents, acids, and cleaning agents.
- B. Notify owner's representative of all heavy equipment work to be performed within the CRZ.
 - 1. Tie-back all flexible limbs and branches, which may be damaged during construction, under the direction of the Owner's representative.
 - 2. Use compaction mitigation strategies such as planking, mulch, or plating as directed by the Owner's representative.

TREE PROTECTION

3.4 DAMAGES FOR LOSS OR INJURY TO TREES

- A. Trees removed or damaged and deemed unviable, during demolition or construction, are to be replaced following consultation with Owner's Arborist or Owner's representative.
- B. Trees removed during demolition or construction are to be replaced following consultation with Owner's Arborist or Owner's Representative. Appraised values of existing trees have been determined according to industry standards and will be provided by the Owner if applicable.
- C. Contractor is to replace any and every tree lost or irreparably damaged as a result of failure of the Contractor to protect or to adequately maintain existing trees. Trees that fail to fully foliate in the spring following completion of construction operations may be presumed to have been lost due to construction operations.
- D. In the event of injuries to the crown, trunk or root system of any tree to remain that are the result of the Contractor's failure to protect and/or maintain such tree, the Owner's Representative may elect to retain the tree and hold the Contractor liable for compensation.
- E. Promptly repair trees damaged by construction operations within 24 hours. Treat damaged trunks, limbs, and roots according to Owner's Arborist's written instructions. Work required by the Owner's Arborist shall be performed by the Contractor at no additional cost to the Owner.
- F. Trees, which are removed without authorization, shall be replaced with a tree of the same size and species. If a tree of the same size and species is not available the Owner's Representative shall provide alternatives. If a tree cannot be replaced because the size exceeds the maximum which can be relocated using latest technology, the Contractor shall compensate the Owner at amount equal to the appraised value.
- G. Should replacement work of large trees be required as a result of Contractor's failure to protect or maintain trees, a subcontractor specializing in relocating large trees shall conduct all replacement work. Submit qualifications of tree relocation Contractor to the Owner's Representative. The cost of the subcontractor will be at the Contractor's expense.
- H. Completely remove and dispose of any tree killed or irreparably damaged as a result of Contractor's failure to protect or maintain trees. Remove those trees damaged or killed as a result of vandalism, natural acts or other causes. Removal and disposal shall include stumps and roots to a depth of two feet below finished grade.

TREE PROTECTION

3.5 PRUNING OF EXISTING TREES

- A. Limbs and branches that have been broken shall be cut off cleanly above the nearest crotch in accordance with International Society of Arboriculture (ISA) standards. Cut limbs and branches greater than one-half inch in diameter. Sterilize equipment with alcohol prior and during trimming and pruning operation. All pruning of damaged trees shall be carried out to the complete satisfaction of the Owner's Representative.
- B. The Contractor shall provide a ISA certified professional to assess and recommend treatment of any damage to trunks or major limbs three inches in diameter or over.
- C. All existing trees to be saved shall be limbed and pruned by a ISA certified Arborist. Limbs shall be pruned to ensure safety and promote health of the tree. Inform the Owner's Representative prior to commencement of pruning.

3.6 EXCAVATION

- A. Install shoring or other protective support systems to minimize sloping or benching of excavations.
- B. Do not excavate within Tree Protection Zones, unless otherwise indicated.
- C. Where excavation for new construction is required within tree protection zones, hand clear and excavate to minimize damage to root systems. Use narrow-tine spading forks and comb soil to expose roots. Work shall be performed under the supervision of the Owner's representative.
 - 1. Redirect roots into backfill areas where possible. If encountering large, main lateral roots, expose roots beyond excavation limits as required to bend and redirect them without breaking. If encountered immediately adjacent to location of new construction and redirection is not practical, cut roots approximately three inches back from new construction.
 - 2. Do not allow exposed roots to dry out before placing permanent backfill. Water and maintain in a moist condition. Temporarily support and protect roots from damage until they are permanently relocated and covered with approved soil.
 - a. Straw Mulch: Thoroughly wet excavated sub-grade where roots of existing trees to remain have been exposed. Apply four inches of wet organic bark mulch on horizontal area and wet burlap mats along exposed trench sides.

- b. Watering and Maintenance: Thoroughly and evenly water protected areas at a rate not to exceed two inches per hour during dry periods. Coordinate water procedures and schedules with the Owner's Representative or the Project Manager. Maintain root protection procedures throughout the term of the Contract, as required.
- D. Where utility trenches are required within tree protection zones, tunnel under or around roots by drilling, auger boring, pipe jacking, or digging by hand.
 - 1. Root Pruning: Do not cut roots larger than 1" without notifying Owner's representative; Cut roots smaller than 1" in accordance with ISA standards.

3.7 POST CONSTRUCTION TREE MAINTENANCE

- A. Ensure that existing trees remaining on the project site shall be in as good condition at completion of the work as at the commencement of the work. If such a condition does not exist at the completion of the work, assume responsibility to provide corrective actions or replacement with new material as directed by the Owner's Representative.

END

TREE PROTECTION

SECTION 02 1000 - SITE PREPARATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Related Sections:
 - 1. Section 021100 – Site Demolition.

1.2 PROJECT CONDITIONS

- A. Traffic:
 - 1. Conduct site clearing operations to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities.
 - 2. Do not close or obstruct streets, walks, or other occupied or used facilities without permission from authorities having jurisdiction.
- B. Protection of Existing Improvements:
 - 1. Provide barricades, coverings or other types of protection necessary to prevent damage to existing improvements indicated to remain in place.
 - 2. Protect improvements on adjoining properties as well as those on Owner's property.
 - 3. Restore improvements damaged by Work to their original condition as acceptable to Owners or other parties or authorities having jurisdiction.
- C. The specified work is located at the east side of the MSU Tennis Center. The Contractor shall notify and coordinate with Owner the site work required, prior to start of site demolition and clearing work.
- D. The Contractor shall confirm an acceptable method of disposal with the Owner and state and local agencies before proceeding. No burning of debris is allowed on site

1.3 OBSTRUCTIONS

- A. Some obstructions may not appear on the Drawings. Bidders are advised to carefully inspect the existing site before preparing their proposals. The protection or removal and replacement of minor obstructions such as fences, small piping and culverts, and similar items shall be anticipated and accomplished even though not shown or specifically mentioned.
- B. Major obstructions encountered that are not shown on the Drawings, or could not have been foreseen by visual inspection of the site prior to bidding, should immediately be brought to the attention of the Owner, Architect and Engineer. The Owner, Architect and/or Engineer will make a determination for proceeding with the work. If the Owner, Architect and/or Engineer find that the obstruction adversely affects the Contractor's costs or schedule of completion, a proper adjustment to the Contract will be made in accordance with the General Conditions.

PART 2 – PRODUCTS NOT USED.

PART 3 - EXECUTION

3.1 PROTECTION

- A. Contractor shall protect existing utilities, structures and other facilities to remain, including supporting soils, from damage at all times during performance of the work.
- B. Protect trees, shrubs and other vegetation not designated for removal. See Owner's specification section on TREE PROTECTION. Prior to starting of work, verify with the Owner which trees which are allowed to be removed.

- C. Monuments and Markers: Preserve and protect survey monuments, benchmarks and markers from damage or displacement throughout construction. If damage occurs or removal becomes necessary, immediately notify Architect and Engineer and restore monument or marker to original condition.

3.2 CLEARING & GRUBBING

- A. Clearing shall consist of cutting, removing, and disposing of a tree and other vegetative growth with the exception of those trees designated to remain, and stockpiling of topsoil for re-use in proposed regraded areas.
- B. Clearing shall not extend beyond the construction/grading limits as shown on the Drawings without prior approval by the Owner, Architect and/or Engineer. Clearing for the construction of utility conduits or pipelines shall not exceed 10 feet on each side of pipe centerline as staked for construction, except as otherwise shown on the Drawings.
- C. Accomplish tree removal in manner to prevent damage to adjacent property, or to vegetation or material indicated to remain

3.3 TOPSOIL

- A. Definition: Topsoil is defined as friable clay loam surface soil found in depth of not less than 4 inches. Satisfactory topsoil is reasonably free of subsoil, clay, lumps, stones and other objects over 2 inches in diameter and without weeds, roots, grass mats or other objectionable material.
- B. Strip and salvage topsoil to depth encountered. Perform stripping to prevent intermingling with underlying subsoil or other objectionable materials. Where trees are indicated to remain, refrain from stripping topsoil within the drip line. See Owner's specification section on TREE PROTECTION.
- C. Stockpile topsoil onsite in designated areas until regrading of site area is complete. Construct storage piles to freely drain surface water. Cover storage piles to prevent wind-blown dust.

3.4 DISPOSAL

- A. Legally dispose of all waste materials, unless otherwise directed by the Owner.

END OF SECTION

SECTION 021100 - SITE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

- A. Description: This section covers removal and disposal of existing site features, along with any other surface structures designated or specified for removal.
- B. Related Sections:
 - 1. Section 021000 - Site Preparation.

1.2 SUBMITTALS

- A. Submit schedule showing sequence of demolition activities. Coordinate protection of existing utilities and coordinate shut-off, capping, and continuation of utility services with the Owner.
- B. Schedule site demolition and removal work to ensure uninterrupted service of all utilities, or to obtain prior approval from the Owner for type, start date and duration of planned service outages.

1.3 PREPARATION

- A. Coordinate with Owner prior to any planned mechanical, electrical, and plumbing shutdowns.
- B. Prior to obstructing streets, walks, or other adjacent occupied facilities, obtain written permission from the authorities having jurisdiction. Provide alternative pedestrian routes in accordance with the requirements of the Owner and governing authorities. Provide, erect, and maintain temporary barriers and security devices.
- C. Conduct Pre-demolition conference in accordance with Section 01 3000 to cover the following:
 - 1. Present draft demolition schedule for review.
 - 2. Coordinate phasing requirements. Site demolition work shall be performed such as to minimize the need for disruption of the Owner's normal operations.
 - 3. Identify items to be protected and preserved before proceeding with work.
 - 4. Conduct walking inspection to identify items to be salvaged for re-installation and Owner use.
 - 5. During walking inspection, photograph or otherwise determine and record existing physical conditions of boundary areas. Surfaces, equipment, or other items damaged during demolition work are to be restored to original condition as recorded during walking inspection.
 - 6. Agree upon location where items salvaged for Owner are to be delivered and stored.
 - 7. Obtain agreement from Owner on day-to-day scheduling requirements and restrictions to avoid disruption of Owner operations resulting from demolition work, dirt, or noise.

1.4 SAFETY REQUIREMENTS

- A. All work shall be done in conformance with the rules and regulations pertaining to safety established by federal, state, and local authorities, and as specified elsewhere in these Specifications
- B. Inform Architect and Owner immediately upon discovery of hazardous materials. Do not remove hazardous materials without Owner authorization.
- C. Maintain accessibility for fire-fighting apparatus at all times, and ensure safe passage of persons and vehicles around the area of site demolition.

PART 2 - PRODUCTS - NOT USED.

PART 3 - EXECUTION

3.1 PROTECTION OF EXISTING FACILITIES

- A. Protect existing adjacent structures, site elements and landscaping materials which are not being demolished.
- B. Prevent movement or settlement of adjacent structures. Provide bracing and shoring as necessary for safety and to support the structure and protect it from movement, settlement or damage.
- C. Maintain existing utilities which are to remain in service and protect them from damage during site demolition operations.

3.2 SALVAGEABLE MATERIAL AND EQUIPMENT

- A. Carefully remove, store and protect salvage materials and equipment for Owner's use. Deliver to specific locations as directed by the Owner.
- B. Carefully remove, store, and protect items noted on the Drawings for salvage and re-installation.
- C. All material and items not specified to be salvaged shall be removed and disposed of offsite by the Contractor. The Contractor shall make all necessary arrangements for this disposal, and shall bear any costs or retain any profit incidental to this disposal.

3.3 DEMOLITION

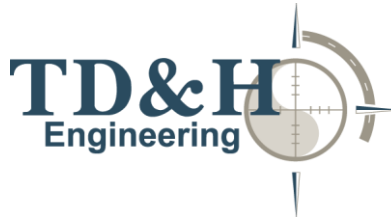
- A. Perform demolition in accordance with governing authorities. Cease demolition operations immediately if adjacent structures appear to be in danger.
- B. Remove and dispose of existing concrete sidewalk sections without damaging adjacent building or site surfaces. Remove existing concrete surfacing to existing joints or to neatly cut lines where no joints exist.
- C. Report to the Architect and Owner unanticipated mechanical, electrical, or structural elements which conflict with intended function or design when encountered. Submit report in writing. Rearrange demolition schedule as necessary to continue overall project progress without delay.
- D. Remove demolished materials from the site, and legally dispose of such materials. Do not burn or bury materials or debris on site.
- E. Fencing may be removed by the Contractor at his option as an aid for construction access. Where such fencing is removed. All fence materials must be replaced in their original condition and location after construction is complete. Any fencing materials damaged by the Contractor's removal or other construction activities must be replaced with new materials matching the existing materials at no extra cost to the Owner.

3.4 CLEANING

- A. Broom clean demolition areas of dust, dirt, and debris caused by demolition operations. Return adjacent areas to condition existing prior to start of work.
- B. Remove temporary work and protection when no longer needed.

END SECTION

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April 19, 2019

MSU CPDC
Montana State University
Bozeman, MT



**RE: GEOTECHNICAL EVALUATION
MSU TEMPORARY GYM STRUCTURES PPA #19-0026
BOZEMAN, MONTANA
TD&H PROJECT NO. B19-028**

The purpose of this report is to provide assumptions of the anticipated subsurface conditions present and provide recommendations for the support of the proposed structure and related site improvements. We understand the proposed construction includes two inflatable structures planned to utilize conventional shallow foundations with an asphalt cement slab. Structural loads for the proposed construction were not available at the time of this report. For the purposes of our analyses, we have assumed that wall loads will be less than 3,000 pounds per lineal foot.

Assumptions

No field investigation was conducted. The assumed soils encountered during excavation are based on previous experience on MSU campus and review of adjacent structure geotechnical analysis reports. It is assumed that lean clay topsoil underlain by native lean clay will be present in the excavations. Based on the assumed depth of the bottom of footings, it is likely that the native lean clay will be encountered at subgrade excavation elevation. In past experience this material has been found to be potentially compressible under adverse moisture conditions and therefore will require some subgrade improvements. The following recommendations are based on the assumption that the soils encountered at subgrade elevation are lean clay that has been observed elsewhere on campus. Should the excavation find materials that vary from this in any way the geotechnical engineer should be consulted immediately to refine foundation recommendations.

Recommendations

Site Grading and Excavation

1. All topsoil, waste piles, organic material, fill, and related construction debris should be removed from the proposed building area and any areas to receive site grading fill. Soil waste piles should not be used for fill under the building footprint but may be used as fill in landscaping areas. For planning purposes, a minimum stripping thickness of 18 to 24 inches is recommended. Thicker stripping depths may be

warranted to remove all detrimental organics and soil waste piles as determined once actual stripping operations are performed.

2. All fill and backfill should be non-expansive, free of organics and debris and should be approved by the project geotechnical engineer. The on-site soils, exclusive of topsoil, are suitable for use as backfill and general site grading fill on this project provided all foundation reinforcement has been designed by a licensed structural engineer based on the recommendations provided. All fill should be placed in uniform lifts not exceeding 8 inches in thickness for fine-grained soils and not exceeding 12 inches for granular soils. All materials compacted using hand compaction methods or small walk-behind units should utilize a maximum lift thickness of 6 inches to ensure adequate compaction throughout the lift. All fill and backfill shall be compacted to the following percentages of the maximum dry density determined by a standard proctor test which is outlined by ASTM D698 or equivalent (e.g. ASTM D4253-D4254).

a) Below Foundations or Spread Footings	98%
b) Backfill Adjacent to Footings or Foundation Walls	95%
c) Below Slab-on-Grade Construction	98%
d) General Site Grading, Non-Structural	92%

3. Imported structural fill should be non-expansive, free of organics and debris, and selected per the following requirements.

Screen or Sieve Size	Percent Passing by Weight
3-inch	100
1½-inch	80 – 100
¾-inch	60 – 100
No. 4	25 – 60
No. 200	10 maximum

4. Develop and maintain site grades which will rapidly drain surface and roof runoff away from foundation and subgrade soils; both during and after construction. The final site grading must conform to all applicable building code requirements. The site grading was not included in our scope of work for this project and is the responsibility of others.
5. At a minimum, downspouts from roof drains should discharge at least six feet away from the foundation or beyond the limits of foundation backfill, whichever is greater. All downspout discharge areas should be properly graded away from the structure to promote drainage and prevent ponding.
6. Site utilities should be installed with proper bedding in accordance with pipe manufacturer’s requirements.
7. It is the responsibility of the Contractor to provide safe working conditions in connection with underground excavations. Temporary construction excavations



greater than four feet in depth, which workers will enter, will be governed by OSHA guidelines given in 29 CFR, Part 1926. For planning purposes, subsoils encountered in the test pits are considered Type B for the lean clay. The soil conditions on site can change due to changes in soils moisture or disturbances to the site prior to construction. Thus, the contractor is responsible to provide an OSHA knowledgeable individual during all excavation activities to regularly assess the soil conditions and ensure that all necessary safety precautions are implemented and followed.

Spread Footing Foundations

The design and construction criteria below should be observed for a spread footing foundation system. The construction details should be considered when preparing the project documents.

8. All footings should bear on at least one foot of properly compacted structural fill (Item 3) as discussed in the Geotechnical Analysis. The limits of removal and replacement with compacted structural fill should extend downward and outward laterally from the bottom edges of footings at a 1:1 (horizontal to vertical) projection.

Compaction should be provided and verified within the structural fill per the requirements of Item 2 above. Footings supported on at least two feet of properly compacted structural fill, as described above, may be designed using a maximum allowable bearing pressure of 1,500 psf. This allowable bearing pressure assumes that vertical displacements, as outlined in the Geotechnical Analysis, are acceptable.

9. Soils disturbed below the planned depths of footing excavations should be recompacted or replaced with suitable compacted backfill approved by the geotechnical engineer.
10. Footings shall be sized by the foundation designer to satisfy the minimum requirements of the applicable building codes and such that the maximum allowable soil bearing pressure provided in Item 8 is not exceeded. The footings should utilize the smallest footing dimensions permitted by the applicable building codes and based on a detailed structural load analysis performed by the foundation designer. Oversize footings should be avoided as they reduce the surcharge available to resist expansive forces.
11. Exterior footings and footings beneath unheated areas should be placed at least 48 inches below finished exterior grade for frost protection.
12. The bottom of the footing excavations should be free of cobbles and boulders to avoid stress concentrations acting on the base of the footings.
13. Lateral loads are resisted by sliding friction between the footing base and the supporting soil and by lateral pressure against the footings opposing movement. For design purposes, a friction coefficient of 0.40 and a lateral resistance pressure

of 150 psf per foot of depth are appropriate for footings bearing on compacted structural fill and walls backfilled with compacted native clay.

14. A representative of the project geotechnical engineer should observe all footing excavations and backfill phases prior to the placement of concrete formwork to verify the proper placement and compaction of the recommended structural fill.
15. The appropriate site class, per the 2015 International Building Code (IBC), for this site is Site Class D. Seismic ground motion values should be determined using the National Earthquake Hazards Reduction Program (NEHRP) recommendations and the above site class. The likelihood of seismically-induced soil liquefaction or settlement for this project is low and does not warrant additional evaluation.

Limitations

This report has been prepared in accordance with generally accepted geotechnical engineering practices in this area for use by the client for design purposes. The assumptions and recommendations contained in this report reflect our professional opinion regarding potential impacts the subsurface conditions may have on the proposed project and are based on anticipated site conditions. Additional site evaluation to assess the expansive or compressible potential of the site soils are recommended and may warrant modifications of the recommendations provided if performed. If additional evaluation of the soils are not performed, the Owner must be willing to accept the risk of any vertical displacements and the associated damages to the structure. The recommendations provided are intended to help control the potential for movements, and sufficient data was not available at the time of this report to fully assess the performance of the proposed construction incorporating these recommendations. Our analysis assumes that the results of the previous geotechnical analyses are representative of the subsurface conditions throughout the site, that is, that the subsurface conditions everywhere are not significantly different from those disclosed by previous work.

Unanticipated soil conditions are commonly encountered and cannot be fully determined. Such unexpected conditions frequently require that some additional expenditures be made to obtain a properly constructed project. Therefore, some contingency fund is recommended to accommodate such potential extra costs.

The recommendations contained within this report are based on the subsurface conditions assumed and are subject to change pending observation of the actual subsurface conditions encountered during construction. TD&H cannot assume responsibility or liability for the recommendations provided if we are not provided the opportunity to perform limited construction inspection and confirm the engineering assumptions made during our analysis. A representative of TD&H should be retained to observe all construction activities associated with subgrade preparation, foundations, and other geotechnical aspects of the project to ensure the conditions encountered are consistent with our assumptions. Unforeseen conditions or undisclosed changes to the project parameters or site conditions may warrant modification to the project recommendations.


Long delays between the geotechnical investigation and the start of construction increase the potential for changes to the site and subsurface conditions which could impact the applicability of the recommendations provided. If site conditions have changed because of

natural causes or construction operations at or adjacent to the site, TD&H should be retained to review the contents of this report to determine the applicability of the conclusions and recommendations provide considering the time lapse or changed conditions.

Misinterpretation of the geotechnical information by other design team members is possible and can result in costly issues during construction and with the final product. We strongly advise that TD&H be retained to review those portions of the plans and specifications which pertain to earthwork and foundations to determine if they are consistent with our recommendations and to suggest necessary modifications as warranted. In addition, TD&H should be involved throughout the construction process to observe construction, particularly the placement and compaction of all fill, preparation of all foundations, and all other geotechnical aspects. Retaining the geotechnical engineer who prepared your geotechnical report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

This report was prepared for the exclusive use of the owner and architect and/or engineer in the design of the subject facility. It should be made available to prospective contractors and/or the contractor for information on factual data only and not as a warranty of subsurface conditions such as those interpreted from the test pit logs and presented in discussions of subsurface conditions included in this report.

Prepared by:



Ahren C. Hastings P.E.
Geotechnical Engineer
TD&H ENGINEERING

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SECTION 028100 - IRRIGATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of each Contract, including General Conditions and Supplementary Conditions, apply to work of this section.

1.2 DESCRIPTION

- A. The work of this section consists of all items necessary to install the revised irrigation around the new site layout as indicated on, and the protection and splicing required to maintain all parts of the existing irrigation system in operation, with the exception of those parts designated to be removed or abandoned. This includes required sleeves for pipe and wire, back-flow prevention devices, reconnections, and miscellaneous modifications to the existing irrigation distribution lines including, but not limited to:
 1. Automatic controller and remote control valves.
 2. Lawn and planting beds sprinkler system.
 3. Connection to proposed irrigation water source and power supply.

1.3 QUALITY ASSURANCE

- A. Qualifications of Installer: Provide at least one person who shall be present at all times during execution of this portion of the work and who shall be thoroughly familiar with the type of materials of installation and who shall direct all work performed under this section. All work of this section and related work listed above shall be performed by the same Contractor.
- B. Codes and Standards:
 1. In addition to complying with all pertinent codes and regulations, comply with the latest rules of the National Electrical Code for all electrical work and materials.
 2. Comply with National Plumbing code at all connections to potable water systems.
 3. Where provisions of pertinent codes and standards conflict with the requirements of this section of these Specifications, the more stringent provisions shall govern.

1.4 SUBMITTALS

- A. Material List: Before any irrigation system materials are delivered to the job site, submit to the Architect a complete list of all irrigation system materials to be furnished and installed.
 1. Show manufacturer's name and catalog number for each item, furnish complete catalog cuts and technical data, and furnish the manufacturer's recommendations as to method of installation. Where materials proposed differ from those specified, furnish complete shop drawings and design calculations to demonstrate equivalent performance of the proposed installation.
 2. Do not permit any irrigation system component to be brought onto the job site without prior approval by the Architect.
- B. Shop Drawings: CONTRACTOR shall submit the proposed sprinkler layout in a schematic form to the Architect for approval. Any modifications to these proposed drawings will be returned to the

CONTRACTOR for the preparation of the final revised layout. The material list will be coordinated with the final shop drawings by the CONTRACTOR. Show all sleeve locations.

- C. Field Verification: CONTRACTOR shall field verify all dimensions, existing and proposed conditions, and as required to provide one complete and operable system. Proposed system shall be laid out above ground using locate flags to show location of all sprinkler heads, valves, and sleeve locations. This layout shall be signed off on by MSU Northern Facilities Staff, before any excavation shall begin.
- D. As-built Drawings: Provide a complete set of as-built shop drawings to the Architect for approval prior to final payment.

1.5 PRODUCT HANDLING

- A. Protection: Use all means necessary to protect irrigation system materials before, during, and after installation and to protect the installed work and materials of all other trades.
- B. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

1.6 PERFORMANCE REQUIREMENTS

- A. Minimum Requirements: The following shall be the minimum requirements of the system. They are not intended to limit the overall intent, which is to obtain a fully operational and completely automatic sprinkler system. Specific requirements of this project manual shall apply to all elements typically. Conflicts between the drawings and the project manual or between specific and general performance of material requirements shall be assumed to be the most expensive.
- B. Project Zones: Refer to the drawings for the general zones to be served by this system.
 - 1. Irrigation layout must be adaptable to the future modification of the system to smaller heads, more intense head arrays and minimal spraying over the sidewalks. This should be accomplished by running the laterals near sidewalk edges whenever possible, and by positioning the mains with this future intent.
 - 2. Contractor will advise himself of all existing and proposed site conditions and related planting and grading as required to coordinate and schedule with the work of other contractors.
 - 3. Heads shall be positioned to prevent damage from spraying on the building envelope and/or causing inside flooding in any and all cases.
 - 4. Organize zones to allow walking across the area on dry sidewalk while the irrigation system is on.

PART 2 - MATERIALS

2.1 PIPE

- A. Plastic Pipe
 - 1. Plastic pipe 4" and under in diameter shall be rigid non-plasticized Schedule 40 PVC IPS solvent-welded conforming to ASTM D-1784 and D-2241 standard specifications for PVC plastic pipe. Plastic pipe 6" and larger in diameter shall be rigid non-plasticized Class 200 PVC IPS gasket fit conforming to ASTM D-1784 and D-2241 standard specifications for PVC plastic pipe. The pipe shall be homogeneous throughout and free from visible cracks, holes, foreign materials, blisters, deleterious material, wrinkles, and dents.
 - 2. All pipes shall be continuously and permanently marked with the following information:
 - a. Manufacturer's name or trademark, size, schedule and type of pipe, working pressure

at 73 deg. F and National Sanitation Foundation (N.S.F.) approval.

3. All main lines shall be a minimum of two inches (2") in diameter, unless otherwise noted.
 4. All lateral lines shall be a minimum of one and one-half inches (1-1/2") in diameter, unless otherwise noted.
 5. All plastic pipe fittings to be installed shall be molded fittings manufactured of the same material as the pipe, rated as a pressure fitting (no DWV fittings shall be allowed) and shall be suitable for solvent weld, slip joint ring-tight seal, or screwed connections. All pipe six inches (6") in diameter and above shall be Class 200 PVC IPS gasket end. All smaller pipes shall be Schedule 40 PVC IPS solvent-welded.
 6. Slip fitting socket taper shall be so sized that a dry, unsoften pipe end, conforming to these specifications, can be inserted no more than halfway into the socket. Plastic saddle and flange fittings will not be permitted. Only schedule 80 pipe may be threaded.
 7. When connection is plastic to metal, plastic male adapters shall be used. The male adapter shall be hand tightened, plus one turn with a strap wrench. Joint compound shall be Teflon Tape on Water Based Teflon Paste.
 8. All mainline pipes shall be traceable via purple or blue-colored 14 gauge single strand direct burial wire attached to the pipe. The wire should be free from moving valve parts to prevent damage. The tracer wire shall surface at and be secured to the controller. This is not necessary for lateral pipelines with irrigation heads attached.
- B. Pipe Sleeves: Pipe sleeves shall be Schedule 40 PVC pipe, six-inch (6") diameter unless noted otherwise, or equal approved by Architect.
1. Installation: Provide empty sleeves along all pathways as noted on the drawings or every 100 feet. Extend sleeves at least one foot (1') beyond pavement on both sides. Sleeves shall be installed 18 inches below finished grade. All sleeves shall be installed at a depth on line and grade with existing or proposed irrigation lines. Sleeves with excessive or shallow invert depth will be rejected. Cap ends of empty sleeves with duct tape.
 2. Sleeve Location Marking:
 - a. New Pavement: The location of each sleeve must be marked along both of the extreme edges of any new pavement installed over the sleeve. This shall be accomplished by pressing the end section of a two-inch (2") pipe into the uncured pavement surface to make an imprint.
 - b. Existing Pavement: For sleeves pushed under existing pavement, sleeve locations shall be marked along the extreme edges of the pavement on both sides where the sleeve emerges from under the pavement. Markings shall consist of scoring the surface of the existing pavement with a 2" O.D. core drill just enough to make the impression of a circle in the pavement surface.

2.2 RISERS/SWING JOINTS

- A. Flexible Risers: Stationary Pop-up and Surface Sprinkler Heads shall be installed using "funny pipe" or four-piece swing joints. Sprinkler Heads with one-half inch (1/2") and/or three-quarter inch (3/4") inlets shall connect with "funny pipe" exclusively, in lengths no longer than two feet (2'). Sprinkler Heads with one-inch (1") inlets shall connect with four-piece swing joints only.
1. Installation with "funny pipe", which is one-half inch (1/2") low density, polyethylene pipe, rated 80 PSI at 100 deg. F, must use Teflon-taped barbed street ells. Use of flexible pipe such as "funny pipe" is limited to connecting laterals to irrigation heads.
 2. Four-piece swing joints shall consist of an assembly using three (3) one inch (1") Marlex street elbows, with a 1" SCH 80 Nipple of required length to set head at grade.

- B. HDPE Pipe:
 1. All HDPE pipe must be SDR11 manufactured in accordance with AWWA C901/C906, ASTM D2239, ASTM D2737, ASTM D3035, ASTM F714 and ANSI/NSF 14/16 listings.
 2. All fusion welds must be done by a certified technician.
 3. All fitting must be fusion welded using butt joints with mechanical fittings or electro fusion fittings designed for use with HDPE.
 4. All HDPE pipe that is damaged to the point where 10% of the overall wall thickness is effected shall be repaired according to owners' recommendation.
- C. Rigid Risers: All risers for shrub spray heads, bubblers, etc., that are in shrub or flowerbed areas and planters, shall be schedule 80 PVC plastic pipe, unless otherwise specified or shown on the plans. The risers shall be of sufficient height so as not to cause any interruption of the stream from the sprinkler nozzle when the plant material has reached its optimum growth.

2.3 VALVES

- A. Ball Valves:
 1. All manual ball valves, sizes 1-1/2" inches and smaller, shall be all bronze double with integral taper seats and with rising stem.
 2. All valves 2" and larger shall be gate valves.
 3. All ball valves shall be full port, with chromium or stainless ball with Teflon seats 150 PSI rated, Hammond, or approved equal.
- B. Pressure Reducing Valves: Provide pressure-reducing valves on main lines only, Watts, Series U5, U5B 1/2" to 2" Standard Capacity, or approved equal.
- C. Gate Valves:
 1. All manual gate valves, sizes four-inch (4") and smaller, shall be made in the U.S.A., brass body, threaded, non-rising stem, full port, 200 PSI/13.8 bar non- shock cold working pressure up to 180 deg. F./82 deg. C., NSF/ANSI 61-8 compliant: NIBCO model TI-8 or approved equal.
 2. All gate valves of 6-inch (6") size or larger shall be at least 150 PSI rated, AWWA-C509 resilient wedge gate valve, made in the U.S.A., featuring non- rising stem, iron body, epoxy coated interior, mechanical joint with appropriate size gaskets for corresponding pipe as per drawing.
- D. Quick-Coupler Valves: Provide Rain Bird #3 DNP Quick Coupler valves and one key per valve.
- E. Automatic Remote Control Valves: Automatic control valves shall consist of:
 1. Rain Bird PESB Series, 24 volts, contamination resistant valve with a pressure operating range of 20-200 psi and a 0.25 to 200 g.p.m. flow range. Glass-filled nylon construction, one-piece solenoid with captured plunger, flow control handle adjusts, manual internal and external bleeds, nylon screen scrubber and purple flow control handles for easy identification of non-potable water systems or approved equal.
- F. Back-Flow Preventers: Back-flow on potable systems only shall be Wilkins Model 720A or approved equal.

2.4 VALVE BOXES

- A. All remote control valves, pressure regulating valves, manual control valves, zone shut-off valves, gate valves or globe valve filters and drains, unless otherwise indicated, shall be installed in a valve access box of proper size as required for easy access to the valve. Valve box to be

Carson, with round, locking green cover ten inches (10") in diameter for quick coupler valves, and 10" x 15" standard for all others unless described otherwise in the contract drawings, or approved equal. All round valve boxes shall be supported underneath the bottom edges with two bricks (minimum). All rectangular valve boxes shall be supported underneath the bottom edges with three bricks (minimum). The base of the valve box should be at or below the body of the valve. The lid of the valve box should be flush or within 1" of turf grade.

2.5 AUTOMATIC IRRIGATION CONTROLLER

- A. Controller Type: The automatic controller shall be 120 volt input, soft-wired, 26.5 volt output, with the number of valve stations and in the type and model number indicated on the plans, and shall be a Rain Bird ESP SAT LS or ESP SAT LW. Wall or pedestal mount type must be pre-approved by the Architect and Owner for the site situation. Controller station size and quantity specified per drawing. Station wiring and timing schedule specified per drawing. All station wiring must be terminated in a Rain Bird ESPSATOB24 mounted in the pedestal or wall mounted wire trough. All controllers must be equipped with a Rain Bird RMK450NARR with a University licensed and authorized frequency, hooked to a Rain Bird Maxilink Ant 01 or Antenex Directional Yagi Model Y4503/Y4505 or University approved substitute. All MaxiCom components must be ordered and installed by a MaxiCom-certified installer.
- B. Electrical Power: Power for the controllers shall be the responsibility of the sprinkler installer. Meet all electrical specifications for installation of controllers and power to the controllers. The controllers must be wired to the power source in the pedestal or wall via an Isobar Ultra 4 surge protector and a two-receptacle Ground Fault Interrupter (GFI) outlet. A pigtail that can reach from the controller to the outlet is required. Power source must be pre-approved by Owner prior to connection.
- C. Sleeves:
1. Provide minimum six inch (6") diameter sleeves under paved areas as necessary to run all control wiring and piping for sprinkler zones. Coordinate with concrete work prior to forms being set. All sleeves shall be installed at a depth on line and grade with existing or proposed irrigation lines. Sleeves with excessive or shallow invert depth will be rejected.
 2. No sleeving shall be put in tunnel walls. All main lines fed from the tunnel shall be cored, and sized to fit link seals for that pipe size. Each mainline shall be sealed using 2 link seals, one on the inner wall and one on the outer wall. No fittings allowed within 3'-0" of outer tunnel wall.
- D. Location:
1. After pre-approval by the Architect and Owner, locate controllers on outside walls of buildings or on pedestals at locations that will maximize the view of the zones serviced by each controller. Verify locations with the Architect to avoid compromising buildings systems and/or appearance concerns.
 2. Pedestals controllers must be mounted to a concrete slab of dimensions 1.5' x 1.5' x 0.33'. Each pedestal slab shall have a minimum of 2 electrical sweep 90's poured into it. First; one 1" sweep shall hold 120V direct bury power wires, second, one 2" sweep shall hold valve control and flow meter wires- additional or larger sweeps shall be installed as needed to avoid wire damage. Two bollards consisting of three inch (3") steel pipe filled with concrete and anchored in concrete shall be installed against the edge of the slab in front and in back of the controller. The bollards shall be primed and painted with a black, epoxy-based paint. The concrete at the top of the pipe must be domed and finished to a smooth, even surface, without concrete residue on the outside surface of the pipe.
- E. Flow Meter:
1. A MaxiCom-compatible flow meter must be installed at every point of connection. This may

be either a Rain Bird Brass Insert Sensor (FS350B) for pipe three inches or larger, or a Rain Bird PVC Tee Sensor of the appropriate size: FS150P for 1-1/2" pipe, FS200P for 2' pipe, and FS300P for 3" pipe. The flow meter must be directly connected to the controller using PE43 communication cable (the blue/blue white wire pair must be used for the flow meter/pulse transmitter connection) and a PT 322 pulse transmitter. All splices using this type of cable must meet Rain Bird MaxiCom standards. Programming and hook up of the PT322 shall be completed by MSU Irrigation Employee.

F. Certified Installation:

1. All MaxiCom components must be ordered and installed by a MaxiCom-certified installer.

2.6 IRRIGATION HEADS

A. Rotary Sprinklers:

1. All rotary sprinkler heads shall be Model I-20R Series, manufactured by Hunter Industries, San Marcos, California; Rain Bird 5004+PCSAMRNP Series, manufactured by Rain Bird Sprinkler Mfg. Corp., Glendora California; Rain Bird 8005NP Series, manufactured by Rain Bird Sprinkler Mfg. Corp., Glendora California; or owner approved equivalent.

B. Spray Heads:

1. All spray head sprinklers shall be Rain Bird Model Nos. 1800 series SAM with variable arc nozzles (VAN) or MPR nozzles, manufactured by Rain Bird Sprinkler Mfg. Corp., Glendora California or approved equal.

C. Bubblers:

1. All bubbler zones must be controlled by a Rain Bird PESB Series Valve incorporating a Rain Bird PRS regulator. There must be a Rain Bird WYE Filter System installed directly downstream of the valve, located inside the valve box in a manner that allows easy maintenance. The bubbler heads must be Rain Bird 1300A-F Series mounted on Rain Bird 1804 SAM Spray Bodies or approved equal.

D. Drip Irrigation: No drip irrigation systems are allowed at Montana State University Northern.

2.7 CONTROL CABLE

A. Type:

1. All electrical control and ground wire shall be Baron irrigation control cable or approved equal, 14-gauge unless otherwise indicated on the drawings. All wiring to be used for connecting the automatic remote control valve to the automatic controllers shall be Type "UF", 600 volt, solid copper, single conductor wire with PVC or polyethylene insulation and bear UL approval for direct underground burial feeder cable.

B. Insulation:

1. Insulation shall be four-sixty-fourths inch (4/64") thick minimum covering of ICC- 100 compound for positive waterproofing protection. All control or "hot" wires shall be red and all common or "ground" wires shall be white. A minimum of one black extra wire shall be included in the wiring run for every four (4) wires installed. All black extra wires shall be intact and usable from the controller to the end of each mainline run with slack wire available at each valve location.

C. Code Compliance: Verification of wire types and installation procedures shall be checked to conform to local codes.

- D. Splices: All splices are to be completed within valve boxes using one-piece, jelly-filled, water-proof wire connectors with 20 expansion coils per splice, allowing work to be completed at ground level. All splices shall be located on as-built drawings.
- E. Trench Installation
 - 1. Tape and bundle all wiring at ten-foot (10') intervals.
 - 2. Attach tracer wire to main line pipe only at ten-foot (10') intervals.
 - 3. All 120 volt wiring shall be in conduit with marker tape installed in the ditch six inches (6") above the conduit.
 - 4. All wiring under pavement and through sleeves shall be in conduit.
 - 5. Tie a loose twenty-inch (20") loop in wiring at all changes in direction greater than 30 degrees. Untie all loops after making connections.

2.8 VAULTS

- A. Water Service Connection: A vault shall be installed at domestic water service connection. Vault shall house domestic water back-flow preventers, blowout assembly and isolation valves. Vault must comply with applicable code(s).
- B. Location: Review location of vault with Architect prior to installation.

2.9 OTHER MATERIALS

- A. Tools to be Furnished
 - 1. Supply as part of this contract the following tools:
 - a. Two keys for each automatic controller
 - b. Two quick-coupler keys, Rain Bird Model 33K with matching hose swivels.
 - 2. The above equipment shall be turned over to the Owner at the conclusion of the project. Before final inspection can occur, evidence that the Owner has received materials must be shown to the Architect.
- B. Concrete: Provide and coordinate installation of all concrete thrust blocks. Refer to Division 3 for concrete requirements. Provide thrust blocks for all lines larger than 3-inch diameter, at all tees and ells.
- C. Other Materials: All other materials not specifically described but required for a complete and proper irrigation system installation, shall be new, first quality of their respective kinds, and subject to the approval of the Architect.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

- A. Inspection:
 - 1. Prior to all work of this section, carefully inspect the installed work of all other trades and verify that such work is complete to the point where this installation may properly commence.
 - 2. Verify that irrigation system may be installed in strict accordance with all pertinent codes and regulations, the original design, the referenced standards, and the manufacturer's recommendations.
- B. Discrepancies:
 - 1. In the event of discrepancy, immediately notify the Architect.
 - 2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.2 FIELD MEASUREMENTS

Make all necessary measurements in the field to ensure precise fit of items in accordance with the original design.

3.3 TRENCHING AND BACKFILLING

A. General:

1. Perform all trenching required for the installation of items where the trenching is not specifically described in other sections of these specifications.
2. Make all trenches in accordance with OSHA Requirements with sufficient width to provide free working space at both sides of the trench and around the installed item as required for gluing, joining, backfilling, and compacting while minimizing width of trenches.
3. The contractor will be required to conduct his work so that trenches will remain open a minimum possible time.

B. Depth:

1. Trench as required to provide the elevations shown on the Plans.
2. Trench to sufficient depth to give a minimum of eighteen inches (18") of fill above the top of the pipe measured from the adjacent finished grade under driveways and sidewalks.
3. All mainline and control cables shall have a minimum cover of eighteen inches (18") above the pipe or wire. All laterals shall have a minimum cover of twelve inches (12") above the pipe.
4. All sleeves shall be installed at a depth on line and grade with existing or proposed irrigation lines. Sleeves with excessive or shallow invert depth will be rejected.

C. Correction of Faulty Grades: Where trench excavation is inadvertently carried below proper elevations, backfill with material approved by the Architect and then compact to provide a firm and unyielding sub grade to the approval of the Architect and at no additional cost to the Owner.

D. Trench Bracing:

1. Properly support all trenches in strict accordance with all pertinent rules and regulations.
2. Brace, sheet, and support trench walls in such a manner that they will be safe and that the ground alongside the excavation will not slide or settle, and that all existing improvements of every kind will be fully protected from damage.
3. In the event of damage to such improvements, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.
4. Arrange all bracing, sheeting, and shoring so as to not place stress on any portion of the completed work until the general construction thereof has proceeded far enough to proven, sufficient strength.

E. Removal of Trench Bracing: Exercise care in the driving and removal of sheeting, shoring, bracing, and timbering to prevent collapse or caving of the excavation faces being supported.

F. Grading and Stockpiling Trenched Material:

1. Control the stockpiling of trenched material in a manner to prevent water from running into the excavation.
2. Do not obstruct surface drainage but provide means whereby storm and wastewater are diverted into existing gutters, other surface drains, or temporary drains.

G. Methods:

1. All trench excavation shall be made by open cut. During excavation, material suitable for backfilling shall be piled in an orderly manner, a sufficient distance from the banks of the trench to avoid overloading, and to prevent slides or cave-ins. All material not required for

backfill or not suitable for backfill shall be removed from the site by the contractor. Banks of trenches shall be kept as nearly vertical as possible, and shall be properly sheeted and braced as may be necessary to prevent caving.

2. The contractor shall provide, place, maintain, and remove all necessary barricades, warning signs, and other safety devices from the start to the finish of the project to prevent pedestrians from falling in open trenches.
3. Trench widths in paved streets or in areas where proximity to other structures requires vertical cuts, shall not be wider than is required for proper handling, jointing and bedding of the pipe.
4. The bottom of the trenches shall be accurately graded to line and grade, and provide uniform bearing and support for each section of the pipe on undisturbed soil, at every point along its entire length. Depressions for joints shall be dug after the trench bottom has been graded, and shall be only of such length, depth, and width as required for properly making the particular type joint. Care shall be taken not to excavate below the depths indicated.
5. Where rock occurs in trench excavation, the rock shall be removed to a depth of six inches (6") below the established grade line, and to a width of twelve inches (12") greater than the outside diameter of the pipe to be installed in the trench.
6. No water shall be permitted to rise or stand in trenches not yet backfilled until after the pipe has been placed, tested and covered with backfill for a depth of at least ten inches (10"). Any pipe having its alignment or grade changed as a result of a flooded trench shall be removed and re-laid after the trench is graded once again at no additional cost to the Owner.

H. Pavement Removal:

1. Where excavation of trenches requires the removal of pavement, the pavement shall be cut in a straight line along the edge of the excavation by use of a spade-bit air hammer, concrete saw or similar approved equipment to obtain straight, square and clean break. After backfilling and sub grade preparations are completed, the pavement section and surfacing shall be replaced.
2. Pavement replacement shall utilize the same materials and design as the original pavement.
3. Excess material, including rock, broken concrete, bituminous materials, debris, or other materials not suitable for backfill, shall be removed from the site and disposed of by the contractor.

3.4 BORING

- A. Locations: Boring shall be used to route pipe, wiring, or both under structures such as walks or curbs where trenching is impractical. Sleeves shall be installed in all bored holes.
- B. Method: Boring shall be accomplished with a drill, auger, water jet, or any other instrument approved by the Architect capable of producing a precise hole. Boring shall not disturb overlying structures or cause settlement and damage to those structures.

3.5 SLEEVES

- A. Locations: Sleeves shall be installed wherever routing of a pipe, wiring, or both crosses a paved area or passes through a bored hole.
- B. Methods:
 1. Sleeves laid in open trenches shall be uniformly and evenly supported by undisturbed soil on the trench bottom. Backfill shall conform to standards hereinafter specified.
 2. Sleeves installed in borings shall be forced through and shall have a snug fit throughout the length of the bored hole. Sleeves cracked or broken shall not be accepted.

3.6 BACKFILL

- A. Material: Backfill material shall be free of clods, lumps of frozen material, or stones larger than one-inch (1") in their maximum dimension. The bedding and select material under, around and six inches (6") above the top of the pipe shall be placed by hand in maximum layers of six inches (6") and carefully compacted in a manner which will not displace the pipe. Compaction of the select backfill shall be at least ninety percent (90%) of the maximum density as determined by AASHTO T-180. Water settling will not be allowed.
- B. Inspection: The trenches shall not be backfilled until inspection has been completed and the pipe installation, including the grade, alignment and jointing has been found to be in compliance with the requirements of the plans and specifications.
- C. Around and Over the Pipe:
 - 1. Select backfill material consisting of sand, fine gravel or select earth, free of large lumps or rocks larger than three-quarters of an inch ($\frac{3}{4}$ ") shall be used in backfilling around and over the installed pipe.
 - 2. The select material shall be obtained from the excavation material removed from the trench and shall be processed by screening, sifting, or selective sorting, so as to produce the type of backfill herein specified. The Contractor may at his option and expense provide an acceptable imported material.
 - 3. This backfill material shall be carefully deposited around and over the pipe in layers not more than six inches (6") thick, loose measurement, unless otherwise permitted by the Architect, wetted to optimum moisture content and uniformly compacted to at least ninety-five percent (95%) of the maximum density obtainable at optimum moisture content as determined by ASTM D698 (latest revision), until the pipe has a cover depth of at least one foot (1').
- D. Remainder of Trench Backfill:
 - 1. The remaining depth of the trench shall be backfilled with excavation material removed from the trench, which shall be wetted or dried to near optimum moisture content.
 - 2. This material shall be carefully deposited in layers not to exceed six inches (6") in compacted thickness and compacted to at least ninety-five percent (95%) of the maximum density as determined by ASTM D698 (latest revision). The method of compaction selected by the Contractor shall not cause damage of any nature to the installed pipe. Replace topsoil on trench fill and compact to eighty-five percent (85%) of maximum density at optimum moisture.
 - 3. The use of water settlement for this portion of the trench backfilling is permissible if the specified density can be obtained and the backfill material is suitable for this type of trench compaction.

3.7 INSTALLATION OF PIPING

- A. General:
 - 1. Layout the piping system in strict accordance with the Plans.
 - 2. Where piping is shown on the Plans to be under paved areas but running parallel and adjacent to planted areas, the intention is to install the piping in the planted areas.
- B. Line Clearance:
 - 1. All lines shall have a minimum clearance of four inches (4") from each other, and six inches (6") from lines of other trades, except through pipe sleeves.
 - 2. Parallel lines shall not be installed directly over one another.
- C. Inspection of Pipe and Fittings: Carefully inspect all pipe and fittings before installation, removing all dirt, scale, and butts and reaming as required; install all pipe with stamped

markings oriented up to allow visual inspection and verification.

D. Plastic Pipe

1. Plastic pipe shall be installed in a manner so as to provide for expansion and contraction as recommended by the manufacturer.
2. All plastic pipe joints shall be solvent-weld joints or gasket fit joints. Only the solvent cement recommended by the pipe manufacturer shall be used and it must be a two-part system consisting of primer and cement. No single part cement system shall be used. All plastic pipe and fittings shall be installed as outlined and instructed by the pipe manufacturer and it shall be the Contractor's responsibility to make arrangements with the pipe manufacturer for any field assistance that may be necessary. The Contractor shall assume full responsibility for the correct installation.
3. All plastic (PVC) to metal joints shall be made with plastic threaded male adaptors into metal threaded female fittings.
4. The solvent-weld joints shall be made on dry pipe.
5. The solvent-weld joints shall be allowed to set at least 24 hours before pressure is applied to the system on PVC pipe.

E. Copper Pipe: Direct buried copper pipe connections shall be made using silver solder.

F. Thrust Blocks: Provide concrete thrust blocks for all pipes as shown on the plans. All thrust blocks shall bear directly on undisturbed earth. Center the pipe in the middle of the thrust block.

3.8 INSTALLATION OF EQUIPMENT

A. General:

1. All fittings, valves, etc., shall be carefully placed in the trenches with concrete thrust blocks, placed where required.
2. All sprinklers, having adjustable nozzles, shall be adjusted for proper and adequate distribution of the water over the coverage pattern of the sprinkler.
3. All nozzles on stationary pop-up sprinklers or stationary spray heads shall be tightened after installation. All sprinklers having an adjusting screw, adjusting stem or adjusting friction collars shall be adjusted as required for the proper arc of coverage, radius, diameter and/or discharge.
4. All control wires shall be clearly labeled by station, using weatherproof material, at the controller and at the valve ends. Mark the underside of all valve box covers, indicating the valve controller station number. All markings shall be made in a neat and legible manner using white enamel paint.
5. All control or "hot" wires shall be red and all common or "ground" wires shall be white. A minimum of one black extra wire shall be included in the wiring run for every four (4) wires installed.

B. Sprinkler Heads:

1. Install lawn sprinkler heads where indicated on the plans and in strict accordance with the manufacturer's recommendations and as necessary to provide complete uniform coverage and precipitation.
2. Upon completion of installation, reset all lawn sprinkler heads flush with grade and firmly anchored with soil.

C. Master Automatic Control Valves: A master automatic control valve shall be installed at the point of connection to the main for any remotely controlled portion of the irrigation system. In cases where there are multiple points of connection, a master valve shall be installed for each, with no more than three points of connection allowed. Each master valve will have its own separate yellow "hot" wire.

3.9 TESTING AND INSPECTION

- A. Covering or Enclosing Work Prior to Inspection: Do not allow or cause any of the work in this section to be covered up or enclosed until it has been inspected, tested, and approved by the Owner's Representative.
- B. Flushing:
 - 1. Before backfilling the mainline, and with all control valves in place, but before lateral pipes are connected, completely flush and test the mainline and repair for all leaks; flush out each section of lateral pipe before sprinkler heads are attached. Complications due to this not being done during install will result in charges to the contractor.
- C. Testing:
 - 1. Make all necessary provisions for thoroughly bleeding the line of air and debris.
 - 2. After valves have been installed, test all live water lines hydrostatically for leaks at a pressure of one hundred fifty (150) psi for a period of two (2) hours, with all couplings exposed and with all pipe sections center loaded.
 - 3. Furnish all necessary testing equipment and personnel.
 - 4. Correct all leaks and retest until acceptance by the Architect.
- D. Final Inspection:
 - 1. Thoroughly clean, adjust, and balance all systems.
 - 2. Demonstrate the entire system to the Architect and Owner, proving that all remote control valves are opening and closing on command, that all heads are properly adjusted for radius and arc of coverage, that all emitters are functioning, and that the installed system is workable, clean, and efficient.
 - 3. Existing irrigation system(s) or portions of systems which have had their performance altered by any of the work related to this project shall be repaired or adjusted using materials and installation methods in accordance with this specification and in a manner to restore head-to-head sprinkler coverage, uniform precipitation rates, control zone integrity, and elimination of the spraying of water on building walls and sidewalks.

3.10 CLEANUP

- A. Upon completion of the work, the entire site shall be cleared of all debris, and ground surfaces shall be finished to smooth, uniform slopes and shall present a neat and workmanlike appearance. Cleanup shall be considered an incidental item, and no additional payment shall be made for any cleanup item. All improvements or other obstructions removed during construction shall be replaced in a condition at least equal to their existing condition.

3.11 MAINTENANCE

- A. The contractor shall, for a period of one (1) year after completion and final acceptance of the work, maintain and repair any trench or boring settlement which may occur, and shall make suitable repairs to any pavements, or other structures which may become damaged as a result of settlement. All such maintenance and repair shall be at the contractor's expense.
- B. The contractor shall inform the Owner of the location and the nature of all damage done to the existing irrigation system not slated for demolition within eight hours of the occurrence of the damage.
- C. The contractor shall maintain the existing and proposed irrigation system in operation during the construction period. Upon completion of the proposed irrigation work the contractor shall balance and adjust the entire (new and existing) system.

3.12 AS-BUILT DRAWINGS, CHARTS AND EQUIPMENT MANUALS

A. Record Drawings:

1. Accurately record on one set of black and white prints of the site plan all installed work including both pressure and non-pressure lines.
2. Upon completion of each increment of work, transfer all such information and dimensions to the print. The dimensions shall be recorded in a legible and workmanlike manner.
3. Dimension from two permanent points of reference (buildings, monuments, sidewalks, curbs, pavement, etc.). Locations shown on as-built drawings shall be kept day-to-day as the project is being installed. All dimensions noted on drawings shall be one-eighth-inch (1/8") in size (minimum).
4. Show locations and depths of the following items:
 - a. Point of connection
 - b. Routing of pressure lines (max. dimension=one hundred feet {100'} along lines)
 - c. Gate valves
 - d. Sprinkler control valves
 - e. Quick coupling valves
 - f. Routing of control wires
 - g. Sprinkler heads
 - h. Other related equipment
5. Maintain as-built drawings on site at all times.
6. Make all notes on drawings in red pencil (no ball point pen).

B. Controller Charts:

1. Architect must approve as-built drawings before charts are prepared.
2. Provide one controller chart for each controller supplied showing the area covered by automatic controller, of the maximum size controller door will allow.
3. The chart is to be a reduced drawing of the actual as-built system.
4. Chart shall be black line print and different colored shading used to show area of coverage for each station.
5. When completed and approved, the chart shall be hermetically sealed between two pieces of plastic.
6. The chart shall be mounted using Velcro or equal type of semi-permanent fastening device.
7. These charts must be completed and approved prior to final acceptance of the irrigation system by the Owner.

C. Operation and Maintenance Manuals:

1. Prepare and deliver to the Architect within ten calendar days prior to completion of construction, all required and necessary descriptive material in complete detail and sufficient quantity, properly prepared in two (2) individually bound copies of the operations and maintenance manual. The manual shall describe the material installed and shall be in sufficient detail to permit operating personnel to understand, operate and maintain all equipment. Spare parts lists and related manufacturer information shall be included for each equipment item installed. Each complete, bound manual shall include the following information:
 - a. Index sheet stating Contractor's address and telephone number, duration of guarantees period, list of equipment with names and addresses of local manufacturer representatives.
 - b. Complete operating and maintenance instructions on all major equipment.
 - c. System start-up and shut down instructions.
2. In addition to the above maintenance manuals, provide the maintenance personnel with instructions for system operation and show written evidence to the Owner at the

conclusion of the project that this service has been rendered.

3.13 GUARANTEE

A. Warranty

1. The entire irrigation and water system shall be guaranteed to give satisfactory service for a period of one year from the date of acceptance by the Owner.
2. Should any trouble develop within the time specified above due to inferior or faulty materials or workmanship, the trouble shall be corrected at no expense to the Owner.
3. Any and all damages resulting from faulty materials or workmanship shall be repaired by the Contractor to the satisfaction of the Owner, at no cost to the Owner.

END OF SECTION

SECTION 028210 - CHAIN-LINK FENCE AND GATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section chain-link fencing and gates to be incorporated with the reuse of existing chain-link fencing, posts and gates salvaged from around the existing tennis courts. Contractor to determine reusable portions of the existing 8' high fence to be installed around the new temporary structures mechanical (A.C. & Generator) units adjacent to the new domes.
- B. This Section includes the following:
 - 1. Galvanized steel chain-link fabric.
 - 2. Galvanized steel framework.

1.3 DEFINITIONS

- A. CLFMI: Chain Link Fence Manufacturers Institute.

1.4 SUBMITTALS

- A. Product Data: Material descriptions, construction details, dimensions of individual components and profiles, and finishes for the following:
 - 1. Fence and gate posts, rails, and fittings.
 - 2. Chain-link fabric, reinforcements, and attachments.
 - 3. Gates and hardware.
- B. Shop Drawings: Show locations of fence, each gate, posts, rails, and tension wires and details of extended posts, extension arms, gate swing, or other operation, hardware, and accessories. Indicate materials, dimensions, sizes, weights, and finishes of components. Include plans, elevations, sections, gate swing and other required installation and operational clearances, and details of post anchorage and attachment and bracing.
- C. Product Certificates: Signed by manufacturers of chain-link fences and gates certifying that products furnished comply with requirements.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed chain-link fences and gates similar in material, design, and extent to those indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

1.6 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
 - 1. Notify Architect not less than two days in advance of proposed utility interruptions.
- B. Field Measurements: Verify layout information for chain-link fences and gates shown on Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

PART 2 - PRODUCTS

2.1 CHAIN-LINK FENCE FABRIC

- A. Steel Chain-Link Fence Fabric: Height indicated on drawings. Provide fabric fabricated in one-piece widths for fencing in height of 12 feet and less. Comply with CLFMI's "Product Manual" and with requirements indicated below:
 - 1. Mesh and Wire Size: 2-inch mesh, 0.192-inch diameter.
 - 2. Zinc-Coated Fabric: ASTM A 392, with zinc coating applied to steel wire [before weaving according to ASTM A 817, Type II, zinc coated (galvanized)] [mesh fabric after weaving] with the following minimum coating weight:
 - a. Class 1: Not less than 1.2 oz./sq. ft. of uncoated wire surface.
- B. Selvage: Knuckled at both selvages.
- C. Privacy Slat Inserts: Provide decorative privacy slats with bottom lock feature. Basis of Design: Slat Source by Privacy Link in Gray color.

2.2 FENCE FRAMING

- A. Round Steel Pipe: Standard weight, Schedule 40, galvanized steel pipe complying with ASTM F 1083. Comply with ASTM F 1043, Material Design Group IA, external and internal coating Type A, consisting of not less than 1.8-oz./sq. ft. zinc; and the following strength and stiffness requirements:
 - 1. Line, End, Corner, Pull Posts and Top Rail: Per requirements for Light Industrial Fence.
- B. Post Brace Rails: Match top rail for coating and strength and stiffness requirements. Provide brace rail with truss rod assembly for each gate, end, and pull post. Provide two brace rails extending in opposing directions, each with truss rod assembly, for each corner post and for pull posts. Provide rail ends and clamps for attaching rails to posts.
- C. Top Rails: Fabricate top rail from lengths 21 feet or longer, with swaged-end or fabricated for expansion-type coupling, forming a continuous rail along top of chain-link fabric.
- D. Bottom Rails: Match top rail for coating and strength and stiffness requirements.

2.3 SWING GATES

- A. General: Comply with ASTM F 900 for the following swing-gate types:
 - 1. Single gate.
- B. Metal Pipe and Tubing: Galvanized steel. Comply with ASTM F 1083 and ASTM F 1043 for materials and protective coatings.
- C. Frames and Bracing: Fabricate members from round galvanized steel tubing with outside dimension and weight according to ASTM F 900 for the following gate fabric height:
 - 1. Gate Fabric Height: As Shown on Drawings.
- D. Frame Corner Construction: As follows:
 - 1. Welded or assembled with corner fittings.
- E. Gate Posts: Fabricate members from round galvanized steel pipe with outside dimension and weight according to ASTM F 900 for the following gate fabric heights and leaf widths:
 - 1. Gate Fabric Height by Leaf Width: 6 feet or less by 4 feet or less, or as otherwise noted on the drawings.
- F. Gate Drop Rod, Guide and Latch: Fabricate members from round galvanized steel pipe with outside dimension of 1 3/8" dia. and weight according to ASTM F 900 for the following connection to vertical gate frame with bolted drop rod guides in 1 5/8" pressed steel, spaced appropriate of rod height, with built-in gate latch that can be padlocked. Provide drop rod sleeve or center stop placed in the ground for the rod to drop into.
- G. Gate Fabric Height by Leaf Width: 6 feet or less by 4 feet or less, or as otherwise noted on the drawings.
- H. Hardware: Latches permitting operation from both sides of gate, hinges, and for each gate leaf more than 5 feet wide, keepers. Fabricate latches with integral eye openings for padlocking; padlock accessible from both sides of gate.

1. Insert requirements for padlocks and chains if not Owner furnished.

2.4 FITTINGS

- A. General: Provide fittings for a complete fence installation, including special fittings for corners. Comply with ASTM F 626.
- B. Post and Line Caps: Hot-dip galvanized pressed steel or hot-dip galvanized cast iron. Provide weathertight closure cap for each post.
 1. Provide line post caps with loop to receive top rail.
- C. Rail and Brace Ends: Hot-dip galvanized pressed steel or hot-dip galvanized cast iron. Provide rail ends or other means for attaching rails securely to each gate, corner, pull, and end post.
- D. Rail Fittings: Provide the following:
 1. Top Rail Sleeves: Hot-dip galvanized pressed steel or round steel tubing. Not less than 6 inches long.
 2. Rail Clamps: Hot-dip galvanized pressed steel. Provide line and corner boulevard clamps for connecting bottom rails in the fence line to line posts.
- E. Tension and Brace Bands: Hot-dip galvanized pressed steel.
- F. Tension Bars: Hot-dip galvanized steel, length not less than 2 inches shorter than full height of chain-link fabric. Provide one bar for each gate and end post, and two for each corner and pull post, unless fabric is integrally woven into post.
- G. Truss Rod Assemblies: Hot-dip galvanized steel rod and turnbuckle or other means of adjustment.
- H. Gate Drop Rod: Hot-dip galvanized steel rod and turnbuckle or other means of adjustment.
- I. Tie Wires, Clips, and Fasteners: Provide the following types according to ASTM F 626:
 1. Standard Round Wire Ties: For attaching chain-link fabric to posts, rails, and frames, complying with the following:
 - a. Hot-Dip Galvanized Steel: 0.148-inch-diameter wire; galvanized coating thickness matching coating thickness of chain-link fence fabric.

2.5 CAST-IN-PLACE CONCRETE

- A. General: Comply with ACI 301 for cast-in-place concrete.
- B. Materials: Portland cement complying with ASTM C 150, aggregates complying with ASTM C 33, and potable water for ready-mixed concrete complying with ASTM C 94.
 1. Concrete Mixes: Normal-weight concrete air entrained with not less than 3000-psi compressive strength (28 days), 3-inch slump, and 1-inch maximum size aggregate.
- C. Materials: Dry-packaged concrete mix complying with ASTM C 387 for normal-weight concrete mixed with potable water according to manufacturer's written instructions.

2.6 GROUT AND ANCHORING CEMENT

- A. Non-shrink, Nonmetallic Grout: Premixed, factory-packaged, non-staining, noncorrosive, non-gaseous grout complying with ASTM C 1107. Provide grout, recommended in writing by manufacturer, for exterior applications.
- B. Erosion-Resistant Anchoring Cement: Factory-packaged, non-shrink, non-staining, hydraulic-controlled expansion cement formulation for mixing with potable water at Project site to create pourable anchoring, patching, and grouting compound. Provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended in writing by manufacturer for exterior applications.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, and other conditions affecting performance.

1. Do not begin installation before final grading is completed, unless otherwise permitted by Architect.
 - B. Proceed with installation only after unsatisfactory conditions have been corrected.
- 3.2 PREPARATION
- A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.
- 3.3 INSTALLATION, GENERAL
- A. General: Install chain-link fencing to comply with ASTM F 567 and more stringent requirements specified.
 1. Install fencing on established boundary lines inside property line.
 - B. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed or compacted soil.
 - C. Post Setting: Hand-excavate holes for post foundations in firm, undisturbed or compacted soil. Set posts in concrete footing. Protect portion of posts aboveground from concrete splatter. Place concrete around posts and vibrate or tamp for consolidation. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during placement and finishing operations until concrete is sufficiently cured.
 1. Exposed Concrete Footings: Extend concrete 2 inches above grade, smooth, and shape to shed water.
 2. Posts Set into Concrete in Voids: Form or core drill holes not less than 5 inches deep and 3/4 inch larger than OD of post. Clean holes of loose material, insert posts, and fill annular space between post and concrete with non-shrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions, and finished sloped to drain water away from post.
- 3.4 CHAIN-LINK FENCE INSTALLATION
- A. Terminal Posts: Locate terminal end, corner, and gate posts per ASTM F 567 and terminal pull posts at changes in horizontal or vertical alignment of 15 degrees or more.
 - B. Line Posts: Space line posts uniformly at 10 feet o.c.
 - C. Post Bracing Assemblies: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Install braces at end and gate posts and at both sides of corner and pull posts. Locate horizontal braces at mid-height of fabric on fences with top rail and at two-thirds fabric height on fences without top rail. Install so posts are plumb when diagonal rod is under proper tension.
 - D. Top Rail: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Run rail continuously through line post caps, bending to radius for curved runs and terminating into rail end attached to posts or post caps fabricated to receive rail at terminal posts. Provide expansion couplings as recommended by fencing manufacturer.
 - E. Bottom Rails: Install, spanning between posts, using fittings and accessories.
 - F. Chain-Link Fabric: Apply fabric to outside of enclosing framework. Leave 1 inch between finish grade or surface and bottom selvage, unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released.
 - G. Tension or Stretcher Bars: Thread through fabric and secure to end, corner, pull, and gate posts with tension bands spaced not more than 15 inches o.c.
 - H. Tie Wires: Use wire of proper length to firmly secure fabric to line posts and rails. Attach wire at one end to chain-link fabric, wrap wire around post a minimum of 180 degrees, and attach other end to chain-link fabric per ASTM F 626. Bend ends of wire to minimize hazard to individuals and clothing.

1. Maximum Spacing: Tie fabric to line posts 12 inches o.c. and to braces 24 inches o.c.
- I. Fasteners: Install nuts for tension bands and carriage bolts on the side of the fence opposite the fabric side. [Peen ends of bolts or score threads to prevent removal of nuts.]

3.5 GATE INSTALLATION

- A. General: Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

3.6 ADJUSTING

- A. Gate: Adjust gate to operate smoothly, easily, and quietly, free from binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.
- B. Lubricate hardware and other moving parts.

END OF SECTION

SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes.
- B. Related Requirements:
 - 1. Section 31 20 00 "Earth Moving" for drainage fill under slabs-on-grade.
 - 2. Section 32 13 13 "Concrete Paving" for concrete pavement and walks.

1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.
- B. W/C Ratio: The ratio by weight of water to cementitious materials.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site. Include any contractors performing work in Section 03 35 43 "Polished Concrete".
 - 1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
 - a. Contractor's superintendent.
 - b. Independent testing agency responsible for concrete design mixtures.
 - c. Ready-mix concrete manufacturer.
 - d. Concrete Subcontractor.
 - e. Special concrete finish Subcontractor.
 - 2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, semirigid joint fillers, forms and form removal limitations, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, methods for achieving specified floor and slab flatness and levelness floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:
 - 1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
 - 2. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.

3. Laboratory Test Reports: For liquid floor treatments and curing and sealing compounds, indicating compliance with requirements for low-emitting materials.
- C. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
 1. Indicate amounts of mixing water to be withheld for later addition at Project site.
- D. Steel Reinforcement Shop Drawings: Placing Drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.
- E. Construction/Control/Isolation Joint Layout: Indicate proposed overall pour sequence and locations for all concrete work as well as any changes to the indicated construction, control, and isolation joints required to construct the structure.
 1. Location of all joints is subject to approval of the Architect/Engineer.
- F. Samples: For waterstops, vapor retarder.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer.
- B. Welding certificates.
- C. Material Certificates: For each of the following, signed by manufacturers:
 1. Cementitious materials.
 2. Admixtures.
 3. Form materials and form-release agents.
 4. Steel reinforcement and accessories.
 5. Waterstops.
 6. Curing compounds.
 7. Floor and slab treatments.
 8. Bonding Adhesives.
 9. Vapor retarders.
 10. Semirigid joint filler.
 11. Joint-filler strips.
 12. Repair materials.
- D. Material Test Reports: For the following, from a qualified testing agency:
 1. Aggregates: Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.
- E. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.
- F. Minutes of preinstallation conference.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

- B. **Manufacturer Qualifications:** A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
 - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
 - C. **Testing Agency Qualifications:** An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
 - 1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
 - 2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Grade I. Testing agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician, Grade II.
 - D. **Welding Qualifications:** Qualify procedures and personnel according to AWS D1.4/D 1.4M.
 - E. **Mockups:** See Section 03 35 43 "Polished Concrete" for required cast concrete slab-on-grade panels to demonstrate typical joints, surface finish, texture, tolerances, floor treatments, and standard of workmanship.
- 1.8 **PRECONSTRUCTION TESTING**
- A. **Preconstruction Testing Service:** Engage a qualified testing agency to perform preconstruction testing on concrete mixtures.
- 1.9 **DELIVERY, STORAGE, AND HANDLING**
- A. **Steel Reinforcement:** Deliver, store, and handle steel reinforcement to prevent bending and damage.
 - B. **Waterstops:** Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.
- 1.10 **FIELD CONDITIONS**
- A. **Cold-Weather Placement:** Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
 - 1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
 - 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 - 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
 - B. **Hot-Weather Placement:** Comply with ACI 301 and as follows:
 - 1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 - 2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

- A. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
 - 1. ACI 301.
 - 2. ACI 117.

2.2 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
 - 1. Plywood, metal, or other approved panel materials.
 - 2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
- B. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.
- C. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.
 - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- D. Form Ties: Factory-fabricated, removable or snap-off glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 - 1. Furnish units that leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
 - 2. Furnish ties that, when removed, leave holes no larger than 1 inch in diameter in concrete surface.
 - 3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.3 STEEL REINFORCEMENT

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- B. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.
- C. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.

2.4 REINFORCEMENT ACCESSORIES

- A. Expansion Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), plain-steel bars, cut true to length with ends square and free of burrs.
- B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
 - 1. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

2.5 CONCRETE MATERIALS

- A. Regional Materials: Concrete shall be manufactured within 500 miles of Project site from aggregates and cementitious materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.
- B. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.
- C. Cementitious Materials:
 - 1. Portland Cement: ASTM C 150/C 150M, Type I/II, gray.
 - 2. Fly Ash: ASTM C 618, Class F.
 - 3. Silica Fume: ASTM C 1240, amorphous silica.
- D. Normal-Weight Aggregates: ASTM C 33/C 33M, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source.
 - 1. Maximum Coarse-Aggregate Size: As indicated in the Drawings.
 - 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- E. Air-Entraining Admixture: ASTM C 260/C 260M.
- F. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
 - 1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 - 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
 - 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
 - 4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
 - 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
 - 6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.
- G. Water: ASTM C 94/C 94M and potable.

2.6 WATERSTOPS

- A. Flexible PVC Waterstops: CE CRD-C 572, with factory-installed metal eyelets, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Greenstreak.
 - b. Paul Murphy Plastics Company.
 - c. Vinylex Corp.
 - 2. Profile: Ribbed without center bulb.
 - 3. Dimensions: 6 inches by 3/8 inch thick; nontapered.
- B. Self-Expanding Rubber Strip Waterstops: Manufactured rectangular or trapezoidal strip, bentonite-free hydrophilic polymer-modified chloroprene rubber, for adhesive bonding to concrete, 3/8 by 3/4 inch.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Adeka Ultra Seal/OCM, Inc.; Adeka Ultra Seal.
 - b. Greenstreak; Hydrotite.

- c. Vinylex Corp.; Swellseal.

2.7 VAPOR RETARDERS

- A. Sheet Vapor Retarder: ASTM E 1745, Class A. Include manufacturer's recommended adhesive or pressure-sensitive tape.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Stego Industries, LLC. : Stego Wrap Vapor Barrier (15 mil)
 - b. Fortifiber Corporation; Moistop Ultra 15.
 - c. Raven Industries Inc.; Vapor Block 15

2.8 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- D. Water: Potable.
- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.

2.9 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.
- B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 according to ASTM D 2240.
- C. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
 - 1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
- D. Reglets: Fabricate reglets of not less than 0.022-inch-thick, galvanized-steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.
- E. Dovetail Anchor Slots: Hot-dip galvanized-steel sheet, not less than 0.034 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

2.10 REPAIR MATERIALS

- A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
 - 1. Cement Binder: ASTM C 150/C 150M, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 - 2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.

3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
 4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109/C 109M.
- B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.
1. Cement Binder: ASTM C 150/C 150M, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
 4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C 109/C 109M.

2.11 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
- B. Cementitious Materials: At contractor's option, may use fly ash in mix designs. Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
1. Fly Ash: 25 percent.
- C. Limit water-soluble, chloride-ion content in hardened concrete to 0.30 percent by weight of cement.
- D. Admixtures: Use admixtures according to manufacturer's written instructions.
1. Use water-reducing, high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
 2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
 3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs, concrete required to be watertight, and concrete with a w/c ratio below 0.50.

2.12 CONCRETE MIXTURES FOR BUILDING ELEMENTS

- A. Footings: Normal-weight concrete.
1. Minimum Compressive Strength: As indicated in the Drawings at 28 days.
 2. Maximum W/C Ratio: As indicated in the Drawings.
 3. Slump Limit: As indicated in the Drawings.
 4. Air Content: As indicated in the Drawings.
- B. Foundation Walls and Columns/Piers/Pilasters: Normal-weight concrete.
1. Minimum Compressive Strength: As indicated in the Drawings at 28 days.
 2. Maximum W/C Ratio: As indicated in the Drawings.
 3. Slump Limit: As indicated in the Drawings.
 4. Air Content: As indicated in the Drawings.

- C. Slabs-on-Grade: Normal-weight concrete.
 - 1. Minimum Compressive Strength: As indicated in the Drawings at 28 days.
 - 2. Maximum W/C Ratio: As indicated in the Drawings.
 - 3. Slump Limit: As indicated in the Drawings.
 - 4. Air Content: As indicated in the Drawings.
 - 5. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.

2.13 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.14 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.
 - 1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK INSTALLATION

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
 - 1. Class A, 1/8 inch for smooth-formed finished surfaces.
- D. Construct forms tight enough to prevent loss of concrete mortar.
- E. Construct forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
 - 1. Install keyways, reglets, recesses, and the like, for easy removal.
 - 2. Do not use rust-stained steel form-facing material.
- F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- H. Chamfer exterior corners and edges of permanently exposed concrete.
- I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

- K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEM INSTALLATION

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.
 - 2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
 - 3. Install dovetail anchor slots in concrete structures as indicated.

3.3 REMOVING AND REUSING FORMS

- A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations, and curing and protection operations need to be maintained.
 - 1. Leave formwork for beam soffits, joists, slabs, and other structural elements that support weight of concrete in place until concrete has achieved its 28-day design compressive strength.
 - 2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
- B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material are not acceptable for exposed surfaces. Apply new form-release agent.
- C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 VAPOR-RETARDER INSTALLATION

- A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.
 - 1. Lap joints 6 inches and seal with manufacturer's recommended tape.

3.5 STEEL REINFORCEMENT INSTALLATION

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
 - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.

- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
 - 1. Weld reinforcing bars according to AWS D1.4/D 1.4M, where indicated.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- E. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- F. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
 - 1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
 - 2. Form keyed joints where indicated. Embed keys at least 1-1/2 inches into concrete.
 - 3. Locate joints for slabs-on-deck as indicated.
 - 4. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
 - 5. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- G. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated within 7 hours of final floating. Construct contraction joint as indicated and as follows:
 - 1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
 - 2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
- H. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
 - 1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
 - 2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Section 07 92 00 "Joint Sealants," are indicated.
 - 3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

3.6 WATERSTOP INSTALLATION

- A. Flexible Waterstops: Install in construction joints and at other joints indicated to form a continuous diaphragm. Install in longest lengths practicable. Support and protect exposed waterstops during progress of the Work. Field fabricate joints in waterstops according to manufacturer's written instructions.
- B. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, adhesive bonding, mechanically fastening, and firmly pressing into place. Install in longest lengths practicable.

3.7 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections are completed.
- B. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
 - 1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- C. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
 - 1. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
 - 2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
 - 3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
- D. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
 - 1. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 - 2. Maintain reinforcement in position on chairs during concrete placement.
 - 3. Screed slab surfaces with a straightedge and strike off to correct elevations.
 - 4. Slope surfaces uniformly to drains where required.
 - 5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

3.8 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
 - 1. Apply to concrete surfaces not exposed to public view.
- B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
 - 1. Apply to concrete surfaces exposed to public view.
- C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.9 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.
 - 1. Apply float finish to surfaces to receive trowel finish.
- C. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
 - 1. Apply a trowel finish to all surfaces.
 - 2. Finish exposed slab on grade surfaces indicated to be “polished concrete” to the following tolerances, according to ASTM E 1155, for a randomly trafficked floor surface:
 - a. Specified overall values of flatness, F(F) 45; and of levelness, F(L) 35; with minimum local values of flatness, F(F) 30; and of levelness, F(L) 24.
 - 3. Finish non-exposed slab on grade surfaces to the following tolerances, according to ASTM E 1155, for a randomly trafficked floor surface:
 - a. Specified overall values of flatness, F(F) 25; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 17; and of levelness, F(L) 15.
 - 4. At exposed slabs on metal decks indicated to be “polished concrete”, finish and measure surface, so gap at any point between concrete surface and an unlevelled, freestanding, 10-ft.- long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/8 inch.
 - 5. At non-exposed slabs on metal decks, finish and measure surface, so gap at any point between concrete surface and an unlevelled, freestanding, 10-ft.- long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/4 inch.

3.10 MISCELLANEOUS CONCRETE ITEM INSTALLATION

- A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.
- B. Equipment Bases and Foundations:
 - 1. Coordinate sizes and locations of concrete bases with actual equipment provided.
 - 2. Construct concrete bases 4 inches high unless otherwise indicated, and extend base not less than 6 inches in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated or unless required for seismic anchor support.
 - 3. Minimum Compressive Strength: 4000 psi at 28 days.
 - 4. Install steel reinforcing to connect concrete base to concrete floor. Unless otherwise indicated, install at centers around the full perimeter of concrete base as indicated.
 - 5. Prior to pouring concrete, place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 6. Cast anchor-bolt insert into bases. Install anchor bolts to elevations required for proper attachment to supported equipment.

- C. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel finish concrete surfaces.

3.11 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for remainder of curing period.
- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
- E. Cure concrete slabs on grade and slabs on metal deck that are indicated to have a “polished finish” by the following method according to ACI 308.1:
 - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - a. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
- F. Cure other concrete not included in the category above according to ACI 308.1, by one or a combination of the following methods:
 - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
 - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
 - a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
 - b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
 - c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies does not interfere with bonding of floor covering used on Project.
 - 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall

within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

- a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound does not interfere with bonding of floor covering used on Project.

3.12 JOINT FILLING

- A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
 1. Defer joint filling until concrete has aged at least one month. Do not fill joints until construction traffic has permanently ceased.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.
- C. Install joint filler full depth in saw-cut joints as indicated.

3.13 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 sieve, using only enough water for handling
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete. Limit cut depth to 3/4 inch. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
 2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar matches surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
 3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
 1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
 2. After concrete has cured at least 14 days, correct high areas by grinding.
 3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.

4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
 5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
 6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
 7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
- E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.
- F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.14 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Inspections:
1. Steel reinforcement placement.
 2. Steel reinforcement welding.
 3. Headed bolts and studs.
 4. Verification of use of required design mixture.
 5. Concrete placement, including conveying and depositing.
 6. Curing procedures and maintenance of curing temperature.
 7. Verification of concrete strength before removal of shores and forms from beams and slabs.
- C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172/C 172M shall be performed according to the following requirements:
1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
 - a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
 3. Air Content: ASTM C 231/C 231M, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below or 80 deg F and above, and one test for each composite sample.
 5. Compression Test Specimens: ASTM C 31/C 31M.
 - a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
 - b. For elements requiring verification of strength before remove of shoring or supports, cast and field cure an additional two sets of two standard cylinder specimens for each composite sample.
 6. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
 - a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
 - b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
 7. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
 8. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
 9. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
 10. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
 11. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.
 12. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
 13. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.
- D. Measure floor and slab flatness and levelness according to ASTM E 1155 within 48 hours of finishing.

END OF SECTION 03 30 00

SECTION 05 40 00 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Load-bearing wall framing.
2. Exterior non-load-bearing wall framing.

B. Related Requirements:

1. Section 05 50 00 "Metal Fabrications" for miscellaneous steel shapes, masonry shelf angles, and connections used with cold-formed metal framing.
2. Section 09 21 16.23 "Gypsum Board Shaft Wall Assemblies" for interior non-load-bearing, metal-stud-framed, shaft-wall assemblies, with height limitations.
3. Section 09 22 16 "Non-Structural Metal Framing" for standard, interior non-load-bearing, metal-stud framing, with height limitations and ceiling-suspension assemblies.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.

B. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.

C. Shop Drawings:

1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

1.5 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

- B. Product Certificates: For each type of code-compliance certification for studs and tracks.

- C. Product Test Reports: For each listed product, for tests performed by manufacturer and witnessed by a qualified testing agency.

1. Steel sheet.
2. Expansion anchors.
3. Power-actuated anchors.
4. Mechanical fasteners.
5. Vertical deflection clips.
6. Horizontal drift deflection clips
7. Miscellaneous structural clips and accessories.

- D. Evaluation Reports: For nonstandard cold-formed steel framing post-installed anchors and power-actuated fasteners, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
- B. Product Tests: Mill certificates or data from a qualified independent testing agency indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.
- C. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Steel Stud Manufacturers Association.
- D. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - 2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. ClarkWestern Building Systems, Inc.
 - 2. Dietrich Metal Framing; a Worthington Industries company.
 - 3. SCAFCO Corporation.
 - 4. Steel Network, Inc. (The).
 - 5. Steeler, Inc.

2.2 PERFORMANCE REQUIREMENTS

- A. Cold-Formed Steel Framing Standards: Unless more stringent requirements are indicated, framing shall comply with AISI S100, AISI S200, and the following:
 - 1. Wall Studs: AISI S211.
 - 2. Headers: AISI S212.
 - 3. Lateral Design: AISI S213.
- B. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency acceptable to authorities having jurisdiction.

2.3 COLD-FORMED STEEL FRAMING MATERIALS

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- B. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating designation as follows:
 - 1. Grade: ST33H.
 - 2. Coating: G60, A60, AZ50, or GF30.

- C. Steel Sheet for Vertical Deflection, Drift Clips: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:
 - 1. Grade: 33 50, Class 1 as required by structural performance.
 - 2. Coating: G60.

2.4 LOAD-BEARING WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: As indicated.
 - 2. Flange Width: As indicated.
 - 3. Section Properties: As indicated.
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with straight flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: As indicated.
 - 2. Flange Width: 1-1/4 inches.
- C. Steel Box or Back-to-Back Headers: Manufacturer's standard C-shapes used to form header beams, of web depths indicated, unpunched, with stiffened flanges, and as indicated.

2.5 EXTERIOR NON-LOAD-BEARING WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: As indicated.
 - 2. Flange Width: As indicated.
 - 3. Section Properties: As indicated.
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: As indicated.
 - 2. Flange Width: 1-1/4 inches.
- C. Vertical Deflection Clips: Manufacturer's standard bypass or head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ClarkWestern Building Systems, Inc.
 - b. Dietrich Metal Framing; a Worthington Industries company.
 - c. SCAFCO Corporation.
 - d. Steel Network, Inc. (The).
 - e. Steeler, Inc.
- D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:
 - 1. Minimum Base-Metal Thickness: as indicated.

2. Flange Width: as indicated.
- E. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.
1. Outer Track: Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:
 - a. Minimum Base-Metal Thickness: as indicated.
 - b. Flange Width: as indicated
 2. Inner Track: Of web depth indicated, and as follows:
 - a. Minimum Base-Metal Thickness: as indicated
 - b. Flange Width: as indicated
- F. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure through positive mechanical attachment to stud web and structure.

2.6 FRAMING ACCESSORIES

- A. Fabricate steel-framing accessories from ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated steel sheet, of same grade and coating designation used for framing members.
- B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
1. Supplementary framing.
 2. Bracing, bridging, and solid blocking.
 3. Web stiffeners.
 4. Anchor clips.
 5. End clips.
 6. Foundation clips.
 7. Gusset plates.
 8. Stud kickers and knee braces.
 9. Joist hangers and end closures.
 10. Hole-reinforcing plates.
 11. Backer plates.

2.7 ANCHORS, CLIPS, AND FASTENERS

- A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.
- B. Power-Actuated Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- C. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.
1. Head Type: Low-profile head beneath sheathing; manufacturer's standard elsewhere.
- D. Welding Electrodes: Comply with AWS standards, use E60XX electrodes unless noted otherwise.

2.8 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: ASTM A 780/A 780M.

- B. Nonmetallic, Nonshrink Grout: Factory-packaged, nonmetallic, noncorrosive, nonstaining grout, complying with ASTM C 1107/C 1107M, and with a fluid consistency and 30-minute working time.
- C. Shims: Load-bearing, high-density, multimonomer, nonleaching plastic; or cold-formed steel of same grade and metallic coating as framing members supported by shims.
- D. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members as required.

2.9 FABRICATION

- A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.
 - 1. Fabricate framing assemblies using jigs or templates.
 - 2. Cut framing members by sawing or shearing; do not torch cut.
 - 3. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners and install according to Shop Drawings, with screws penetrating joined members by no fewer than three exposed screw threads.
 - 4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.
- B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies by means that prevent damage or permanent distortion.
- C. Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable variation of 1/8 inch in 10 feet and as follows:
 - 1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
 - 2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, conditions, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.
- B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that required to obtain fire-resistance ratings indicated. Protect remaining fire-resistive materials from damage.

- C. Install load-bearing shims or grout between the underside of load-bearing wall bottom track and the top of foundation wall or slab at locations with a gap larger than 1/4 inch to ensure a uniform bearing surface on supporting concrete or masonry construction.
- D. Install sealer gaskets at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

- A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.
- B. Install cold-formed steel framing according to AISI S200, AISI S202, and manufacturer's written instructions unless more stringent requirements are indicated.
- C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.
 - 1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.
- D. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.
 - 1. Cut framing members by sawing or shearing; do not torch cut.
 - 2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners, install according to Shop Drawings, and comply with requirements for spacing, edge distances, and screw penetration.
- E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.
- F. Install temporary bracing and supports to secure framing and support loads equal to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.
- G. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.
- H. Install insulation, specified in Section 07 21 00 "Thermal Insulation," in framing-assembly members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.
- I. Fasten hole-reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.

3.4 LOAD-BEARING WALL INSTALLATION

- A. Install continuous top and bottom tracks sized to match studs. Align tracks accurately and securely anchor at corners and ends, and at spacings as follows:
 - 1. Anchor Spacing: As indicated.

- B. Squarely seat studs against top and bottom tracks, with gap not exceeding 1/8 inch between the end of wall-framing member and the web of track. Fasten both flanges of studs to top and bottom tracks. Space studs as follows:
 - 1. Stud Spacing: As indicated on Drawings.
 - C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar configurations.
 - D. Align studs vertically where floor framing interrupts wall-framing continuity. Where studs cannot be aligned, continuously reinforce track to transfer loads.
 - E. Align floor and roof framing over studs according to AISI S200, Section C1. Where framing cannot be aligned, continuously reinforce track to transfer loads.
 - F. Anchor studs abutting structural columns or walls, including masonry walls, to supporting structure.
 - G. Install headers over wall openings wider than stud spacing. Locate headers above openings. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates.
 - 1. Frame wall openings with not less than a double stud at each jamb of frame. Fasten jamb members together to uniformly distribute loads.
 - 2. Install tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with clip angles or by welding, and space jack studs same as full-height wall studs.
 - H. Install supplementary framing, blocking, and bracing in stud framing indicated to support fixtures, equipment, services, casework, heavy trim, furnishings, and similar work requiring attachment to framing.
 - 1. If type of supplementary support is not indicated, comply with stud manufacturer's written recommendations and industry standards in each case, considering weight or load resulting from item supported.
 - I. Install horizontal bridging in stud system, spaced vertically 48 inches. Fasten at each stud intersection.
 - 1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs with a minimum of two screws into each flange of the clip angle for framing members up to 6 inches deep.
 - J. Install miscellaneous framing and connections, including supplementary framing, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.
- 3.5 EXTERIOR NON-LOAD-BEARING WALL INSTALLATION
- A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure.
 - B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Space studs as follows:
 - 1. Stud Spacing: As indicated on Drawings.
 - C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

- D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
 - 1. Install single deep-leg deflection tracks and anchor to building structure.
 - 2. Install double deep-leg deflection tracks and anchor outer track to building structure.
 - 3. Connect vertical deflection clips to bypassing studs and anchor to building structure.
 - 4. Connect drift clips to cold-formed steel framing and anchor to building structure.
- E. Install horizontal bridging in wall studs, spaced vertically in rows indicated but not more than 48 inches apart. Fasten at each stud intersection.
 - 1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
- F. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.
 - 1. Install solid blocking at 96-inch centers.
- G. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.6 ERECTION TOLERANCES

- A. Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
 - 1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.7 FIELD QUALITY CONTROL

- A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Field and shop welds will be subject to testing and inspecting.
- C. Testing agency will report test results promptly and in writing to Contractor and Architect.
- D. Cold-formed steel framing will be considered defective if it does not pass tests and inspections.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.8 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A 780/A 780M and manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 05 40 00

SECTION 055120 - MODULAR ALUMINUM RAMPS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Custom fabricated aluminum building entrance ramps.

1.02 RELATED SECTIONS

- A. Section 133423 - Modular Toilet Rooms Building.

1.03 REFERENCES

- A. ASTM B 209 - Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate.
- B. ASTM B 221 - Standard Specification for Aluminum and Aluminum Alloy Extruded Bars, Rods, Wire, Shapes and Tubes.
- C. ASTM B 429 - Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube; 2002.
- D. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum.
- E. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.
- F. ADA - ADA Standards for Accessibility Design.

1.04 DESIGN / PERFORMANCE REQUIREMENTS

- A. Design shall conform to ADA Standards for Accessibility Design and applicable local codes and standards.
- B. Design landings and ramps for a minimum uniform live load of 100 lbs/sf and a concentrated vertical load of 400 lbs distributed uniformly over an area of 1 sf.
 - 1. Handrails and Guardrails: Provide handrails and railings capable of withstanding the following structural loads without exceeding allowable design working stress of materials for handrails, railings, anchors and connections:
 - 2. Handrails and guardrails shall be designed and constructed to resist a single concentrated load of 200 lbs applied at any point and in any direction at the top of the handrail or guardrail.
- C. Handrails and guardrails shall be designed and constructed for a load of 50 lbs/lf applied horizontally at the required guardrail height and a simultaneous load of 100 lbs/lf applied vertically downward at the top of the guardrail.
- D. Corrosion Resistance: Separate incompatible materials to prevent galvanic corrosion.

1.05 SUBMITTALS

- A. Submit under provisions of Section 01 30 00 - Administrative Requirements.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
- C. Shop Drawings: Drawings showing plans, elevations, sections and details of components. Show member sizes and part identification, fasteners, anchor requirements, fittings and evidence of compliance with structural performance requirements.
- D. Design under direct supervision of Professional Engineer experienced in design of this Work and licensed at Project location.
- E. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

- F. Verification Samples: For each finish product specified, two samples, minimum size 6 inches square, representing actual product, color, and patterns.
 - G. Manufacturer's Certificates: Certify products meet or exceed specified requirements.
 - H. Closeout Submittals: Provide manufacturer's maintenance instructions that include recommendations for periodic checking and adjustment of all components.
- 1.06 QUALITY ASSURANCE
- A. Fabricator Qualifications: Shop that employs skilled workers who fabricates products similar to those required for this Project and whose products have a record of successful in-service performance.
 - B. Installer Qualifications: All products listed in this section shall be installed by a single installer with demonstrated experience in installing products of the same type and scope as specified.
- 1.07 DELIVERY, STORAGE, AND HANDLING
- A. Deliver materials to the job site in good condition and adequately protected against damage as handrails are a finished product.
 - B. Inspect ramp and rail sections for damage before signing the receipt from the trucking company. Truck driver must note damaged goods on the bill of lading if damaged product is found
 - C. Store products in manufacturer's unopened packaging until ready for installation.
- 1.08 SEQUENCING
- A. Ensure that locating templates and other information required for installation of products of this section are furnished to affected trades in time to prevent interruption of construction progress.
- 1.09 PROJECT CONDITIONS
- A. Field Measurements: Where ramps and railings are indicated to fit to other construction, check actual dimensions of other construction by accurate field measurements before fabrication.
- 1.10 WARRANTY
- A. Provide with manufacturer's three-year limited warranty on the modular ramp system against manufacturers defects.

PART 2 - PRODUCTS

- 2.01 MANUFACTURERS (must meet all product requirements in this specification)
- A. American Access, Inc., www.aaramps.com
 - B. EZ Access, Inc., www.ezaccess.com
 - C. National Ramp, www.nationalramp.com
 - D. AlumiRamp, Inc., www.alumiramp.com
 - E. Approved manufacturers per Section 016000 - Product Requirements.
- 2.02 MATERIALS
- A. Extruded aluminum Bars, Rods, Wire, Shapes and Tubes shall have a minimum ultimate tensile strength of 22,000 psi. Comply with ASTM B 221.
 - B. Sheet and Plate Aluminum: ASTM B 209.
 - C. Extruded Aluminum-Alloy Structural Pipe and Tube. Comply with ASTM B 429.
 - D. Mechanical Fasteners: Aluminum, stainless steel or other non-corrosive materials compatible with aluminum members, trim, hardware, anchors and other components of the modular system.
- 2.03 MODULAR RAMP SYSTEM
- A. Ramp Sections: Ramp sections are prefabricated aluminum shapes.

1. Dimensions as shown on Drawings.
- B. Walking surface shall be continuous, without gaps and aluminum deck with extruded slip resistant surface.
- C. Ramp sections have a wheelchair guard 3 inches plus or minus 1 inch from decking surface.
- D. Landings: Fabricated of aluminum shapes and deck.
 1. Prefabricated in sections. Larger sizes will be fabricated as required by local codes and for specific applications as indicated on the Drawings.
 2. Walking surface of the landing shall be continuous, without gaps, knurled or cross-hatched, aluminum deck with extruded slip resistant surface.
- E. Legs: Fabricated of aluminum shapes and plate.
 1. Lengths as required to fit site conditions.
 2. Provide with foot pads for grade conditions as needed.
 3. Design to be independent each side, perpendicular to the ground and allow for adjustment without additional foundation systems.
 4. Legs shall not protrude outside the footprint of the walking surface, eliminating tripping hazards.
- F. Handrail and Guardrail: Fabricated of aluminum tubing and fittings.
 1. Handrail shall have outside diameter of 1.5 inches.
 2. Handrail gripping surface shall be smooth and continuous throughout ramp sections, steps and landings.
 3. Guardrails shall form a protective barrier of a minimum of 42 inches high and designed such that a 4 inch sphere can not pass through any opening.
 4. Pickets, balusters will be minimum aluminum 3/4 inch by 3/4 inch, 4 inches o.c.
 5. Inside handrail to be attached to guardrail 34 inches to 38 inches above walking surface.
- G. Deck: Fabricated of aluminum shapes and deck.
 1. Walking surface of the ramp to be fabricated of extruded aluminum decking or grating that allows for snow to fall through with a slip resistant surface. Provide with closures as needed.

2.04 FINISHES

- A. Shop finish ramp components as follows"
 1. Preparation: Brush Off Blast SSPC-SP10.
 2. Remove all oil, grease, dirt, mill scale, corrosion products, oxides or other foreign from the surface by abrasive blasting, except for very light shadows, very slight streaks or slight discolorations caused by mill scale oxides.
 3. At least 95 percent of each square inch of surface area shall be free of all visible residues, and the remainder shall be limited to the light discolorations. Final blast profile should not exceed 0.7mils.
- B. Powder Coat:
 1. Electrostatically applied Thermosetting Powder Coating, Polyester Powder Coating, meeting performance requirements of AAMA 2603.
 2. Color to be selected from manufacturer's full range of colors.

2.05 FABRICATION

- A. Fit and shop assemble components in largest practical sizes for delivery to site.
- B. Fabricate components with joints tightly fitted and secured. Furnish spigots and sleeves to accommodate site assembly and installation.
- C. Exposed Mechanical Fastenings: Screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

- D. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, and flush. Ease exposed edges to small uniform radius.
- E. Accurately form components to suit stairs and landings, to each other and to building structure as applicable.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. Verify field conditions are acceptable and are ready to receive work
- C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install components plumb and level, accurately fitted, free from distortion or defects.
- C. Conceal bolts and screws whenever possible.
- D. All legs should land on a solid surface or a concrete paver. Minimum dimensions of paver must be equal to or greater than 2 inches H by 6 inches W by 9 inches.
- E. Anchor assembly using anchors provided as specified in Section 05 50 00 - Metal Fabrications.

3.04 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 06 1000 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Wood backing, grounds, nailers, and blocking.

1.3 DEFINITIONS

- A. Rough Carpentry: Carpentry work not specified in other Sections and not exposed, unless otherwise specified.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Keep materials under cover and dry. Protect from weather and contact with damp or wet surfaces. Stack lumber, plywood, and other panels. Provide for air circulation within and around stacks and under temporary coverings.

PART 2 - PRODUCTS

2.1 LUMBER, GENERAL

- A. Lumber Standards: Comply with DOC PS 20, "American Softwood Lumber Standard," and with applicable grading rules of inspection agencies certified by ALSC's Board of Review.
- B. Inspection Agencies: Inspection agencies, and the abbreviations used to reference them, include the following:
 - 1. WCLIB - West Coast Lumber Inspection Bureau.
 - 2. WWPA - Western Wood Products Association.
- C. Grade Stamps: Provide lumber with each piece factory marked with grade stamp of inspection agency evidencing compliance with grading rule requirements and identifying grading agency, grade, species, moisture content at time of surfacing, and mill.
 - 1. For exposed lumber, furnish pieces with grade stamps applied to ends or back of each piece, or omit grade stamps and provide grade-compliance certificates issued by inspection agency.
- D. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
 - 1. Provide dressed lumber, S4S, unless otherwise indicated.
 - 2. Provide dry lumber with 19 percent maximum moisture content at time of dressing for 2-inch nominal thickness or less, unless otherwise indicated.

2.2 DIMENSION LUMBER

- A. General: Provide dimension lumber of grades indicated according to the ALSC National Grading Rule (NGR) provisions of the inspection agency indicated.
- B. Non-structural Light Framing: Standard grade or better. No utility grade.

- C. Structural Light Framing: No. 2 or better.
- D. Lumber for Miscellaneous Use: Unless otherwise indicated, use standard grade lumber for support of other work, including bucks, nailer, blocking, furring, grounds, stripping, and similar members.

2.3 MISCELLANEOUS LUMBER

- A. General: Provide lumber for support or attachment of other construction, including rooftop equipment curbs and support bases, cant strips, bucks, nailers, blocking, furring, grounds, stripping, and similar members.
- B. Fabricate miscellaneous lumber from dimension lumber of sizes indicated and into shapes shown.
- C. Moisture Content: 19 percent maximum for lumber items not specified to receive wood preservative treatment.
- D. Grade: For dimension lumber sizes, provide No. 3 or Standard grade lumber per ALSC's NGRs of any species. For board-size lumber, provide No. 3 Common grade per NELMA, NLGA, or WWPA; No. 2 grade per SPIB; or Standard grade per NLGA, WCLIB or WWPA of any species.
- E. Plywood Backing Panels: For mounting electrical or telephone equipment, provide fire-retardant-treated plywood panels with grade, C-D Plugged Exposure 1, in thickness indicated or, if not otherwise indicated, not less than 15/32 inch thick.

2.6 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
 - 1. Nails, Wire, Brads, and Staples: FS FF-N-105.
 - 2. Power-Driven Fasteners: CABO NER-272.
 - 3. Wood Screws: ASME B18.6.1.
 - 4. Lag Bolts: ASME B18.2.1.
 - 5. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Discard units of material with defects that impair quality of rough carpentry and that are too small to use with minimum number of joints or optimum joint arrangement.
- B. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted.
- C. Fit rough carpentry to other construction; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds, and similar supports to allow attachment of other construction.
- D. Apply field treatment complying with AWWPA M4 to cut surfaces of preservative-treated lumber and plywood.
- E. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. CABO NER-272 for power-driven staples, P-nails, and allied fasteners.
 - 2. Published requirements of metal framing anchor manufacturer.

3. "Recommended Nailing Schedule" of referenced framing standard and with AFPA's "National Design Specifications for Wood Construction."
- F. Use common wire nails, unless otherwise indicated. Use finishing nails for finish work. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood; predrill as required.
- G. Use hot-dip galvanized or stainless-steel nails where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity.

3.2 WOOD GROUNDS, NAILERS, BLOCKING, AND BACKING

- A. Install wood grounds, nailers, blocking, and backing where shown and where required for screeding or attaching other work. Form to shapes shown and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated. Build into masonry during installation of masonry work. Where possible, anchor to formwork before concrete placement.
- C. Install permanent grounds of dressed, preservative-treated, key-beveled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

END OF SECTION

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section Includes:
 - 1. Sealants and joint backing.
- B. Related Requirements:
 - 1. Section 033000 "Poured in Place Concrete" for joints in paved slabs, walkways, and curbing requiring joint sealants.

1.03 ACTION SUBMITTALS

- A. Product Data: For each joint-sealant product.
- B. Sustainable Design Submittals:
 - 1. Product Data: For sealants, indicating VOC content.
 - 2. Laboratory Test Reports: For sealants, indicating compliance with requirements for low-emitting materials.
- C. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- D. Joint-Sealant Schedule: Include the following information:
 - 1. Joint-sealant application, joint location, and designation.
 - 2. Joint-sealant manufacturer and product name.
 - 3. Joint-sealant formulation.
 - 4. Joint-sealant color.

1.04 FIELD CONDITIONS

- 1. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

PART 2 - PRODUCTS

2.01 JOINT SEALANTS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- B. VOC Content: Sealants and sealant primers shall comply with the following:
 - 1. Architectural sealants shall have a VOC content of 250 g/L or less.
 - 2. Sealants and sealant primers for porous substrates shall have a VOC content of 775 g/L or less.

- C. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.02 SILICONE JOINT SEALANTS

- A. Silicone, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT, A, G, M, O; Color: Match adjacent finished surfaces. At Interior Wet Areas.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Pecora Corporation; AVB Silicone or a comparable product by one of the following:
 - a. Dow Corning Corporation.
 - b. GE Construction Sealants
 - c. Polymeric Systems, Inc.
 - d. Approved Substitution

2.03 URETHANE JOINT SEALANTS

- A. Urethane, S, P, 35, T, NT: Single-component, pourable, plus 35 percent and minus 35 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type S, Grade P, Class 35, Uses T and NT.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide BASF Corporation - Construction Systems; MasterSeal CR 195 or MasterSeal NP 1 or a comparable product by one of the following:
 - a. Bostik, Inc.
 - b. LymTal International Inc.
 - c. Approved Substitution.
- B. Urethane, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type S, Grade P, Class 25, Uses T and NT.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Pecora Corporation; Urexpam NR-201 or a comparable product by one of the following:
 - a. BASF Corporation; Construction Systems.
 - b. Polymeric Systems, Inc.
 - c. Schnee-Morehead, Inc.; An ITW Company.
 - d. Approved Substitution.

2.04 SILYL-TERMINATED POLYURETHANE (STPU) JOINT SEALANTS

- A. STPU, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, silyl-terminated polyurethane joint sealant; ASTM C 920, Type S, Grade P, Class 25, Uses T and NT.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Pecora Corporation; Dynatrol I-XLHybrid or a comparable product by one of the following:
 - a. Soudal USA.
 - b. SiroFlex.
 - c. Approved Substitution.

2.05 BUTYL JOINT SEALANTS

- A. Butyl-Rubber-Based Joint Sealants: Nondrying, nonhardening, non-skinning butyl sealant.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Pecora Corporation; BA-98 or a comparable product by one of the following:
 - a. Sika Corporation; Joint Sealants.
 - b. Dow Corning Corporation
 - c. Tremco Incorporated
 - d. Approved Substitution.

2.06 LATEX JOINT SEALANTS

- A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Pecora Corporation; AC-20 or a comparable product by one of the following:
 - a. Bostik, Inc.
 - b. Sonneborn
 - c. May national Associates, In.; a subsidiary of Sika Corporation.
 - d. Tremco Incorporated.
 - e. Approved Substitution.

2.07 MISCELLANEOUS MATERIALS

- A. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way and formulated to promote optimum adhesion of sealants to joint substrates.
- B. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
 - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.

2. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.
- B. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.03 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
1. Place sealants so they directly contact and fully wet joint substrates.
 2. Completely fill recesses in each joint configuration.
 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- C. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
1. Remove excess sealant from surfaces adjacent to joints.

3.04 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.05 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.06 JOINT-SEALANT SCHEDULE EXTERIOR

- A. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces JS-#1.
1. Joint Locations:
 - a. Isolation and contraction joints in cast-in-place concrete slabs.
 - b. Other joints as indicated on Drawings.
 2. Joint Sealant: Urethane, S, P, 25, T, NT or STPU, S, P, 25, T, NT.
- B. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces JS-2.

1. Joint Locations:
 - a. Joints at Cement board paneling.
 - b. Construction joints in cast-in-place concrete.
 - c. Joints between metal panels.
 - d. Joints between different materials listed above.
 - e. Perimeter joints between materials listed above and frames of doors, windows, and louvers.
 - f. Other joints as indicated on Drawings.
 2. Joint Sealant: Silicone, S, NS, 25, NT.
- C. Joint-Sealant Application: Interior joints in horizontal traffic surfaces JS-3.
1. Joint Locations:
 - a. Isolation joints in Interior cast-in-place concrete slabs.
 2. Joint Sealant: Urethane, S, P, 25, T, NT or STPU, S, P, 25, T, NT.
- D. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces not subject to significant movement JS-4.
1. Joint Locations:
 - a. Perimeter joints between interior wall surfaces and frames of interior doors.
 - b. Other joints as indicated on Drawings.
 2. Joint Sealant: Acrylic latex or siliconized acrylic latex.
- E. Joint-Sealant Application: Concealed mastics JS-6.
1. Joint Locations:
 - a. Aluminum thresholds.
 - b. Sill plates.
 - c. Terminations in vapor retarders and air barriers.
 - d. Other joints as indicated on Drawings.
 2. Joint Sealant: Butyl-rubber based or Silicone, S, NS, 25, NT
- F. Joint-Sealant Application: Silyl-Terminated Polyurethane (STPU) JS-7.
1. Joint Locations:
 - a. Joints at Cement Board Siding.
 - b. Joints between metal flashing and Cement Board Siding
 - c. Other joints as indicated on Drawings.
 2. Joint Sealant: STPU S, NS, 25, NT

END OF SECTION

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes:
 - 1. Incorporation of MSU door hardware requirements into the doors and hardware provided by Others
- B. Related Sections:
 - 1. Section 133113 – Air-Supported Fabric Structures.
 - 2. Section 133423 – Modular Toilet Rooms Building.

1.3 REFERENCE STANDARDS

- A. Provide hardware in accordance with the following standards in addition to those specified in Division 01 Section “References.”
 - 1. American National Standards Institute (ANSI), A117.1: Accessible and Usable Buildings and Facilities, edition as adopted by local Authority Having Jurisdiction (AHJ).
 - 2. Builders Hardware Manufacturer’s Association (BHMA)
 - a. ANSI/BHMA A156.18: Materials and Finishes, 2006 edition
 - 3. Door and Hardware Institute (DHI)
 - a. Recommended Locations for Architectural Hardware for Flush Wood Doors, 1993 edition
 - b. Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames, 2004 edition
 - c. Installation Guide for Doors and Hardware, 1994 edition
 - d. Keying Systems and Nomenclature, 2003 edition
 - e. Sequence and Format for the Hardware Schedule, 2001 edition

1.4 COORDINATION

- A. Coordinate installation with MSU and Air-Supported Fabric Structure installer.

1.5 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. General
 - 1. Provide submittals in accordance with Division 01 Section “Submittal Procedures.”
 - 2. Advise architect within the submittal package of incompatibility or issues which may detrimentally affect the work of this section.
 - 3. Submittals shall be prepared by or under the supervision of Architectural Hardware Consultant. Stamp submittals with the DHI certification seal and signature of the supervising Architectural Hardware Consultant.
 - a. Submittals submitted without the above certification seal shall be marked incomplete and returned.

4. Submittal sequence: Submit product data, hardware schedule, samples, and qualification data concurrently. Coordinate submission of finish hardware schedule with scheduling requirements of other work to facilitate the fabrication of other work that is critical in project construction schedule. Upon approval of first submittal package, submit wiring diagrams and key schedule.

C. Product Data

1. Submit manufacturer's technical product data for each item of finish hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
2. Highlight relevant product information such as model, function, trim, finish, options, electrical requirements, and accessories.

D. Certificates: Certify that products meet or exceed specified requirements.

1.6 FIELD CONDITIONS

- A. Do not install glazing when ambient temperature is less than 50 degrees F.
- B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

1.8 WARRANTY

- A. Warrant finish hardware against defects in material and workmanship as set forth in Division 01 Section "Warranties."
- B. Special warranties specified herein shall not deprive owner of other rights specified in the contract documents, but shall be in addition to, and run concurrent with, other warranty requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS (SEE HARDWARE SCHEDULE AT END OF SECTION)

PART 3 -

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify conditions of walls, flooring, doors, frames, and hardware are satisfactory for installation of hardware.
 1. Prior to installing doors and hardware, wash down of masonry and concrete and painting or staining of doors and frames shall be completed.
 2. Verify function, quantity, type, hand, and finish of hardware to be installed with the approved hardware schedule.
- B. Conditions that do not allow proper installation of hardware shall be corrected before proceeding.

3.2 INSTALLATION

- A. Install hardware to meet the requirements of the hardware manufacturers.

3.3 CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by door hardware installation.
- B. Clean operating items as necessary to restore proper function and finish.
- C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

3.4 HARDWARE SCHEDULE

- A. Hardware provided by Others that requires coordination with GC and MSU provided hardware:
 - 1. At Modular Toilet Rooms Building:
 - a. At Women's and Men's Restroom, and Janitors closet doors will come with Schlage ND Series deadbolts to receive MSU's Best cores and keys.
 - b. At Entry/Exit double doors will come with Von Duprin 99 Rim Devices and a removable center mullion.
 - 2. At Air-Supported Fabric Structures:
 - a. The airlock Entrance Doors from the manufacturer will come with a Von Duprin EL99 Rim Device. (one door each at the south and north domes)
- B. Hardware to be provided and installed by General Contractor:
 - 1. Cylinders: All interchangeable core cylinder, are to be Best cylinders, which will accept the 7 pin Best Core.
 - 2. Cores and Keying:
 - a. During construction, outside door lock should be installed with brass construction cores. Inside doors may be installed with brass or plastic disposable construction cores. A copy of the construction core operating and core key to be supplied to Owner. Permanent cores are to be Best Peaks 7 pin cores, with keyway and keying specified by the MSU Locksmith shop. Furnish 2 keys per core to be cut as specified by Owner. Permanent cores, keys and bitting list to be shipped to Owner and cores are to be installed by Owner.
 - 3. Access Control Items: At airlock Entrance Doors to the south and north domes to connect to the Von Duprin EL99 Rim Device:
 - a. Power supply for the locking device is to be the Von Duprin PS 914-2RS with 900-4R.
 - b. Power Transfer on new construction are the Von Duprin Electrical Power Transfer EPT-2.
 - c. Card reader: HID Global iClass SE/multiclass SE Reader
 - d. All locking devices are to have a keyed by-pass, using the core and keying as described, and fail secure type.
 - e. Access control doors are to be controlled by the MSU Cat Card Access Control System using the Trilogy DL3000 IC/26D.
 - f. NOTE: General Contractor is responsible to coordinate the work associated with providing and installing the access control components and to review all elements with MSU prior to ordering and installation.

END OF SECTION

SECTION 096240 – MODULAR ATHLETIC FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Modular athletic flooring system including interlocking suspended flooring modular tile, transition materials, underlayment and game court striping.
- B. Related Work specified under other sections:
 - 1. Asphalt subfloors finish to a tolerance of 1/8" in any 10' radius. High spots shall be ground level and low spots filled with approved leveling material.
 - 2. Volley Ball Net Pole Inserts, per Section 116623.

1.3 QUALITY ASSURANCE

- A. Perform work of this section in accordance with Performance Standard DIN 18032 Part II.
- B. Manufacturer of synthetic flooring system shall be ISO 9001:2008 Certified to assure proper quality control.
- C. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum ten years' experience.
- D. Products specified in this section shall be installed and supervised by an authorized factory trained representative.
- E. Installer Qualifications: Company factory authorized by manufacturer to perform the work of this section and installation of wood flooring system.

1.4 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data for flooring.
- C. Shop Drawings: Indicate floor layout, marking layout and installation in the space.
- D. Samples: Submit one sample 12 x 12 inch modular floor section illustrating textures, color, and thickness. Submit one sample 12 x 12 inches underlayment material.
- E. Installation Instructions: Indicate standard and special installation procedures.
- F. Maintenance Data: Include maintenance procedures.

1.5 FIELD CONDITIONS

- A. Do not install flooring until wet construction work is complete and ambient air at installation space has moisture content stabilized per the manufacturer's requirements.
- B. Building shall be enclosed and weather tight, with heat, light, and ventilation prior to installation.
- C. Store materials and maintain minimum room temperature required by manufacturer.

- D. Subfloor shall be determined dry and ready for installation per requirements of the flooring manufacturer.

1.6 WARRANTY

- A. Manufacturer's 16 year warranty on material defects and Flooring Installers 3 year warranty on installation defects.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Hardwood Flooring:
 - 1. Basis of Design Manufacturer and Product: SnapSports Inc.; Product: Revolution Suspended Modular Flooring System; Salt Lake City, Utah; www.snapsports.com.
 - 2. Substitutions: per Section 01 6000 - Product Requirements.

2.2 MATERIALS

- A. Flooring:
 - 1. 12" x 12" x 5/8", high impact polypropylene suspended floor tile with 64 impact zones per tile, 6 heavy duty square locks with integrated locating pin, two hanging lock connectors per lock and in-mold protective coated surface layer.
 - 2. Flooring tiles shall be laid in straight parallel pattern.
- B. Flooring to meet the following product test results:
 - 1. Flame Spread Index (ASTM E84): 90
 - 2. Smoke Generation (ASTM E84): 90
 - 3. Friction (ASTM C 1028); Dry – 0.77, Wet – 0.54
 - 4. Compression vs. Crush (ASTM D 3998): No Break
 - 5. Noise Reduction Coefficient (ASTM C 423): 5-10%
 - 6. Rolling Load (DIN 18032-2): Pass
 - 7. Force Reduction (ASTM F2772): Class 1
 - 8. Standard Deformation (DIN 18032-2): 0.9 mm
 - 9. Ball Rebound (DIN 18032-2): 98%
 - 10. Load Bearing Capacity (DIN 18032-2): > 250 psi
 - 11. R-Value: $x < 1.0$
 - 12. Flatness: 0.0" mm
 - 13. Lateral Movement: 0.00" – 0.025"
- C. Flooring to have the following sanitary results:
 - 1. Resistance to fungi (when tested in compliance with ASTM G-21): No Growth
 - 2. Resistance to the following:
 - a. Bacteria and mildew.
 - b. Gram-positive bacterial Staphylococcus Aureus
 - c. Gram-negative Klebsiella Pneumoniae
 - d. Pink-staining organism
 - e. STV Reticulum
 - 3. Tested and Certified by the NSF (National Sanitation Foundation).
- D. Floor System Size:

1. Floor system to measure 158' x 238' at Air-Supported Fabric Structure (north dome).
- E. Non-Slip, Shock Absorbing Underlayment System:
1. Non-directional pyramid pattern combined with a special polyvinylchloride , 0.125" thickness. Install in 6' foot wide rolls. Seams to be taped together per manufacturer's requirements.
 2. Install underlayment parrallel to the direction of play, and trim to within 3/4" to any wall or obstruction to prevent any potential buckling areas.
 3. Design Basis Product: Court Keeper Non-Slip Underlayment by SnapSports, Inc.
- F. Subsurface:
1. Subsurface will be a combination of existing tennis court surface on asphalt and new asphalt surfacing at new perimeter concrete foundation system, per the drawings.
- G. Game Lines and Marking:
1. Game lines and marking primer and paints shall be high solids polyurethane gloss with ultra deep base, as supplied by the manufacturer.
 2. Paint shall be compatible to the gymnasium floor finish.
 3. All lines and marking shall be 2" wide, per NCAA standards and per layout on the drawings (two main courts and four cross courts for basketball and six volleyball courts).
 4. Color of game lines and marking shall be one color for basketball courts and one color for volleyball courst and match color reference as provided by Owner.
- H. Transitional ramping edge at all ends of sports flooring system, color black.

2.3 ACCESSORIES

- A. Volleyball installation sleeves provided by others, to be installed into the flooring, as required by volleyball equipment manufacturer.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Inspect subbase surface for proper tolerances, dryness and level. Report any discrepancies in writing to General Contractor, Owner and Architect.
- B. Sub-base to be broom cleaned prior to installation of flooring system and underlayment.
- C. Installer shall document all working conditions prior to the commencement of installation.

3.2 INSTALLATION

- A. Discard units of material with defects that impair quality of the flooring system.
- B. Prep Sub-base to accommodate the flooring underlayment and flooring materials.
- C. Unroll underlayment and allow to relax in the space prior to installation. When unrolling underlayment, allow a 1/8 inch gap between rolls and secure the seams with manufacturer's recommended seam tap.
- D. Install modular flooring to conform to the approved shop drawing layout.
- E. Game Lines and Marking application:
1. Floor surface shall be clean and dustfree.
 2. Use only 3M 401+ tape for masking game lines, or tape approved by flooring manufacturer.
 3. Prime and paint lines per manufacturer's requirements.

4. Keep all trades off of installed flooring for a period of 72 hours to allow proper paint cure.

3.2 CLEANING

- A. Remove all waste materials from the area of work. Dispose of empty containers in accordance with federal and local statutes.
- B. Clean floor surfaces in accordance with manufacturer's instructions.
- C. Place protective coverings over finished floors; do not remove coverings until Substantial Completion.

END OF SECTION

SECTION 096466 - WOOD ATHLETIC FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wood modular flooring system, at South Dome.
- B. Storage Carts.
- C. Surface finishing and game markings.

1.02 RELATED REQUIREMENTS

- A. Section 033000 – Cast in Place Concrete.
- B. Section 116623 – Gymnasium Equipment.

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data for complete flooring system.
- C. Shop Drawings:
 - 1. Indicate floor layout, joint pattern and termination details.
 - 2. Indicate location, size, design, and color of game markings.
- D. Samples: Submit a sample illustrating floor finish, color, and sheen.
- E. Installation Instructions: Indicate standard and special installation procedures.
- F. Maintenance Data: Include maintenance procedures.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 6000 - Product Requirements, for additional provisions.
 - 2. Extra Owner Stock Flooring Material: 10 square yards matching installed flooring.

1.04 QUALITY ASSURANCE

- A. Perform work of this section in accordance with MFMA (SPEC) and Performance Standard DIN 18032 Part II.
- B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum ten years' experience. Manufacturer to provide installation supervisor to direct the offloading of the floor panels and installation of the flooring system. General Contractor to provide installation supervisor with forklift for offloading and installation supervision use.
- C. Installer Qualifications (provided by General Contractor): Company specializing in performing work of this section and installation of wood flooring system.

1.05 FIELD CONDITIONS

- A. Do not install wood flooring until wet construction work is complete and ambient air at installation space has moisture content stabilized per the manufacturer's requirements.
- B. Building shall be enclosed and weather tight, with heat, light, and ventilation prior to installation.
- C. Store materials and maintain minimum room temperature required by manufacturer.
- D. Subfloor shall be determined dry and ready for installation per requirements of the flooring manufacturer.

1.65 WARRANTY

- A. Manufacturer's 3 year warranty on material defects and Flooring Installers 3 year warranty on installation defects.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Hardwood Flooring:
 1. Basis of Design Manufacturer and Product: Connor Sports Flooring; Product QuickLock Portable Wood Athletic Flooring System; www.connorfloor.com.
 2. Substitutions: Not allowed.

2.02 MATERIALS

- A. Flooring:
 1. 25/32" x 2 1/4", 1st Grade, Northern Hard Maple Flooring, TGM, MFMA Grade marked and stamped as manufactured by Connor Hardwood Courts, Amasa, MI. Flooring shall be laid in straight parallel pattern.
- B. Floor System Size:
 1. Floor system to measure 128'-8" x 160' consisting of approx.. 640 full 4' x 8' panels.
- C. Subfloor:
 1. Subfloor shall be 7/16" oriented strand board on asphalt sub-base, flatness to be 1/8" in 10'.
- D. Sleepers: Double layer nominal 1/4" Fir, Pine or Spruce softwood sleepers.
- E. Resilient Pads:
 1. 3/4" x 1 3/4" x 7/16" Rezill R4 SmartPads attached 12" on center with PowerGuard heavy-duty pad encasements.
- F. Panel Connectors
 1. Panels shall provide continuous 1/4" steel tongues with panel attachment holes provided.
 2. Panels shall provide high-density polyethylene tapered grooves to mate with steel tongues of adjacent panels.
 3. Quicklock pins shall be included for insertion into panel attachment holes as provided in overlapping tongue locations. Inner panel connections shall not be visible after floor system assembly.
- G. Floor Sanding and Finishing:
 1. Flooring to be sanded with coarse, medium and fine paper to a smooth even and uniform surface.
 2. Sanding dust shall be removed for floor surface by tack and vacuum.
 3. Floor shall be inspected to insure surface is acceptable for finishing, free from sanding dust, perfectly clean.
 4. Two (2) coats of MFMA approved heavy-duty gymnasium seal applied.
 5. Two (2) coats of MFMA approved heavy-duty gymnasium finish applied.
 6. Floor to be buffed and cleaned in between each coat.
- H. Game Lines and Marking –
 1. Game lines and marking shall be applied between seal and finish coat of finish.
 2. Paint shall be compatible to the gymnasium floor finish.
 3. All lines and marking shall be NCAA standards and per layout on the drawings (one main court and cross court for basketball and volleyball main court)
 4. Color of game lines and marking shall match color reference as provided by Owner.
- I. Storage Carts:
 1. Provide storage carts measuring 4' x 8' to store the main playing court sections.

2.03 ACCESSORIES

- A. Transitional ramping edge at east and west ends of floor, color black.
- B. Volleyball installation sleeves provided by others, to be installed as required by volleyball equipment manufacturer.

2.04 SOURCE QUALITY CONTROL

- A. Inspect and stamp species and grade on underside of each piece of wood flooring at factory.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that asphalt subfloor surface is clean, smooth and flat to plus or minus 1/8 inch in 10 feet.
- C. Verify that required any floor-mounted utilities are in correct location.

3.02 INSTALLATION

- A. Assembly: Install the Portable Wood Athletic Flooring System per the manufacturer's Instructions and requirements.

3.04 CLEANING

- A. Clean and polish floor surfaces in accordance with manufacturer's instructions.
- B. Remove excess and waste materials from area and job site.

3.05 PROTECTION

- A. Prohibit traffic on floor finish for 48 hours after installation.
- B. Place protective coverings over finished floors; do not remove coverings until Substantial Completion.

END OF SECTION

SECTION 099000 - PAINTING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section includes surface preparation and the application of paint systems on exterior substrates.
 - 1. Fiber-cement or T1-11 siding.
 - 2. Factory Primed Steel.
 - 3. Factory Primed Aluminum.
- B. Painting specification is being provided to include miscellaneous touch up painting of items provided by others, such as the modular building, misc. exposed steel and alum elements. It is not intended for a large scope of painting work.

1.03 DEFINITIONS

- A. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- B. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
 - 1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
 - 2. Indicate VOC content.
- B. Samples for Verification: For each type of paint system and each color and gloss of topcoat.
 - 1. Submit Samples on rigid backing, 8 inches (200 mm) square.
 - 2. Apply coats on Samples in steps to show each coat required for system.
 - 3. Label each coat of each Sample.
 - 4. Label each Sample for location and application area.
- C. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.05 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Paint: 5 percent, but not less than 1 gal. (3.8 L) of each material and color applied.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).
 - 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Remove rags and waste from storage areas daily.

1.07 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).
- B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. Sherwin Williams Company.
 - 2. Benjamin Moore & Co.
 - 3. PPG Architectural Coatings, Inc.
- B. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include but are not limited to products listed in the Exterior Painting Schedule for the paint category indicated.

2.02 PAINT, GENERAL

- A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."
- B. Material Compatibility:
 - 1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 - 2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
- C. Colors: As indicated on the drawings.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - 1. Fiber-Cement Board: 12 percent.

- C. Proceed with coating application only after unsatisfactory conditions have been corrected.
 - 1. Application of coating indicates acceptance of surfaces and conditions.

3.02 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.
- B. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and re-prime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- C. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

3.03 APPLICATION

- A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."
 - 1. Use applicators and techniques suited for paint and substrate indicated.
 - 2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
 - 3. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
 - 4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 - 5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- C. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

3.04 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.05 EXTERIOR PAINTING SCHEDULE

A. Cement Board or T1-11 Siding Substrates:

1. Latex System MPI EXT 3.3A:
 - a. Prime Coat: Factory primed, confirm that factory system is compatible with EXT 3.3A.
 - b. Intermediate Coat: Latex, exterior, matching topcoat.
 - c. Topcoat: Latex, exterior, low sheen (MPI Gloss Level 3-4), MPI #15.
 - 1) Benjamin Moore Ben 100% Acrylic Exterior Low-Lustre Finish 542/K542
 - 2) Sherwin Williams A100 Exterior Latex Satin A82W00151

B. Steel Substrates:

1. Water-Based Light Industrial Coating System MPI EXT 5.1C:
 - a. Prime Coat: Factory primed, confirm that factory system is compatible with EXT 5.1C.
 - b. Intermediate Coat: Light industrial coating, exterior, water based, matching topcoat.
 - c. Topcoat: Light industrial coating, exterior, water based (MPI Gloss Level 3), MPI #161.
 - 1) Sherwin Williams Pro Industrial DTM Acrylic Eggshell B66W01251.

C. Aluminum Substrates:

1. Water-Based Light Industrial Coating System MPI EXT 5.4G:
 - a. Prime Coat: Factory primed, confirm that factory system is compatible with EXT 5.4G.
 - b. Intermediate Coat: Light industrial coating, exterior, water based, matching topcoat.
 - c. Topcoat: Light industrial coating, exterior, water based (MPI Gloss Level 3), MPI #161.
 - 1) Sherwin Williams Pro Industrial DTM Acrylic Eggshell B66W01251.

END OF SECTION

SECTION 101400 - SIGNAGE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Section Includes:
 - 1. Surface Adhered Vinyl signs that are directly attached to the Temporary Structures Doors.

1.02 SUBMITTALS

- A. Product Data: Submit product data for each type of sign specified, including details of construction relative to materials, dimensions, profiles, and finishes.
- B. Shop Drawings:
 - 1. Submit shop drawings covering fabrication, installation and finish of specified systems for the Surface Adhered Vinyl signs. Include following:
 - a. Fully dimensioned elevations.
 - b. Message list for each sign required.

1.03 QUALITY ASSURANCE

- A. Single-Source Responsibility: For each separate sign type required, obtain signs from one source of a single manufacturer.
- B. Fabricator and Installer Qualifications: Signage shop that employs skilled workers who can fabricate and install products similar to those required for this Project and show products have a record of successful in-service performance.

1.04 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
 - 1. Failures Include, but are not limited to the following:
 - a. Deterioration of finishes beyond normal weathering.
 - b. Deterioration of colors.
 - 2. Warranty Period: One year from date of Substantial Completion of Signage installation.

PART 2 - PRODUCTS

2.01 SURFACE ADHERED VINYL SIGNS

- A. Produce smooth, vinyl one-piece signs, rated for exterior use with UV protective coating.
- B. Signs shall be of one-piece construction; added-on and/or engraved characters and braille are unacceptable.
- C. Surface Adhered Vinyl: Fabricate with edges mechanically and smoothly finished to conform with following requirements:
 - 1. Shape: Square, sizes as noted in SIGN SCHEDULE
 - 2. Mounting: Integral Adhesive on back side

- D. Color: SEE SIGN SCHEDULE.
- E. Graphic Content and Style: Sign copy that complies with requirements indicated for size, style, spacing, content, position, material, finishes, and colors of letters, numbers, and other graphic devices.
 - 1. Type style: Franklin Gothic Book, Upper Case Letters only.
 - 2. Copy Text: Sign Drawings and Final text will be provided as part of shop drawing review.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General:

- 1. Install signs level, plumb, and at height indicated, with sign surfaces free from distortion or other defects in appearance.
- 2. Attach signs to door surfaces using vinyl adhesive recommended by manufacturer.
- 3. Do not begin installation until substrates have been properly prepared.
- 4. Install in accordance with manufacturer's instructions.
- 5. Install signs after surfaces to receive signage are finished.

3.02 CLEANING AND PROTECTION

- A. Clean surfaces thoroughly prior to installation.
- B. Verify that mounting locations and height for each sign with Architect.
- C. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- D. After installation, clean soiled sign surfaces according to manufacturer's instructions.
- E. Protect from damage until acceptance by Owner and not more than 48 hours prior to Date of Substantial Completion.

3.03 SIGNAGE SCHEDULE

- A. Exterior Entry Signs: "MSU TEMPORARY ATHLETIC BUILDING A" & "MSU TEMPORARY ATHLETIC BUILDING B" Signs 10" high x 14" wide, White Background with Royal Blue Letters, applied to exterior side of Temporary Structures Entrance Doors. (doors are anticipated to be stainless steel).
- B. Exterior and Interior "EXIT ONLY" Signs. 8" x 8" White Background with Red Letters. Applied to all both side of all Temporary Structures Exit Doors. (doors are anticipated to be stainless steel).

END OF SECTION

SECTION 104313 – DEFIBRILLATORS AND ACCESSORIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section Includes:

- 1. Automated External Defibrillators (AED)
- 2. Defibrillator cabinets, free-standing.

- B. Related Requirements:

- 1. Section 013300 - Submittal Procedures: For administrative and procedural requirements for processing of submittals during the construction phase.
- 2. Section 017700 - Closeout Procedures: For administrative and procedural requirements for completion of the Work.

1.03 REFERENCES

- A. Reference Standards:

- 1. American Heart Association (AHA):
 - a. American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care - current Edition.
- 2. ASTM International (ASTM):
 - a. ASTM E814-11a, Standard Test Method for Fire Tests of Penetration Firestop Systems.
- 3. International Code Council (ICC):
 - a. International Building Code (IBC) - 2012 Edition.
- 4. National Fire Protection Association (NFPA):
 - a. NFPA 70-2011, National Electrical Code.
- 5. Underwriters Laboratories, Inc. (UL)

1.04 ACTION SUBMITTALS

- A. Submit Product Data in accordance with Section 013300:

- 1. Cabinets: Materials description for defibrillator cabinets, details showing, door hardware, cabinet type and materials, trim style and door construction, door style and materials.
- 2. Installation instructions for each product specified.

1.05 QUALITY ASSURANCE

- A. Provide cabinets and accessories produced by a single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and protect defibrillator cabinets and related materials using means and methods that will prevent damage, deterioration, or loss.
 - 1. Deliver components in manufacturer's original packaging, properly labeled for identification.

PART 2 - PRODUCTS

2.01 AUTOMATED EXTERNAL DEFIBRILLATORS (AED)

- A. Manufacturers:
 - 1. Basis of Design: Physio-Control, Inc., 11811 Willows Rd. NE, Redmond, Washington.
- B. Product: LIFEPAK CR Plus Fully Automatic AED. Complies with 2010 Emergency Cardiovascular Care Guidelines from the American Heart Association.
- C. Size:
 - 1. Height: 10.7 cm (4.2inches)
 - 2. Width: 20.3 cm (8.0 inches)
 - 3. Depth: 24.1 cm (9.5 inches), excluding carrying handle
 - 4. Weight: 2.0 kg (4.5 lbs.) with CHARGE-PAK and electrodes.
- D. Features:
 - 1. Output Energy Sequence: 200-300-360 Joules
 - 2. Output Energy Accuracy: +/- 10% into 50 ohms, +/- 15% into 25 to 100 ohms.
 - 3. ECG analysis system and shock advisory based on DF39
 - 4. Capacity: typical 30 full discharges or 210 minutes of "on time" fully charged; minimum 20 full discharges or 140 minutes of "on time" fully charged.
 - 5. Controls: Lid release/ON-OFF controls device power.
 - 6. Electrical Protection: Input protected against high voltage defibrillator pulses per IEC60601-1/EN60601.1.
- E. User Interface
 - 1. Interface: Voice prompts, audible tones and graphic prompts
 - 2. Readiness display shows device status
 - 3. OK Indicator shows "OK" when last self-test completed successfully.

4. CHARGE-PAK Indicator displays when battery charger requires replacement. Includes Attention Indicator and Service Indicator.

F. Environmental Limits:

1. Operating Temperature: 0 to +50 degrees C (+32 to +122 degrees F)
2. Storage Temperature: -40 to +70 degrees C (-40 to +158 degrees F) with CHARGE-PAK and electrodes, maximum exposure time limited to one week.
3. Relative Humidity: 5 to 95 % (non-condensing)

G. Accessories:

1. CHARGE-PAK Battery Charger
2. Type: Li/SO₂Cl₂ Lithium Sulfuryl Chloride, 11.7V, 1.4-amp hours
3. Weight 80.5 grams (0.18 lbs.)
4. QUIK-PAK Electrode pads.
5. Infant/Child Reduced Energy Defibrillation Electrodes for use on infants and children less than 8 years of age or less than 55 lbs. (25 kg).

H. Intelitemp Heat Mat 19.7 x 11.8 (30 Watts)

- a. Thermostat with DC Chip, BAH-1000

I. Factory Warranty: 8 years.

2.02 DEFIBRILLATOR CABINET MANUFACTURERS

A. Manufacturers:

1. Basis of Design: J. L. Industries, Inc., a division of Activar Construction Products Group, 9702 Newton Av S. Bloomington, MN.

B. Substitutions: Comply with the Owner's Instructions to Bidders contained in the Project Manual.

2.03 FREE-STANDING AED CABINET

A. Galvannealed Steel Cabinet Tub and Door: 1483 Free-standing Series, Model 1483.

1. Cabinet Style: Mounted in free-standing frame.
2. Components: Tub and door constructed from galvannealed steel. Door includes continuous bulb gasket to protect against water intrusion.
 - a. Standard Color: White
3. Door Hardware: Keyed turn.
4. Door Glazing:
 - a. Type 10: Clear acrylic.
5. Cabinet Size: 17 inches by 15 inches by 7 inches deep.
6. Alarms: 85 db Commander (audible) cabinet-mounted alarm standard (battery operated) to protect against theft or tampering. Alarm deactivated when door is closed.

7. Wall Signs and Cabinet Lettering:

- a. AED wall signs: 14TS

PART 3 - EXECUTION

3.01 INSTALLATION

- A. General: Install one Defibrillator and freestanding cabinet in each temporary structure.

3.02 ADJUSTING AND CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as defibrillator cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.
- B. Adjust cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.
- C. On completion of installation, clean interior and exterior surfaces as recommended by manufacturer.
- D. Touch up marred finishes or replace cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by cabinet manufacturer.
- E. Replace items that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 104416 - FIRE EXTINGUISHERS AND ACCESSORIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section includes portable, hand-carried fire extinguishers, cabinets and mounting brackets for wall mounted fire extinguishers.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher.

1.04 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.05 COORDINATION

- A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets and brackets to ensure fit and function.

1.06 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Faulty operation of valves or release levers.
 - 2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

2.02 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Potter Roemer LLC.
 - b. Guardian Fire Equipment, Inc.
 - c. JL Industries, Inc.; a division of the Activar Group.
- B. Single Source all fire extinguishers, cabinets and brackets from single manufacturer.

2.03 FIRE EXTINGUISHERS

- A. Multipurpose Dry-Chemical Type in Aluminum Container: UL-rated 2-A:10-B:C, 5-lb nominal capacity, with monoammonium phosphate-based dry chemical in enameled-aluminum container.

2.04 MOUNTING BRACKETS

- A. Mounting Brackets: Manufacturer's standard galvanized steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or black baked-enamel finish.
- B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.
 - 1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.

2.05 FREESTANDING FIRE EXTINGUISHER CABINETS

- A. Fiberglass, free-standing fire extinguisher cabinet.
 - 1. Molded 1/8" thick fiberglass, color infused red (or yellow).
 - 2. Door with break glass opening (safety glass) and instructional decal.
 - 3. Free-standing with optional base blocks to secure to floor.
- B. Product Basis of Design: JL Industries, Inc, FB Series Model # 1363D12.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine fire extinguishers for proper charging and tagging.
 - 1. Remove and replace damaged, defective, or undercharged fire extinguishers.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. General: Install one fire extinguisher and freestanding cabinet in each temporary structure.

END OF SECTION

SECTION 116623 - GYMNASIUM EQUIPMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes the following gymnasium equipment:
 - 1. Portable Basketball backboards and goals.
 - 2. Volleyball systems with in-floor pole sockets.
 - 3. Portable Score Boards.
 - 4. Shot Clocks.
- B. Related Requirements:
 - 1. Section 096240 – Modular Athletic Flooring.
 - 2. Section 096466 - Wood Athletic Flooring.
 - 3. Gymnasium flooring: Layout and painting of court lines to be coordinated with installation volley ball floor sleeve inserts.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Large Components: Ensure that large components can be moved into final position without damage to other construction.
- B. Electrically Operated Equipment: Coordinate location and electrical characteristics of service connection.
- C. Coordinate placement of in-floor volleyball pole sockets.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's data showing configuration, sizes, materials, finishes, hardware, and accessories.
- C. Shop drawings showing equipment layout, dimensions and installation details.
- D. Operating and maintenance data, for each operating equipment item.
- E. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacture.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than seven years of experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified with minimum five years of experience.

- C. All components of each type of equipment assembly, including framing, electric winches, controls, and accessories shall be products of a single manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to project site in manufacturer's original packaging with factory original labels attached.
- B. Store products indoors and elevated above floor; prevent warping, twisting, or sagging.
- C. Store products in accordance with manufacturer's instructions; protect from extremes of weather, temperature, moisture, and other damage.

1.07 WARRANTY

- A. See Section 01 7000 - Closeout Submittals, for additional warranty requirements.
- B. Provide lifetime manufacturer warranty for all parts.

PART 2 PRODUCTS

2.01 GYMNASIUM EQUIPMENT - GENERAL REQUIREMENTS

- A. See drawings for locations.
- B. Where mounting dimensions or sizes are not indicated, comply with applicable requirements of the NCAA sports rules.
- C. Provide mounting plates, brackets, and anchors of sufficient size and strength to securely attach equipment to building structure; comply with requirements of contract documents.

2.02 BASKETBALL

- A. Portable Competition Basketball Backstop Unit:
 - 1. Rated for college level intramural and recreation sport use.
 - 2. Standards: FIBA approved level 3 with projection of 225 cm.
 - 3. Movable by one person.
 - 4. Spring Assisted Mechanism.
 - 5. Floor anchoring set with floor hook included.
 - 6. Auto-stability: with Automatic Pedestal Feet, a one-step set-up system.
 - 7. Portable: 4 swivel wheels in the front and 4 fixed wheels in the back
 - 8. Padding: Blue safety padding to front, sides and backboard
 - 9. Backboards: Tempered glass, 72" x 42" rectangular shaped.
 - a. Frame: Brushed aluminum edge, steel mounting.
 - b. Tempered Glass Thickness: 3/8 inches.
 - c. Markings: Painted.
 - d. Provide safety padding at lower edges of backboard.
 - e. Color: Owner selected from Manufacturer's standard.
 - 10. Goals: Steel rim, mounted to backboard, with attached nylon anti-whip net; complete with mounting hardware.
 - a. Pro-strength breakaway dunk-ring.
 - b. Rim flexible within 180 degrees.

- c. Provide safety pad for goal mounting.
 - e. Finish: Powder coat orange.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
- 1. Basis of Design Product: SAM225 Club; manufactured by Schelde Sports North America, Lansing MI; www.scheldesports.com
- C. Other acceptable products:
- 1. The G8 Portable Backstop, by Spaulding Sports Equipment, www.spauldingequipment.com
 - 2. The EZ-Sharpshooter 96 Portable Backstop by Draper Inc., www.draperinc.com
 - 3. The Hurricane Portable Basketball System, by First Team Inc., www.firstteaminc.com

2.03 VOLLEYBALL

- A. Indoor steel volleyball systems including covered in-floor sockets for poles.
- B. Poles:
- 1. Poles to be 3" OD steel, telescoping from 6' to 8' by internal bevel gear system.
 - 2. Heavy duty net ratchet with crank handle.
 - 3. Zinc plated upper section and painted enamel lower section.
 - 4. Pole bottom has a non-skid, non-marking rubber insert to protect the gym floor.
- C. Floor Sockets:
- 1. Floor sockets shall consist of an aluminum socket assembly and a hinged bronze floor plate assembly.
- D. Nets:
- 1. The net shall be one meter high, be constructed of black polypropylene 3.5mm knotless woven webbing, have a white Kevlar top rope and polypropylene bottom rope.
- E. Padding:
- 1. Tapered Indoor pole safety pad - shall conform to all NCAA rules.
 - 2. Padding material shall be minimum 1½" thick high-density foam with a heavy vinyl cover.
 - 3. Color: Navy Blue.
- F. Antennas: Antennas shall conform to all applicable rules, provide a pair for each court.
- G. Attaching adjustable Officials Stand with wheels, provide one per building.
- H. Volleyball Pole Storage Cart: hold 6 poles each, provide one per building.
- D. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
- 1. Basis of Design Product: 55lb DE11 Steel Indoor Volleyball System; manufactured by Sports Imports, Columbus OH; www.sportsimports.com
- E. Other acceptable manufacturers:
- 1. Porter Athletics www.porterathletic.com
 - 2. Draper Inc., www.draperinc.com

2.04 PORTABLE SCOREBOARD

- A. Portable Scoreboard: Multi-sport LED scoreboard displays time to 99:59, HOME and GUEST scores to 99 and PERIOD to nine.

1. Four wheeled cart with adjustable legs to raise and lower scoreboard.
 2. Controller: RC-200 wireless hand-held controller.
 3. Scoreboard: 34" high x 52" wide x 8" deep, Alcoa aluminum alloy 5052.
 4. Scoreboard with Cart Dimensions: 40" high x 55" wide x 30" deep.
 5. Weight: 150 lb uncrated.
 6. Power: 300 Watts, 2.5 Amps with 120 VAC power cord; 28 A/H with 2 rechargeable 12 VDC batteries.
 7. Digits: 8 inches high, red.
 8. Captions: HOME and GUEST to be 5 inches high. PERIOD caption is 4 inches high. White vinyl applied to scoreboard face.
 9. Product Safety Approvals: ETL-listed to UL 48, tested to CSA standards and CE labeled.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
1. Basis of Design Product: MS-2114; manufactured by Daktronics, Brookings, SD; www.daktronics.com
- C. Substitution of as-equal approved manufacturers per Section 016000 - Product Requirements.

2.05 SHOT CLOCK

- A. Shot Clock: Two-sided LED Basketball game clock and shot clock timer displays GAME Time to 99.59 and SHOT Times up to a value of 99 seconds.
1. Hand held start/stop/reset switch.
 2. Scoreboard: 28" high x 29" wide x 7" deep, 0.063" thick all-aluminum cabinet in navy blue.
 3. Weight: 45 lb uncrated.
 4. Power: 100 Watts, .9 Amps with 120 VAC power cord; 28 A/H with 2 rechargeable 12 VDC batteries.
 5. Digits: Game Clock Digits are 7" high, PanaView red. Shot Clock Digits are 13" high.
 6. Horn: Automatic internal horn when clocks counts to zero
 7. Product Safety Approvals: ETL-listed to UL 48, tested to CSA standards and CE labeled.
 8. Accessory Equipment: Carrying Handle.
- D. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
1. Basis of Design Product: BB-2109; manufactured by Daktronics, Brookings, SD; www.daktronics.com
- E. Substitution of as-equal approved manufacturers per Section 016000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Take field measurements to ensure proper fitting of work. If taking field measurements before fabrication will delay work, allow for adjustments within recommended tolerances.
- B. Inspect areas and conditions before installation. Notify Architect in writing of unsatisfactory or detrimental conditions. Do not proceed until conditions have been corrected. Commencing installation constitutes acceptance of work site conditions.
- C. Verify that electrical services are correctly located and of the proper characteristics.

3.02 INSTALLATION

- A. Install in accordance with contract documents and manufacturer's instructions.
- B. Install equipment rigid, straight, plumb, and level.
- C. Secure all equipment with manufacturer's recommended anchoring devices.
- D. Install padding securely, with edges tight to wall and without wrinkles in fabric covering.
- E. Separate dissimilar metals to prevent electrolytic corrosion.

3.03 ADJUSTING

- A. Verify proper placement of equipment.
- B. Verify proper placement of equipment anchors and sleeves. Use actual movable equipment to be anchored if available.
- C. Adjust operating equipment for proper operation; remove and replace equipment causing noise or vibration. Lubricate equipment if recommended by manufacturer.

3.04 CLEANING

- A. Remove masking or protective covering from finished surfaces.
- B. Clean equipment in accordance with manufacturer's recommendations.

3.05 PROTECTION

- A. Protect installed products until Substantial Completion.
- B. Replace damaged products before Substantial Completion.

3.06 EQUIPMENT SCHEDULE

- A. Portable Competition Basketball Backstop Units: (QTY: 16)
- B. Indoor Volleyball Systems:
 - 1. Steel Poles with tapered safety pads in navy blue: (QTY: 10)
 - 2. Nets in black netting and white edging: (QTY: 7)
 - 3. Heavy Duty Net Ratchet with crank handle in red: (QTY: 7)
 - 4. Attaching Adjustable Official Stand with wheels: (QTY: 1)
 - 5. Official Stand safety padding in navy blue: (QTY: 1)
 - 6. Pole storage carts to hold 6 poles: (QTY: 3)
- C. Portable Scoreboard: (QTY: 1)
- D. Shot Clocks: (QTY: 2)

END OF SECTION

SECTION 13 3113 – AIR-SUPPORTED FABRIC STRUCTURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SECTION INCLUDES

- A. Section includes custom design and manufacture of Air-Supported Fabric Structures

1.03 RELATED SECTIONS

- A. Section 033000 – Cast-In-Place Concrete – footing and foundation systems.
- B. Section 054000 – Cold-Form Metal Framing – support systems at connections.
- C. Section 87100 – Door Hardware – coordination of access controls hardware.
- D. Divisions 22, 23, 26, and 28 – Mechanical and Electrical coordination.

1.04 DESIGN / PERFORMANCE REQUIREMENTS

- A. Design of air-supported membrane structures shall comply with all applicable local codes.
- B. Design to comply with minimum criteria of Standard ASCE 17-96 for the design and operation of air-supported membrane structures.
- C. Design of air-supported membrane structures, shall pass NFPA 701 requirements for building materials.
- D. Mechanical and ventilation elements shall be installed as specified in the International Mechanical Code and the International Fuel Gas Code. Final design and installation of the Air-supported fabric structure shall be approved by the local fire code official.
- E. Manufacturer to provide complete design and detailed drawings, specifications and structural calculations for the air-supported fabric membranes, and be stamped by a structural engineer registered in the state of Montana.
- F. The Owner will be responsible for mechanical, electrical, civil and structural drawings for the foundation system. The temporary structures manufacturer/supplier to coordinate the design and drawings with the Owner's design team prior to final execution of the drawings and calculations.
- G. Manufacturer to provide final design, drawings and structural calculations submittal package to the Owner by May 6, 2019 at 9:00 a.m. local time.

1.05 SUBMITTALS

- A. Submit under provisions of Section 01 30 00 - Administrative Requirements.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
- C. Shop Drawings: Drawings showing plans, elevations, sections and details of components. Show member sizes and part identification, fasteners, anchor requirements, fittings and evidence of compliance with structural performance requirements.

- D. Design under direct supervision of Professional Engineer experienced in design of this Work and licensed at Project location.
- E. Manufacturer's Certificates: Certify products meet or exceed specified requirements.
- F. Closeout Submittals: Provide manufacturer's maintenance instructions that include recommendations for periodic checking and adjustment of all components

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in designing and manufacturing complete turn-key air-supported fabric structures as specified in this sections with a minimum of ten year's experience.
- B. Fabricator Qualifications: Shop that employs skilled workers who fabricates products similar to those required for this Project and whose products have a record of successful in-service performance.
- C. Installer Qualifications: All products listed in this section shall be installed by installers with demonstrated experience in installing products of the same type and scope as specified, with a minimum of five year's experience.
- D. Manufacturer's Installation Supervisor: Provide manufacturer's approved installation supervisor who shall be present at all times during execution of this portion of the work, thoroughly familiar with the type of materials of installation and who shall direct all work performed under this section.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Manufacturer will be responsible for and include all shipping and handling of the air-supported fabric structure materials to the job site in good condition and adequately protected against damage.
- B. Manufacturer to provide supervision of freight coordination, loading at factory and unloading upon delivery to the job site by the manufacturer's approved installation supervisor.
- C. Inspect materials for damage before signing the receipt from the trucking company. Truck driver must note damaged goods on the bill of lading if damaged product is found.
- D. Protection: Use all means necessary to protect air-supported fabric structure system materials before, during, and after installation and to protect the installed work and materials of all other trades.
- E. Store products in manufacturer's unopened packaging until ready for installation in weather protected space.

1.08 COORDINATION, SEQUENCING AND INSTALLATION

- A. Manufacturer to provide manufacturer's approved installation supervision for a complete turnkey installation of the fabric membrane, insulation, access and door components, lighting, mechanical equipment and all associated components for the complete air-supported fabric structure, including labor and equipment. Installation supervision to be coordinated with Owner's designated General Contractor.
- B. Ensure that locating templates and other information required for installation of products of this section are furnished to affected trades in time to prevent interruption of construction progress.
- C. Coordinate with Owner's designated General Contractor the schedule and sequencing of foundation systems, floor surface, shipping, delivery and installation of air-supported fabric structures.

1.09 PROJECT CONDITIONS

- A. Field Measurements: Where air-supported fabric structures are indicated to fit to other construction, check actual dimensions of other construction by accurate field measurements before fabrication.

1.10 WARRANTY

- A. Provide with manufacturer's five-year minimum fabrication warranty and a 20 year minimum exterior fabric membrane warranty.

PART 2 - PRODUCTS

2.01 MANUFACTURERS/SUPPLIERS

- A. Manufacturers/Suppliers: Subject to compliance with requirements, acceptable manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. Yeadon Fabric Domes, LLC., Minneapolis, MN; www.yeadondomes.com
 - 2. The Farley Group Manufacturing Inc., Puslinch, Ontario CA, www.thefarleygroup.com
- B. Substitution of as-equal approved manufacturers per Section 016000 - Product Requirements.

2.02 MATERIALS

- A. General: Manufacturer to design and provide and install air-supported fabric structures (domes) as shown on the drawings. North Dome is approximately 242 feet x 162 feet and the South Dome is 162 feet x 130 feet.
- B. Fabric Membrane: The air-supported fabric membrane (dome) to be constructed out of a fabric membrane.
 - 1. Premium outer membrane must be 28 oz. bright white vinyl coated opaque polyester fabric with a Tedlar outer coating.
 - 2. The liner fabric must be 15 oz per square yard, high gloss finish vinyl coated polyester fabric. The side of the liner fabric should be blue up to 10' in height, with the remainder being white.
- C. Insulation: The dome is to have hi-performance, reflective insulation, provided with an E-value of 0.003 and an average R-value of 10. The insulation must be 2 layers of polyethylene bubbles with low emissivity aluminum foil laminated on both sides and will be positioned between the inner and outer membranes. The insulation is required to meet or exceed ASTM E84 standard testing requirements.
- D. Flame Resistance: The dome fabric must be flame resistant tested and meet California fire marshal requirements, UL 214, NFPA 701, UBC (#42-1 & #55-5), and ULC S109 Standard for Flame Tests of Flame Resistant Fabrics and Films.
- E. Membrane Fabrication: All seams and edges to be dielectrically welded to form the dome's profile. The membrane must include rope edges to suit extruded profile anchoring system. The dome to be manufactured in the six sections, fastened using aluminum joining plates with Velcro fastened fabric covers to the outside.
- F. Structure Components: Structural elements design and provided by manufacturer:
 - 1. Anodized aluminum channel for grade beam in lineal footage required for size of dome. Channels for the grade beam will be provided to the Owner's designated contractor for installation.
 - 2. 7/8" diameter PVC restraining cables and cast in cable anchor plates in number required for size of dome.
 - 3. All turnbuckles, attachments and miscellaneous hardware required for a complete dome structure installation.
- G. Access and Doors: Manufacturer to provide the following openings at each dome structure:
 - 1. Revolving Door / Pedestrian Airlock: One 3 - leaf revolving door / pedestrian airlock combo.
 - a. Revolving door is 93" wide x 84" deep x 83" high.

- b. Pedestrian airlock is 86" wide x 84" deep x 83" high, with windows and is designed to meet ADA requirements and barrier-free design.
 - 2. Single-Width Emergency Exits: Supply 6 steel-framed aluminum balanced exit doors with cast-in bracing which will have a clear opening of 40". Each exit will be provided with combination emergency/exit light pack. (These units to be supplied to suit a 120-volt AC service by others).
 - 3. Vehicle Airlock: One (1) 30' long complete with two - 10' x 10' overhead doors and electric door operators with man doors. The vehicle airlock is provided with a fabric covering matching the outer fabric described above. (This unit will be supplied to suit a 120-volt AC service) Purchaser responsible for providing power and installation of the electric door operators.
 - 4. Manufacturer's associated and required hardware for all openings to properly function to be included (hinges, panic exit hardware, closers, thresholds, weather-stripping, construction cores and keys). Coordinate permanent cores and keys with General Contractor and Owner's locksmiths.
 - 5. Provide Owner required panic exit hardware at ADA Pedestrian Airlock Entrance Door (both domes) as follows:
 - a. Von Duprin EL99 rim device with keyed bypass, using the core and key provided by Owner's Locksmiths. Von Duprin PS 914-2RS power supply and Von Duprin EPT-2 power transfer. All locking devices are to be fail secure type.
 - b. Owner's designated General Contractor will coordinate installation of access controls to the main entrance doors to the north and south dome, including power, low voltage connections, etc.
 - c. Manufacturer to coordinate necessary product information with Owner to confirm proper hardware is installed at these doors and ready to receive access controls connections.
- H. Divider Curtains: Manufacturer to design and provide divider curtains / nets
- 1. Sizes and configurations as shown in the drawings between courts including cables, connections and controls.
 - 2. Colors: as selected by Owner from Manufactures standard selections.
- I. Extra Fabric Membrane: The North dome to have an approximate 15' wide x 18' long connector space from the Revolving Door / Pedestrian Airlock entry and the Owner's Restroom Modular building. Connector space to be constructed of steel stud frame work per the drawings and covered with extra outer fabric membrane to match dome. Manufacturer to provide required connections in the extra fabric membrane for attachment of the edges to the Dome and the Modular Building.
- J. Lighting: Manufacturer to design and provide lighting in the dome and door access vestibules/air-locks.
- 1. Athletic facility appropriate LED hanging lights, to provide fifty (50) foot candles at floor level and each with net protection, and appropriate support, wiring and electrical connections. Cord ends running from fixture location to closest perimeter base (extra three feet of wire provided at attachment point of grade beam and electrician is to provide and install the plug ends to match his receptacle). Fixtures to be UL and CE Listed.
 - 2. A fire alarm system will be added to the temporary structures as required by the local fire department by the Owner's designated fire protection subcontractor.
 - 3. Owner's designated General Contractor will be responsible for installation of electrical outlets at the dome perimeters as required for lights. Manufacturer to coordinate locations and types in shop drawing submittal.
- K. Mechanical: Manufacturer to design and provide the dome mechanical systems:

1. Mechanical equipment designed using an outside winter temperature range of -15 degrees F to 89 degree F, and must supply an air volume of 12,452 cfm minimum.
2. The heat and inflation system must be a bottom discharge configuration, indirect fired natural gas heat and inflation unit with 2.50 Mbtu output at North Dome & 1.25 Mbtu at South Dome.
3. Standby Inflation Unit & Generator: Provide the necessary connections and equipment for single fan stand-by unit and electric motor, 40 KW Diesel Generator with transfer switch and life safety.
4. Remote Control Panel with wind and snow sensor and with all necessary switching, indicator lights, auto/manual pressure controls, thermostats and pressure indicators.
5. Provide all necessary connections and equipment for 3 phase 480 voltage (connected to Owner's new transformer by General Contractor's electrical subcontractor).
6. Provide the necessary connections and equipment for potential 60 Ton unit air conditioner hook up (see Proposal Bid Add Alternate).
7. After utility hookups, a mechanical start-up must be provided by a factory trained and authorized team is required.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates and conditions, with General Contractor and Owner present, for compliance with requirements and conditions affecting performance of the Work.
- B. Do not begin installation until substrates and conditions have been properly prepared.
- C. Verify field conditions are acceptable and are ready to receive work

3.02 PREPARATION AND PROTECTION

- A. Comply with manufacturer's written instructions and recommendations for preparation of the conditions prior to installation.
- B. Clean surfaces thoroughly prior to installation.
- C. Protect materials and surfaces during installation from other trades and construction activities.

3.03 INSTALLATION

- A. Manufacturer to provide manufacturer's approved installation supervision for a complete turnkey installation of all components for the complete air-supported fabric structure, including labor and equipment.
- B. Installation supervision to be coordinated with Owner's designated General Contractor and electrical and mechanical connections with General Contractor's subcontractors.
- C. Install in accordance with manufacturer's instructions.
- D. Install components plumb and level, accurately fitted, free from distortion or defects, conceal bolts and screws whenever possible.

3.04 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, and other discarded materials from Project site.
- B. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage. Correct damage to work of other trades by cleaning, repairing, or replacing, as approved by Owner, and leave in an undamaged condition.

- D. At completion of construction activities of other trades, touch up and restore damaged or defaced surfaces.

3.05 CLOSEOUT PROCEDURES

- A. Final Walkthrough: The temporary structures manufacturer/supplier to provide an authorized technician on-site to conduct the final review of the installed temporary structure and components with the Owner, Owner's designate General Contractor and project design team.
- B. Startup / Commissioning: The temporary structures manufacturer/supplier to provide an authorized technician on-site to supervise the startup of the lighting equipment. The temporary structure's mechanical start-up must be provided by a factory trained and authorized team.
- C. Owner Training and Manual: The temporary structures manufacturer/supplier to provide Owner training on how to manage and operate the temporary structures, equipment and components, along with an Owner's manual identifying the operational procedures, tools, support contacts and warranty information.
- D. Final Closeout and Owner Turnover: The air-supported fabric structure manufacturer/supplier to complete the closeout and turnkey completion no later than August 15, 2019.

END OF SECTION

SECTION 133423 – MODULAR TOILET ROOMS BUILDING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SECTION INCLUDES

- A. Section includes custom design and manufacture of custom prefabricated Modular Toilet Rooms Building.

1.03 RELATED SECTIONS

- A. Section 033000 – Cast-In-Place Concrete – footing and foundation systems.
- B. Section 054000 – Cold-Form Metal Framing – support systems at connections.
- C. Section 079000 – Joint Sealants – seal joints after installation.
- D. Section 87100 – Door Hardware – coordination of access controls hardware.
- E. Divisions 22, 23, 26, and 28 – Mechanical and Electrical coordination.

1.04 REFERENCES

- A. American Society of Civil Engineers (ASCE): ASCE 7 - Minimum Design Loads for Buildings and Other Structures
- B. APA - The Engineered Wood Association:
- C. PRP-108 - Performance Standards and Policies for Structural-Use Panels.
- D. PFS PRP-133 - Performance Standards and Policies for Structural-Use Panels.
- E. National Fire Protection Association (NFPA): NFPA 70 - National Electric Code.
- F. Underwriters Laboratories Inc. (UL): UL 752 - Standard for Bullet Resisting Equipment.
- G. American National Standards Institute (ANSI): ICC/ANSI A117.1 - Accessible and Useable Buildings and Facilities.

1.05 DESIGN REQUIREMENTS

- A. Provide factory built, prefabricated modular structure capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated.
- B. Design Loads: Determine loads based on the following minimum requirements:
 - 1. Uniform pressure of 40 lbf/sq ft, acting inward or outward.
 - 2. Floor Load: Buildings; 50 lbf/sq ft.
 - 3. Wind Load: Buildings; 115 mph.
 - 4. Snow Load: Buildings; 40 lbf/sq ft.
- C. Codes: FBC, NFPA, NEC, FMC, FPC, IEEC (Compatible with International Building Code).
- D. Energy Code: Provide factory built, prefabricated structures that meet energy code requirements for the state the structure will reside in.
- E. Seismic Performance: Provide factory built, prefabricated structures and shelters capable of withstanding the effects of earthquake motions determined according to:
 - 1. ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 9, "Earthquake Loads".

- F. Thermal Movements: Provide factory built, prefabricated structures and shelters that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
- G. Electrical Devices: Devices UL listed with wiring bearing UL classification and conforming to the current NEC.

1.06 PERFORMANCE REQUIREMENTS

- A. Design of air-supported membrane structures shall comply with all applicable local codes. Cooperate with regulatory agency or authority and provide data as requested by authority having jurisdiction.
- B. Design to comply with minimum criteria of Standard ASCE 17-96 for the design and operation of air-supported membrane structures.
- C. Prefabricated structures and shelters specified herein shall be handicapped accessible in accordance with ICC/ANSI A117.1 and other state and local requirements as applicable. Design of Prefabricated Modular structures, shall pass NFPA 701 requirements for building materials.
- D. Mechanical and ventilation elements shall be installed as specified in the International Mechanical Code and the International Fuel Gas Code. Final design and installation of the prefabricated structure shall be approved by the local fire code official.
- E. Manufacturer to provide complete design and detailed drawings, specifications and structural calculations for the air-supported fabric membranes, and be stamped by a structural engineer registered in the state of Montana.
- F. The Owner will be responsible for mechanical, electrical, and civil work associated with connections of utilities to the Prefabricated Modular Building. The prefabricated structures manufacturer/supplier to coordinate the design and drawings with the Owner's design team prior to final execution of the drawings and calculations.
- G. Manufacturer to provide final design, drawings and structural calculations submittal package to the Owner by May 6, 2019 at 9:00 a.m. local time.

1.07 SUBMITTALS

- A. Submit under provisions of Section 01 30 00 - Administrative Requirements.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Construction details, material descriptions, dimensions of individual components and profiles, and finishes.
 - 2. Preparation instructions and recommendations.
 - 3. Storage and handling requirements and recommendations.
 - 4. Installation methods.
- C. Complete Engineered Shop Drawings: Drawings showing plans, elevations, sections, details and attachments to other work. Show member sizes and part identification, fasteners, anchor requirements, fittings and evidence of compliance with structural performance requirements.
- D. Selection Samples: For each finish product specified, one sets of color chips representing manufacturer's full range of available colors and patterns for selection by Owner and Architect.
- E. Design under direct supervision of Professional Engineer experienced in design of this Work and licensed at Project location.

- F. Manufacturer's Certificates: Certify products meet or exceed specified requirements.
- G. Closeout Submittals: Provide manufacturer's maintenance instructions that include recommendations for periodic checking and adjustment of building's systems; and warranty documentation.

1.08 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in designing and manufacturing prefabricated structures as specified in this section with a minimum documented experience of twenty years and with a quality assurance program utilizing an independent third party quality control firm with a 5-stage, 35 step, quality inspection for each system.
- B. Prefabricated Components: Comply with manufacturer's published literature for products meeting indicated design loads in accordance with state and local requirements as applicable.
- C. Pre-installation Meetings: Conduct meetings to verify project requirements, substrate conditions, utility connections, manufacturer's installation instructions, and warranty requirements. Comply with Division 1 requirements.
- D. Manufacturer's Installer Qualifications: All products listed in this section shall be installed by the manufacturer's installers with demonstrated experience in installing products of the same type and scope as specified, with a minimum of five year's experience.

1.09 DELIVERY, STORAGE, AND HANDLING

- A. Manufacturer will be responsible for and include all shipping and handling of the pre-fabricated modular structure to the job site in good condition and adequately protected against damage.
- B. Manufacturer to provide supervision of freight coordination, loading at factory and unloading upon delivery to the job site.
- C. Protection: Use all means necessary to protect pre-fabricated modular structure before, during, and after installation and to protect the installed work and materials of all other trades.
- D. Store products in manufacturer's unopened packaging until ready for installation.

1.10 COORDINATION, SEQUENCING AND INSTALLATION

- A. Manufacturer installation of pre-fabricated modular structure to be coordinated with Owner's designated General Contractor.
- B. Ensure that locating templates and other information required for installation of products of this section are furnished to affected trades in time to prevent interruption of construction progress.
- C. Coordinate with Owner's designated General Contractor the schedule and sequencing of foundation systems, utility connections, shipping, delivery and installation of pre-fabricated modular structure.

1.11 PROJECT CONDITIONS

- A. Field Measurements: Where pre-fabricated modular structure is indicated to fit to other construction, check actual dimensions of other construction by accurate field measurements before fabrication.

1.12 WARRANTY

- A. Provide with manufacturer's five-year minimum warranty on materials and workmanship.

PART 2 - PRODUCTS

2.01 MANUFACTURERS/SUPPLIERS

- A. Manufacturers/Suppliers: Subject to compliance with requirements, acceptable manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. US Modular Group; www.usmodulargroup.com
 - 2. Pacific Mobile Structures, www.pacificmobile.com
- B. Requests for substitution will be considered in accordance with provisions of Section 016000 - Product Requirements.

2.02 MATERIALS

- A. Dimensional Lumber: Provide grades indicated according to the ALSC National Grading Rule (NGR) provisions of the inspection agency indicated.
 - 1. Structural Light Framing: No. 2 or better.
 - 2. Non-structural Light Framing: Standard grade or better. No utility grade.
- B. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish specified, and as follows:
 - 1. Sheet: ASTM B 209.
 - 2. Extruded Shapes: ASTM B 221.
 - 3. Rolled Tread Plates: ASTM B 632/B 632M, Alloy 6061-T4.
 - 4. Rolled Tread Plates: ASTM B 632/B 632M, Alloy 6061-T6.
- C. Cold-Rolled Steel Sheet: ASTM A 1008/A, Commercial Steel (CS), Type B.
- D. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A, commercial quality, G60 (Z180) coating designation; mill phosphatized.
- E. Aluminum Treadplates: 1/8-inch aluminum plate conforming to ASTM B 209.
- F. Steel Mechanical Tubing: ASTM A 513, welded steel mechanical tubing.
- G. Expanded Polystyrene (EPS) Cores: Minimum of .95 pcf complying with ASTM C-578 Type 1.
- H. Oriented Strand Boards (OSB): Standard Grade; min. physical properties conforming to APA PRP-108.
- I. Clear Tempered Float Glass: ASTM C 1048, Kind FT, Condition A, Type I, Class 1, Quality q3.
- J. Anchorages: Anchor bolts, as specified in Section 03 30 00 - Cast-in-Place Concrete.

2.03 PREFABRICATED MODULAR TOILET ROOMS BUILDING

- A. General: Manufacturer to design, build, transport and install pre-fabricated Modular Toilet Rooms Building, 12' wide x 73' long and in the configuration of spaces of Entry, Janitor Closet, Women's and Men's Restrooms, as shown on the drawings.
- B. Chassis:
 - 1. Type: Outrigger
 - 2. Beam Size: 12" I Beam.
 - 3. Hitch: Detachable
 - 4. Bottom Board: 40 mil plastic
- C. Floor Construction:
 - 1. Joists: 2 x 10 @ 16" o.c.
 - 2. Decking: 3/4" T & G Plywood
 - 3. Insulation: R-38 Fiberglass Batt.
 - 4. Bottom Board: 40 mil plastic.

5. Floor Covering: 80 mil rollgoods, heat seamed Armstrong Connection Corlon.
 6. Floor base: 4" resilient cove base.
- D. Exterior Wall Construction:
1. Wall Studs: 2 x 6 @ 16" o.c.
 2. Interior Finish: FRP wall panels over 7/16" wall board.
 3. Insulation: R-21 Fiberglass Batt.
 4. Sheathing: Building wrap.
 5. Siding: 7/16" Smart Panel T1-11.
 6. Trims: 1 x 4 and 1 x 6 Protrim.
- E. Interior Wall Construction:
1. Wall Studs: 2 x 4 at 16" o.c.
 2. Wall Finish: FRP wall panels and trims, over 7/16" wall board.
 3. Insulation: 3" sound attenuation batt.
- F. Roof Construction:
1. Type: Shed Roof, slope to west side walls at 4" in 12".
 2. Joists: 2" x 12" roof joists at 24" o.c.
 3. Sheathing: 3/4" plywood roof sheathing
 4. Insulation: R-49 Fiberglass batt.
 5. Roofing: 3-tab asphalt shingles, Class A
 6. Interior Finish: 2 x 4 ceiling grid and acoustical tiles at 95" a.f.f.
 7. Roof Edge, Fascia & Flashing: Aluminum.
 8. Gutter and Downspout: at west edge of roof, Aluminum.
 9. Overhang & Eaves: 6" Protrim
 10. Venting: Per Code.
- G. Interior Doors:
1. Size: 3'-0" x 7'-0" x 1 3/4" single swing doors.
 2. Type: Solid Core wood oak doors, clear finish.
 3. Frame: 18 ga. hollow metal frames.
 4. Hardware: Manufacturer's standard hinges, closers, push and pull plates, and Best 93K series deadbolt, to receive Owner's specified interchangeable Best cylinder, Best Peaks 7 pin cores and keyway.
- H. Exterior Doors:
1. Size: 3'-0" x 7'-0" x 2" – double doors with removable center steel mullion.
 2. Type: Insulated 18 ga. H.M. Flush, with narrow vision light 6" x 18".
 3. Frame: 18 ga. hollow metal frames.
 4. Hardware: Manufacturer's standard hinges, thresholds, closers, weather-stripping, construction cores and keys.
 5. Provide Special Hardware required by Owner at West Double Doors:
 - a. Von Duprin EL99 rim device with keyed bypass, Von Duprin PS 914-2RS power supply and Von Duprin EPT-2 power transfer. All locking devices are to be fail secure type.
 - b. Removable steel center mullion.
 - c. Owner's specified interchangeable Best cylinder, Best Peaks 7 pin cores and keyway.
 6. Special Hardware at East Double Doors:
 - a. Von Duprin 99 rim device with keyed bypass.
 - b. Removable steel center mullion.
 - c. Owner's specified interchangeable Best cylinder, Best Peaks 7 pin cores and keyway.
 7. Owner's designated General Contractor will coordinate installation of access controls to the West (main entrance) double doors, including power, low voltage connections, etc.

8. Manufacturer to coordinate necessary product information with Owner to confirm proper hardware is installed at these doors and ready to receive access controls connections.

I. Electrical: Manufacturer to design and provide the electrical and lighting systems:

1. Coordinate electrical connection locations and types in shop drawing submittal.
2. Panel size: 150 amp 120/240 volt panel
3. Service: Exterior mounted.
4. Raceway: MC Cable
5. Interior Lights: LED Flat Panel 2x4 recessed troffer, UL and CE listed.
6. Exterior Lights: LED Wall Mounted Porch Light, UL and CE listed.
7. Exit Lights: Exit and Emergency Lights as required by code.
8. Receptacles: Standard and GFI duplex outlets are noted on plans.
9. Receptacle: Dedicated at Water Heater.
10. Communications rough-in to ceiling space for Owner's Data lines.
11. Communications: By Others.
12. Fire Alarm: By others.

J. HVAC: Manufacturer to design and provide the HVAC systems:

1. Coordinate mechanical connection locations and types in shop drawing submittal.
2. HVAC Unit Type: Bard, wall mounted
3. Size: 3 ton 10 KW
4. Supply and Return Ducts: 8" x 24" 50 LF Galvanized
5. Diffusers and Return Air Grills: 24" x 24"
6. Exhaust Fans: 200 CFM Broan or equal

K. Plumbing: Manufacturer to design and provide the plumbing systems:

1. Coordinate plumbing connection locations and types in shop drawing submittal.
2. Water Line: Pex
3. Service Size: 1 1/2"
4. Drain Waist Vent: ABS 4"
5. Waterclosets: Elongated, commercial grade with open toilet seats and manual flush valves
6. Lavatory: Wall Mounted with manual faucets
7. Floor Drains: Commercial grade, in toilet rooms.
8. Urinal: Wall mounted with manual flush valves
9. Janitor Mop Sink: Floor type with hose and mop holder

L. Toilet Room Accessories:

1. Toilet Rooms designed in compliance with ADA accessibility requirements.
2. Toilet stall partitions: Metal with baked enamel finish.
3. Toilet Paper Dispensers
4. Grab Bars per code.
5. Restroom signage at restroom door.
6. Mirrors

2.04 FABRICATION

- A. Fabricate factory built, prefabricated modular structures completely in factory.
- B. Preglaze windows and doors at factory.
- C. Prewire factory built, prefabricated structures and shelters at factory, ready for connection to service at Project site.
- D. Separate dissimilar materials using nonconductive tape, paint, or other material not visible in finished work.

- E. Fabricate factory built, prefabricated structures for crane unloading under base or welded in place concealed lifting lugs at roof that are suitable for placement of the structure on prepared foundations.

2.05 FINISHES

- A. Comply with National Association of Architectural Metal Manufacturers (NAAMM) "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine supporting foundations for compliance with manufacturer's requirements, including installation tolerances and other conditions affecting performance of supporting members.
- B. Examine conditions, with General Contractor and Owner present, for compliance with requirements and conditions affecting performance of the Work.
- C. Do not begin installation until substrates and conditions have been properly prepared.
- D. Verify the rough-in of required mechanical and electrical services prior to placement of the structure.
- E. Verify field conditions are acceptable and are ready to receive work

3.02 PREPARATION AND PROTECTION

- A. Comply with manufacturer's written instructions and recommendations for preparation of the conditions prior to installation.
- B. Commencement of installation constitutes acceptance of conditions.
- C. Clean surfaces thoroughly prior to installation.
- D. Protect materials and surfaces during installation from other trades and construction activities.

3.03 INSTALLATION

- A. Manufacturer to provide manufacturer's approved installation supervision for a complete turnkey installation of all components for the complete air-supported fabric structure, including labor and equipment.
- B. Installation supervision to be coordinated with Owner's designated General Contractor and electrical and mechanical connections with General Contractor's subcontractors.
- C. Install in accordance with manufacturer's instructions.
- D. Install components plumb and level, accurately fitted, free from distortion or defects, conceal bolts and screws whenever possible.
- E. Place on prepared concrete foundations and slabs provided as specified under Section 03 30 00 - Cast-in-Place Concrete.
- F. Anchor securely in place, allowing for required movement, including expansion and contraction.
- G. Connect mechanical and electrical services as specified under Divisions 22, 23, 26, and 28.

3.04 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, and other discarded materials from Project site.
- B. Do not scratch or damage adjacent finished surfaces.

- C. Protect work of other trades against damage. Correct damage to work of other trades by cleaning, repairing, or replacing, as approved by Owner, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced surfaces.

3.05 CLOSEOUT PROCEDURES

- A. Final Walkthrough: The prefabricated modular structures manufacturer/supplier to provide an authorized technician on-site to conduct the final review of the installed temporary structure and components with the Owner, Owner's designate General Contractor and project design team.
- B. Startup / Commissioning: The prefabricated modular structures manufacturer/supplier to provide an authorized technician on-site to supervise the startup of the lighting equipment. The temporary structure's mechanical start-up must be provided by a factory trained and authorized team.
- C. Owner Training and Manual: The prefabricated modular structures manufacturer/supplier to provide Owner training on how to manage and operate the temporary structures, equipment and components, along with an Owner's manual identifying the operational procedures, tools, support contacts and warranty information.
- D. Final Closeout and Owner Turnover: The prefabricated modular structure manufacturer/supplier to complete the closeout and turnkey completion no later than August 15, 2019.

END OF SECTION

SECTION 220000 – GENERAL REQUIREMENTS OF PLUMBING AND HVAC

PART 1 - GENERAL

1.1 SUMMARY

- A. The requirements listed in this section are supplemental to the Division 01 General Requirements.
- B. It shall be the responsibility of the Plumbing and Mechanical Contractor to examine and refer to all Architectural, Civil, Structural, Electrical, and Landscape and specifications for construction conditions which may affect the scope of Plumbing and HVAC work. Inspect the building site and existing facilities for verification of present conditions. Make proper provisions for these conditions in performance of the work and cost thereof.
- C. Plumbing and Mechanical work for this project shall include all items, articles, materials and the associated labor mentioned, schedules or shown in these specifications and in the accompanying drawings.
- D. Furnish and install all equipment, materials and any required incidental items required by good practice to complete the systems described herein.

1.2 CODES AND STANDARDS

- A. Work shall meet the requirements of the plans and specifications and shall not be less than the minimum requirements of applicable sections of the latest Codes and Standards of the following Organizations:
 - 1. American Gas Association (AGA)
 - 2. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
 - 3. American Society of Mechanical Engineers (ASME)
 - 4. Sheet Metal and Air Conditioning Contractors' National Association Inc. (SMACNA)
 - 5. American Water Works Association (AWWA)
 - 6. National Electrical Code (NEC)
 - 7. National Electrical Manufacturers Association (NEMA)
 - 8. National Fire Protection Association (NFPA)
 - 9. Uniform Plumbing Code (UPC)
 - 10. Occupational Safety & Health Act (OSHA)
 - 11. Plastic Pipe Institute (PPI)
 - 12. International Mechanical Code (IMC)
 - 13. International Building Code (IBC)
 - 14. International Energy Conservation Code (IECC)
 - 15. Requirements of the Serving Utility Company
 - 16. Local and State Codes and Ordinances

1.3 FEES AND PERMITS

- A. The Plumbing and Mechanical Contractors shall pay all fees and arrange all permits required for work done under their contract and under their supervision by subcontract.
- B. All usage contracts between the Owner and the serving utilities company, such as membership and usage charges or fees, etc., for the purpose of obtaining the services for the utility company shall be applied for and paid for by the Owner.

1.4 MATERIALS AND EQUIPMENT

- A. Manufacturer's trade names and catalog numbers listed are intended to indicate the quality of equipment or materials desired. Manufacturers not listed in the specification will be considered substitutions and must have prior approval.
- B. See Division 01 for Substitutions Procedures. Requests for substitution are to be submitted sufficiently ahead of the deadline, to give ample time for examination. Prior approval request for substitution must indicate the specific item or items to be furnished in lieu of those scheduled, together with complete technical and comparative data on scheduled items and items proposed for substitution.
- C. If the engineer approves any proposed substitution, the approved product will be listed in an addendum. Bidders shall not rely on approval made in any other manner.
- D. Mechanical equipment may be installed with manufacturer's standard finish and color except where specific color, finish or choice is indicated. If the manufacturer has no standard finish, equipment shall have a prime coat and two finish coats of gray enamel.
- E. High altitude operation: Capacity of all equipment is to be sized and manufactured to perform at the elevation of the project site. If not specifically indicated in the equipment schedule or in the specifications provide all required accessories and equipment for proper operation at elevation of the project site.
- F. This Contractor shall be responsible for materials and equipment installed under this contract. Contractor shall also be responsible for the protection of materials and equipment of others from damage as a result of his work.
- G. Manufactured material and equipment shall be applied, installed, connected, erected, used, cleaned and conditioned as directed by manufacturer unless herein specified to the contrary.
- H. This Contractor shall make the required arrangement with General Contractor or Construction Manager for the introduction into the building of equipment too large to pass through finished openings.
- I. Store materials and equipment indoors at the job site or, if this is not possible, store on raised platforms and protect from the weather by means of waterproof covers. Coverings shall permit circulation of air around the materials to prevent condensation of moisture. Screen or cap openings in equipment to prevent the entry of vermin.

1.5 INTENT OF DRAWINGS

- A. The drawings are diagrammatic and do not necessarily show exact location of piping and ductwork unless specifically dimensioned. Riser and other diagrams are schematic and do not necessarily show the physical arrangement of the equipment. They shall not be used for obtaining lineal runs of piping or ductwork, nor shall they be used for shop drawings for piping and ductwork fabrication or ordering. Discrepancies shown on different plans, or between plans and actual field conditions shall be brought to the attention of the Architect/Engineer for resolution.

1.6 RESPONSIBILITY

- A. Plumbing and HVAC work shall conform to requirements of all divisions 22 and 23 specifications.
- B. The Plumbing and Mechanical Contractors shall be responsible for the installation of a satisfactory and complete system in accordance with the intent of the drawing and specifications. Provide, at no extra cost, all incidental items, materials, accessories and labor required for completion of the work even though they are not specifically mentioned or indicated on the drawings or in the specifications.
- C. The drawings do not attempt to show complete details of the building construction which affect the mechanical and plumbing installation; and reference is therefore required to the Architectural, Civil, Structural, Landscape and Electrical drawings and specifications and to shop drawings of all trades for additional details which affect the installation of the work covered under this Division of the Contract.
- D. Location of mechanical and plumbing system components shall be checked for conflicts with openings, structural members and components of other systems having fixed locations. In the event of any conflicts, the Architect/Engineer shall be consulted and their decision shall govern. Necessary changes shall be made at the Contractor's expense.
- E. Determine, and be responsible for, the proper location and character of inserts for hangers, chases, sleeves, and other openings in the construction required for the work, and obtain this information well in advance of the construction progress so work will not be delayed.
- F. Final location of inserts, hangers, etc., required for each installation, must be coordinated with facilities required for other installations to prevent interference.
- G. Take extreme caution not to install work that connects to equipment until such time as complete Shop Drawings of such equipment have been approved by the Architect/Engineer. Any work installed by the Contractor, prior to approval of Shop Drawings, will be at the Contractor's risk.
- H. All modifications and changes required due to installation of equipment other than the scheduled equipment shall be made at the contractor's expense.
- I. It shall be the responsibility of the installing contractor to coordinate changes to work by other trades that result from the installation of equipment other than the scheduled equipment.
- J. If the provided equipment is heavier or larger than the scheduled or specified equipment, it shall be the responsibility of the installing contractor to coordinate the required structural changes and pay for any and all associated cost.

- K. If the provided equipment has different motor characteristics or electrical requirements than the scheduled or specified equipment, it shall be the responsibility of the installing contractor to coordinate the required changes and pay for any and all associated cost.
- L. If larger or additional electrical conduits, wire or breakers are required due to the installation of equipment other than the scheduled or specified equipment it shall be the responsibility of the installing contractor to coordinate the required changes and pay for any and all associated cost.
- M. If the provided equipment requires different fluid flow rates than the scheduled or specified equipment, it shall be the responsibility of the installing contractor to coordinate all required changes including but not limited to pumps, piping, valves, etc and pay for any and all associated cost.
- N. At all times during the performance of this Contract, properly protect work from damage and protect the Owner's property from injury or loss. Make good any damage, injury or loss, except such as may be directly due to errors in the Bidding Documents or caused by Agents or Employees of the Owner. Adequately protect adjacent property as provided by law and the Bidding Documents. Provide and maintain passageways, guard fences, lights and other facilities for protection required by Public Authority or Local conditions.
- O. The Contractor shall be responsible for damages due to the work of their contractors, to the building or its contents, people, etc.

1.7 REVIEW

- A. All work and material is subject to review at any time by the Architect/Engineer or his representative. If the Architect/Engineer or his representative finds material that does not conform to these specifications or that is not properly installed or finished, correct the deficiencies in a manner satisfactory to the Architect/Engineer at the Contractor's expense.

1.8 WORKMANSHIP

- A. Work under this contract shall be performed by workmen skilled in the particular trade, including work necessary to properly complete the installation in a workmanlike manner to present a neat and finished appearance.
- B. Obtain Architect's/Engineer's approval before performing any cutting on structural members or patching of building surfaces. Any damage to the building or equipment by the Mechanical or Plumbing Contractor shall be the responsibility of the Mechanical or Plumbing Contractor and shall be repaired by skilled craftsmen of the trades involved at the Contractor's expense.
- C. Chases, openings, sleeves, hangers, anchors, recesses, equipment pads, framing for equipment, provided by others only if so noted on the drawings. Otherwise, they will be provided by the Mechanical or Plumbing Contractor for their work.

1.9 COORDINATION

- A. This Mechanical and Plumbing Contractors shall plan their work to proceed with a minimum interference with other trades and it shall be their responsibility to inform the General Contractor of all openings required in the building structure for installation of work, and to provide sleeves as required. Dimensions of equipment installed and/or provided by others shall be checked in order that correct clearances and connections may be made.
- B. In general, pipelines requiring gravity drainage shall be installed first, followed by ductwork, large piping mains and electrical conduit. The location fire protection piping and heads shall be coordinated with other trades to ensure that installations by other trades do not block heads.
- C. Leave sufficient space for the installation of insulation on piping and ductwork as specified. It is not acceptable to compress pipe or duct insulation for any reason.

1.10 CLEANING

- A. Keep the job site clean. The Mechanical and Plumbing Contractors shall remove all waste a rubbish associated with their work.
- B. Upon completion of work, remove materials, scraps and debris relative to plumbing and mechanical work and leave all spaces including tunnels, crawlspaces, pipe or duct chases and ceiling plenums clean and orderly.
- C. The Mechanical and Plumbing contractors will be responsible for cleaning the exterior and interior of all equipment prior to star-up. Once all equipment has been cleaned it shall be inspected by the Architect/Engineer prior to start-up.
- D. The Mechanical and Plumbing Contractors shall provide dust protection of existing materials and equipment as well a new materials and equipment for the duration of the project. Protect existing materials and equipment from damage for the duration of the project. Clean the exterior and interior of all existing equipment at the completion of the project.

1.11 TEMPORARY FACILITIES

- A. Offices
 - 1. The Mechanical and Plumbing Contractor must have the permission of the Owner and General Contractor or Construction Manager to install a temporary office/job trailer on the project site.
 - 2. Contractor shall completely remove his temporary installations when no longer needed and the premises shall be completely clean, disinfected, patched, and refinished to match adjacent areas.
- B. Ladders and Scaffolds
 - 1. The Mechanical and Plumbing Contractors shall provide their own ladders, scaffolds, etc. of substantial construction for access to their work in various portions of the building as may be required. When no longer needed, they shall be removed by the Contractor.
- C. Protection Devices

1. The Mechanical and Plumbing Contractors shall provide and maintain his own necessary barricades, fences, signal lights, etc., required by all governing authorities or shown on the drawings. When no longer needed, they shall be removed by the Contractor.

D. TEMPORARY FIRE PROTECTION

1. The Mechanical and Plumbing Contractors shall provide all necessary first aid hand fire extinguishers for Class A, B, C and special hazards as may exist in his own work area only in accordance with good and safe practice and as required by jurisdictional safety authority.

1.12 SUBMITTALS

- A. Submittals will be required for each piece of equipment, material or product as noted in the table below. All submittal shall be submitted, reviewed and all discrepancies addressed prior to ordering equipment or starting work. Any equipment ordered without having first completed the submittal process is done at the risk of the contractor. Any work performed prior to completing the submittal process is done at the risk of the contractor.

Specification Section	Product Data	Performance Data	Shop Drawing	Delegated Design	Wiring Diagram	Color Chart	Sustainability Compliance	Notes
220500	X			X				Provide Delegated Design per the requirements of this section
220529	X			X				Provide Delegated Design per the requirements of this section
220553	X							
231123	X							
231124	X	X			X			

B. Submittal Definitions

1. **Product Data:** Provide manufacturers cut sheets that include general product information including but not limited to: Model Number, physical data, nominal capacities, rough-in requirements.
2. **Performance Data:** Provide detailed performance and capacities based on project specific requirements including but not limited to: flow rates, capacities, pressure loss, temperatures, fan curves, pump curves, part load performance, sound data, and electrical characteristics.
3. **Shop Drawings:** Provide detailed drawings of the equipment showing overall dimensions, location of electrical and piping connection, location of anchorage points, location of electrical and control panels, and all operating, service and maintenance clearances.

4. Delegated Design: Provide detailed drawings prepared and stamped by a registered Professional Engineer that detail pertinent design criteria, the materials and products to be installed and the required installation locations.
5. Wiring Diagram: Provide diagrams that identify and detail required field wiring.
6. Color Chart: Provide a physical color chart of material samples required for selection of equipment colors.
7. Sustainability Compliance: Provide literature that indicated a product's compliance with LEED or Green Globes. See Division 01 for additional information and requirements.

C. Submittal Formats:

1. Include the following information with each submittal:
 - a. Project Name
 - b. Submittal Date
 - c. Name of Architect
 - d. Name of Engineer
 - e. Name of General Contractor or Construction Manager
 - f. Name of Sub-Contractor
 - g. Name of firm or entity that prepared the submittal
 - h. Unique Submittal Number
 - i. Type of Submittal
 - j. Specification Section
 - k. Name or Mark of equipment or material and detail or drawings reference.
2. All Submittal with the exception of color charts or material samples shall be electronically transmitted PDFs.

D. Submittal Requirements

1. Submittals shall be submitted as a complete specification section. The submittal must include all materials and equipment for that specification section. Submittals for individual materials of equipment will be rejected without review.
2. Submittals shall be complete, clearly show item used, size, dimensions, capacity, rough in, etc., as required for complete check and installation. Manufacturer's literature showing more than one item shall be clearly marked as to which item is being furnished or it will be rejected and returned without review.
3. Each submittal shall be thoroughly checked by the Contractor for compliance with the Contract Document requirements, accuracy of dimensions, relationship to the work of other trades, and conformance with sound, safe practices as to erection and installation. Each submittal shall then bear a stamp evidencing such checking and shall show corrections made, if any. Submittals requiring extensive corrections shall be revised before submission. Each submittal not stamped and signed by the Contractor evidencing such checking will be rejected and returned without review.
4. On each submittal, clearly indicate deviations from requirements in the Contract Documents, including minor variations and limitations; include relevant additional

information and revisions, other than those requested on previous submittals. Indicate by highlighting on each submittal or noting on attached separate sheet.

5. Review of the shop drawings and literature by the engineer shall not relieve the contractor for responsibility for deviations for the drawings or specifications, nor shall it relieve the contractor from responsibility for errors in the shop drawings or literature. It is the responsibility of the contractor to provide materials and equipment which meet the specifications and job requirements.

1.13 OPERATION AND MAINTENANCE MANUALS

- A. Operation and Maintenance Manuals (O&M Manuals) shall contain:
 1. Names and contact information for the Project Architect, Project Engineer.
 2. Names and contact information for the General Contractor or Construction Manager.
 3. Names and contact information for sub-contractors.
 4. Installation, maintenance and operating instructions for each piece of equipment.
 5. Parts lists
 6. Wiring Diagrams
 7. Equipment Start-up and inspection certificates
 8. Test and Balance Reports
 9. Commissioning Reports
 10. Copies of Equipment Warranties
 11. Copies of Submittals
 12. Record Drawings.
- B. Prior to substantial completion submit an electronic copy of the O&M manual in PDF format to the Architect, Engineer and Owner for Review and approval. The PDF shall be one file with an index and hyperlinks to each section. Individual bound PDFs without automated navigation will be rejected. All O&M data shall be grouped by the equipment type and ordered by the specification numbering.
- C. Prior to final payment a final electronic copy of the O&M manual on an archival quality DVD as well as two printed copies shall be furnished to the owner. Printed copies shall have commercial quality 8-1/2" x 11" 3-ring binders with tabbed dividers for each section.

1.14 AS-BUILT RECORD DRAWINGS

- A. The Contractor shall furnish to the Owner and Architect/Engineer a marked print showing the location of all concealed or underground pipe or conduit runs and other equipment installed other than as shown on the drawings. Dimension underground lines from established building lines. Indicate all installed pull boxes in conduit runs.
- B. The Contractor shall furnish to the Architect/Engineer a marked print showing the location of all mechanical equipment, plumbing fixtures, piping, ductwork, diffusers, grilles, etc. The location of any item which deviates from the bid documents shall be accurately drawn and dimensioned.

- C. All underground piping and ductwork shall be dimensioned from nearest column and/or exterior walls. The location of all maintenance related items such as duct access doors, fire dampers, isolation valves, filters, etc., shall be highlighted on as built drawing.

1.15 PLACING SYSTEM INTO OPERATION

- A. Prior to starting of equipment the Mechanical of Plumbing Contractor shall thoroughly inspect the installation and any work completed by other trades and subcontractors to verify compliance with the contract documents.
- B. Start-up of all HVAC equipment shall be completed by factory trained representatives. At the completion of start-up, the factory representative shall submit to the architect and engineer, a start-up report that indicates any problems encountered, potential problems including installation issues, adjustments made or required to be made to ensure proper operation. Any installation deficiencies identified shall be corrected at no additional cost to the owner.

1.16 OWNER TRAINING

- A. General
 - 1. The system training is intended to familiarize the Owner's operating and maintenance staff with all systems requiring maintenance. Training is to be provided after the systems are in place and operational, after issues noted during commissioning have been resolved, and before final acceptance.
 - 2. Provide second set of training sessions for automatic control systems about 6-9 months after the first sessions.
- B. Systems Requiring Training
 - 1. All mechanical, electrical, safety, standby, and automatic control systems in the project, and other systems specified elsewhere to have training.
- C. Attendance:
 - 1. Training is to be provided by contractor's representatives that are familiar with the system's operation and maintenance requirements. Individual training sessions (modules) are to be provided for each type or group of systems, separated roughly by trade group that will be performing maintenance on the system. The trades groups and systems typically requiring training are:
 - a. HVAC & Refrigeration (Hydronic and or steam heating systems, refrigeration, chilled water, packaged cooling systems, fan systems, controls)
 - b. Plumbers (Domestic and Sanitary Plumbing, gas-fired heating, miscellaneous process piping systems)
- D. Schedule:
 - 1. Duplicate training sessions are to be provided for each training module, so that Owner's operating personnel can be split into two groups during training. Duplicate training sessions to be scheduled on different days. Length of training sessions will be determined by scope of training indicated below, and as coordinated with Owner after draft copy of training documents have been reviewed.
- E. Training Documentation:

1. Contractor to submit draft copy of agenda and training documents to Owner for review at least two weeks prior to training date.
2. Provide a copy of the following items for each person that will be attending the training sessions. Coordinate required number with the Owner.
 - a. Training agenda.
 - b. Summary of new systems and existing systems affected by this project.
 - c. Summary of work performed under this project.
 - d. Control system drawings and sequences of operation.
 - e. List of important maintenance and trouble-shooting operations for all systems.
3. Provide minimum of 2 copies of following items:
 - a. Contract documents including all drawings, specifications, addendums, and change orders.

F. Training Sessions:

1. Assemble at location to be determined by the Owner.
2. Distribute training documentation as indicated above.
3. Provide classroom style training if required for orientation, discussion of new systems and existing systems affected by this project, and other issues appropriate for a classroom format.
4. Visit site and review locations, and perform detailed review of operation and maintenance requirements for current systems.

1.17 WARRANTY

- A. The Contractor shall guarantee that all materials and labor installed are new and of first quality and that any material or labor found defective shall be replaced without cost to the Owner within one (1) year after substantial completion of the Contract or one (1) full season of heating and cooling operation, whichever is the greater. The guarantee shall list the date of the beginning of the one (1) year period, which shall be the date that the Substantial Completion Certificate is issued.
- B. Any damage to the building, caused by defective work or material of the Contractor within the above-mentioned period, shall be satisfactorily repaired without cost to the Owner.
- C. The guarantee does not include maintenance of equipment. The Owner shall accept full responsibility for proper operation and maintenance of equipment immediately upon substantial completion and occupancy of the building.
- D. Final acceptance by the Owner will not occur until all operating instructions are mounted in Equipment Rooms and Operating Personnel thoroughly indoctrinated in the operation of all mechanical equipment by the Contractor.
- E. No equipment installed as part of this project shall be used for temporary heat during construction.

END OF SECTION 220000

SECTION 220500 - GENERAL PROVISION OF PLUMBING AND HVAC

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes the following:
 - 1. Pipe Sleeves
 - 2. Sleeve Seals Systems for Piping
 - 3. Silicone Sealant
 - 4. Escutcheons for Piping
 - 5. Floor Plates

1.2 SUBMITTALS

- A. See Section 220000 "General Requirements of Plumbing and HVAC" for Submittal requirements.

1.3 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe and Pressure-Vessel Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

1.4 PERFORMANCE REQUIREMENTS

- A. Compatibility: Products shall be suitable for piping service fluids, materials, working pressures, and temperatures.
- B. Capability: Products to absorb 200 percent of maximum axial movement between anchors.

PART 2 - PRODUCTS

2.1 SLEEVES

- A. Galvanized-Steel Sheet Pipe Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

2.2 SLEEVE-SEAL SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Advance Products & Systems, Inc.
 - 2. CALPICO, Inc.
 - 3. GPT; an EnPro Industries company.
 - 4. Metraflex Company (The).

- B. Description:
 - 1. Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
 - 2. Designed to form a hydrostatic seal of 20-psig.
 - 3. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size.
 - 4. Pressure Plates: Composite plastic.
 - 5. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.3 SILICONE SEALANTS

- A. Silicone, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade P, Class 25, Uses T and NT. Grade P Pourable (self-leveling) formulation is for opening in floors and other horizontal surfaces that are not fire rated.

2.4 ESCUTCHEONS

- A. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.
- C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

2.5 FLOOR PLATES

- A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.

PART 3 - EXECUTION

3.1 SLEEVE INTALLATION

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.

- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
 - 2. Using silicone sealant, seal space outside of sleeves in slabs and walls without sleeve-seal system.
- D. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke-Barrier Penetrations: Maintain indicated fire or smoke rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping and fill materials specified in Section 078413 "Penetration Firestopping."

3.2 SLEEVE-SEALS SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls at piping entries into building.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal-system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.3 SLEEVE-SEAL SCHEDULE

- A. Use sleeve and sleeve-seals for the following piping-penetration applications:
 - 1. Exterior Concrete Walls Above Grade: Galvanized-Steel Sheet Pipe Sleeves with Sleeve-seal system
 - 2. Exterior Concrete Walls Below Grade: Galvanized-Steel Sheet Pipe Sleeves with Sleeve-seal system
 - 3. Interior or Exterior Concrete Slabs-on-Grade: Sleeve not required.
 - 4. Interior Concrete Slabs Above Grade: Galvanized-Steel Sheet Pipe Sleeves with Silicone Sealant or Fire calk
 - 5. Interior Partitions: Sleeve not require – fire calk penetrations of rated assemblies.

3.4 ESCUTCHEON INSTALLATION

- A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.
- B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

3.5 FLOOR PLATE INSTALLATION

- A. Install floor plates for piping penetrations of equipment-room floors.
- B. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

END OF SECTION 220500

SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING AND HVAC PIPING AND
EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Thermal-hanger shield inserts.
4. Fastener systems.
5. Pipe positioning systems.
6. Equipment supports.

1.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
1. Design supports for multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
 2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
 3. Design seismic-restraint hangers and supports for piping and equipment.

1.3 SUBMITTALS

- A. See Section 220000 "General Requirements of Plumbing and HVAC" for submittal requirements.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following; include Product Data for components:
1. Trapeze pipe hangers.
 2. Equipment supports.
- C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 QUALITY ASSURANCE

- A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pre-galvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Copper Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

2.2 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 THERMAL-HANGER SHIELD INSERTS

- A. Insulation-Insert Material for Cold Piping: ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.
- B. Insulation-Insert Material for Hot Piping: ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength.
- C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- E. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.4 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.5 PIPE POSITIONING SYSTEMS

- A. Description: IAPMO PS 42, positioning system of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

2.6 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.7 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
 - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
 - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.

2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- D. Fastener System Installation:
1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- E. Pipe Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.
- F. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- I. Install lateral bracing with pipe hangers and supports to prevent swaying.
- J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- K. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- M. Insulated Piping:
1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
 - b. NPS 4: 12 inches long and 0.06 inch thick.
 - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
 - d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
 - e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.
 3. Remove welding flux immediately.

4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.5 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports and metal trapeze pipe hangers and attachments for general service applications.
- F. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.
- G. Use padded hangers for piping that is subject to scratching.
- H. Use thermal-hanger shield inserts for insulated piping and tubing.
- I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of non-insulated or insulated, stationary pipes NPS 1/2 to NPS 30.
 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
 4. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of non-insulated, stationary pipes NPS 1/2 to NPS 8.
 5. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
 6. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.

7. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
 8. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
 9. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
- J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.
- K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
- L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
 6. C-Clamps (MSS Type 23): For structural shapes.
 7. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - a. Light (MSS Type 31): 750 lb.
 - b. Medium (MSS Type 32): 1500 lb.
 - c. Heavy (MSS Type 33): 3000 lb.
 8. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
 9. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
- M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.

2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- N. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
 2. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
 3. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
- O. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- P. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.
- Q. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION 220529

SECTION 220553 - IDENTIFICATION FOR PLUMBING AND HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Equipment labels.
 - 2. Warning signs and labels.
 - 3. Pipe labels.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

- A. Plastic Labels for Equipment:
 - 1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
 - 2. Letter Color: White
 - 3. Background Color: Black
 - 4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
 - 5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
 - 6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
 - 7. Fasteners: Stainless-steel rivets or self-tapping screws.
 - 8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

2.2 WARNING SIGNS AND LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
- B. Letter Color: White

- C. Background Color: Red
- D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- F. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
- G. Fasteners: Stainless-steel rivets or self-tapping screws.
- H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- I. Label Content: Include caution and warning information plus emergency notification instructions.

2.3 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- B. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- C. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.
 - 1. Flow-Direction Arrows: Integral with piping-system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
 - 2. Lettering Size: At least 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances.

PART 3 - EXECUTION

3.1 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

3.2 PIPE LABEL INSTALLATION

- A. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations and on both sides of through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

B. Pipe Label Color Schedule:

1. Natural Gas Piping:
 - a. Background: Yellow
 - b. Letters: Black:
2. Domestic Water Piping:
 - a. Background: Green
 - b. Letter Colors: White
3. Sanitary Waste and Storm Drainage Piping:
 - a. Background Color: Black
 - b. Letter Color: White

END OF SECTION 220553

SECTION 231123 - FACILITY NATURAL-GAS PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipes, tubes, and fittings.
2. Piping specialties.
3. Piping and tubing joining materials.
4. Manual gas shutoff valves.
5. Motorized gas valves.
6. Earthquake valves.
7. Pressure regulators.
8. Dielectric unions.
9. Labeling and Identifying

1.2 SUBMITTALS

- A. See Section 220000 "General Requirements of Plumbing and HVAC" for submittal requirements.

1.3 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

- A. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Minimum Operating-Pressure Ratings:

1. Piping and Valves: 100 psig minimum unless otherwise indicated.
2. Service Regulators: 100 psig minimum unless otherwise indicated.

B. Natural-Gas System Pressure within Buildings: 0.5 psig or less

2.2 PIPES, TUBES, AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.

1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.
3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
4. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and PE.

a. Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.

B. Corrugated, Stainless-Steel Tubing: Comply with ANSI/IAS LC 1.

1. Tubing: ASTM A 240/A 240M, corrugated, Series 300 stainless steel.
2. Coating: PE with flame retardant.

a. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

- 1) Flame-Spread Index: 25 or less.
- 2) Smoke-Developed Index: 50 or less.

3. Fittings: Copper-alloy mechanical fittings with ends made to fit and listed for use with corrugated stainless-steel tubing and capable of metal-to-metal seal without gaskets. Include brazing socket or threaded ends complying with ASME B1.20.1.
4. Striker Plates: Steel, designed to protect tubing from penetrations.
5. Manifolds: Malleable iron or steel with factory-applied protective coating. Threaded connections shall comply with ASME B1.20.1 for pipe inlet and corrugated tubing outlets.
6. Operating-Pressure Rating: 5 psig.

C. PE Pipe: ASTM D 2513, SDR 11.

1. PE Fittings: ASTM D 2683, socket-fusion type or ASTM D 3261, butt-fusion type with dimensions matching PE pipe.

2. PE Transition Fittings: Factory-fabricated fittings with PE pipe complying with ASTM D 2513, SDR 11; and steel pipe complying with ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
3. Anodeless Service-Line Risers: Factory fabricated and leak tested.
 - a. Underground Portion: PE pipe complying with ASTM D 2513, SDR 11 inlet.
 - b. Casing: Steel pipe complying with ASTM A 53/A 53M, Schedule 40, black steel, Type E or S, Grade B, with corrosion-protective coating covering.
 - c. Aboveground Portion: PE transition fitting.
 - d. Outlet shall be threaded or suitable for welded connection.
 - e. Tracer wire connection.
 - f. Ultraviolet shield.
 - g. Stake supports with factory finish to match steel pipe casing or carrier pipe.
4. Transition Service-Line Risers: Factory fabricated and leak tested.
 - a. Underground Portion: PE pipe complying with ASTM D 2513, SDR 11 inlet connected to steel pipe complying with ASTM A 53/A 53M, Schedule 40, Type E or S, Grade B, with corrosion-protective coating for aboveground outlet.
 - b. Outlet shall be threaded or suitable for welded connection.
 - c. Bridging sleeve over mechanical coupling.
 - d. Factory-connected anode.
 - e. Tracer wire connection.
 - f. Ultraviolet shield.
 - g. Stake supports with factory finish to match steel pipe casing or carrier pipe.

2.3 PIPING SPECIALTIES

A. Flexible Piping Joints:

1. Approved for Natural Gas service.
2. Stainless-steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket.
3. Minimum working pressure of 250 psig and 250 deg F operating temperature.
4. Threaded-end connections to match equipment connected and shall be capable of minimum 3/4-inch misalignment.
5. Maximum 12-inch length for natural gas lines.

B. Appliance Flexible Connectors:

1. Indoor, Fixed-Appliance Flexible Connectors: Comply with ANSI Z21.24.
2. Indoor, Movable-Appliance Flexible Connectors: Comply with ANSI Z21.69.
3. Outdoor, Appliance Flexible Connectors: Comply with ANSI Z21.75.
4. Corrugated stainless-steel tubing with polymer coating.
5. Operating-Pressure Rating: 0.5 psig.
6. End Fittings: Zinc-coated steel.
7. Threaded Ends: Comply with ASME B1.20.1.
8. Maximum Length: 72 inches

C. Quick-Disconnect Devices: Comply with ANSI Z21.41.

1. Copper-alloy convenience outlet and matching plug connector.
2. Nitrile seals.
3. Hand operated with automatic shutoff when disconnected.
4. For indoor or outdoor applications.
5. Adjustable, retractable restraining cable.

D. Y-Pattern Strainers:

1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller.
3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig.

E. Weatherproof Vent Cap: Cast- or malleable-iron increaser fitting with corrosion-resistant wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.

2.4 JOINING MATERIALS

- A. Joint Compound and Tape: Suitable for natural gas.
- B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- C. Brazing Filler Metals: Alloy with melting point greater than 1000 deg F complying with AWS A5.8/A5.8M. Brazing alloys containing more than 0.05 percent phosphorus are prohibited.

2.5 MANUAL GAS SHUTOFF VALVES

- A. General Requirements for Metallic Valves, NPS 2 and Smaller: Comply with ASME B16.33.
1. CWP Rating: 125 psig.
 2. Threaded Ends: Comply with ASME B1.20.1.
 3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
 4. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 5. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch and smaller.
 6. Service Mark: Valves 1-1/4 inches to NPS 2 shall have initials "WOG" permanently marked on valve body.
- B. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

- a. A.Y. McDonald Mfg. Co.
 - b. Apollo Valves; Conbraco Industries, Inc.
 - c. BrassCraft Manufacturing Co.; a Masco company.
- 2. Body: Bronze, complying with ASTM B 584.
 - 3. Ball: Chrome-plated bronze.
 - 4. Stem: Bronze; blowout proof.
 - 5. Seats: Reinforced TFE; blowout proof.
 - 6. Packing: Threaded-body packnut design with adjustable-stem packing.
 - 7. Ends: Threaded.
 - 8. CWP Rating: 600 psig.
 - 9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 - 10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
- C. PE Ball Valves: Comply with ASME B16.40.
- 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Kerotest Manufacturing Corp.
 - b. Lyall, R. W. & Company, Inc.
 - c. Perfection Corporation. Body: PE.
 - 2. Ball: PE.
 - 3. Stem: Acetal.
 - 4. Seats and Seals: Nitrile.
 - 5. Ends: Plain or fusible to match piping.
 - 6. CWP Rating: 125 psig.
 - 7. Operating Temperature: Minus 20 to plus 140 deg F.
 - 8. Operator: Nut or flat head for key operation.
 - 9. Include plastic valve extension.
 - 10. Include tamperproof locking feature for valves where indicated on Drawings.
- D. Valve Boxes:
- 1. Cast-iron, two-section box.
 - 2. Top section with cover with "GAS" lettering.
 - 3. Bottom section with base to fit over valve and barrel a minimum of 5 inches in diameter.
 - 4. Adjustable cast-iron extensions of length required for depth of bury.
 - 5. Include tee-handle, steel operating wrench with socket end fitting valve nut or flat head, and with stem of length required to operate valve.

2.6 MOTORIZED GAS VALVES

- A. Electrically Operated Valves: Comply with UL 429.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. ASCO
 - b. Prior approved equal
2. Body: Aluminum.
3. Seats and Disc: NBR
4. Springs and Valve Trim: Stainless steel.
5. Electrical: 120-V ac, 60 Hz.
6. Solenoid Enclosure: NEMA ICS 6, Type 4 (Water tight).
7. Normally closed.
8. Visual position indicator.

2.7 EARTHQUAKE VALVES

- A. Earthquake Valves, Maximum Operating Pressure of 60 psig (414 kPa): Comply with ASCE 25.
 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Pacific Seismic Products, Inc.
 2. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 3. Maximum Operating Pressure: 60 psig.
 4. Cast-aluminum body with stainless-steel internal parts.
 5. Nitrile-rubber, reset-stem o-ring seal.
 6. Valve position, open or closed, indicator.
 7. Composition valve seat with clapper held by spring or magnet locking mechanism.
 8. Level indicator.
 9. End Connections: Threaded for valves NPS 2 and smaller.

2.8 PRESSURE REGULATORS

- A. General Requirements:
 1. Single stage and suitable for natural gas.
 2. Steel jacket and corrosion-resistant components.
 3. Elevation compensator.
 4. End Connections: Threaded for regulators NPS 2 and smaller.
- B. Line Pressure Regulators: Comply with ANSI Z21.80.
 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

- a. American Meter Company.
- b. Fisher Control Valves & Instruments; a brand of Emerson Process Management.
2. Body and Diaphragm Case: Cast iron or die-cast aluminum.
3. Springs: Zinc-plated steel; interchangeable.
4. Diaphragm Plate: Zinc-plated steel.
5. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
6. Orifice: Aluminum; interchangeable.
7. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
8. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
9. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
10. Overpressure Protection Device: Factory mounted on pressure regulator.
11. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
12. Maximum Inlet Pressure: 125 psig.

C. Appliance Pressure Regulators: Comply with ANSI Z21.18.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Maxitrol Company.
2. Body and Diaphragm Case: Die-cast aluminum.
3. Springs: Zinc-plated steel; interchangeable.
4. Diaphragm Plate: Zinc-plated steel.
5. Seat Disc: Nitrile rubber.
6. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
7. Factory-Applied Finish: Minimum three-layer polyester and polyurethane paint finish.
8. Regulator may include vent limiting device, instead of vent connection, if approved by authorities having jurisdiction.
9. Maximum Inlet Pressure: 2 psig.

2.9 DIELECTRIC UNIONS

A. Dielectric Unions:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. A.Y. McDonald Mfg. Co.
 - b. Watts; a Watts Water Technologies company.
 - c. Zurn Industries, LLC.
2. Description:

- a. Standard: ASSE 1079.
- b. Pressure Rating: 125 psig minimum at 180 deg F.
- c. End Connections: Solder-joint copper alloy and threaded ferrous.

2.10 LABELING AND IDENTIFYING

- A. Detectable Warning Tape: Acid- and alkali-resistant, PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored yellow.

PART 3 - EXECUTION

3.1 OUTDOOR PIPING INSTALLATION

- A. Comply with NFPA 54 and the International Fuel Gas Code for installation and purging of natural-gas piping.
- B. Install underground, natural-gas piping buried at least 36 inches below finished grade. Comply with requirements in Section 312000 "Earth Moving" for excavating, trenching, and backfilling.
 - 1. If natural-gas piping is installed less than 36 inches below finished grade, install it in containment conduit.
- C. Install underground, PE, natural-gas piping according to ASTM D 2774.
- D. Install fittings for changes in direction and branch connections.
- E. Install pressure gage downstream from each service regulator. Pressure gages are specified in Section 230519 "Meters and Gages for HVAC Piping."

3.2 INDOOR PIPING INSTALLATION

- A. Comply with NFPA 54 and the International Fuel Gas Code for installation and purging of natural-gas piping.
- B. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.
- C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

- F. Locate valves for easy access.
- G. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Verify final equipment locations for roughing-in.
- K. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.
- L. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.
 - 1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.
- M. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.
- N. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.
- O. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.
- P. Connect branch piping from top or side of horizontal piping.
- Q. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment.
- R. Do not use natural-gas piping as grounding electrode.
- S. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.
- T. Install pressure gage upstream and downstream from each line regulator. Pressure gages are specified in Section 230519 "Meters and Gages for HVAC Piping."
- U. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."
- V. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."

- W. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230518 "Escutcheons for HVAC Piping."

3.3 VALVE INSTALLATION

- A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing or copper connector.
- B. Install underground valves with valve boxes.
- C. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.
- D. Install earthquake valves aboveground outside buildings according to listing.

3.4 PIPING JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Threaded Joints:
 - 1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
 - 2. Cut threads full and clean using sharp dies.
 - 3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
 - 4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
 - 5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- D. Welded Joints:
 - 1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
 - 2. Bevel plain ends of steel pipe.
 - 3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.
- E. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
 - 1. Plain-End Pipe and Fittings: Use butt fusion.
 - 2. Plain-End Pipe and Socket Fittings: Use socket fusion.

3.5 HANGER AND SUPPORT INSTALLATION

- A. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."
- B. Comply with requirements for pipe hangers and supports specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
- C. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:
 - 1. NPS 1 and Smaller: Maximum span, 96 inches; minimum rod size, 3/8 inch.
 - 2. NPS 1-1/4: Maximum span, 108 inches; minimum rod size, 3/8 inch.
 - 3. NPS 1-1/2 and NPS 2: Maximum span, 108 inches; minimum rod size, 3/8 inch.
- D. Install hangers for horizontal, corrugated stainless-steel tubing with the following maximum spacing and minimum rod sizes:
 - 1. NPS 3/8: Maximum span, 48 inches; minimum rod size, 3/8 inch.
 - 2. NPS 1/2: Maximum span, 72 inches; minimum rod size, 3/8 inch.
 - 3. NPS 3/4 and Larger: Maximum span, 96 inches; minimum rod size, 3/8 inch.

3.6 CONNECTIONS

- A. Connect to utility's gas main according to utility's procedures and requirements.
- B. Install natural-gas piping electrically continuous, and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.
- C. Install piping adjacent to appliances to allow service and maintenance of appliances.
- D. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.
- E. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

3.7 LABELING AND IDENTIFYING

- A. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for piping and valve identification.
- B. Install detectable warning tape directly above gas piping, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.8 FIELD QUALITY CONTROL

- A. Test, inspect, and purge natural gas according to NFPA 54 and the International Fuel Gas Code and authorities having jurisdiction.
- B. Natural-gas piping will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.9 PIPING SCHEDULE

- A. Piping system materials are identified in the table below.

Application	Location	Size	Material	Fittings
Outdoor Natural Gas Piping	Below Grade	All	PE	Fusion Joint
Outdoor Natural Gas Piping	Above Grade	½” to 2”	Steel	Threaded, Malleable Iron
Outdoor Natural Gas Piping	Above Grade	2-1/2” and larger	Steel	Welded, Wrought-Steel
Indoor Natural Gas Piping	Above Grade	½” to 2”	Steel	Threaded, Malleable Iron
Indoor Natural Gas Piping	Above Grade	2-1/2” and larger	Steel	Welded, Wrought-Steel
Indoor Natural Gas Piping	Above Grade	1” and smaller	CCST*	Mechanical Fittings*

* Corrugated stainless-steel tubing with mechanical fittings shall only be used for branch piping serving a single appliance and shall be limited to 10’ total length maximum.

3.10 UNDERGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

- A. Connections to Existing Gas Piping: Use valve and fitting assemblies made for tapping utility's gas mains and listed by an NRTL.
- B. Underground: PE valves.

3.11 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

- A. Valves for pipe sizes NPS 2 and smaller at service meter shall be the following:
 - 1. Two-piece, full-port, bronze ball valves with bronze trim.
- B. Distribution piping valves for pipe sizes NPS 2 and smaller shall be the following:
 - 1. Two-piece, full-port, bronze ball valves with bronze trim.
- C. Valves in branch piping for single appliance shall be the following:
 - 1. Two-piece, full-port, bronze ball valves with bronze trim.

END OF SECTION 231123

SECTION 231124 - NATURAL GAS METERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes natural gas meters. Products in this section are supplemental to the metering requirements of the natural gas utility.
- B. Related Requirements:
 - 1. Section 231123 “Facility Natural Gas Piping”

1.2 SUBMITTALS

- A. See Section 220000 “General Requirements of Plumbing and HVAC”

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Itron
- B. NMT
- C. Prior approved equal

2.2 DESCRIPTION

- A. Provide positive displacement type gas meter rated for outdoor installation.

2.3 CONSTRUCTION & FEATURES

- A. Weather and tamper proof index housing
- B. Double low frequency pulse output

2.4 INDEX

- A. Sealed – rated for outdoor use
- B. 8-Digit Readout – cubic feet
- C. 2-pulsed outputs

- D. UV Resistant

2.5 PULSED OUTPUT

- A. Two Low Frequency (LF) pulse outputs. The LF transmitter consists of 2 dry reed switches, normally open, and actuated by a magnet located in the first odometer drum on the index register.
- B. Volume per pulse contact
 - 1. ft³ index; 1 ft³/pulse

2.6 PERFORMANCE

- A. Max Operating Pressure: 230 psig
- B. Operating temperature Range: -22F to 140F
- C. Pressure Drop at Max Flow: less than 2" W.C.
- D. Provide meter with capacity to meet total building gas load.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Follow manufacturer's recommendation for installation. Installation will conform to the guidelines provided by the Installation & Operation Manual.

3.2 RESPONSIBILITY

- A. The Plumbing Contractor shall furnish and install in the flow meter in the location shown on the plans.
- B. The electrical contractor shall provide all wiring (line and low voltage) between the flow meter and smart meter (see electrical drawings for location).

END OF SECTION 231124

SECTION 260513 MEDIUM VOLTAGE CABLE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Material and installation requirements for:
 - a. Medium voltage cable (601 V and above).
 - b. Cable terminations and splices.
- B. Related Specification Sections include but are not necessarily limited to:
1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
 2. Division 01 - General Requirements.
 3. Section 26 05 00 - Electrical: Basic Requirements.
 4. Section 26 08 13 - Acceptance Testing.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
1. Association of Edison Illuminating Companies (AEIC):
 - a. CS8, Specification for Extruded Dielectric Shielded Power Cables Rated 5 Through 46kV.
 2. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
 - a. 48, Standard for Test Procedures and Requirements for Alternating-Current Cable Terminations Used on Shielded Cables Having Laminated Insulation Rated 2.5kV Through 756kV or Extruded Insulation Rated 2.5 kV through 500 kV.
 - b. 386, Standard for Separable Insulated Connector Systems for Power Distribution Systems Above 600V.
 - c. 404, Standard for Extruded and Laminated Dielectric Shielded Cable Joints Rated 2500 V to 500,000 V.
 3. National Electrical Manufacturers Association/Insulated Cable Engineers Association (NEMA/ICEA):
 - a. WC 74/S-93-639, 5-46 kV Shielded Power Cable for Use in the Transmission and Distribution of Electric Energy.
 4. National Fire Protection Association (NFPA):
 - a. 70, National Electrical Code (NEC).
 5. Underwriters Laboratories, Inc. (UL):
 - a. 486A-486B, Wire Connectors.
 - b. 1072, Standard for Safety Medium Voltage Power Cables.
- B. Qualifications:
1. Cable technician:
 - a. Three (3) years experience in handling, terminating and splicing medium voltage cables.
 - b. Specifically trained by a factory representative on the terminations and splices to be used on the project.

- 1) If not trained on the products to be used, on-site training by the factory representative shall be performed before any terminations or splices are made.

1.3 SUBMITTALS

- A. Shop Drawings:
 1. Product data:
 - a. Provide submittal data for all products specified in PART 2 of this Specification Section.
 - b. See Specification Section 26 05 00 for additional requirements.
 2. Fabrication and/or layout drawings:
 - a. Cable pulling plan.
 3. Factory Tests:
 - a. Conductor resistance testing
 - b. Insulation resistance testing
 - 1) Shall be measured in megohms/100 feet
 - 2) Shall not be less than 50,000 megohms/1000 feet when corrected to 60 degC.
 - c. Concentric neutral resistance
- B. Informational Submittals:
 1. Cable pulling tension measurements.
 2. Submit the following before terminating cables:
 - a. Cable Technician qualifications.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Ship cable with removable watertight end seals, and store in dry place.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 1. Wire and cable:
 - a. The Okonite Company.
 - b. General Cable.
 - c. The Kerite Company.
 - d. Prysmian Cable Corporation.
 - e. Southwire Company.
 2. Lugs, connectors and terminations:
 - a. Eaton Cooper Power Systems.
 - b. 3M Company.
 - c. Elastimold, a Thomas and Betts Company.
 - d. Hubbell
 - e. Joslyn.
 - f. Raychem.

2.2 MEDIUM VOLTAGE CABLES

- A. General:
 - 1. Cable shall be suitable for use in wet and dry locations in conduit, underground duct, direct burial and aerial riser installations.
- B. Shipping Lengths:
 - 1. Contractor shall determine required quantity of cable.
 - 2. Cable shipping lengths shall be determined such that cable splices are not required except at those locations determined necessary by cable pulling calculations.
 - 3. Additional cable splices, for any reason, will not be acceptable and will be cause for rejection.
- C. Ratings:
 - 1. 15kV class unless otherwise indicated on the Drawings.
- D. Standards:
 - 1. NEMA/ICEA WC 74/S-93-639.
 - 2. AEIC CS8.
 - 3. UL 1072.
- E. Conductor configuration:
 - 1. Single conductors, Triplex configuration in conduit
- F. Conductor Material - new:
 - 1. Compact stranded aluminum.
 - 2. Class B strand
- G. Conductor Material – Replace in kind:
 - 1. Compact stranded copper.
 - 2. Class B strand
- H. Insulation:
 - 1. Temperature rating: Type MV-90 or MV-105 per NFPA 70.
 - 2. Ethylene-propylene rubber (EPR) base
 - 3. 133 percent insulation level (220 mil).
- I. Shielding:
 - 1. Shielding on cables rated above 2 kV consists of:
 - a. Semiconductor conductor screen.
 - 1) Resistivity not in excess of 50,000 ohm-cm at 90 degC
 - 2) Average thickness of 15 mils
 - 3) Free stripping from conductor and firmly bonded to insulation.
 - b. Semiconductor insulation screen.
 - 1) Resistivity not in excess of 50,000 ohm-cm at 90 degC
 - 2) Free stripping from conductor and firmly bonded to insulation.
 - c. 1/3 Copper concentric neutral.
- J. Jackets:
 - 1. Direct buried cables shall be rated for direct bury.
 - 2. Jacket:

- a. PVC or Polyethylene.
- b. Jacket shall be installed in such a manner that neutral wires are not displaced and voids between neutral wires and the jacket are negligible.
- c. Print manufacturer's name, cable type, insulation thickness, conductor size and type, rated voltage, sequential footage number, and year of manufacture on the jacket in contrasting ink.

K. Conduit Fill:

- 1. New conduit for MV cable to be Schedule 40 PVC conduit, unless otherwise shown on Drawings
 - a. 1/0 and 4/0 conductor shall utilize 4-inch or larger
 - b. 500 aluminum and 350 copper conductor shall utilize 5-inch or larger
- 2. MV cable to be installed meet NEC conduit fill requirements:
 - a. Single Cable – 53 percent filled
 - b. Three or more conductors – 40 percent filled

L. Installation Schedule:

- 1. New express feeder circuits to be 500 kcmil aluminum
- 2. Replacement express feeder circuits to be 350 kcmil copper, unless approved by Owner
- 3. New feeder circuits to be 4/0 aluminum
- 4. Replacement feeder circuits to be 4/0 copper, unless approved by Owner
- 5. Minor taps to be 1/0 aluminum

M. Operating temperature:

- 1. 90 degrees C for normal operation
- 2. 130 degrees C for emergency operation
- 3. 250 degrees C for short circuit condition

2.3 CABLE ACCESSORIES

A. Lugs and Connectors:

- 1. Lugs:
 - a. Compression type.
 - b. Standard: UL 486A for copper cables.
 - c. Voltage rating: Up to 35 kV.
 - d. Current rating: Continuous operation at the rating of the cable.
 - e. Material: Tin-plated copper.
 - f. Number of holes: Two (2), except one (1) on motor leads.
- 2. Splice connectors:
 - a. Standard: UL 486A for copper cables.
 - b. Voltage rating: Up to 35kV.
 - c. Current rating: Continuous operation at the rating of the cable.
 - d. Material: Tin-plated copper

B. Terminations:

- 1. General:
 - a. All components shall be premolded and factory tested
 - b. All components shall be deadfront design
- 2. Nominal voltage:
 - a. 15 kV

- b. 95 kV BIL
- c. 60 Hz
- 3. Operating voltage:
 - a. 7.2/12.5 kV grounded wye
- 4. Capable of switching on a three-phase system.
- 5. End caps:
 - a. Cold or hot shrink.
 - b. Used to environmentally seal and mechanically protect exposed cable ends.
- 6. Cold shrink kits:
 - a. Standard: IEEE 48, Class 1 termination.
 - b. Voltage rating: Same as the cable rating.
 - c. Current rating: Continuous operation at the rating of the cable.
 - d. One-piece design, where high-dielectric constant stress control is integrated within a skirted insulator made of silicone rubber.
 - e. Suitable for contaminated indoor and outdoor locations.
- 7. Molded rubber kit:
 - a. Standard: IEEE 48.
 - b. Voltage rating: Same as the cable rating.
 - c. Current rating: Continuous operation at the rating of the cable.
 - d. One-piece design or modular with stress cone and skirts, where high-dielectric constant stress control is integrated within a skirted insulator made of EPDM rubber.
 - e. Suitable for contaminated indoor and outdoor locations.
- 8. Elbow connectors:
 - a. Standard: IEEE 386.
 - b. Voltage rating: Same as the cable rating.
 - c. Current rating: See Drawings for installation location.
 - d. One-piece design, comprised of an insulation shield, insulation layer and an outer shield constructed of EPDM rubber.
 - e. 200 amp installations:
 - 1) Deadfront, loadbreak type with:
 - a) Hot stick pulling eye.
 - b) Grounding tab.
 - c) Test point.
 - d) Continuous current rating: 200 amps
 - f. 600 amp installations:
 - 1) Deadfront, deadbreak type with:
 - a) T-body type.
 - b) Grounding tab.
 - c) Test point.
 - d) Continuous current rating: 600 amps
 - g. Accessories to be constructed in a similar manner as the elbow connector:
 - 1) Bushing inserts.
 - 2) Bushing well plugs.
 - 3) Feed thru inserts.
 - 4) Protective caps.

C. Splices:

- 1. Cold shrink kits:
 - a. Standard: IEEE 404.
 - b. Voltage rating: Same as the cable rating.

- c. Current rating: Continuous operation at the rating of the cable.
 - d. One-piece design, comprised of an insulation shield, insulation layer and a silicone rubber body.
 - e. Suitable for indoor, direct burial or submersible applications.
2. Molded rubber kit:
- a. Standard: IEEE 386 or IEEE 404.
 - b. Voltage rating: Same as the cable rating.
 - c. Current rating: Continuous operation at the rating of the cable.
 - d. One- or multi-piece design, comprised of an insulation shield, insulation layer and an outer shield constructed of EPDM rubber.
 - e. Suitable for indoor, direct burial or submersible applications.
3. Modular separable molded rubber:
- a. Standard: IEEE 386.
 - b. Voltage rating: Same as the cable rating.
 - c. Current rating: 600A.
 - d. One-piece design, comprised of an insulation shield, insulation layer and an outer shield constructed of EPDM rubber.
 - e. Deadfront, deadbreak type.
 - f. Components: T-body, insulating plug with cap, insulating plug with cap and stud, and connecting plug.
 - g. Suitable for submersible applications.
- D. Elbow Arrester
- 1. Approved manufacturer
 - a. Eaton Cooper
 - b. Or approved equal
 - 2. Requirements
 - a. 15 kV
 - b. Load break elbow
 - c. #4 copper ground or larger
 - d. 1 elbow per phase
 - e. 8.4 MCOV
- E. Parking Stand Arrester
- 1. Approved manufacturer
 - a. Eaton Cooper
 - b. Or approved equal
 - 2. Requirements
 - a. 15 kV
 - b. Load break elbow
 - c. #4 copper ground or larger
 - d. 1 arrester per phase
 - e. 8.4 MCOV
- F. Fault Indicators
- 1. Type 1
 - a. Test Point Reset
 - b. 300A Trip
 - 2. Type 2
 - a. Current Reset
 - b. 300A Trip

- G. Cable Shield Grounding Adapters:
 - 1. Type: Molded rubber with constant force spring and solder-blocked tinned copper braid pigtail.
 - 2. Waterproof, providing a positive seal for the cable jacket.
 - 3. May be integral with termination of splice device with Engineer's approval.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Do not install cable during wet conditions.
 - 1. Prior to pulling cables, drain or pump out manholes and other low points if standing water is present.
 - 2. Blow out conduits with dried compressed air if moisture is present in conduits.
 - 3. Install end caps immediately on all cut ends of cable prior to pulling, and maintain end caps while pulling in cable.
 - a. If end caps are damaged, remove and install new end caps.
 - b. Do not remove end caps until ready to terminate or splice cable.
- B. Cable Installation in Manholes:
 - 1. Provide enough cable slack in each manhole for a complete loop around the manhole.
 - a. When cable is spliced in a manhole, provide enough cable slack for a complete loop around the manhole.
 - b. The loop will provide slack to facilitate future cable repairs.
 - 2. Arc-proof all cables in manholes.
 - a. Apply in spiral, half-overlap fashion to full exposed length of each cable in manhole.
 - b. Secure in place with glass cloth electrical tape.
 - 1) Apply in reverse spiral to arc-proofing tape, at maximum interval of 9 IN and double wrapped at each end.
- C. Do not install conductors when ambient temperature is near minimum as recommended by manufacturer for installation of the type of conductor insulation.
- D. Provide components in kit form, complete with instructions, supplied by a single approved manufacturer and suitable for each shielded cable termination.
 - 1. Select correct termination to match cable diameter and construction.
 - 2. Form and install terminations in strict accordance with instructions of cable manufacturer and termination manufacturer.
- E. Splices:
 - 1. Provide components in kit form, complete with instructions, supplied by a single approved manufacturer and suitable for the type of cable being used.
 - 2. Prepare cable ends, provide materials and follow all application steps in accordance with manufacturer's instructions.
 - a. As a minimum requirement:
 - 1) The cable ends shall be cut squarely.
 - 2) The insulation shall be free from nicks or burrs after removal of jacket.
 - 3) The conductors shall be cleaned and an oxide inhibitor applied.

- 4) For splices, connector indents shall be filled with insulating putty to eliminate voids or prepared per manufacture's instructions.
 - 5) Attach grounding lead to system ground.
 3. Splices shall be avoided whenever possible.
 - a. No more than one (1) splice is permitted between termination points without Engineer's approval.
 - b. No splices are permitted in runs less than 100 FT long.
 - c. Splices will be made only at manholes or other accessible locations.
 - d. Do not pull splices into duct banks or conduits or leave them under tension.
- F. The ground shield grounding adaptors shall be grounded:
 1. Shirted and elbow terminators: Grounded to ground bar or cable loop in equipment.
 2. Splices: Grounded to ground bar or rod in manhole.
 3. Connect with insulated, stranded #6 AWG wire.

3.2 FIELD QUALITY CONTROL

- A. Provide cable pulling plan showing all proposed splice points and cable pulling direction for each pull.
- B. Provide measurement of tensions during the pull.
- C. See Specification Section 26 08 13 for acceptance testing requirements.

END OF SECTION 260513

SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Copper building wire rated 600 V or less.
2. Aluminum building wire rated 600 V or less.
3. Metal-clad cable, Type MC, rated 600 V or less.
4. Connectors, splices, and terminations rated 600 V and less.

B. Related Requirements:

1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 COPPER BUILDING WIRE

A. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Alcan Products Corporation; Alcan Cable Division.
2. Alpha Wire Company.
3. Belden Inc.
4. Cerro Wire LLC.
5. Encore Wire Corporation.
6. General Cable Technologies Corporation.
7. Okonite Company.
8. Service Wire Co.
9. Southwire Incorporated.
10. WESCO

C. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

2. RoHS compliant.
 3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
- D. Conductors: Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 for stranded conductors.
- E. Conductor Insulation:
1. Type USE-2 and Type SE: Comply with UL 854.
 2. Type THHN and Type THWN-2: Comply with UL 83.
 3. Type THW-2: Comply with NEMA WC-70/ICEA S-95-658 and UL 83.
 4. Type XHHW-2: Comply with UL 44.

2.2 METAL-CLAD CABLE, TYPE MC

- A. Description: A factory assembly of one or more current-carrying insulated conductors in an overall metallic sheath.
- B. Approved for lighting whips 6' or less only.
- C. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. AFC Cable Systems.
 2. Alpha Wire Company.
 3. Belden Inc.
 4. Encore Wire Corporation.
 5. General Cable Technologies Corporation.
 6. Okonite Company.
 7. Service Wire Co.
 8. Southwire Incorporated.
 9. WESCO
- D. Standards:
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
 2. Comply with UL 1569.
- E. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
- F. Conductors: Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 for stranded conductors.
- G. Ground Conductor: Insulated.
- H. Conductor Insulation:
1. Type TFN/THHN/THWN-2: Comply with UL 83.

- I. Armor: Steel, interlocked.
- J. Jacket: PVC applied over armor for mechanical connection or wet/damp environments.

2.3 CONNECTORS AND SPLICES

- A. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. 3M Electrical Products
 - 2. AFC Cable Systems, Inc.
 - 3. Gardner Bender.
 - 4. Hubbell Power Systems, Inc.
 - 5. Ideal Industries, Inc.
 - 6. IlSCO; a branch of Bardes Corporation.
 - 7. NSi Industries LLC.
 - 8. O-Z/Gedney; a brand of the EGS Electrical Group.
 - 9. Service Wire Co.
 - 10. TE Connectivity Ltd.
 - 11. Thomas and Betts Corp

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Branch Circuits and Feeders: Copper; solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.2 CONDUCTOR INSULATION AND WIRING METHODS

- A. Service Entrance: Type THHN/THWN-2, single conductors in raceway.
- B. Feeders: Type THHN/THWN-2, single conductors in raceway.
- C. Branch Circuits: Type THHN/THWN-2, single conductors in raceway.
- D. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.

- B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.
- C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- F. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."
- G. **Provide a dedicated neutral conductor for each 120 V branch circuit.**

3.4 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches (150 mm) of slack.

3.5 IDENTIFICATION

- A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."
- B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.6 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.7 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly.

END OF SECTION 260519

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. RATIONALE – Grounding provides the foundation to the entire electrical system. This system is designed to:
 - 1. Protect personnel.
 - 2. Minimize damage to equipment and property in the event of high fault current situations,
 - 3. Improve overall electrical system reliability, and
 - 4. Minimize the effects of transient overvoltages.
- B. Section includes grounding and bonding systems and equipment.
- C. Section includes grounding and bonding systems and equipment, plus the following special applications:
 - 1. Underground distribution grounding.
 - 2. Foundation steel electrodes.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Plans showing dimensioned as-built locations of grounding features specified in "Field Quality Control" Article.
 - 1. Ground rods
 - 2. Plate electrodes
 - 3. Ground ring
- B. Qualification Data: For testing agency and testing agency's field supervisor.
- C. Field quality-control reports.
- D. Photographs of ground rod installation prior to burial.

- E. Photographs of Cadweld connections to rebar and building steel.
- F. Photographs of connection to water service and all bonding jumpers.
- G. Certified test results from ground resistance measurements.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.
 - 1. Plans showing as-built, dimensioned locations of grounding features specified in "Field Quality Control" Article, including the following:
 - a. Ground rods.
 - b. Ground rings.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

2.2 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Equipment and wiring device grounding conductor shall be as follows:
 - 1. Bare copper or have green insulation of same type as circuit conductors (larger wires may be permanently marked with green).
 - 2. Properly sized in accordance with the NEC.
- C. Bare Copper Conductors:
 - 1. Solid Conductors: ASTM B 3.
 - 2. Stranded Conductors: ASTM B 8.
 - 3. Tinned Conductors: ASTM B 33.
 - 4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.
 - 5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
 - 6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
 - 7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

- D. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches (6.3 by 100 mm) in cross section, with 9/32-inch (7.14-mm) holes spaced 1-1/8 inches (28 mm) apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be Lexan or PVC, impulse tested at 5000 V.

2.3 CONNECTORS

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, pressure type with at least two bolts.
 - 1. Pipe Connectors: Clamp type, sized for pipe.
- C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
- D. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.
- E. Beam Clamps: Mechanical type, terminal, ground wire access from four directions, with dual, tin-plated or silicon bronze bolts.
- F. Cable-to-Cable Connectors: Compression type, copper or copper alloy.
- G. Conduit Hubs: Mechanical type, terminal with threaded hub.
- H. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with hex head bolt.
- I. Lay-in Lug Connector: Mechanical type, copper rated for direct burial terminal with set screw.
- J. Service Post Connectors: Mechanical type, bronze alloy terminal, in short- and long-stud lengths, capable of single and double conductor connections.
- K. Signal Reference Grid Clamp: Mechanical type, stamped-steel terminal with hex head screw.
- L. Straps: Solid copper, copper lugs. Rated for 600 A.
- M. Tower Ground Clamps: Mechanical type, copper or copper alloy, terminal one-piece clamp.
- N. U-Bolt Clamps: Mechanical type, copper or copper alloy, terminal listed for direct burial.
- O. Water Pipe Clamps:
 - 1. Mechanical type, two pieces with zinc-plated bolts.
 - a. Material: Die-cast zinc alloy.
 - b. Listed for direct burial.

2.4 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel; 3/4 inch by 10 feet (19 mm by 3 m).

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Conductors: Install solid conductor for No. 10 AWG and smaller, and stranded conductors for No. 8 AWG and larger unless otherwise indicated.
- B. Underground Grounding Conductors: Install bare tinned-copper conductor, No. 2/0 AWG minimum.
 - 1. Bury at least 24 inches (600 mm) below grade.
- C. Grounding Bus: Install in electrical equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
 - 1. Install bus horizontally, on insulated spacers 2 inches (50 mm) minimum from wall, 6 inches (150 mm) above finished floor unless otherwise indicated.
- D. Conductor Terminations and Connections:
 - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
 - 2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
 - 3. Connections to Ground Rods at Test Wells: Bolted connectors.
 - 4. Connections to Structural Steel: Welded connectors.
 - 5. Any threaded bolt connectors shall be torqued in accordance with manufacturer's guidelines.

3.2 GROUNDING AT THE SERVICE

- A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

3.3 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

- A. Comply with IEEE C2 grounding requirements.
- B. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches (100 mm) will extend above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches (50 mm) above to 6 inches (150 mm) below concrete. Seal floor opening with waterproof, nonshrink grout.

- C. **Grounding Connections to Manhole Components:** Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper bonding conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields according to written instructions by manufacturer of splicing and termination kits.
- D. **Pad-Mounted Transformers and Switches:** Install ground rods and ground ring around the pad as shown on drawings. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than No. 2 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 6 inches (150 mm) from the foundation.

3.4 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits. Do not rely on conduit for the grounding path.
- B. Multiple circuits sharing a raceway may share a single grounding conductor if all of the following requirements are met:
 1. All circuits originate in the same panel.
 2. No more than three single pole circuits may share a ground conductor.
 3. Size the ground conductor for the largest circuit.
- C. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
 1. Feeders and branch circuits.
 2. Lighting circuits.
 3. Receptacle circuits.
 4. Single-phase motor and appliance branch circuits.
 5. Three-phase motor and appliance branch circuits.
 6. Flexible raceway runs.
 7. Armored and metal-clad cable runs.
- D. **Air-Duct Equipment Circuits:** Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.
- E. **Water Heater, Heat-Tracing, and Antifrost Heating Cables:** Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.
- F. **Poles Supporting Outdoor Lighting Fixtures:** Do not install a grounding electrode and a separate insulated equipment grounding conductor at these locations. Bond the equipment grounding conductor installed with branch-circuit conductors to the grounding terminal at the pole base.

3.5 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Ground Rods: Drive rods until tops are 2 inches (50 mm) below finished floor or final grade unless otherwise indicated.
 - 1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
 - 2. For grounding electrode system, install at least 2 rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.
- C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
 - 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
 - 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
 - 3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.
- D. Grounding and Bonding for Piping:
 - 1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
 - 2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
 - 3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.
- E. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity. Size bonding conductors and jumpers in accordance with NEC 250.122, using the rating of the circuit that is likely to energize the ducts.
- F. Ufer Ground (Concrete-Encased Grounding Electrode): Fabricate according to NFPA 70, and as detailed on drawings. If drawing does not provide Ufer ground detail install the grounding electrode as defined below:
 - 1. Use a minimum of 20 feet (6 m) of bare copper conductor not smaller than No. 4 AWG.

2. If concrete foundation is less than 20 feet (6 m) long, coil excess conductor within base of foundation.
 3. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building's grounding grid or to grounding electrode external to concrete.
- G. Structural Steel: When available, bond structural steel to grounding electrode system, according to NFPA 70.

3.6 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
 2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
 3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at individual ground rods. Make tests at ground rods before any conductors are connected.
 - a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
 - b. Perform tests by fall-of-potential method according to IEEE 81.
 4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.
- C. Grounding system will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.
- E. Report measured ground resistances that exceed 25 ohms to ground.
- F. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 260526

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Steel slotted support systems.
2. Conduit and cable support devices.
3. Support for conductors in vertical conduit.
4. Structural steel for fabricated supports and restraints.
5. Mounting, anchoring, and attachment components, including powder-actuated fasteners, mechanical expansion anchors, concrete inserts, clamps, through bolts, toggle bolts, and hanger rods.
6. Fabricated metal equipment support assemblies.

B. Related Requirements:

1. Section 260548 "Seismic Controls for Electrical Systems" for products and installation requirements necessary for compliance with seismic criteria.

1.2 ACTION SUBMITTALS

- ##### A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

- ##### A. Seismic Qualification Data: Certificates, for hangers and supports for electrical equipment and systems, accessories, and components, from manufacturer.

1.4 COORDINATION

- ##### A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified together with concrete Specifications.
- ##### B. Coordinate installation of roof curbs, equipment supports, and roof penetrations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- ##### A. Seismic Performance: Hangers and supports shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the supported equipment and systems will remain in place without separation of any parts when subjected to the seismic forces specified and the supported equipment and systems will be fully operational after the seismic event."

2.2 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Preformed steel channels and angles with minimum 13/32-inch- (10-mm-) diameter holes at a maximum of 8 inches (200 mm) o.c. in at least one surface.
 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Allied Tube & Conduit; a part of Atkore International.
 - b. B-line, an Eaton business.
 - c. ERICO International Corporation.
 - d. Flex-Strut Inc.
 - e. Gripple Inc.
 - f. G-Strut.
 - g. Thomas & Betts Corporation; A Member of the ABB Group.
 - h. Unistrut; Part of Atkore International.
 2. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
 3. Material for Channel, Fittings, and Accessories: Galvanized steel.
 4. Channel Width: Selected for applicable load criteria.
 5. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
 6. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
 7. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
 8. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- C. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for nonarmored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be made of malleable iron.
- D. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M steel plates, shapes, and bars; black and galvanized.
- E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
 1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
3. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

2.3 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Comply with the following standards for application and installation requirements of hangers and supports, except where requirements on Drawings or in this Section are stricter:
 1. NECA 1.
 2. NECA 101
 3. NECA 102.
 4. NECA 105.
 5. NECA 111.
- B. Comply with requirements for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.
- C. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."
- D. Maximum Support Spacing and Minimum Hanger Rod Size for Raceways: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter.
- E. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
 1. Secure raceways and cables to these supports with two-bolt conduit clamps.
- F. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch (38-mm) and smaller raceways serving branch circuits and communication systems above suspended ceilings, and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC and RMC may be supported by openings through structure members, according to NFPA 70.
- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
 - 1. To Wood: Fasten with lag screws or through bolts.
 - 2. To New Concrete: Bolt to concrete inserts.
 - 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 - 4. To Existing Concrete: Expansion anchor fasteners.
 - 5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick.
 - 6. To Steel: Beam clamps (MSS SP-58, Type 19, 21, 23, 25, or 27), complying with MSS SP-69.
 - 7. To Light Steel: Sheet metal screws.
 - 8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that comply with seismic-restraint strength and anchorage requirements.
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- B. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated but not less than 4 inches (100 mm) larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

- B. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete.
- C. Anchor equipment to concrete base.
 - 1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 2. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

END OF SECTION 260529

SECTION 260533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal conduits and fittings.
2. Nonmetallic conduits and fittings.
3. Metal wireways and auxiliary gutters.
4. Surface raceways.
5. Boxes, enclosures, and cabinets.
6. Handholes and boxes for exterior underground cabling.

1.2 ACTION SUBMITTALS

- ##### A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

1.3 INFORMATIONAL SUBMITTALS

- ##### A. Seismic Qualification Data: Certificates, for enclosures, cabinets, and conduit racks and their mounting provisions, including those for internal components, from manufacturer.

PART 2 - PRODUCTS

2.1 METAL CONDUITS AND FITTINGS

A. Metal Conduit:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Allied Tube & Conduit; a part of Atkore International.
 - b. Electri-Flex Company.
 - c. O-Z/Gedney; a brand of Emerson Industrial Automation.
 - d. Patriot Aluminum Products, LLC.
 - e. Perma-Cote.
 - f. Picoma Industries, Inc.
 - g. Plasti-Bond.
 - h. Republic Conduit.
 - i. Southwire Company.
 - j. Thomas & Betts Corporation; A Member of the ABB Group.

- k. Western Tube and Conduit Corporation.
 - 2. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 3. GRC: Comply with ANSI C80.1 and UL 6.
 - 4. IMC: Comply with ANSI C80.6 and UL 1242.
 - 5. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.
 - a. Comply with NEMA RN 1.
 - b. Coating Thickness: 0.040 inch (1 mm), minimum.
 - 6. EMT: Comply with ANSI C80.3 and UL 797.
 - 7. FMC: Comply with UL 1; zinc-coated steel.
 - 8. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.
- B. Metal Fittings: Comply with NEMA FB 1 and UL 514B.
- 1. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 2. Fittings, General: Listed and labeled for type of conduit, location, and use.
 - 3. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 1203 and NFPA 70.
 - 4. Fittings for EMT:
 - a. Material: Steel.
 - b. Type: Setscrew.
 - 5. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
 - 6. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.
- C. Joint Compound for IMC, GRC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS AND FITTINGS

A. Nonmetallic Conduit:

- 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Arnco Corporation.
 - b. CANTEX INC.
 - c. CertainTeed Corporation.
 - d. Champion Fiberglass, Inc.
 - e. Condux International, Inc.

- f. Electri-Flex Company.
 - g. FRE Composites.
 - h. Kraloy.
 - i. Lamson & Sessions.
 - j. Niedax Inc.
 - k. RACO; Hubbell.
 - l. Thomas & Betts Corporation; A Member of the ABB Group.
- B. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- 1. ENT: Comply with NEMA TC 13 and UL 1653.
 - 2. RNC: Type EPC-40-PVC or Type EPC-80-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
 - 3. LFNC: Comply with UL 1660.
 - 4. Rigid HDPE: Comply with UL 651A.
 - 5. Continuous HDPE: Comply with UL 651B.
- C. Nonmetallic Fittings:
- 1. Fittings, General: Listed and labeled for type of conduit, location, and use.
 - 2. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.
 - 3. Fittings for LFNC: Comply with UL 514B.
 - 4. Solvents and Adhesives: As recommended by conduit manufacturer.

2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
- 1. B-line, an Eaton business.
 - 2. Hoffman; a brand of Pentair Equipment Protection.
 - 3. MonoSystems, Inc.
- B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1, Type 3R, Type 4 or Type 12 unless otherwise indicated, and sized according to NFPA 70.
- 1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- D. Wireway Covers: Screw-cover type unless otherwise indicated.
- E. Finish: Manufacturer's standard enamel finish.

2.4 SURFACE RACEWAYS

- A. Listing and Labeling: Surface raceways and tele-power poles shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Surface Metal Raceways: Galvanized steel with snap-on covers complying with UL 5. Manufacturer's standard enamel finish in color selected by Architect.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Mono-Systems, Inc.
 - b. Panduit Corp.
 - c. Wiremold / Legrand.

2.5 BOXES, ENCLOSURES, AND CABINETS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. Crouse-Hinds, an Eaton business.
 - 2. Erickson Electrical Equipment Company.
 - 3. Hoffman; a brand of Pentair Equipment Protection.
 - 4. Hubbell Incorporated.
 - 5. Hubbell Incorporated; Wiring Device-Kellems.
 - 6. Milbank Manufacturing Co.
 - 7. MonoSystems, Inc.
 - 8. Oldcastle Enclosure Solutions.
 - 9. O-Z/Gedney; a brand of Emerson Industrial Automation.
 - 10. RACO; Hubbell.
 - 11. Stahlin Non-Metallic Enclosures.
 - 12. Thomas & Betts Corporation; A Member of the ABB Group.
- B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.
- C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, aluminum, Type FD, with gasketed cover.
- E. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.
- F. Metal Floor Boxes. See drawings for differing floor box requirements based on location, floor material and box use.
 - 1. All floor boxes shall be:

- a. Fully adjustable.
 - b. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Specific conditions include:
- a. Concrete floors (3" min. pour depth) - 4-gang floor box with corrosion resistant coating for on-grade use and up to 2" conduit feed.
 - b. Raised access floors - 4-gang floor box for up to 2" conduit feed.
 - c. Fire rated poke-through floor box for elevated concrete slabs:
 - 1) Small - 3" diameter core.
 - 2) Large - 8" diameter for up to 2" conduit feed.
 - d. Flush, round single surface floor box for concrete floors with up to 1" conduit feed.
 - e. Tombstone pedestal floor box with 1" conduit feed.
3. Include all interior box dividers, flanges, mounting hardware, wiring devices, faceplates, etc. to provide complete floor box outlet in accordance with drawings.
- G. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb (23 kg). Outlet boxes designed for attachment of luminaires weighing more than 50 lb (23 kg) shall be listed and marked for the maximum allowable weight.
- H. Paddle Fan Outlet Boxes: Nonadjustable, designed for attachment of paddle fan weighing 70 lb (32 kg).
- 1. Listing and labeling: Paddle fan outlet boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- I. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- J. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.
- K. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- L. Device Box Dimensions: 4 inches square by 2-1/8 inches deep (100 mm square by 60 mm deep) with single gang mud ring unless device(s) requires otherwise.
- M. Gangable boxes are allowed for 6-gang or larger.
- N. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1, Type 3R, Type 4 or Type 12 with continuous-hinge cover with flush latch unless otherwise indicated.
- 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
 - 2. Nonmetallic Enclosures: Plastic.
 - 3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.
- O. Cabinets:

1. NEMA 250, Type 1, Type 3R or Type 12 galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.
6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.6 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. General Requirements for Handholes and Boxes:

1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Armorcast Products Company.
 - b. NewBasis.
 - c. Oldcastle Enclosure Solutions.
 - d. Oldcastle Precast, Inc.
 - e. Quazite (Hubbell).
2. Standard: Comply with ANSI/SCTE 77.
3. Load Ratings:
 - a. Tier 5 for non-traffic areas and sidewalk applications with a safety factor for occasional non-deliberate vehicular traffic.
 - b. Tier 15 for driveway, parking lot, and off-road applications subject to occasional non-deliberate heavy vehicular traffic.
 - c. AASHTO H-20 for roadways and other deliberate vehicular traffic applications.
4. Configuration: Designed for flush burial with open bottom unless otherwise indicated.
5. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
6. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
7. Cover Legend: Molded lettering, "ELECTRIC" or "COM" as indicated on drawings.
8. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below unless otherwise indicated:
1. Exposed Conduit: GRC.
 2. Concealed Conduit, Aboveground: EMT.
 3. Underground Conduit: RNC, Type EPC-40-PVC in fine bedded trench.
 4. Under roadways and paved or concrete walkways: Type EPC-80-PVC in fine bedded trench.
 5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
 6. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.
- B. Indoors: Apply raceway products as specified below unless otherwise indicated.
1. Exposed, Not Subject to Physical Damage: EMT.
 2. Exposed and Subject to Severe Physical Damage: GRC.
 3. Concealed in Ceilings and Interior Walls and Partitions: EMT.
 4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
 5. Damp or Wet Locations: GRC.
 6. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 nonmetallic in institutional and commercial kitchens and damp or wet locations.
 7. Concealed in CMU block wall: Type EPC-40-PVC.
- C. Minimum Raceway Size: 1 inch (25.4mm) trade size for telecom/data and 3/4 inch (21mm) trade size for all other applications.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
 2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
 3. EMT: Use setscrew, steel fittings. Comply with NEMA FB 2.10.
 4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.
- E. Install surface raceways only where specifically indicated on Drawings.
- F. Install nonmetallic conduit or tubing for protecting bare grounding conductors.
- G. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F (49 deg C).

3.2 INSTALLATION

- A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.
- B. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
- C. Do not install raceways or electrical items on any "explosion-relief" walls or rotating equipment.
- D. Do not fasten conduits onto the bottom side of a metal deck roof.
- E. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- F. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.
- G. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- H. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches (300 mm) of changes in direction.
- I. Make bends in raceway using large-radius preformed ells. Field bending shall be according to NFPA 70 minimum radii requirements. Use only equipment specifically designed for material and size involved.
- J. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- K. Support conduit within 12 inches (300 mm) of enclosures to which attached.
- L. Raceways Embedded in Slabs:
 - 1. All conduit in slabs must be approved by structural engineer. Contractor must provide full shop drawings showing routing, conduit count, and sizes. Embedded conduits cannot be installed without written approval by the structural engineer.
 - a. Run conduit larger than 1-inch (27-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-foot (3-m) intervals.
 - b. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
 - c. Arrange raceways to keep a minimum of 2 inches (50 mm) of concrete cover in all directions.
 - d. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
 - e. Change from RNC, Type EPC-40-PVC to PVC Coated GRC bend and thru slab stub before rising above floor.

- M. Stub-ups to Above Recessed Ceilings:
1. Use EMT for raceways.
 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- N. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- O. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.
- P. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.
- Q. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- R. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.
- S. Cut conduit perpendicular to the length. For conduits 2-inch (53-mm) trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.
- T. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch (35-mm) trade size and insulated throat metal bushings on 1-1/2-inch (41-mm) trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.
- U. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.
- V. Surface Raceways:
1. Install surface raceway with a minimum 2-inch (50-mm) radius control at bend points.
 2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches (1200 mm) and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.
- W. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces.
- X. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where an underground service raceway enters a building or structure.
3. Conduit extending from interior to exterior of building.
4. Conduit extending into pressurized duct and equipment.
5. Conduit extending into pressurized zones that are automatically controlled to maintain different pressure set points.
6. Where otherwise required by NFPA 70.

Y. Expansion-Joint Fittings:

1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F (17 deg C) and that has straight-run length that exceeds 25 feet (7.6 m).
2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
 - a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F (70 deg C) temperature change.
 - b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F (86 deg C) temperature change.
 - c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F (70 deg C) temperature change.
 - d. Attics: 135 deg F (75 deg C) temperature change.
3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per degree F (0.06 mm per meter of length of straight run per degree C) of temperature change for PVC conduits.
4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

Z. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches (1830 mm) of flexible conduit for recessed and semi-recessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations subject to severe physical damage.
2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

AA. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

BB. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between the box and cover plate or the supported equipment and box.

CC. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

- DD. Locate boxes so that cover or plate will not span different building finishes.
- EE. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
- FF. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.
- GG. Set metal floor boxes level and flush with finished floor surface.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavation

- a. Excavate trenches to indicated depths.
- b. Excavate trenches to uniform widths to provide 12 inches on each side of conduits. Excavate trench walls vertically from trench bottom to 12 inches higher than top of conduits UNO.
- c. Excavate and shape trench bottoms to provide uniform bearing and support of conduits. Shape subgrade to provide continuous support for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.
- d. Trenches in Tree- and Plant-Protection Zones:
 - 1) Hand-excavate to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
 - 2) Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities.

2. Initial Backfill

- a. Place backfill on subgrades free of mud, frost, snow, or ice.
 - b. Place and compact bedding course on trench bottoms. Shape bedding course to provide continuous support for joints, fittings, and bodies of conduits.
- 3. Install manufactured duct elbows for stub-up at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
 - 4. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.
 - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete for a minimum of 12 inches on each side of the coupling.
 - b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of

60 inches from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.

5. Backfill - After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process.
 - a. Trenches under Footings: Backfill trenches excavated under footings and within 18 inches of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings.
 - b. Trenches under Roadways: Provide 4-inch thick, concrete-base slab support for conduits less than 30 inches below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches of concrete before backfilling or placing roadway subbase course.
 - c. Initial Backfill: Place and compact initial backfill of subbase material, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the conduits. Carefully compact initial backfill under conduit haunches and compact evenly up on both sides and along the full length of conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.
 - d. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction.
6. Underground Warning Tape: Comply with requirements in Section 260553 "Identification for Electrical Systems."
7. Compaction - Firmly hand tamp backfill around conduit to provide maximum supporting strength. Coordinate all requirements with site civil specifications. Prior to commencing work, the more stringent requirement shall take precedence.
 - a. Compact each layer of initial and final backfill soil material at 95 percent.

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.
- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch (12.5-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch (25 mm) above finished grade.
- D. Where required, field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.5 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.6 FIRESTOPPING

- A. Install firestopping at penetrations of fire-rated floor and wall assemblies.

3.7 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage and deterioration.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 260533

SECTION 260543 MEDIUM VOLTAGE EXTERIOR UNDERGROUND ELECTRICAL

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Material and installation requirements for:
 - a. Vaults.
 - b. Underground conduits and ductbanks.
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Division 00 - Procurement and Contracting Requirements.
 - 2. Division 01 - General Requirements.
 - 3. Section 26 05 26 - Grounding.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. American Association of State Highway and Transportation Officials (AASHTO):
 - a. HB, Standard Specifications for Highway Bridges.
 - 2. American Iron and Steel Institute (AISI).
 - 3. ASTM International (ASTM):
 - a. A536, Standard Specification for Ductile Iron Castings.
 - b. D2564, Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
 - c. D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
 - d. D4253, Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
 - e. D4254, Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.
 - 4. National Fire Protection Association (NFPA):
 - a. 70, National Electrical Code (NEC).
 - 5. Society of Cable Telecommunications Engineers (SCTE):
 - a. 77, Specification for Underground Enclosure Integrity.
 - 6. Underwriters Laboratories, Inc. (UL):
 - a. 467, Grounding and Bonding Equipment.
 - b. 651, Standard for Schedule 40 and 80 Rigid PVC Conduit and Fittings.

1.3 DEFINITIONS

- A. Direct-buried conduit(s):
 - 1. Individual (single) underground conduit.
 - 2. Multiple underground conduits, arranged in one or more planes, in a common trench.

1.4 SUBMITTALS

- A. Shop Drawings:
 - 1. Product technical data:
 - a. Provide submittal data for all products specified in PART 2 of this Specification Section except:
 - 1) Conduit fittings.
 - 2) Support systems.
 - b. See Specification Section 26 05 00 for additional requirements.
 - 2. Fabrication and/or layout drawings:
 - a. Provide dimensional drawings of each vault indicating all specified accessories and conduit entry locations.

1.5 SITE CONDITIONS

- A. Avoid overloading or surcharge a sufficient distance back from edge of excavation to prevent slides or caving.
 - 1. Maintain and trim excavated materials in such manner to be as little inconvenience as possible to public and adjoining property owners.
- B. Provide full access to public and private premises and fire hydrants, at street crossings, sidewalks and other points as designated by Owner to prevent serious interruption of travel.
- C. Protect and maintain bench marks, monuments or other established points and reference points and if disturbed or destroyed, replace items to full satisfaction of Owner and controlling agency.
- D. Verify location of existing underground utilities.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 - 1. Precast vaults:
 - a. Utility Vault Co.
 - b. Oldcastle Precast, Inc.
 - c. Lister Industries.
 - 2. Vault and ductbank accessories:
 - a. Neenah.
 - b. Unistrut.
 - c. Condux International, Inc.
 - d. Underground Devices, Inc.
 - 3. Rigid nonmetallic conduit:
 - a. Prime Conduit (Carlton).
 - b. Cantex.
 - c. Osburn Associates.
 - 4. Conduit fittings and accessories:
 - a. Appleton Electric Co.

- b. Carlon.
 - c. Cantex.
 - d. Crouse-Hinds.
 - e. Killark.
 - f. Osburn Associates.
 - g. OZ Gedney Company.
 - h. RACO.
 - i. Steel City.
 - j. Thomas & Betts.
5. Support systems:
- a. Unistrut Building Systems.
 - b. Eaton B-Line.
 - c. Kindorf.
 - d. Minerallac Fastening Systems.
 - e. Caddy.
 - f. Thomas & Betts Superstrut.

2.2 VAULTS

- A. Precast vaults:
- 1. Fiberglass reinforced polymer concrete or steel reinforced cement concrete structures.
 - 2. AASHTO live load rating: HS-20 for full deliberate vehicle traffic.
 - 3. Minimum size: 8 FT x 6 FT x 6 FT-4 IN high
 - 4. Mating edges: Tongue and groove type.
 - 5. Solid bottom with a 12 IN x 12 IN or 12 IN DIA french drain in the bottom of each vault.
 - 6. Cover extension rings as required.
 - 7. Cable pulling eyes opposite all conduit entrances.
 - a. Coordinate exact location with installation contractor.

2.3 CONCRETE VAULT ACCESSORIES

- A. Cable Racks and Hooks:
- 1. Material: Heavy-duty nonmetallic (glass reinforced nylon).
 - 2. Hook loading capacity: 400 LBS minimum.
 - 3. Rack loading capacity: Four (4) hooks maximum.
 - 4. Hook deflection: 1/4 IN maximum.
 - 5. Hooks: Length, as required, with positive locking device to prevent upward movement.
 - 6. Mounding hardware: Stainless steel.
- B. Cover:
- 1. 36 IN diameter, round
- C. Conduit penetrations:
- 1. Bell end fittings.
 - 2. Penetrations into existing vault walls shall be core drilled.
- D. Cable Pulling Irons:
- 1. 7/8 IN DIA hot-dipped galvanized steel.
 - 2. 5000 LB minimum pulling load.

- E. Ground Rods and Grounding Equipment: See Specification Section 26 05 26.

2.4 RIGID NONMETALLIC CONDUIT

- A. Schedules 40 (PVC-40) and 80 (PVC-80):
 1. Polyvinyl-chloride (PVC) plastic compound which includes inert modifiers to improve UV degradation, weatherability and heat distribution.
 2. Rated for direct sunlight exposure.
 3. Fire retardant and low smoke emission.
 4. Shall be suitable for use with 90 DegC wire and shall be marked "maximum 90 DegC".
 5. Standards: UL 651.
 6. Size: See Section 26 05 13 for conductor requirements.
 7. Quantity:
 - a. A minimum of one spare conduit, matching the maximum conduit size in the duct bank, shall be installed in all new duct banks.

2.5 CONDUIT FITTINGS AND ACCESSORIES

- A. Fittings for Use with Rigid Nonmetallic PVC Conduit:
 1. Coupling, adapters and conduit bodies:
 - a. Same material, thickness, and construction as the conduits with which they are used.
 - b. Homogeneous plastic free from visible cracks, holes or foreign inclusions.
 - c. Bore smooth and free of blisters, nicks or other imperfections which could damage the conductor.
 2. Solvent cement for welding fittings shall be supplied by the same manufacturer as the conduit and fittings.
 3. Standards: ASTM D2564, UL 651, UL 514B.
- B. Weather and Corrosion Protection Tape:
 1. PVC based tape, 10 mils thick.
 2. Protection against moisture, acids, alkalis, salts and sewage and suitable for direct bury.
 3. Used with appropriate pipe primer.

2.6 CONDUIT SUPPORT SYSTEMS

- A. Multi-conduit Surface or Trapeze Type Support and Pull or Junction Box Supports:
 1. Material requirements:
 - a. Galvanized steel: ASTM A123/A123M or ASTM A153/A153M.
 - b. Stainless steel: AISI Type 316.
 - c. PVC coat galvanized steel: ASTM A123/A123M or ASTM A153/A153M and 20 mil PVC coating.
- B. Single Conduit and Outlet Box Support Fasteners:
 1. Material requirements:
 - a. Zinc plated steel.
 - b. Stainless steel.
 - c. Malleable iron.
 - d. PVC coat malleable iron or steel: 20 mil PVC coating.

- e. Steel protected with zinc phosphate and oil finish.
- C. Duct Spacers/Supports:
- 1. High density polyethylene or high impact polystyrene.
 - 2. Interlocking.
 - 3. Provide 2 IN minimum spacing between conduits.
 - 4. Accessories, as required:
 - a. Hold down bars.
 - b. Ductbank strapping.

2.7 FILL MATERIALS

- A. Backfill Material:
- 1. As approved by Engineer.
 - a. Free of rock cobbles, roots, sod or other organic matter, and frozen material.
 - b. Moisture content at time of placement: 3 percent plus/minus of optimum moisture content as specified in accordance with ASTM D698.
 - 2. For conduit
 - a. Backfill within 6 inches of the conduit shall not have solid material greater than 4 inches in size, or with sharp edges likely to damage the conduit.
 - b. The remainder of backfill should be free from solid material greater than 8 inches in size.
- B. Flowable fill/concrete:
- 1. Description: Flowable fill/concrete shall be a mixture of cement, fly ash, fine sand, water, and air having a consistency which will flow under a very low head.
 - 2. Material characteristics:
 - a. The approximate quantities of each component per cubic yard of mixed material shall be as follows:
 - 1) Cement (Type I or II): 50 LBS.
 - 2) Fly ash: 200 LBS.
 - 3) Fine sand: 2,700 LBS.
 - 4) Water: 420 LBS.
 - 5) Air content: 10 percent.
 - b. Actual quantities shall be adjusted to provide a yield of 1 cubic yard with the materials used.
 - c. Approximate compressive strength should be 85 to 175 psi.
 - d. Fine sand shall be an evenly graded material having not less than 95 percent passing the No. 4 sieve and not more than 5 percent passing the No. 200 sieve.
 - 3. Thickness:
 - a. Minimum 4" slab thickness over the conduits.

PART 3 - EXECUTION

3.1 GENERAL

- A. Drawings indicate the intended location of vaults and routing of ductbanks and direct buried conduit.

1. Field conditions may affect actual routing.
- B. Remove and dispose of unsuitable materials as directed by Geotechnical Engineer to site provided by Contractor.
- C. Vault Locations:
 1. Approximately where shown on the Drawings.
 2. As required for pulling distances.
 3. As required to keep pulling tensions under allowable cable tensions.
 4. As required for number of bends in ductbank routing.
 5. Shall not be installed in a swale or ditch.
 6. Determine the exact locations after careful consideration has been given to the location of other utilities, grading, and paving.
 7. Locations are to be approved by the Engineer prior to excavation and placement or construction of vaults.
- D. Install products in accordance with manufacturer's instructions.

3.2 EXCAVATION

- A. Excavation for Appurtenances:
 1. 12 IN (minimum) clear distance between outer surface and embankment.
- B. Trench Excavation:
 1. Excavate trenches by open cut method to depth shown on Drawings and necessary to accommodate work.
 - a. Support existing utility lines and yard piping where proposed work crosses at a lower elevation.
 - 1) Stabilize excavation to prevent undermining of existing utility.
 2. Open trench outside buildings, units, and structures:
 - a. No more than the distance between two vaults, structures, units, or 300 LF, whichever is less.
 - b. Field adjust limitations as weather conditions dictate.
 3. Trench shall be backfilled immediately following installation of conduit.
 4. Observe following trenching criteria:
 - a. Trench size:
 - 1) Excavate width to accommodate free working space.
 - 2) Cut trench walls vertically from bottom of trench to 1 FT above top of pipe, conduit, or utility service.
 - 3) Keep trenches free of surface water runoff.
 - a) Include cost in Bid.
 - b) No separate payment for surface water runoff pumping will be made.
- C. Trenching for Electrical Installations:
 1. Observe the preceding Trench Excavation paragraph in PART 3 of this Specification Section.
 2. Modify for electrical installations as follows:
 - a. For trenches 12 IN to 30 IN wide, open no more than 600 LF of trench.
 - b. For trenches less than 12 IN wide, any length of trench may be opened in exterior locations.

- c. Do not over excavate trench vertically.
 - d. Cut trenches for electrical runs with minimum 36 IN cover, unless otherwise specified or shown on Drawings.
3. The bottom of the trench should be undisturbed, tamped, or relatively smooth earth. Where the excavation is in rock, the bottom of the the conduit should be laid on a protective layer of clean well-tamped backfill. The backfill should be adequately compacted.

D. Flowable Fill/concrete:

- 1. Flowable fill/concrete shall be:
 - a. Discharged from a mixer by any means acceptable to the Engineer into the area to be filled.
 - b. Placed in 4 FT maximum lifts to the elevations indicated.
 - 1) Allow 12 HR set-up time before placing next lift or as approved by the Engineer.
 - 2) Contractor shall place flowable fill lifts in such a manner as to prevent flotation of the pipe.
- 2. Flowable fill shall not be placed on frozen ground.
- 3. Subgrade on which flowable fill is placed shall be free of disturbed or softened material and water.
- 4. Flowable fill batching, mixing, and placing may be started if weather conditions are favorable, and the air temperature is 34 DegF and rising.
- 5. At the time of placement, flowable fill must have a temperature of at least 40 DegF.
- 6. Mixing and placing shall stop when the air temperature is 38 DegF or less and falling.
- 7. Each filling stage shall be as continuous an operation as is practicable.
- 8. Contractor shall prevent traffic contact with flowable fill for at least 24 HRS after placement or until flowable fill is hard enough to prevent rutting by construction equipment.
- 9. Flowable fill shall not be placed until water has been controlled or groundwater level has been lowered.

3.3 BACKFILLING METHODS

A. Common Trench Backfill:

- 1. Perform in accordance with the following:
 - a. Place backfill in lift thicknesses capable of being compacted to densities specified.
 - b. Observe specific manufacturer's recommendations regarding backfilling and compaction.
 - c. Avoid displacing joints and appurtenances or causing any horizontal or vertical misalignment, separation, or distortion.

B. Water flushing for consolidation is not permitted.

3.4 COMPACTION

A. General:

- 1. Place and assure bedding, backfill, and fill materials achieve an equal or higher degree of compaction than undisturbed materials adjacent to the work.
- 2. In no case shall degree of compaction below minimum compactions specified be accepted.

3.5 FIELD QUALITY CONTROL

A. Testing:

1. Perform in-place moisture-density tests as directed by the Owner.
2. Perform tests through recognized testing laboratory approved by Owner.
3. Costs of "Passing" tests paid by Owner.
4. Perform additional tests as directed until compaction meets or exceeds requirements.
5. Cost associated with "Failing" tests shall be paid by Contractor.
6. Assure Owner has immediate access for testing of all soils related work.
7. Ensure excavations are safe for testing personnel.

3.6 VAULTS

A. Precast vaults:

1. For use in vehicular and non-vehicular traffic areas.
2. Construction:
 - a. Grout or seal all joints, per manufacturer's instructions.
 - b. Support cables on walls by cable racks:
 - 1) Provide a minimum of two (2) racks, install symmetrically on each wall of vaults and handholes.
 - a) Provide additional cable racks, as required, so that both ends of cable splices will be supported horizontally.
 - 2) Equip cable racks with adjustable hooks: Quantity of cable hooks as required by the number of conductors to be supported.
 - c. In each vault, drive 3/4 IN x 10 FT long copper clad ground rod into the earth with approximately 6 IN exposed above finished floor.
 - 1) Drill opening in floor for ground rod.
 - 2) Connect all metallic components to ground rod by means of #8 AWG minimum copper wire and approved grounding clamps.
 - 3) Utilize a ground bar in the vault or handhole if the quantity of ground wires exceeds three (3).
 - a) Connect ground bar to ground rod with a #1/0 AWG minimum copper wire.
3. Place vault on a foundation.
 - a. Foundation shall have 1/4 to 1/2 IN crushed rock or gravel.
 - b. A minimum of 8 IN thick and 6 IN larger than vaults footprint on all sides.
4. Install so that the top of cover is 1 IN above finished grade.
 - a. Where existing grades are higher than finished grades, install sufficient number of courses of curved segmented concrete block between top of vault frame to temporarily elevate vault cover to existing grade level.
5. After installation is complete, backfill and compact soil around vaults.
6. Vault size:
 - a. As indicated on the Drawings or as required for the number and size of conduits entering or as indicated on the Drawings.
 - b. Minimum floor dimension of 6 FT x 6 FT and a minimum depth of 6 FT.

3.7 UNDERGROUND CONDUITS

A. General Installation Requirements:

1. Ductbank types per location:
 - a. Direct-buried conduit(s):
 - 1) As indicated on the Drawings
 2. Do not place soil until conduits have been observed by the Engineer.
 3. During construction and after conduit installation is complete, plug the ends of all conduits.
 4. Provide conduit supports and spacers.
 - a. Place supports and spacers for rigid nonmetallic conduit on maximum centers as indicated for the following trade sizes:
 - 1) 3-1/2 to 6 IN: 7 FT.
 - b. Securely anchor conduits to supports and spacers to prevent movement during placement of concrete or soil.
 5. Stagger conduit joints at intervals of 6 IN vertically.
 6. Make conduit joints watertight and in accordance with manufacturer's recommendations.
 7. Accomplish changes in direction of runs exceeding a total of 15 degrees by long sweep bends having a minimum radius of 25 FT.
 - a. Sweep bends may be made up of one or more curved or straight sections or combinations thereof.
 8. Furnish manufactured bends at end of runs.
 - a. Minimum radius of 48 IN for conduits 3 IN trade size and larger.
 9. Field cuts requiring tapers shall be made with the proper tools and shall match factory tapers.
 10. After the conduit run has been completed:
 - a. Clean the conduit by pulling a heavy duty wire brush mandrel followed by a rubber duct swab through each conduit.
 11. Pneumatic rodding may be used to draw in lead wire.
 - a. Install a heavy nylon cord free of kinks and splices in all unused new ducts.
 - b. Extend cord 3 FT beyond ends of conduit.
 12. Place warning tape in trench directly over ductbanks, direct-buried conduit, and direct-buried wire and cable.
- B. Direct-Buried Conduit(s):
1. Install so that the top of the uppermost conduit, at any point:
 - a. Is not less than 36 IN below grade.
 - b. Is below pavement sub-grading.
 2. Provide a uniform minimum clearance of 2 IN between conduits.

3.8 CONDUIT FITTINGS AND ACCESSORIES

- A. Conduit Seals:
1. Installed in conduit systems located in hazardous areas as required by the NFPA 70.
 2. Filler plug and drain shall be accessible.
 3. Pour the conduit seals in a two-step process.
 - a. Pour the seal and leave cover off.
 - b. After seal is dry, inspect for proper sealing, install cover and mark (for example, paint or permanent marker) as complete.
- B. Rigid nonmetallic conduit and fittings shall be joined utilizing solvent cement.
1. Immediately after installation of conduit and fitting, the fitting or conduit shall be rotated 1/4 turn to provide uniform contact.

- C. Install Expansion Fittings:
 - 1. Where conduits are exposed to the sun and conduit run is greater than 200 FT.
 - 2. Elsewhere as identified on the Drawings.
- D. Install Expansion/Deflection Fittings:
 - 1. Where conduits enter a structure.
 - a. Except electrical vaults.
 - b. Except where the ductbank is tied to the structure with rebar.
 - 2. Where conduits span structural expansions joints.
 - 3. Elsewhere as identified on the Drawings.
- E. Threaded connections shall be made wrench-tight.
- F. Conduit joints shall be watertight:
 - 1. Where subjected to possible submersion.
 - 2. In areas classified as wet.
 - 3. Underground.
- G. Terminate Conduits:
 - 1. When stubbed up through the floor into floor mount equipment:
 - a. With an insulated grounding bushing on metallic conduits.
 - b. With end bells on nonmetallic conduits.
- H. Threadless couplings shall only be used to join new conduit to existing conduit when the existing conduit end is not threaded and it is not practical or possible to cut threads on the existing conduit with a pipe threader.

3.9 CONDUIT SUPPORT

- A. Permitted multi-conduit surface or trapeze type support system per area designations and conduit types:
 - 1. Dry or wet:
 - a. Galvanized system consisting of: Galvanized steel channels and fittings, nuts and hardware and conduit clamps.
 - b. Aluminum system consisting of: Aluminum channels, fittings and conduit clamps with stainless steel nuts and hardware.
 - 2. Conduit type shall be compatible with the support system material.
 - a. Fiberglass system may be used with PVC-40 and PVC-80.
- B. Permitted single conduit support fasteners per area designations and conduit types:
 - 1. Dry or wet:
 - a. Material: Zinc plated steel, stainless steel and malleable iron.
 - b. Types of fasteners: Straps, hangers with bolts, clamps with bolts and bolt on beam clamps.
 - 2. Conduit type shall be compatible with the support fastener material.
 - a. Nonmetallic fasteners may be used with PVC-40 and PVC-80.
- C. Conduit Support General Requirements:
 - 1. Maximum spacing between conduit supports per NFPA 70.
 - 2. Support conduit from the building structure.

3. Do not support conduit from process, gas, air or water piping; or from other conduits.
4. Provide hangers and brackets to limit the maximum uniform load on a single support to 25 LBS or to the maximum uniform load recommended by the manufacturer if the support is rated less than 25 LBS.
 - a. Do not exceed maximum concentrated load recommended by the manufacturer on any support.
 - b. Conduit hangers:
 - 1) Continuous threaded rods combined with struts or conduit clamps: Do not use perforated strap hangers and iron bailing wire.
 - c. Do not use suspended ceiling support systems to support raceways.
 - d. Hangers in metal roof decks:
 - 1) Utilize fender washers.
 - 2) Not extend above top of ribs.
 - 3) Not interfere with vapor barrier, insulation, or roofing.
5. Conduit support system fasteners:
 - a. Use sleeve-type expansion anchors as fasteners in masonry wall construction.
 - b. Do not use concrete nails and powder-driven fasteners.

D. Duct bank spacers

1. Maintain the separation of multiple planes of conduits by one of the following methods:
 - a. Install multilevel conduits with the use of conduit supports and separators to maintain the required separations, and backfill with flowable fill (100 PSI) or concrete.
 - b. Install the multilevel conduits one level at a time.
 - 1) Each level is backfilled with the appropriate amount of soil and compaction to maintain the required separations.

END OF SECTION 260543

SECTION 260544 - SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
2. Sleeve-seal systems.
3. Sleeve-seal fittings.
4. Grout.
5. Silicone sealants.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Wall Sleeves:

1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.

B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

C. Sleeves for Rectangular Openings:

1. Material: Galvanized sheet steel.
2. Minimum Metal Thickness:
 - a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and with no side larger than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
 - b. For sleeve cross-section rectangle perimeter 50 inches (1270 mm) or more and one or more sides larger than 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2.2 SLEEVE-SEAL SYSTEMS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Advance Products & Systems, Inc.
 - b. CALPICO, Inc.
 - c. Metraflex Company (The).
 - d. Pipeline Seal and Insulator, Inc.
 - e. Proco Products, Inc.
 - f. 3M
 2. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 3. Pressure Plates: Stainless Steel.
 4. Connecting Bolts and Nuts: Stainless Steel of length required to secure pressure plates to sealing elements.

2.3 SLEEVE-SEAL FITTINGS

- A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.

2.4 GROUT

- A. Description: Non-shrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.
- B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

2.5 SILICONE SEALANTS

- A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.
1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.

- B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, non-shrinking foam.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

- A. Comply with NECA 1.
- B. Comply with NEMA VE 2 for cable tray and cable penetrations.
- C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:
 - 1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
 - a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint.
 - b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.
 - 2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
 - 3. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed, **unless seismic criteria require different clearance.**
 - 4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
 - 5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level. Install sleeves during erection of floors.
- D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:
 - 1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
 - 2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.
- E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work, and in accordance with roof system manufacturer's warranty requirements.
- F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.
- B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.3 SLEEVE-SEAL-FITTING INSTALLATION

- A. Install sleeve-seal fittings in new walls and slabs as they are constructed.
- B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.
- C. Secure nailing flanges to concrete forms.
- D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION 260544

SECTION 260548 - SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Restraint channel bracings.
2. Restraint cables.
3. Seismic-restraint accessories.
4. Mechanical anchor bolts.

1.2 ACTION SUBMITTALS

A. Delegated-Design Submittal: For each seismic-restraint device.

1. Include design calculations and details for selecting seismic restraints complying with performance requirements, design criteria, and analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
2. Design Calculations: Calculate static and dynamic loading caused by equipment weight, operation, and seismic and wind forces required to select seismic and wind restraints and for designing vibration isolation bases.
 - a. Coordinate design calculations with wind load calculations required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.
3. Seismic and Wind Restraint Details:
 - a. Design Analysis: To support selection and arrangement of seismic and wind restraints. Include calculations of combined tensile and shear loads.
 - b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.
 - c. Coordinate seismic-restraint and vibration isolation details with wind-restraint details required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.
 - d. In lieu of design analysis and details, preapproval documentation by OSHPD, ICC-ES or another agency acceptable to authorities having jurisdiction are acceptable.

1.3 QUALITY ASSURANCE

- ##### A. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

- B. Seismic-restraint devices shall have horizontal and vertical load testing and analysis. They shall bear anchorage preapproval from OSHPD in addition to preapproval, showing maximum seismic-restraint ratings, by ICC-ES or another agency acceptable to authorities having jurisdiction. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) that support seismic-restraint designs must be signed and sealed by a qualified professional engineer.
- C. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Wind-Restraint Loading:
 - 1. Basic Wind Speed: 100 mph.
 - 2. Building Classification Category: See architectural documents.
 - 3. Minimum 10 lb/sq. ft. (48.8 kg/sq. m) multiplied by maximum area of component projected on vertical plane normal to wind direction and 45 degrees either side of normal.
- B. Seismic-Restraint Loading:
 - 1. Design seismic restraints for components for seismic design forces defined in Chapter 13 of ASCE 7-10.
 - a. Design Spectral Response Acceleration at Short Periods, $S_{DS} = 0.600$
 - b. Component Importance Factor, $I_P = 1.0$ for electrical equipment except for components required for life-safety purposes after an earthquake such as egress lighting and fire alarm control panel where $I_P = 1.5$.
 - c. Component Response Modification Factor, R_P : See Table 13.6-1 of ASCE 7-10
 - d. Component Amplification Factor, a_P : See Table 13.6-1 of ASCE 7-10

2.2 RESTRAINT CHANNEL BRACINGS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. Atkore Unistrut
 - 2. B-line, an Eaton business.
 - 3. Hilti, Inc.
 - 4. Mason Industries, Inc.
- B. Description: MFMA-4, shop- or field-fabricated bracing assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end, with other matching components, and with corrosion-resistant coating; rated in tension, compression, and torsion forces.

2.3 RESTRAINT CABLES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
1. Gripple Inc.
 2. Kinetics Noise Control, Inc.
 3. Vibration & Seismic Technologies, LLC.
 4. Vibration Mountings & Controls, Inc.
- B. Restraint Cables: ASTM A 603 galvanized steel cables. End connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; with a minimum of two clamping bolts for cable engagement.

2.4 SEISMIC-RESTRAINT ACCESSORIES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
1. Atkore Unistrut
 2. B-line, an Eaton business.
 3. Kinetics Noise Control, Inc.
 4. Mason Industries, Inc.
- B. Hanger-Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod.
- C. Hinged and Swivel Brace Attachments: Multifunctional steel connectors for attaching hangers to rigid channel bracings and restraint cables.
- D. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings and matched to type and size of anchor bolts and studs.
- E. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings and matched to type and size of attachment devices used.
- F. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

2.5 MECHANICAL ANCHOR BOLTS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
1. B-line, an Eaton business.
 2. Hilti, Inc.
 3. Kinetics Noise Control, Inc.
 4. Mason Industries, Inc.

- B. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Multiple Raceways or Cables: Secure raceways and cables to trapeze member with clamps complying with delegated design submittal requirements.
- B. Hanger-Rod Stiffeners: Install hanger-rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods caused by seismic forces.
- C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.2 SEISMIC-RESTRAINT DEVICE INSTALLATION

- A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork.
- B. Equipment and Hanger Restraints:
 - 1. Install resilient, bolt-isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch (3.2 mm).
- C. Install cables so they do not bend across edges of adjacent equipment or building structure.
- D. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.
- E. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.
- F. Drilled-in Anchors:
 - 1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
 - 2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
 - 3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
 - 4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole

and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.

5. Set anchors to manufacturer's recommended torque using a torque wrench.
6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.3 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

- A. Install flexible connections in runs of raceways, cables, wireways, cable trays, and busways where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where connection is terminated to equipment that is anchored to a different structural element from the one supporting them as they approach equipment.

END OF SECTION 260548

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Color and legend requirements for raceways, conductors, and warning labels and signs.
 - 2. Tapes and stencils.
 - 3. Signs.
 - 4. Cable ties.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Comply with ASME A13.1.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Comply with NFPA 70E requirements for arc-flash warning labels.
- F. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

2.2 COLOR AND LEGEND REQUIREMENTS

- A. Raceways and Cables Carrying Circuits within Buildings. Identify the covers of each junction and pull box of the following systems with paint as follows:
 - 1. Battery or Generator Backed up Emergency System: Orange
 - 2. Fire Detection and Alarm System: Red
 - 3. Systems with voltage greater than 600V: Yellow
 - 4. Direct current systems (Solar PV system): Green

5. Affix label with black letters on color noted above indicating voltage and system or service type.
- B. Conductor Color-Coding for Phase and Voltage-Level Identification, 600 V or Less: Use colors listed below for ungrounded service, feeder and branch-circuit conductors.
1. Utilize factory applied, colored insulation for No. 8 AWG and smaller.
 2. If Authority Having Jurisdiction permits, for sizes larger than No. 8 AWG, where conductors with factory colored insulation are not commonly available, colored non-aging, plastic tape may be field applied. Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
 3. Colors for Three-Phase Wye, 208/120V Circuits:
 - a. Phase A: Black.
 - b. Phase B: Red.
 - c. Phase C: Blue.
 - d. Neutral: White.
 4. Color for Equipment Grounds: Bare copper or Green.
 5. Colors for Isolated Grounds: Green with white stripe.
 6. Lighting Circuit Switched Legs and 3-way/4-way Traveler: Color unique to those listed above.
- C. Warning Label Colors:
1. Identify system voltage with black letters on an orange background.
- D. Warning labels and signs shall include, but are not limited to, the following legends:
1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
 2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES (915 MM)."
 3. Arc Flash Warning: "WARNING – KEEP CLEAR. RISK OF ELECTRIC SHOCK OR ARC FLASH. PPE REQUIRED.”.
- E. Equipment Identification Labels:
1. Black letters on a white field.
 2. 1” minimum height letters for service disconnect and emergency shut-off switches.
 3. 1/2" minimum height letters for panelboards, switchboards, relay enclosures and transformers.
 4. 1/4" minimum height letters for disconnect switches and motor starters.
 5. 1/8” minimum height letters for device coverplates (where required).

2.3 TAPES AND STENCILS

- A. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide; compounded for outdoor use.
- B. Floor Marking Tape: 2-inch- (50-mm-) wide, 5-mil (0.125-mm) pressure-sensitive vinyl tape, with yellow and black stripes and clear vinyl overlay.
- C. Underground-Line Warning Tape:
 - 1. Tape:
 - a. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
 - b. Printing on tape shall be permanent and shall not be damaged by burial operations.
 - c. Tape material and ink shall be chemically inert and not subject to degradation when exposed to acids, alkalis, and other destructive substances commonly found in soils.
 - 2. Color and Printing:
 - a. Comply with ANSI Z535.1, ANSI Z535.2, ANSI Z535.3, ANSI Z535.4, and ANSI Z535.5.
 - b. Inscriptions for Red-Colored Tapes: "ELECTRIC LINE, HIGH VOLTAGE".
 - c. Inscriptions for Orange-Colored Tapes: "TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE".
 - 3. Type:
 - a. Detectable three-layer laminate, consisting of a printed pigmented polyolefin film, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core; bright colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
 - b. Width: 3 inches (75 mm).
 - c. Overall Thickness: 5 mils (0.125 mm).
 - d. Foil Core Thickness: 0.35 mil (0.00889 mm).
 - e. Weight: 28 lb/1000 sq. ft. (13.7 kg/100 sq. m).
 - f. Tensile according to ASTM D 882: 70 lbf (311.3 N) and 4600 psi (31.7 MPa).

2.4 SIGNS

- A. Baked-Enamel Signs:
 - 1. Preprinted aluminum signs, high-intensity reflective, punched or drilled for fasteners, with colors, legend, and size required for application.
 - 2. 1/4-inch (6.4-mm) grommets in corners for mounting.
 - 3. Nominal Size: 7 by 10 inches (180 by 250 mm).
- B. Laminated Acrylic or Melamine Plastic Signs:
 - 1. Engraved legend.

2. Thickness:
 - a. For signs up to 20 sq. in. (129 sq. cm), minimum 1/16 inch (1.6 mm) thick.
 - b. For signs larger than 20 sq. in. (129 sq. cm), 1/8 inch (3.2 mm) thick.
 - c. Engraved legend with black letters on white face
 - d. Punched or drilled for mechanical fasteners with 1/4-inch (6.4-mm) grommets in corners for mounting.
 - e. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.5 CABLE TIES

- A. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.
 1. Minimum Width: 3/16 inch (5 mm).
 2. Tensile Strength at 73 Deg F (23 Deg C) according to ASTM D 638: 12,000 psi (82.7 MPa).
 3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
 4. Color: Black, except where used for color-coding.
- B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.
 1. Minimum Width: 3/16 inch (5 mm).
 2. Tensile Strength at 73 Deg F (23 Deg C) according to ASTM D 638: 12,000 psi (82.7 MPa).
 3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
 4. Color: Black.
- C. Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one piece, and self-locking.
 1. Minimum Width: 3/16 inch (5 mm).
 2. Tensile Strength at 73 Deg F (23 Deg C) according to ASTM D 638: 7000 psi (48.2 MPa).
 3. UL 94 Flame Rating: 94V-0.
 4. Temperature Range: Minus 50 to plus 284 deg F (Minus 46 to plus 140 deg C).
 5. Color: Black.

2.6 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).
- B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 COORDINATION

- A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.
- B. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.
- C. Coordinate installation of identifying devices with location of access panels and doors.
- D. Install identifying devices before installing acoustical ceilings and similar concealment.

3.2 INSTALLATION

- A. Verify identity of each item before installing identification products.
- B. Apply identification devices to surfaces that require finish after completing finish work.
- C. Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.
- D. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.
- E. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from the floor.
- F. Floor Marking Tape: Apply stripes to finished surfaces following manufacturer's written instructions.
- G. Underground Line Warning Tape:
 - 1. During backfilling of trenches, install continuous underground-line warning tape directly above cable or raceway at 6 to 8 inches (150 to 200 mm) below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches (400 mm) overall.
 - 2. Install underground-line warning tape for direct-buried cables and cables in raceways.
- H. Laminated Acrylic or Melamine Plastic Signs:
 - 1. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
- I. Cable Ties: General purpose, for attaching tags, except as listed below:

1. Outdoors: UV-stabilized nylon.
2. In Spaces Handling Environmental Air: Plenum rated.

3.3 IDENTIFICATION SCHEDULE

- A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.
- B. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations of high visibility. Identify by system and circuit designation.
- C. Accessible Fittings for Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive labels containing the wiring system legend and system voltage. System legends shall be as follows:
 1. "EMERGENCY POWER."
 2. "FIRE ALARM."
 3. "HIGH VOLTAGE."
 4. "DIRECT CURRENT."
- D. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use write-on tags with the conductor or cable designation, origin, and destination.
- E. Control-Circuit Conductor Termination Identification: For identification at terminations, provide self-adhesive wraparound labels with the conductor designation.
- F. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source.
- G. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
 2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
 3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.
- H. Locations of Underground Lines: Underground-line warning tape for power, lighting, communication, and control wiring and optical-fiber cable.
- I. Workspace Indication: Apply floor marking tape to finished surfaces. Show working clearances in the direction of access to live parts. Workspace shall comply with NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.
- J. Instructional Signs: Self-adhesive labels, including the color code for grounded and ungrounded conductors.

- K. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive equipment labels.
 - 1. Apply to exterior of door, cover, or other access.
 - 2. For equipment with multiple power or control sources, apply to door or cover of equipment, including, but not limited to, the following:
 - a. Power-transfer switches.
 - b. Controls with external control power connections.
- L. Arc Flash Warning Labeling: Self-adhesive labels.
- M. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
- N. Emergency Operating Instruction Signs: Self-adhesive labels, Laminated acrylic or melamine plastic signs with white legend on a red background with minimum 3/8-inch- (10-mm-) high letters for emergency instructions at equipment used for power transfer and load shedding.
- O. Equipment Identification Labels:
 - 1. Indoor Equipment: Engraved, laminated acrylic or melamine plastic label.
 - 2. Outdoor Equipment: Engraved, Laminated acrylic or melamine label.
 - 3. Equipment to Be Labeled:
 - a. Panelboards/Switchboards:
 - 1) Label shall be self-adhesive, engraved, laminated acrylic or melamine. Label shall include: Panelboard/switchboard name, voltage, amperage, number of phases and wires, source and available fault current with date calculated.
 - 2) Typewritten directory of circuits in the location provided by panelboard manufacturer. Spares shall be filled in by hand with pencil.
 - 3) On main distribution panel door / switchboard front provide a laminated one-line diagram of the electrical system and all panel configurations.
 - b. Enclosures and electrical cabinets.
 - c. Access doors and panels for concealed electrical items.
 - d. Switchgear.
 - e. Transformers: Label that includes tag designation shown on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
 - f. Emergency system boxes and enclosures.
 - g. Enclosed switches.
 - h. Enclosed controllers.
 - i. Push-button stations.
 - j. Power transfer equipment.
 - k. Contactors.
 - l. Remote-controlled switches, dimmer modules, and control devices.
 - m. Battery-inverter units.
 - n. Battery racks.
 - o. Power-generating units.

- p. Monitoring and control equipment.
- q. UPS equipment.
- r. Wiring devices: See specification section “Wiring Devices”.

END OF SECTION 260553

SECTION 260813 MEDIUM VOLTAGE ACCEPTANCE TESTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Basic requirements for acceptance testing.
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Division 00 - Procurement and Contracting Requirements.
 - 2. Division 01 - General Requirements.
 - 3. Section 260500 - Electrical: Basic Requirements.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
 - a. 400, Guide for Field Testing and Evaluation of the Insulation of Shielded Power Cable Systems.
 - b. 400.3, Guide for Partial Discharge Testing of Power Cable Systems in a Field Environment.
 - 2. Nationally Recognized Testing Laboratory (NRTL).
- B. Qualifications:
 - 1. Testing firm qualifications: See Specification Section 260500.
 - 2. Field personnel:
 - a. See Specification Section 260500.
 - b. As an alternative, supervising technician may be certified by the equipment manufacturer.
 - 3. Analysis personnel:
 - a. See Specification Section 260500. As an alternative, supervising technician may be certified by the equipment manufacturer.
- C. Phasing Diagram:
 - 1. Coordinate with Utility Company for phase rotations and Phase A, B and C markings.
 - a. Create a phasing diagram showing the coordinated phase rotations with generators and motors through the transformers.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Verify with MSU for electrical equipment and connection testing plan submittal requirements.
- B. Informational Submittals:
 - 1. Prior to energizing equipment:

- a. Coordinated phasing diagram.
- b. Photocopies of continuity tests.
2. Within two (2) weeks after successful completion of Demonstration Period (Commissioning Period):
 - a. Single report containing information including:
 - 1) Summary of Project.
 - 2) Information from pre-energization testing.

PART 2 - PRODUCTS

2.1 FACTORY QUALITY CONTROL

- A. Provide Electrical equipment with all factory tests required by the applicable industry standards or NRTL.
- B. Factory testing will not be accepted in lieu of field acceptance testing requirements specified in this Specification Section.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

- A. General:
 1. Complete electrical testing in three (3) phases:
 - a. Pre-energization testing phase.
 - 1) Verify electrical phasing prior to equipment energization.
 - b. Equipment energized with no load.
 - c. Equipment energized under load.
 2. Perform testing in accordance with this Specification Section and manufacturer's recommendations.
 3. Provide field setting and programming of all adjustable protective devices and meters to settings provided by the Engineer.
- B. Equipment Monitoring and Testing Plan: See MSU medium voltage specifications.
- C. Instruments Used in Equipment and Connections Quality Control Testing: See MSU medium voltage specifications.
- D. Testing and Monitoring Program Documentation: See MSU medium voltage specifications.
- E. Electrical Equipment and Connections Testing Program:
 1. See MSU medium voltage specifications.
 2. See individual Division 26 Specification Sections for equipment specific testing requirements.
 3. Test all electrical equipment per manufacturer's recommendations.

3.2 SPECIFIC EQUIPMENT TESTING REQUIREMENTS

- A. Transformers - Liquid Filled:
 - 1. Perform inspections and tests per manufacturer's recommendations.
 - 2. Components: Test all components per applicable paragraphs of this Specification Section and manufacturer's recommendations.
 - 3. Perform the following additional tests:
 - a. Record phase-to-phase, phase-to-neutral, and neutral-to-ground voltages at no load after energizing, and at operating load after start-up.
 - 4. Adjust tap changer setting as required to provide secondary voltage within 2-1/2 percent of nominal under normal load after approval of Engineer.
 - 5. Record as-left tap changer setting.

- B. Cable - Medium Voltage:
 - 1. Perform inspections and tests per manufacturer's recommendations.
 - 2. Very low frequency (VLF) test (IEEE 400.2):
 - a. Prior to energization, perform a VLF test for baseline data for future VLF maintenance testing.
 - b. VLF testing shall include:
 - 1) Withstand test to evaluate whether the cable can handle the test voltage
 - 2) Tangent delta test, including differential tangent delta and tangent delta stability, for baseline comparison
 - c. Results for new cable shall be compared to Table G.2 in IEEE 400.2
 - 3. Non-destructive partial discharge test:
 - a. After energization, perform a partial discharge test for baseline data for future partial discharge maintenance testing.
 - b. Perform the work while the medium voltage circuits and equipment are energized.
 - 1) The cables shall not be disconnected or de-energized and the testing shall not expose the cables to voltages that exceed normal operating voltage.
 - c. Use a frequency domain detection process incorporating a spectrum analyzer with radio frequency current transformer (RF CT) sensors.
 - 1) The detection system, including spectrum analyzer, RF CT's and interconnecting cable, shall have a partial discharge detection range that at least covers the frequency range of 10 kHz to 300 MHz.
 - 2) Testing shall be performed in a manner that complies with the requirements of IEEE 400 and IEEE 400.3.

- C. Medium Voltage Circuit Breakers and Vacuum Fault Interrupters:
 - 1. Perform inspections and tests per manufacturer's recommendations.
 - 2. Components: Test all components per applicable paragraphs of this Specification Section and manufacturer's recommendations.
 - 3. Perform the following additional tests:
 - a. High-potential vacuum integrity test per manufacturer's recommendations.
 - b. Control wiring insulation resistance.
 - c. Minimum trip and close voltage.
 - d. Overpotential.

- D. Protective Relays:
 - 1. Perform inspections and tests per manufacturer's recommendations.
 - a. Tests to be performed using secondary injection of 3 PH current and potential at final settings.

- b. Test at manufacturer's recommended test points and critical timing points identified on relay setting sheet.
 - 2. Perform the following additional tests:
 - a. Verification of direct trip of associated lockout relay or circuit breaker(s) by using relay test function or shorting trip contact at relay case.
 - b. Microprocessor-based relays:
 - 1) Complete commissioning procedure per manufacturer's instructions, followed by tests of each relay element at final settings.
 - 2) Verification of all internally-programmed logic.
 - c. Verification of all auxiliary input and output signals.
 - d. Verification of power supply/self-diagnostic alarm contact and remote annunciation.
 - 3. Record as-left settings.
- E. Metering:
 - 1. Perform inspections and tests per manufacturer's recommendations.
 - 2. Components: Test all components per applicable paragraphs of this Specification Section and manufacturer's recommendations.
- F. Grounding:
 - 1. Perform inspections and tests per manufacturer's recommendations.
 - 2. Components: Test all components per applicable paragraphs of this Specification Section.

END OF SECTION 260813

SECTION 260923 - LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Time switches.
2. Indoor occupancy and vacancy sensors.
3. Switchbox-mounted occupancy sensors
4. Digital timer light switches.
5. High-bay occupancy sensors.
6. Lighting contactors.
7. Emergency shunt relays.
8. Lighting Control Relay Panels

B. Related Requirements:

1. Section 262726 "Wiring Devices" for wall-box dimmers and manual light switches.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Show installation details for occupancy/vacancy and light-level sensors.
2. Interconnection diagrams showing field-installed wiring.
3. Include diagrams for power, signal, and control wiring.

1.3 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

B. Remote Configuration Tools.

1.4 WARRANTY

A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace lighting control devices that fail(s) in materials or workmanship within specified warranty period.

1. Warranty Period: Five year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 TIME SWITCHES

1. Cooper Industries, Inc.
 2. Intermatic, Inc.
 3. Leviton Manufacturing Co., Inc.
 4. Tork by NSi Industries LLC.
- B. Electronic Time Switches: Solid state, programmable, with alphanumeric display; complying with UL 917.
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Contact Configuration: SPST, or as noted on plans.
 3. Contact Rating: 20A ballast load, 120/240V ac.
 4. Programs: Two on-off set points on a 24-hour schedule, allowing different set points for each day of the week and an annual holiday schedule that overrides the weekly operation on holidays.
 5. Circuitry: Allow connection of a photoelectric relay as substitute for on-off function of a program on selected channels.
 6. Astronomic Time: All channels.
 7. Automatic daylight savings time changeover.
 8. Battery Backup: Not less than seven days reserve, to maintain schedules and time clock.

2.2 INDOOR OCCUPANCY AND VACANCY SENSORS

- A. Manufacturers: Design is based on WattStopper DT-300 and DT-200 Series, but subject to compliance with requirements, available manufacturers offering products that may be substituted into the Work include, but are not limited to the following:
1. Cooper Industries, Inc.
 2. Hubbell Building Automation, Inc.
 3. Leviton Manufacturing Co., Inc.
 4. Lithonia Lighting; Acuity Brands Lighting, Inc.
 5. Lutron Electronics Co., Inc.
 6. Philips Lighting Controls.
 7. Sensor Switch, Inc.
- B. General Requirements for Sensors:
1. Wall and Ceiling-mounted, solid-state indoor occupancy and vacancy sensors.
 2. Dual technology (passive infrared and ultrasonic).
 3. Separate power pack, unless installed on gyp. board ceilings or walls.
 4. Hardwired (line or low-voltage) connection to switch.
 5. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 6. Operation (as noted on plans):

- a. Occupancy Sensor: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn them off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
 - b. Vacancy Sensor: Unless otherwise indicated, lights are manually turned on and sensor turns lights off when the room is unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
- 7. Sensor Output: Sensor is powered from the power pack.
 - 8. Power: Line voltage where installed on gyp. board ceilings or walls.
 - 9. Power Pack: Dry contacts rated for 20A LED load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by NFPA 70.
 - 10. Mounting:
 - a. Sensor: Suitable for mounting in any position on a standard outlet box.
 - b. Relay: Externally mounted through a 1/2-inch (13-mm) knockout in a standard electrical enclosure.
 - c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
 - 11. Indicator: Digital display, to show when motion is detected during testing and normal operation of sensor.
 - 12. Bypass Switch: Override the "on" function in case of sensor failure.
 - 13. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc (21.5 to 2152 lux); turn lights off when selected lighting level is present.
- C. Dual-Technology Type: Wall or Ceiling mounted (as noted on plans); detect occupants in coverage area using PIR and ultrasonic detection methods. The particular technology or combination of technologies that control on-off functions is selectable in the field by operating controls on unit.
- 1. Sensitivity Adjustment: Separate for each sensing technology.
 - 2. Detector Sensitivity: Detect occurrences of 6-inch- (150-mm-) minimum movement of any portion of a human body that presents a target of not less than 36 sq. in. (232 sq. cm), and detect a person of average size and weight moving not less than 12 inches (305 mm) in either a horizontal or a vertical manner at an approximate speed of 12 inches/s (305 mm/s).
 - 3. Ceiling Mounted Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. (93 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
 - 4. Wall Mounted Detection Coverage: Detect occupancy anywhere within a 180-degree pattern centered on the sensor over an area of 2000 square feet (220 square meters) when mounted 72 inches above finished floor.

2.3 SWITCHBOX-MOUNTED OCCUPANCY SENSORS, DUAL TECHNOLOGY

- A. Manufacturers: Design is based on WattStopper DW-100 Series, but subject to compliance with requirements, available manufacturers offering products that may be substituted into the Work include, but are not limited to the following:
 - 1. Cooper Industries, Inc.

2. Hubbell Building Automation, Inc.
3. Leviton Manufacturing Co., Inc.
4. Lithonia Lighting; Acuity Brands Lighting, Inc.
5. Lutron Electronics Co., Inc.
6. Philips Lighting Controls.
7. Sensor Switch, Inc.

B. Description: Switchbox-mounted, combination lighting-control sensor and conventional switch lighting-control unit using dual technology (passive infrared and ultrasonic).

1. Connections: Hard wired.
2. Rated 1200 W at 120-V ac for tungsten lighting, 10 A at 120-V ac or 10 A at 277-V ac for fluorescent or LED lighting, and 1/6 hp at 120-V ac.
3. Adjustable time delay of 5 to 20 minutes.
4. Comply with NEMA WD 1, UL 20, and FS W-S-896.

2.4 DIGITAL TIMER LIGHT SWITCHES

A. Manufacturers: Design is based on WattStopper TS-400 Series, but subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Cooper Industries, Inc.
2. Intermatic, Inc.
3. Invensys Controls.
4. Leviton Manufacturing Co., Inc.
5. NSi Industries LLC.
6. TE Connectivity Ltd.
7. WattStopper; a Legrand® Group brand.

B. Description: Combination digital timer and conventional switch lighting control unit. Switchbox-mounted, backlit LCD display, with selectable time interval in 10 minute increments.

1. Rated 960 W at 120-V ac for tungsten lighting, 10 A at 120-V ac or 10 amps at 277-V ac for LED, and 1/4 horsepower at 120-V ac.
2. Voltage: Dual voltage - 120 and 277 V.
3. Color: Match color of other wiring devices.
4. Faceplate: Color matched to switch.

2.5 HIGH-BAY OCCUPANCY SENSORS

A. Manufacturers: Design is based on WattStopper HBP-100 Series, but subject to compliance with requirements, available manufacturers offering products that may be substituted into the Work include, but are not limited to the following:

1. Cooper Industries, Inc.
2. Hubbell Building Automation, Inc.
3. Leviton Manufacturing Co., Inc.
4. Lithonia Lighting; Acuity Brands Lighting, Inc.

5. Lutron Electronics Co., Inc.
6. Philips Lighting Controls.
7. Sensor Switch, Inc.

B. Description:

1. Rated for indoor use.
2. Mounting heights between 15' and 40'.
3. Adjustable time delay (15 seconds - 30 minutes; factory preset at 15 minutes).
4. Low-voltage operation with power pack, or line-voltage operation with integral power pack.
5. Operating conditions: Temperature 32-158°F (0-70°C); Humidity 20-90%, non-condensing.

C. PIR Type: Ceiling mounted; detect occupants in coverage area by their heat and movement.

1. Detector Sensitivity: Detect occurrences of 6-inch- (150-mm-) minimum movement of any portion of a human body that presents a target of not less than 36 sq. in. (232 sq. cm).
2. Detection Coverage: Detect occupancy anywhere in a circular area of 40-foot diameter when mounted on a 20-foot high ceiling.
3. Detection Coverage: Detect occupancy anywhere in a circular area of 100-foot diameter when mounted on a 40-foot high ceiling.
4. Detection Coverage: Detect occupancy anywhere in a linear area of 60-foot long when mounted on a 40-foot high ceiling.

D. Remote Configuration Tool: Include remote configuration tool to allow for sensor setup and adjustment from the floor.

2.6 LIGHTING CONTACTORS

1. Allen-Bradley/Rockwell Automation.
2. ASCO.
3. Eaton.
4. General Electric Company.
5. Square D.

B. Description: Electrically operated and mechanically held, complying with NEMA ICS 2 and UL 508.

1. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballast with 15 percent or less THD of normal load current).
2. Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.
3. Enclosure: Comply with NEMA 250.
4. Provide with Hand-Off-Auto switch and pilot devices as indicated on Drawings, matching the NEMA type specified for the enclosure.
5. Provide solid-state control module as required for 2 or 3 wire control.

2.7 EMERGENCY LIGHTING CONTROL DEVICES

- A. Manufacturers: Design is based on WattStopper ELCU-200 Series, but subject to compliance with requirements, other manufacturers' products may be submitted for prior approval.
- B. Emergency Lighting Control Unit - A UL 924 listed device that monitors a switched circuit providing normal lighting to an area. The unit provides normal ON/OFF control of emergency lighting along with the normal lighting. Upon normal power failure the emergency lighting circuit will close, forcing the emergency lighting ON until normal power is restored. Features include:
 - 1. 120/277 volts, 50/60 Hz, 20 amp ballast rating
 - 2. Push to test button
 - 3. Auxiliary contact for remote test or fire alarm system interface

2.8 LIGHTING CONTROL RELAY PANEL

- A. Manufacturers: Design is based on WattStopper LC8 Series, but subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. Acuity Controls.
 - 2. Crestron
 - 3. Hubbell Automation.
 - 4. Leviton.
- B. Panel description:
 - 1. UL Listed with 14,000 SCCR.
 - 2. Enclosure: NEMA 1 rated with hinged, lockable, surface or flush cover (as shown on plans).
 - 3. Interior: Barrier for separation of high voltage (class 1) and low voltage (class 2) wiring.
 - 4. Relays: Up to (8) single-pole or (4) two-pole relays. Relays shall be electrically held relays with auxiliary contacts for pilot light switching. SPST and DPST relays with 20A contact ratings for:
 - a. Light fixture ballasts/drivers.
 - b. General purpose loads.
 - c. 1/2 HP motor at 120V.
 - d. 1 HP motor at 208, 240 or 480V.
 - 5. Back-lit Touchscreen User Interface:
 - a. Timeclock with 8 Channels of time control, up to 42 holidays and automatic daylight savings adjustment.
 - b. Non-volatile program memory to retain time keeping during power outages for at least 48 hours.
- C. External Control device interface:
 - 1. 8 universal switch inputs that are low voltage, self-configuring and do not require programming to accept momentary on/ momentary off switch, push button switch (cycling), maintained switch or 24VDC signals from occupancy sensors, photocells or other interfacing devices.

2. After-hour interior lighting shut off control shall provide a full duration override time of 1 to 240 minutes with a warning blink five minutes prior to shutting the lighting off. An impending shut off will be cancelled and the override period re-initialized by pressing the automatic control switch push button (WattStopper No. AS-100 or equivalent).
3. Control exterior lighting via photocell input (do not use astronomical clock function).

2.9 CONDUCTORS AND CABLES

- A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- B. Classes 2 and 3 Control Cable: Multi-conductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables." Consult manufacturer for Class 2 wiring requirements. Provide in a separate raceway if manufacturer does not allow cabling shared with Class 1 cabling.
- C. Class 1 Control Cable: Multi-conductor cable with stranded-copper conductors not smaller than No. 14 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 DEVICE LOCATIONS - Device locations on plan drawings are approximate and are intended to indicate general area to be covered.

1. All devices shall be installed in strict accordance with manufacturer's guidelines.
2. Contractor shall provide additional devices and associated hardware as required to cover the entire area.
3. Occupancy sensor locations shall be shifted as necessary to ensure the following:
 - a. Normal devices shall be installed only no higher than 120" AFF.
 - b. No device employing PIR sensing shall be installed in a location where obstacles may block the sensor's field of view.
 - c. Any device employing ultrasonic sensing shall be installed at a minimum of 6' away from any strong transfer of air such as supply diffusers.

3.2 INSTALLATION

- A. Comply with NECA 1.
- B. Examine all lighting control devices before installation. Reject lighting control devices that are wet, moisture damaged, or mold damaged.
- C. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.

- D. Install and aim sensors in locations to achieve not less than 90-percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.
 - E. Mount electrically held lighting contactors with elastomeric isolator pads to eliminate structure-borne vibration unless contactors are installed in an enclosure with factory-installed vibration isolators.
 - F. Provide detailed point to point wiring diagrams for every termination. Provide wire specifications and wire colors to simplify contactor termination requirements
 - G. Install the work of this Section in accordance with manufacturer's printed instructions unless otherwise indicated.
 - H. Calibrate all sensor time delays and sensitivity to guarantee proper detection of occupants and energy savings.
 - 1. Adjust time delay so that controlled area remains lighted for 5 minutes after occupant leaves area.
 - I. Provide written or computer-generated documentation on the commissioning of the system including room by room description including:
 - 1. Sensor parameters, time delays and sensitivities.
 - 2. Sequence of operation, (e.g. manual ON, Auto OFF. etc.)
 - 3. Load Parameters (e.g. blink warning, etc.)
- 3.3 WIRING - In general, all devices and equipment shall be wired in accordance with manufacturer's guidelines. Wireless devices shall only be used if specifically approved in writing by the Engineer.
- A. Wiring Method: Comply with Section 260519 "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size is 3/4 inch.
 - B. Low voltage cables do not require raceway where concealed in accessible ceilings. Cabling shall be cleanly organized and supported by J-Hooks or approved methods every 6 feet.
 - C. Low voltage cables shall be installed in conduit/raceway where exposed.
 - D. Wiring within Enclosures: Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.
 - E. Size conductors according to lighting control device manufacturer's written instructions unless otherwise indicated.
 - F. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.4 IDENTIFICATION

- A. Identify components and power and control wiring according to Section 260553 "Identification for Electrical Systems."
 - 1. Identify controlled circuits in lighting contactors.
 - 2. Identify circuits or luminaires controlled by photoelectric and occupancy sensors at each sensor.
- B. Label time switches and contactors with a unique designation.

3.5 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Operational Test: After installing time switches and sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Lighting control devices will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

3.6 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting lighting control devices to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.
 - 1. For occupancy and motion sensors, verify operation at outer limits of detector range. Set time delay to suit Owner's operations.
 - 2. For daylighting controls, adjust set points and deadband controls to suit Owner's operations.
 - 3. Align high-bay occupancy sensors using manufacturer's laser aiming tool.

3.7 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices.

END OF SECTION 260923

SECTION 261219 DISTRIBUTION TRANSFORMERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Distribution pad-mounted transformers.
 - 2. Fiberglass Ground Sleeve
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Division 01 - General Requirements.
 - 2. Section 260813 - Acceptance Testing.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. American National Standards Institute (ANSI).
 - 2. Institute of Electronic and Electronics Engineers, Inc. (IEEE):
 - a. 386, Standard for Separable Insulated Connector Systems for Power Distribution Systems Above 600 V.
 - b. C57.12.00, Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers.
 - c. C57.12.25, Transformers - Pad-Mounted, Compartmental-Type, Self-Cooled, Single-Phase Distribution Transformers with Separable Insulated High-Voltage Connectors; High Voltage, 34 500 Grdy/19 920 Volts and Below; Low-Voltage, 240/120 Volts; 167 kVA and Smaller
 - d. C57.12.28, Standard Requirements for Pad-Mounted Equipment - Enclosure Integrity.
 - e. C57.12.34, Standard Requirements for Pad-Mounted, Compartmental-Type, Self-Cooled, Three-Phase Distribution Transformers (2500 kVa and Smaller) - High-Voltage: 34 500 GrdY/19 920 Volts and Below; Low-Voltage: 480 Volts and Below.
 - f. C57.12.70, Standard Terminal Markings and Connections for Distribution and Power Transformers.
 - g. C57.12.80, Standard Terminology for Power and Distribution Transformers.
 - h. C57.12.90, Standard Test Code for Liquid-Immersed Distribution, Power, and Regulating Transformers.
 - i. C62.11, Standard for Metal-Oxide Surge Arresters for Alternating Current Power Circuits (>1 kV).
 - 3. National Fire Protection Association (NFPA):
 - a. 70, National Electrical Code (NEC).

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Product technical data:

- a. Provide submittal data for all products including subcomponents specified in PART 2 of this Specification Section.
 - b. See Specification Section 260500 for additional requirements.
 - 2. Fabrication and/or layout Drawings.
 - a. Outline Drawing including dimensions, weight and identification of all components and features.
 - b. Nameplate Drawing.
 - 3. Certifications:
 - a. Letter stating compliance with current Department of Energy efficiency requirements.
- B. Contract Closeout Information:
 - 1. Operation and Maintenance Data:
 - a. Content of Operation and Maintenance Manual:
 - 1) Instruction and maintenance manual.
 - 2) Product technical data provided in the submittal.
 - 3) Outline drawing updated for as-built conditions.
 - 4) Nameplate Drawing updated for as-built conditions.
 - 5) Actual impedance data.
 - 6) Factory test report.
 - 7) Acceptance testing report.
 - 8) Renewal parts lists for all replaceable parts and assemblies.
 - b. Furnish five (5) copies at least two (2) weeks prior to shipment.
- C. Informational Submittals:
 - 1. Factory test report.

1.4 EQUIPMENT GUARANTEE

- A. Without limiting any other provision regarding guarantees, manufacturer shall guarantee the equipment as follows:
 - 1. Seller shall guarantee to the Owner that the equipment together with all parts included in the original purchase, is free of defect in workmanship and materials and is capable of continuous and satisfactory performance when operated in accordance with the instructions provided by the Seller at the specified rating and capacity.
 - 2. Guarantee shall extend for a minimum of one (1) year from the date of commercial operation. It shall cover all defects and malfunctions of the equipment and accessories.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 - 1. Eaton Cooper Power Systems.
 - 2. ABB.
 - 3. G&W
 - 4. Howard Industries, Inc.
 - 5. Prolec GE.

6. Square D Company.

2.2 THREE-PHASE TRANSFORMER

A. General:

1. Transformer to be designed and constructed in accordance with:
 - a. IEEE C57.12.00, IEEE C57.12.28, IEEE C57.12.34, IEEE C57.12.70, IEEE C57.12.80.

B. Ratings and Configurations:

1. Type: Outdoor, pad-mounted, liquid-immersed, self-cooled, compartmental type.
 - a. "Unit Residential" type padmount transformers are not acceptable.
2. Operation and application: Step-down operation.
3. Configuration:
 - a. Dead-front, loop-feed primary.
4. Voltage:
 - a. Primary: 12.47 grounded wye/7.2 kV.
 - b. Secondary: 208Y/120V or 480Y/277V, as shown on Drawings.
5. kVA Ratings: As specified on the Drawings.
6. Number of phases: Three (3), unless shown on Drawings.
7. Class: OA.
8. Frequency: 60 Hz.
9. Polarity: ANSI standard.
10. Percent impedance: ANSI standard.
11. Basic impulse level (BIL):
 - a. Primary: 95 kV
 - b. Secondary: 30kV.
12. Temperature rise: 65 DegC.
13. Efficiency: Meet all current Department of Energy rules.
14. Connections:
 - a. Wye-wye
 - b. Primary:
 - 1) 200 ampere bushing wells and insert for loadbreak elbows
 - 2) Dead front design
 - c. Secondary (208/120V):
 - 1) Less than 750 kVA: Six-hole, tin-plated, NEMA spade-type minimum or as required.
 - 2) Removable ground strap on neutral terminal.
 - d. Secondary (480/277V):
 - 1) Less than 750 kVA: Six-hole, tin-plated, NEMA spade-type minimum or as required.
 - 2) Removable ground strap on neutral terminal.
15. Tap-changer: None required
16. Sectionalizing oil immersed load break primary switch:
 - a. Rating: 200A
 - b. Four (4) position, 'T' blade, with the switch positions labeled:
 - 1) "SOURCE A" (Loop is open and the coil is energized by Source A).
 - 2) "SOURCE B" (Loop is open and the coil is energized by Source B).
 - 3) "SOURCE A & B" (Loop is closed and the coil is energized by both sources).

- 4) "LOOP CLOSED & XFMR OPEN" (Loop is closed and the coil is de-energized).
 - c. Switch shall:
 - 1) Be gang operated
 - 2) Be rotary (360 degree operation)
 - 3) Have movable index plate to limit accidental switch rotation
 - 4) Be hook stick operable
 - 5) Have permanently attached handle
 - 6) Be marked for switch position and circuit identification
 - d. Provide one-line diagram of switch arrangement mounted in clear view.
- C. Components:
1. Core and Coil:
 - a. Coil material: Aluminum or copper.
 - b. Windings:
 - 1) Designed to reduce losses.
 - 2) Connected for grounded-wye to grounded-wye operations
 - 3) Two winding type construction
 - 4) Autotransformers are not allowed.
 - c. Insulating materials rated for 120 DegC class.
 - d. Core material: High-grade, grain-oriented, burr-free, silicon core steel with high magnetic permeability, low hysteresis and eddy current losses.
 - e. Core frame:
 - 1) Designed to provide maximum support for the core and coil assembly.
 - 2) Welded or bolted to ensure maximum short-circuit strength.
 - f. Designed and manufactured to meet the short circuit requirements of ANSI C57.12.90.
 - g. Vacuum processed and energized to set the epoxy coating on the insulating paper and remove moisture from the insulation. While energized and under vacuum, the transformer is to be filled with preheated, filtered, and degassed insulating fluid.
 - h. h.Triplex or five legged core design.
 2. Tank and Terminal Cabinet Enclosure:
 - a. Carbon steel reinforced with external, internal or sidewall braces, with all seams and joints continuously welded.
 - b. Design the tank and attached components to withstand 7 psi without permanent deformation, and 15 psi without rupture. The tank shall include a 15 psig pressure relief valve with a flow rate minimum of 35 SCFM.
 - c. Sealed-tank construction:
 - 1) 500kVA and below: Bolted main tank cover.
 - d. Lifting lugs welded to tank.
 - e. Steel divider between high-voltage (left side) and low-voltage (right side) compartments.
 - f. No exposed screws, bolts, or other fastening devices that are externally removable.
 - g. Tamper resistant per IEEE C57.12.28.
 - h. Cabinet depth: IEEE standard or 20 IN minimum.
 - i. 1 IN upper fill plug.
 - j. 1 IN drain valve with sampling device.
 - k. Automatic pressure relief device.
 - l. Ground pad(s):
 - 1) 500kVA and below: Two (2) steel pads with one (1) hole. m. Door:

- 2) Each compartment will have removable, three-point latching hinged doors equipped for latching in the open position.
- 3) The high-voltage compartment door will have a fastening device that is accessible only through the low-voltage compartment.
- 4) The hinge assemblies made of corrosion-resistant material.
 - a) Provide stainless-steel hinge pins of 3/8 IN minimum diameter.
- 5) Both compartment doors capable of securing with a single padlock having a maximum 1/2 IN DIA shackle.
- 6) Door secured with a penta-head bolt.
- 7) Provisions to secure doors in open position.
- 8) Provide 7"x10" "Caution" warning signs on exterior of all access doors.
- m. Grounding lug attachments:
 - 1) Minimum of two welded attachments for connection to concentric neutral termination on front of tank
 - 2) Lugs shall accommodate 1/0 copper ground conductor.
3. Overcurrent protection:
 - a. Internal partial-range current limiting backup fuse.
 - b. Provide and install full range protection two fuse system.
 - c. Partial-range current limiting backup fuse.
 - 1) Interrupting rating: 50,000A.
 - 2) Under oil, non-field replaceable.
 - d. Dual sensing, expulsion-type, Bay-O-Net fuse.
 - e. High amp overload, expulsion-type, Bay-O-Net fuse.
 - 1) Under oil, field replaceable.
 - 2) Load break operable with hot stick.
 - 3) In series with the current limiting fuse.
 - 4) Provide Bay-O-Net assembly with flapper valve.
 - 5) Provide metal drip shield or snap on drip guard.
 - 6) Provide spare fuse element for fuse size.
4. Finish:
 - a. Manufacturer's standard corrosion protection system in accordance with IEEE C57.12.28.
 - b. Color: Munsell Green 7GY 3.29/1.5.
5. Dielectric Fluid:
 - a. Tested for compatibility with the transformer.
 - b. Less-flammable, non-toxic, non-bioaccumulating, biodegradable per US EPA OPPTS 835.3100 and certified to comply with US EPA Environmental Technology Verification requirements.
 - 1) Fluid is to be 100% derived from edible seed oils and food grade performance enhancing additives.
 - 2) The fluid shall not require genetically altered seeds for its base oil.
 - c. Permanently affix nameplate stamped "Non PCB".
6. Accessories:
 - a. Liquid level gage
 - b. Dial-type thermometer gage.
 - c. Pressure vacuum gage
 - d. Stainless steel or laser-scribed anodized aluminum nameplate, with date of manufacturer.
 - e. Cable parking stands, one per bushing.

2.3 INSULATING SECONDARY COVERS

- A. Insulated secondary covers shall be included on all secondary terminals.
- B. Covers shall be installed over terminals and cable, without the need to remove cables.
- C. Rated for 600V minimum.

2.4 SURGE ARRESTERS

- A. Surge arresters shall be included on all radial fed or normal open, looped transformers.
- B. Arresters may be either elbow or parking stand type.
 - 1. See Section 260513 for arrester requirements.

2.5 SOURCE QUALITY CONTROL

- A. Factory Tests: At a minimum, provide all routine tests as specified in IEEE C57.12.00 in accordance with IEEE C57.12.90.

2.6 MAINTENANCE MATERIALS

- A. Touch-up paint, two (2) separate one (1) quart containers.

2.7 PAD GROUND SLEEVE

- A. Owner prefers cast concrete.
 - 1. With Owner approval, fiberglass ground sleeves are acceptable when not subject to damage by snow removal or grounds keeping.
- B. Pad dimensions shall be determined by the equipment dimensions, weight of equipment and pulling sheave radius.
- C. Approved fiberglass manufacturers:
 - 1. Nordic Fiberglass
 - 2. Hubbell
 - 3. Highline Products
 - 4. Or approved equal.
- D. Fiberglass Ground Sleeve Requirements:
 - 1. Fiberglass construction
 - 2. Fire retardant resin
 - 3. 18 inch minimum depth
 - 4. Sized to fit sectionalizing enclosure
 - 5. Adequately reinforced to support sectionalizing enclosure and ancillary equipment.
 - 6. Color: Green to match equipment.

- E. Concrete pads
 - 1. Concrete mix shall be designed for the intended purpose and have the following minimum design parameters:
 - a. Minimum cement content of six (6) sacks per cubic yard
 - b. Maximum water content of six (6) gallons per sack
 - c. Minimum 28 day compressive strength of 4,000 PSI
 - d. Slump ranges from 2 to 4 inches
 - e. Air content shall be 5 percent by volume

2.8 FAULT INDICATORS

- A. General Description:
 - 1. Fault indicators shall be completely self-contained, requiring no external wiring.
 - 2. Units shall be sealed and suitable for installation in wet locations.
 - 3. Fault indicators shall be automatically resetting requiring no external tools for resetting.
- B. Electrical Characteristics:
 - 1. Nominal voltage 15 kV, BIL 95 kV, 60 Hz
 - 2. Trip current ratings: 300 amps.

2.9 METERING EQUIPMENT

- A. Meters shall be:
 - 1. Class 20 CT rated
 - 2. Form 9S
 - 3. Three-phase, four-wire wye
 - 4. 120V or 277V, as required
 - 5. Three Stator
 - 6. KWH/KW demand meter
- B. Meters shall be programmable type with KYZ pulse initiators.
 - 1. Pulse output ratios shall be programmable.
- C. Meter sockets shall be:
 - 1. 13 terminal with circuit closing devices and 10 pole test switch installed.
 - 2. Rated 100 amps continuous current.
- D. Current transformers shall be:
 - 1. Meter accuracy class.
 - 2. Suitable for clamping to the transformer secondary bushings.
 - 3. Ratioed for the nearest standard ratio below the rated full load current of the transformer.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install on pad as detailed on the Drawings and in accordance with NFPA 70 and manufacturer's instructions.
- B. Transformer locations as shown on the Drawings are intended to be used as a guide.
 - 1. Field conditions may affect actual transformer location.
 - 2. Coordinate final location with Owner.
 - 3. Transformers shall be positioned so that switch-operating and elbow removal can be completed without interference of an 8-foot hot stick.
- C. Bollards:
 - 1. If installed, shall not impede operation of doors or switches.
 - 2. Transformer doors shall be able to be opened at least 90 degrees to provide access to the inside of the transformer.

3.2 FIELD QUALITY CONTROL

- A. Acceptance Testing: See Specification Section 260813.

3.3 FINAL ACCEPTANCE

- A. Owner will not accept equipment as final until equipment is ascertained to be in conformance with specifications and guarantees.
- B. Upon shipment of equipment, drawings, instruction books, and test reports as required by these specifications, the Seller shall submit to the Owner a detailed statement of equipment shipped.

END OF SECTION 261219

SECTION 262416 - PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Distribution panelboards.
 - 2. Lighting and appliance branch-circuit panelboards.
 - 3. Load centers.

1.2 RELATED SECTIONS

- A. Section 262813 – Fuses
- B. Section 264313 - Surge Protection for Low-Voltage Electrical Power Circuits

1.3 DEFINITIONS

- A. OCPD: Overcurrent protective device.
- B. MCCB: Molded-case circuit breaker.
- C. SPD: Surge protective device.
- D. NRTL: Nationally Recognized Testing Laboratory.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of panelboard, overcurrent protective device, surge protection device, ground-fault protector, accessory, and component.
- B. Shop Drawings: For each panelboard and related equipment.
 - 1. Include dimensioned plans, elevations, sections, and details.
 - 2. Detail enclosure types including mounting and anchorage, environmental protection, knockouts, corner treatments, covers and doors, gaskets, hinges, and locks.
 - 3. Detail bus configuration, current, and voltage ratings.
 - 4. Short-circuit current rating of panelboards and all individual overcurrent protective devices.
 - 5. Current limitation curves and time-current coordination curves for each type and rating of overcurrent protective device.
 - 6. Time-current coordination curves for each type and rating of overcurrent protective device included in panelboards.
 - 7. Schematic and wiring diagrams for power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

- A. Panelboard schedules for installation in panelboards.
- B. Seismic Qualification Data: Certificates, for panelboards, overcurrent protective devices, accessories, and components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.
 - 1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
 - 2. Field settings for all adjustable overcurrent protective devices.
- B. Record of performance testing for ground fault breakers in accordance with NEC 230.95(C).

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Keys: Two (2) spares for each type of panelboard cabinet lock.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: Workers qualified as defined in NEMA PB 1.1 and trained in electrical safety as required by NFPA 70E.

1.9 FIELD CONDITIONS

- A. Environmental Limitations:
 - 1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
 - 2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 - a. Ambient Temperature: Not exceeding 23 deg F (minus 5 deg C) to plus 104 deg F (plus 40 deg C).

b. Altitude not exceeding 6600 feet (2000 m).

B. Service Conditions: NEMA PB 1.1, usual service conditions, as noted above.

1.10 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, ductwork, encumbrances to workspace clearance requirements and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels in accordance with NEC 110.26.

1.11 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace panelboards enclosures, buswork, overcurrent protective devices, accessories that fail in materials or workmanship within specified warranty period.

1. Panelboard Warranty Period: 12 months from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic Requirements: Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Section 260548.16 "Seismic Controls for Electrical Systems."

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2.2 PANELBOARDS COMMON REQUIREMENTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Square D by Schneider Electric.
2. Eaton Cutler-Hammer.
3. ABB/General Electric Company.

B. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

- D. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Section 260548.16 "Seismic Controls for Electrical Systems."
- E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- F. Comply with NEMA PB 1.
- G. Comply with NFPA 70.
- H. Enclosures: Flush and Surface-mounted (as noted on plans), dead-front cabinets.
 - 1. Rated for environmental conditions at installed location.
 - a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
 - b. Outdoor Locations: NEMA 250, Type 3R.
 - c. Kitchen or Wash-Down Areas: NEMA 250, Type 4X, stainless steel.
 - d. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
 - e. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.
 - 2. Height: 84 inches (2.13 m) maximum.
 - 3. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box. Trims shall cover all live parts and shall have no exposed hardware.
 - 4. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover. Trims shall cover all live parts and shall have no exposed hardware.
- I. Incoming Mains Location: Top or Bottom as determined by Contractor, based on field conditions, UNO.
- J. Phase, Neutral, and Ground Buses: Hard-drawn copper, 98 percent conductivity.
- K. Conductor Connectors: Suitable for use with conductor material, quantity and sizes. Refer to the Feeder Schedule on the contract documents.
 - 1. Material: Hard-drawn copper, 98 percent conductivity.
 - 2. Main and Neutral Lugs: Mechanical type, with a lug on the neutral bar for each pole in the panelboard.
 - 3. Ground Lugs and Bus - Configured Terminators: Mechanical type, with a lug on the bar for each pole in the panelboard.
- L. NRTL Label: Panelboards shall be labeled by an NRTL acceptable to authority having jurisdiction for use as service equipment with one or more main service disconnecting and overcurrent protective devices.
- M. Future Devices: Panelboards shall have mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
- N. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals. Assembly listed by an NRTL for 100 percent interrupting capacity.

2.3 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. All OCPDs shall be fully rated for available fault current. No series rating will be allowed.
- B. Manufacturers – Breakers shall be manufactured by the same manufacturer as the panelboard in which they are installed.
- C. Branch Overcurrent Protective Devices - Bolt-on circuit breakers or plug-in circuit breakers where individual positive-locking device requires mechanical release for removal. Replaceable without disturbing adjacent units.

2.4 CIRCUIT BREAKERS

A. General requirements

- 1. Breakers shall meet current NEMA and UL specifications as applicable to frame size, standard rating and interrupting capability.
- 2. Breakers shall be one-, two-, or three-pole as scheduled, operate manually for normal ON-OFF switching and automatically under overload and short circuit conditions.
- 3. The operating handle shall open and close all poles simultaneously on multi-pole breakers. The operating mechanism shall be trip-free so that contacts cannot be held closed against abnormal overcurrent or short circuit conditions. Do not use single-pole circuit breakers with handle ties where multi-pole breakers are indicated on the panel schedule or where required for poly-phase loads.
- 4. Breakers shall be of the type noted on panel schedule (shunt-trip, GFCI, arc-fault, etc.) or as required by the equipment being provided.
- 5. Breakers noted as GFI protected for equipment shall have a 30mA or greater trip.
- 6. Breakers noted as GFI protected for personnel shall have a 6mA trip.
- 7. A control transformer with primary and secondary fusing shall be provided as required for control of shunt-trip breakers.

B. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.

- 1. Molded case circuit breakers shall be bolt-on type only and suitable for individual as well as panelboard mounting. No breakers designated "plug-on" type allowed unless specifically noted on plans.
- 2. Thermal-Magnetic Circuit Breakers:
 - a. Inverse time-current element for low-level overloads.
 - b. Instantaneous magnetic trip element for short circuits.
 - c. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
- 3. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
- 4. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replaceable electronic trip; and the following field-adjustable settings (LSIG):
 - a. Instantaneous trip.
 - b. Long- and short-time pickup levels.

- c. Long and short time adjustments.
 - d. Ground-fault pickup level, time delay, and I squared t response.
5. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
 6. GFCI Circuit Breakers: Single- and double-pole configurations with Class A ground-fault protection (6-mA trip).
 7. GFEP Circuit Breakers: Class B ground-fault protection (30-mA trip).
 8. Arc-Fault Circuit Interrupter Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
 9. Subfeed Circuit Breakers: Vertically mounted.
 10. MCCB Features and Accessories:
 - a. Standard frame sizes, trip ratings, and number of poles.
 - b. Breaker handle indicates tripped status.
 - c. UL listed for reverse connection without restrictive line or load ratings.
 - d. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
 - e. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and HID lighting circuits.
 - f. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
 - g. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.

2.5 SURGE PROTECTION DEVICES

- A. Refer to Section 264313; Surge Protection for Low-Voltage Electrical Power Circuits.

2.6 DISTRIBUTION PANELBOARDS

- A. Design is generally based on the Square D, I-Line panelboard.
- B. Panelboards: NEMA PB 1, distribution type.
- C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
 1. For doors more than 36 inches (914 mm) high, provide two latches, keyed alike.
- D. Mains: As noted on drawings.
- E. Branch OCPDs: Bolt-on or plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

2.7 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

- B. Mains: As noted on drawings.
- C. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- D. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.
- E. Column-Type Panelboards: Single row of overcurrent devices with narrow gutter extension and overhead junction box equipped with ground and neutral terminal buses.

2.8 LOAD CENTERS

- A. Load Centers: Comply with UL 67.
- B. Mains: As noted on Drawings.
- C. Branch Overcurrent Protective Devices: Plug-in circuit breakers, replaceable without disturbing adjacent units.
- D. Conductor Connectors: Mechanical type for main, neutral, and ground lugs and buses.

2.9 IDENTIFICATION

- A. Service Equipment Label: NRTL labeled for use as service equipment for switchboards (as applicable) with one or more service disconnecting and overcurrent protective devices.
- B. Breaker Labels - Faceplate shall list current rating, UL and IEC certification standards, and AIC rating.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Receive, inspect, handle, and store panelboards according to NEMA PB 1.1.
- B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.
- C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.
- D. Examine all OCPDs before installation. Reject any that are moisture damaged or physically damaged.
- E. Examine utilization equipment nameplates and installation instructions. Install OCPDs of sizes and with characteristics appropriate for each piece of equipment.
- F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with NECA 1.
- B. Install panelboards and accessories according to NEMA PB 1.1.
- C. Comply with mounting and anchoring requirements specified in Section 260548.16 "Seismic Controls for Electrical Systems."
- D. Mount top of trim 90 inches (2286 mm) above finished floor unless otherwise indicated. (Ensure that the operating handle of top-most switch or circuit breaker, in on position, is not higher than 79 inches (2000 mm) above finished floor or grade).
- E. Mount panelboard cabinet plumb and rigid without distortion of box.
- F. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.
- G. Install filler plates in unused spaces.
- H. Install overcurrent protective devices and controllers not already factory installed.
 - 1. Set field-adjustable, circuit-breaker trip ranges.
- I. Make grounding connections and bond neutral for services and separately derived systems to ground. Make connections to grounding electrodes, separate grounds for isolated ground bars, and connections to separate ground bars.
- J. Ground fault breaker settings.
 - 1. Set GF Trip Pickup at 0.5 for all Main and Branch GF breakers, UNO.
 - 2. Set GF Trip Delay to 0.1 for the Main breaker and to 0 or OFF for all Branch GF breakers, UNO.
 - 3. Set GF Trip Slope to 0 for all Main and Branch GF breakers, UNO.
- K. Spare conduit stub-outs at recessed panels
 - 1. In the following paragraphs, accessible is defined as being arranged so that an appropriately dressed person, 6'-2" tall, weighing 250 pounds, may approach the area in question with tools and products necessary for the work intended, and may then position himself/herself to properly and safely perform the task to be accomplished, without disassembly or damage to the surrounding installation.
 - 2. All spare conduits shall be terminated in locations where they are accessible from a crawlspace, attic, or by ladder in areas that have t-grid ceilings. They shall be terminated away from equipment, ducts or pipes that would obstruct access.
 - 3. Stub four (4) 1-inch empty conduits from panelboard into accessible ceiling space above the panel, or a space designated to be ceiling space in the future.
 - 4. Where applicable, stub four (4) 1-inch empty conduits into accessible floor space or accessible ceiling space on the level below.
- L. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

3.3 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems."
- B. Circuit Directory: Directory card inside panelboard door, mounted in transparent card holder. Indicate installed circuit loads; incorporate Owner's final room designations. Obtain approval before installing. Handwritten directories are not acceptable. Install directory inside panelboard door.
- C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems." Include: Panel name, voltage, amperage, number of phases and wires, source and available fault current with date calculated.
- D. Device Nameplates: Label each branch circuit device in power panelboards with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- E. Install warning signs/labels complying with requirements in Section 260553 "Identification for Electrical Systems" identifying source of remote circuit.
- F. On main distribution panel door provide a laminated one-line diagram of the electrical system and all panel configurations.

3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Acceptance:
 - a. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit. Open control and metering circuits within the panelboard, and remove neutral connection to surge protection and other electronic devices prior to insulation test. Reconnect after test.
 - b. Test continuity of each circuit.
 - 2. Test ground-fault protection of equipment for service equipment per NFPA 70.
 - 3. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
 - 4. Test and adjust controls, remote monitoring, and safeties. Replace any damaged and malfunctioning controls and equipment.
 - 5. Test and demonstrate proper function of all GFCI, AFCI and shunt-trip breakers.
- B. Panelboards will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 DEMONSTRATION

A. Train Owner's maintenance personnel:

1. To adjust, operate, and maintain panelboards, overcurrent protective devices, instrumentation, and accessories.

END OF SECTION 262416

SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Straight-blade convenience receptacles.
2. GFCI receptacles.
3. Special-purpose receptacles.
4. Toggle switches.
5. Wall-box dimmers.
6. Wall plates.
7. Finishes.

1.2 RELATED DOCUMENTS

- ##### A. Refer to Section 260923 "Lighting Control Devices" for occupancy/vacancy sensors, daylight sensors, low-voltage lighting control panels and devices, room controllers, etc.

1.3 DEFINITIONS

A. Abbreviations of Manufacturers' Names:

1. Cooper: Copper Wiring Devices; Division of Cooper Industries, Inc.
2. Hubbell: Hubbell Incorporated: Wiring Devices-Kellems.
3. Leviton: Leviton Mfg. Company, Inc.
4. P&S: Pass & Seymour/Legrand.

1.4 ACTION SUBMITTALS

- ##### A. Product Data: For each type of product.
- ##### B. Dimmer switch and LED lamp manufacturers' literature showing compatibility between the two.

1.5 CLOSEOUT SUBMITTALS

- ##### A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 GENERAL WIRING-DEVICE REQUIREMENTS

- A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.
- C. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:
 - 1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
 - 2. Devices shall comply with the requirements in this Section.
- D. Devices for Owner-Furnished Equipment:
 - 1. Receptacles: Match plug configurations including wire count, poles, twistlock, etc.
- E. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 STRAIGHT-BLADE RECEPTACLES

- A. Duplex Convenience Receptacles, 125V, 20A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cooper; 5351 (single), 5362 (duplex).
 - b. Hubbell; HBL5361 (single), HBL5362 (duplex).
 - c. Leviton; 5361 (single), 5362 (duplex).
 - d. P&S; 5351 (single), CRB5362 (duplex).
- B. Tamper-Resistant Convenience Receptacles, 125V, 20A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R UL 498, and FS W-C-596.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cooper; TR5362 (duplex).
 - b. Hubbell; HBL5362TR (duplex).
 - c. Leviton; 5362-SG (duplex).
 - d. P&S; TR5352 (duplex).

2.3 GFCI RECEPTACLES

- A. General Description:

1. 125V, 20A, straight blade, non-feed-through type.
2. Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, UL 943 Class A, and FS W-C-596.
3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.
4. Self-testing:
 - a. Automatic test initiates within 5 seconds of power availability to the line or load terminals and repeats at least every 3 hours.
 - b. If auto-monitoring detects a problem, GFCI will trip with the inability to reset.

B. Duplex GFCI Convenience Receptacles, 125V, 20A:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cooper; VGF20.
 - b. Hubbell; GFR5352L.
 - c. Leviton; GFNT2.
 - d. P&S; 2097.

C. Tamper-Resistant, Duplex GFCI Convenience Receptacles, 125V, 20A:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cooper; TRVGF20.
 - b. Hubbell; GFRTRST20.
 - c. Leviton; GFTR2-KW.
 - d. P&S; 2097TR.

D. Weather Resistant, Self-Testing, Duplex GFCI Receptacles, 125V, 20A:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cooper; WRSGF20.
 - b. Hubbell; GFTWRST20.
 - c. Leviton; GFWR2.
 - d. P&S; 2097TRWR.
2. For use only with wet or damp location covers.

2.4 TOGGLE SWITCHES

A. Comply with NEMA WD 1, UL 20, and FS W-S-896.

B. Switches, 120/277V, 20A:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

- a. Single Pole:
 - 1) Cooper; AH1221.
 - 2) Hubbell; HBL1221.
 - 3) Leviton; 1221-2.
 - 4) P&S; CSB20AC1.
- b. Two Pole:
 - 1) Cooper; AH1222.
 - 2) Hubbell; HBL1222.
 - 3) Leviton; 1222-2.
 - 4) P&S; CSB20AC2.
- c. Three Way:
 - 1) Cooper; AH1223.
 - 2) Hubbell; HBL1223.
 - 3) Leviton; 1223-2.
 - 4) P&S; CSB20AC3.
- d. Four Way:
 - 1) Cooper; AH1224.
 - 2) Hubbell; HBL1224.
 - 3) Leviton; 1224-2.
 - 4) P&S; CSB20AC4.

C. Lit-Handle Switches, 20A:

- 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cooper; AH1221LT.
 - b. Hubbell; HBL1201IL.
 - c. Leviton; 1221-LH1.
 - d. P&S; PS20AC1-CSL.
- 2. Description: Single pole, with lighted handle, illuminated when switch is "off".

D. Pilot-Light Switches, 20A:

- 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cooper; AH1221PL (single-pole), AH1222PL (two-pole).
 - b. Hubbell; HBL1221PL (single-pole), HBL1222PL (two-pole).
 - c. Leviton; 1221-PLR (single-pole), 1222-PLR (two-pole).
 - d. P&S; PS20AC1-RPL (single-pole), PS20AC2-RPL (two-pole).
- 2. Description: Single pole or two-pole, with lighted handle, illuminated when switch is "on."

E. Key-Operated Switches, 120/277V, 20A:

- 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

- a. Single Pole:
 - 1) Cooper; AH1221L.
 - 2) Hubbell; HBL1221L.
 - 3) Leviton; 1121-2L.
 - 4) P&S; PS20AC1L.
- b. Two Pole:
 - 1) Cooper; AH1222L.
 - 2) Hubbell; HBL1222L.
 - 3) Leviton; 1122-2L.
 - 4) P&S; PS20AC2L.
- c. Three Way:
 - 1) Cooper; AH1223L.
 - 2) Hubbell; HBL1223L.
 - 3) Leviton; 1123-2L.
 - 4) P&S; PS20AC3L.
- d. Four Way:
 - 1) Cooper; AH1224L.
 - 2) Hubbell; HBL1224L.
 - 3) Leviton; 1124-2L.
 - 4) P&S; PS20AC4L.

2. Description: Single pole, with factory-supplied key in lieu of switch handle.

- F. Single-Pole, Double-Throw, Momentary-Contact, Center-off Switches: 120/277V, 15A; for use with mechanically held lighting contactors.
 - a. Cooper; 1995, 1995L (keyed).
 - b. Hubbell; HBL1557, HBL1557L (keyed)
 - c. Leviton; 1257-W, 1257-L (keyed).
 - d. Pass & Seymour; 1251, 1251L (keyed).

2.5 DIGITAL TIMER LIGHT SWITCH

- A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Watt Stopper; TS-200.
 - 2. Hubbell; TD300.
 - 3. P&S; RT-100
- B. Description: Switchbox-mounted, combination digital timer and conventional switch lighting-control unit, with backlit digital display, with selectable time interval from 5 minutes to 12 hours.
 - 1. Rated 0-800W at 120V ac, and 0-1200W at 277V ac for tungsten, fluorescent, and LED loads.
 - 2. Optional beep warning every five seconds during last minute of countdown.
 - 3. Optional one second light flash warning at one minute before timer runs out.

4. Time scrolling options for overriding the preset time.
5. Electroluminescent back-lit Liquid Crystal Display shows timer countdown.
6. Integral relay for connection to BAS.

2.6 WALL-BOX DIMMERS

- A. General: These are stand-alone dimmer switches. See Section 260923 “Lighting Control Devices” for dimmers that interface with daylight sensors, low-voltage lighting control panels, room controllers, etc.
- B. 0-10V Dimming for LED fixtures:
 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Philips; Sunrise series.
 - b. Watt Stopper; Radiant series.
 - c. Synergy; ISD-BC.
 - d. Lutron; Diva series.
 2. Slide dimmer with separate ON/OFF switch button. Lighting is switched ON or OFF at the level currently set by the slider.
 3. Designed for use with standard three-way and four-way switches for applications requiring control from multiple locations.
 4. Match dimmer to lamp(s) being dimmed in accordance with manufacturer’s guidelines.
- C. Dimmer Switches for screw-in LED lamps (LED lamps with integral drivers, designed to replace incandescent or screw-in compact fluorescent lamps):
 1. Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.
 2. Match dimmer to lamp(s) being dimmed in accordance with manufacturer’s guidelines.
 3. 600 W dimmers shall require no derating when ganged with other devices.

2.7 WALL PLATES

- A. Single and combination types shall match corresponding wiring devices.
 1. Plate-Securing Screws: Metal with head color to match plate finish.
 2. Material for Finished Spaces: 0.035-inch- (1-mm-) thick, satin-finished, Type 302 stainless steel.
 3. Material for Unfinished Spaces: Galvanized steel.
 4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.
- B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable cover.

2.8 FINISHES

A. Device Color:

1. Wiring Devices Connected to Normal Power System: Gray or As selected by Architect unless otherwise indicated or required by NFPA 70 or device listing.
2. Wiring Devices Connected to Emergency Power System: Red.

B. Wall Plate Color: For plastic covers, match device color.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

B. Coordination with Other Trades:

1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.
5. Coordinate receptacle configuration, location and mounting height with equipment/function it serves.

C. Conductors:

1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:
 - a. Cut back and pigtail, or replace all damaged conductors.
 - b. Straighten conductors that remain and remove corrosion and foreign matter.
 - c. Pigtail existing conductors is permitted, provided the outlet box is large enough.

D. Device Installation:

1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.

2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the left.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Dimmers:

1. Install dimmers within terms of their listing.
2. Verify that dimmers used for fan-speed control are listed for that application.
3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.
4. Match dimmer to lamp(s) being dimmed in accordance with manufacturer's guidelines.

H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

I. GFCI Receptacles: Install non-feed-through-type GFCI receptacles.

3.2 FIELD QUALITY CONTROL

A. Test Instruments: Use instruments that comply with UL 1436.

B. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

C. Perform the following tests and inspections:

1. Tests for Convenience Receptacles:
 - a. Line Voltage: Acceptable range is 105 to 132V.

- b. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
- c. Ground Impedance: Values of up to 2 ohms are acceptable.
- d. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
- e. Using the test plug, verify that the device and its outlet box are securely mounted.
- f. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

D. Wiring device will be considered defective if it does not pass tests and inspections.

3.3 IDENTIFICATION

A. Receptacles: Identify panelboard and circuit number from which the device is served.

- 1. Mark inside of box or coverplate with permanent marker. Test to ensure that marker lines are not visible on outside of cover when it is installed.
- 2. Mark outside of coverplate using labeler such as Brother PT-90 to produce 1/8" black letters (white letters if cover is dark) on clear tape.

3.4 WEATHER STRIPPING

A. Behind exterior wall devices

- 1. Install a precut foam insulation pad over the fixture and reinstall the cover.

END OF SECTION 262726

SECTION 262813 - FUSES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cartridge and plug fuses rated 600 V ac and less for use in the following:
 - a. Control circuits.
 - b. Switchboards.
 - c. Enclosed switches.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Ambient Temperature Adjustment Information: If ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses with adjusted ratings.
 - a. For each fuse having adjusted ratings, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.
 - b. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.
2. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
3. Current-limitation curves for fuses with current-limiting characteristics.
4. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse.

1.3 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1. Ambient temperature adjustment information.
2. Current-limitation curves for fuses with current-limiting characteristics.
3. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse.

MAINTENANCE MATERIAL SUBMITTALS

- B. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

1.4 PROJECT CONDITIONS

- A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F (5 deg C) or more than 100 deg F (38 deg C), apply manufacturer's ambient temperature adjustment factors to fuse ratings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Bussmann
 2. Edison Fuse
 3. Ferraz Shawmut
 4. Littelfuse
- B. Obtain fuses, for use within a specific product or circuit, from a single source from a single manufacturer.

2.2 FUSES

- A. Cartridge fuse characteristics: Current-limiting, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.
 1. Type RK-1: 250V and 600V, zero to 600A rating, 200 kAIC, dual-element time delay.
 2. Type RK-5: 250V and 600V, zero to 600A rating, 200 kAIC, dual-element, time delay.
 3. Type CC: 600V, zero to 30A rating, 200 kAIC, fast acting.
 4. Type CD: 600V, 31 to 60A rating, 200 kAIC, fast acting.
 5. Type L: 600-V, 601 to 6000A rating, 200 kAIC, time delay.
- B. Plug fuse characteristics: Current-limiting with rejection base and voltage ratings consistent with circuit voltages.
 1. Type S: 125V, zero to 15A rating, dual-element, time delay.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. Comply with NEMA FU 1 for cartridge fuses.
- E. Comply with NFPA 70.

- F. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.
- B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.
- C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.
- D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FUSE APPLICATIONS

- A. Apply fuses in the following circumstances:
 - 1. Service Entrance: Class L or Class RK-1, time delay.
 - 2. Feeders and Branch Circuits: Class L or Class RK-1, time delay.
 - 3. Motors, Welders, Transformers: Class RK-5, time delay.
 - 4. Control Circuits: Class CC, fast acting.
 - 5. Luminaires: In accordance with fixture manufacturer's guidelines.
 - 6. Fustats: Type S, time delay with rejection base.
- B. Size fuses as shown and specified, or as required by load being served. Where fusing in accordance with manufacturer's guidelines requires smaller fuses, provide necessary reducers with no additional cost to Owner.

3.3 INSTALLATION

- A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

3.4 IDENTIFICATION

- A. Install labels complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems" and indicating fuse replacement information inside of door of each fused switch and adjacent to each fuse block, socket, and holder.

END OF SECTION 262813

SECTION 262816 - ENCLOSED SWITCHES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fusible switches.
2. Nonfusible switches.
3. Fustats
4. Enclosures.

1.2 DEFINITIONS

- A. NC: Normally closed.
- B. NO: Normally open.
- C. SPDT: Single pole, double throw.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of enclosed switch, accessory, and component indicated. Include nameplate ratings, dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
- B. Shop Drawings: For enclosed switches.
 1. Include plans, elevations, sections, details, and attachments to other work.
 2. Include wiring diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Certificates: For enclosed switches, accessories, and components, from manufacturer.
- B. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.6 WARRANTY

- A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace components that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: One year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Enclosed switches shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2.2 GENERAL REQUIREMENTS

- A. Source Limitations: Obtain enclosed switches, overcurrent protective devices, components, and accessories, within same product category, from single manufacturer.
- B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
- D. Comply with NFPA 70.

2.3 FUSIBLE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Square D by Schneider Electric.
 - 2. Eaton Cutler-Hammer.
 - 3. ABB/General Electric Company.
- B. Type HD, Heavy Duty:
 - 1. Single throw.
 - 2. Two or three pole.
 - 3. 240 or 600V ac as noted on plans.
 - 4. 1200 A and smaller.

5. UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate fuses indicated on plans, or as required by manufacture of the equipment being protected.
6. Lockable handle (in the OFF position) with capability to accept three padlocks, and interlocked with cover in closed position.
7. Ability to also lock switch handle in the ON position for exterior main disconnect.

C. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
4. Lugs: Suitable for number, size, and conductor material.
5. Service-Rated Switches: Labeled for use as service equipment.

2.4 NONFUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Square D by Schneider Electric.
2. Eaton Cutler-Hammer.
3. ABB/General Electric Company.

B. Type HD, Heavy Duty:

1. Single throw.
2. Two or three pole.
3. 240 or 600V ac as noted on plans.
4. 1200 A and smaller.
5. UL 98 and NEMA KS 1, horsepower rated.
6. Lockable handle (in the OFF position) with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Lugs: Suitable for number, size, and conductor material.

2.5 FUSTAT

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Bussmann.

2. Littelfuse.

- B. NEMA 1 rated and designed to mount on square, pressed steel box.
 - 1. 15A and smaller.
 - 2. 120V ac.
 - 3. Type S fuse socket.
 - 4. Toggle switch.
 - 5. Pilot light.

2.6 ENCLOSURES

- A. Enclosed Switches: UL 489, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
- B. Enclosure Finish: The enclosure shall be finished with:
 - 1. Gray baked enamel paint, electrodeposited on cleaned, phosphatized steel (NEMA 250 Type 1).
 - 2. Gray baked enamel paint, electrodeposited on cleaned, phosphatized galvanized steel (NEMA 250 Types 3R, 12).
 - 3. Brush finish on Type 304 stainless steel (NEMA 250 Type 4-4X stainless steel).
 - 4. Copper-free cast aluminum alloy (NEMA 250 Types 7, 9).
- C. Conduit Entry: NEMA 250 Types 4, 4X, and 12 enclosures shall contain no knockouts. NEMA 250 Types 7 and 9 enclosures shall be provided with threaded conduit openings in both endwalls.
- D. Operating Mechanism: The switch operating handle shall be externally operable with the operating mechanism being an integral part of the box, not the cover. The cover interlock mechanism shall have an externally operated override. The override shall not permanently disable the interlock mechanism, which shall return to the locked position once the override is released. The tool used to override the cover interlock mechanism shall not be required to enter the enclosure in order to override the interlock.
- E. Enclosures designated as NEMA 250 Type 4, 4X stainless steel, 12, or 12K shall have a dual cover interlock mechanism to prevent unintentional opening of the enclosure cover when the switch is ON and to prevent turning the switch ON when the enclosure cover is open.
- F. NEMA 250 Type 7/9 enclosures shall be furnished with a breather and drain kit to allow their use in outdoor and wet location applications.

PART 3 - EXECUTION

3.1 ENCLOSURE ENVIRONMENTAL RATING APPLICATIONS

- A. Enclosed Switches: Provide enclosures at installed locations with the following environmental ratings.
 - 1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.

2. Outdoor Locations: NEMA 250, Type 3R.
3. Kitchen/Wash-Down Areas: NEMA 250, Type 4X, stainless steel.
4. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.
5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.
6. Hazardous Areas Indicated on Drawings: NEMA 250, Type 7/Type 9 with cover attached by Type 316 stainless steel bolts.

3.2 INSTALLATION

- A. Coordinate layout and installation of switches and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Install individual wall-mounted switches with tops at uniform height unless otherwise indicated.
- C. Comply with mounting and anchoring requirements specified in Section 260548.16 "Seismic Controls for Electrical Systems."
- D. Temporary Lifting Provisions: Remove temporary lifting of eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- E. Install fuses in fusible devices.
- F. Comply with NFPA 70 and NECA 1.

3.3 IDENTIFICATION

- A. Comply with requirements in Section 260553 "Identification for Electrical Systems."
 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
 2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections for Switches:
 1. Visual and Mechanical Inspection:
 - a. Inspect physical and mechanical condition.
 - b. Inspect anchorage, alignment, grounding, and clearances.
 - c. Verify that the unit is clean.
 - d. Verify blade alignment, blade penetration, travel stops, and mechanical operation.
 - e. Verify that fuse sizes and types match the Specifications and Drawings.
 - f. Verify that each fuse has adequate mechanical support and contact integrity.

- g. Inspect bolted electrical connections for high resistance using one of the two following methods:
 - 1) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.
 - a) Bolt-torque levels shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.
 - h. Verify correct phase barrier installation.
 - i. Verify lubrication of moving current-carrying parts and moving and sliding surfaces.
- C. Enclosed switches will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.
 - 1. Test procedures used.
 - 2. Include identification of each enclosed switch tested and describe test results.
 - 3. List deficiencies detected, remedial action taken, and observations after remedial action.

END OF SECTION 262816

SECTION 264313 - SURGE PROTECTION FOR LOW-VOLTAGE ELECTRICAL POWER
CIRCUITS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes SPDs for low-voltage (120 to 600 V) power distribution and control equipment.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
 - 2. Copy of UL Category Code VZCA certification, as a minimum, listing the tested values for VPRs, Inominal ratings, MCOVs, type designations, OCPD requirements, model numbers, system voltages, and modes of protection.

1.3 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.
- B. Sample Warranty: For manufacturer's special warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.5 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to replace or replace SPDs that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL SPD REQUIREMENTS

- A. SPD with Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

- B. Comply with NFPA 70.
- C. Comply with UL 1449.
- D. MCOV of the SPD shall be the nominal system voltage.

2.2 SERVICE ENTRANCE SUPPRESSOR

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. Advanced Protection Technologies Inc. (APT).
 - 2. Current Technology Inc.
 - 3. Eaton.
 - 4. General Electric Company.
 - 5. Leviton Manufacturing Co., Inc.
 - 6. Liebert; a brand of Vertiv.
 - 7. Square D.
- B. SPDs: Comply with UL 1449, Type 1.
 - 1. Permanently connected, hard-wired SPD that can be installed in both locations noted:
 - a. Between the secondary of the service transformer and the line side of the main service equipment overcurrent protective device.
 - b. On the load side of the main service equipment.
 - 2. SPDs with the following features and accessories:
 - a. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.
 - b. Indicator light display for protection status.
- C. Features and Accessories:
 - 1. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.
 - 2. Indicator light display for protection status.
 - 3. Surge counter.
- D. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than 200 kA. The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in a given mode.
- E. Characteristics and protection modes and UL 1449 VPR for grounded wye circuits with 480Y/277 V, three-phase, four-wire circuits shall be as follows:
 - 1. Maximum Continuous Operating Voltage (MCOV):
 - a. Line to Neutral: 420 V.
 - b. Line to Line: 840 V.
 - 2. Peak Voltage Let-Through (Vpk):

- a. Line to Ground: 1200 V.
 - b. Line to Neutral: 1200 V.
 - c. Line to Line: 2000 V.
 - 3. Nominal Current Rating (I-nom): 20 kA
 - 4. Short Circuit Current Rating (SCCR): 100 kA.
- F. Characteristics and protection modes and UL 1449 VPR for grounded wye circuits with 208Y/120 V, three-phase, four-wire circuits shall be as follows:
- 1. Maximum Continuous Operating Voltage (MCOV):
 - a. Line to Neutral: 180 V.
 - b. Line to Line: 360 V.
 - 2. Peak Voltage Let-Through (Vpk):
 - a. Line to Ground: 700 V.
 - b. Line to Neutral: 700 V.
 - c. Line to Line: 1000 V.
 - 3. Nominal Current Rating (I-nom): 20 kA
 - 4. Short Circuit Current Rating (SCCR): 100 kA.
- G. Characteristics and protection modes and UL 1449 VPR for 240/120 V, single-phase, three-wire circuits shall be as follows:
- 1. Maximum Continuous Operating Voltage (MCOV):
 - a. Line to Neutral: 150 V.
 - b. Line to Line: 300 V.
 - 2. Peak Voltage Let-Through (Vpk):
 - a. Line to Ground: 700 V.
 - b. Line to Neutral: 700 V.
 - c. Line to Line: 1000 V.
 - 3. Nominal Current Rating (I-nom): 20 kA
 - 4. Short Circuit Current Rating (SCCR): 25 kA.

2.3 PANEL SUPPRESSORS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
- 1. Advanced Protection Technologies Inc. (APT).
 - 2. Current Technology Inc.
 - 3. Eaton.
 - 4. General Electric Company.
 - 5. Leviton Manufacturing Co., Inc.
 - 6. Liebert; a brand of Vertiv.
 - 7. Square D.
- B. SPDs: Comply with UL 1449, Type 2.
- 1. Permanently connected, hard-wired SPD intended for installation on the load side of the main service equipment overcurrent protective device.
 - 2. Include LED indicator lights for power and protection status.

3. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.
- C. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than 100 kA. The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in a given mode.
- D. Characteristics and protection modes and UL 1449 VPR for grounded wye circuits with 480Y/277 V, three-phase, four-wire circuits shall be as follows:
1. Maximum Continuous Operating Voltage (MCOV):
 - a. Line to Neutral: 420 V.
 - b. Line to Line: 840 V.
 2. Peak Voltage Let-Through (Vpk):
 - a. Neutral to Ground: 1200 V.
 - b. Line to Ground: 1200 V.
 - c. Line to Neutral: 1200 V.
 - d. Line to Line: 2000 V.
 3. Nominal Current Rating (I-nom): 20 kA
 4. Short Circuit Current Rating (SCCR): 100 kA.
- E. Characteristics and protection modes and UL 1449 VPR for grounded wye circuits with 208Y/120 V, three-phase, four-wire circuits shall be as follows:
1. Maximum Continuous Operating Voltage (MCOV):
 - a. Line to Neutral: 180 V.
 - b. Line to Line: 360 V.
 2. Peak Voltage Let-Through (Vpk):
 - a. Neutral to Ground: 700 V.
 - b. Line to Ground: 700 V.
 - c. Line to Neutral: 700 V.
 - d. Line to Line: 1200 V.
 3. Nominal Current Rating (I-nom): 20 kA
 4. Short Circuit Current Rating (SCCR): 100 kA.
- F. Characteristics and protection modes and UL 1449 VPR for 240/120 V, single-phase, three-wire circuits shall be as follows:
1. Maximum Continuous Operating Voltage (MCOV):
 - a. Line to Neutral: 150 V.
 - b. Line to Line: 300 V.
 2. Peak Voltage Let-Through (Vpk):
 - a. Neutral to Ground: 700 V.
 - b. Line to Ground: 700 V.
 - c. Line to Neutral: 700 V.
 - d. Line to Line: 1200 V.
 3. Nominal Current Rating (I-nom): 20 kA
 4. Short Circuit Current Rating (SCCR): 25 kA.

2.4 ENCLOSURES

- A. Install integral within switchgear/panelboard.
- B. Indoor Enclosures: NEMA 250, Type 1.
- C. Outdoor Enclosures: NEMA 250, Type 3R.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1.
- B. Install an OCPD or disconnect as required to comply with the UL listing of the SPD.
- C. Install SPDs with conductors between suppressor and points of attachment as short and straight as possible, and adjust circuit-breaker positions to achieve shortest and straightest leads. Do not splice and extend SPD leads unless specifically permitted by manufacturer. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground.
- D. Use crimped connectors and splices only. Wire nuts are unacceptable.
- E. Complete startup checks according to manufacturer's written instructions. Energize SPDs after power system has been energized, stabilized, and tested.

3.2 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections with the assistance of a factory-authorized service representative.
 - 1. Compare equipment nameplate data for compliance with Drawings and Specifications.
 - 2. Inspect anchorage, alignment, grounding, and clearances.
 - 3. Verify that electrical wiring installation complies with manufacturer's written installation requirements.
- B. An SPD will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.3 DEMONSTRATION

- A. Train Owner's maintenance personnel to operate and maintain SPDs.

END OF SECTION 264313

SECTION 265110 - LED LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes the following types of LED luminaires:
 - 1. Lighting fixtures that are designed for and exclusively use LED lamp technology.
 - 2. Emergency power units.
 - 3. Exit signs.
 - 4. Emergency lighting units.
 - 5. Luminaire supports.
 - 6. Poles for exterior fixtures.

- B. Related Requirements:
 - 1. Section 260923 "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.
 - 2. Section 262726 "Wiring Devices"

1.2 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color Rendering Index.
- C. EPA: Equivalent projected area.
- D. Fixture: See "Luminaire."
- E. IP: International Protection or Ingress Protection Rating.
- F. LED: Light-emitting diode.
- G. Lumen: Measured output of lamp and luminaire, or both.
- H. Luminaire: Complete lighting unit, including lamp, reflector, and housing.
- I. Pole: Luminaire-supporting structure, including tower used for large-area illumination.
- J. Standard: See "Pole."
- K. THD: Total Harmonic Distortion.

1.3 PRIOR APPROVAL

- A. Prior approvals are not required unless otherwise noted on the Luminaire Schedule.
 - 1. All material supplied to the project must meet or exceed the quality, performance, and have similar features to the product originally specified. It is the contractor's responsibility to ensure that substituted equipment matches the exterior dimensions, weight, and configuration of the specified equipment.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product, arranged by designation.
 - 1. Physical description of lighting fixture including dimensions.
 - 2. Emergency lighting units including battery and charger.
 - 3. Ballast/Driver, including THD.
 - 4. Energy-efficiency data.
 - 5. Life, output (lumens, CCT, and CRI), and energy-efficiency data for fixtures.
 - 6. Fixture UL/ETL rating.
 - 7. Design Lights Consortium (DLC) certification and/or Energy Star rating.
 - 8. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing & Calculation Guides, of each lighting fixture type. The adjustment factors shall be for lamps, ballasts, and accessories identical to those indicated for the lighting fixture as applied in this Project.
 - a. Manufacturer Certified Data: Photometric data shall be certified by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
 - 9. Color samples (if color is to be chosen by architect/engineer).
 - 10. Foot-candle calculations for spot lights, flood lights and pole mounted fixtures.
 - 11. List of all parts necessary for particular installation configuration.
 - 12. Poles for mounting of exterior fixtures:
 - a. Detail fabrication and assembly of poles and pole accessories.
 - b. Plans, elevations, sections, mounting and attachment details.
 - c. Weight and EPA for pole mounted fixtures.
 - d. Windload information for pole configurations.
 - e. Foundation construction details, including material descriptions, dimensions, anchor bolts, support devices, and calculations, signed and sealed by a professional engineer licensed in the state of installation.
 - f. Anchor bolt templates keyed to specific poles and certified by manufacturer.
 - g. Method and procedure of pole installation. Include manufacturer's written instructions.
- B. Shop Drawings: For nonstandard or custom luminaires.
 - 1. Include plans, elevations, sections, and mounting and attachment details.
 - 2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Include diagrams for power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Certificates: For luminaires, accessories, and components, from manufacturer.
- B. Sample warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Plastic Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.
 - 2. Fixture-mounted, emergency battery pack: One for every 50 emergency lighting unit.
 - 3. Ballasts/Drivers: One for every 100 of each type and rating installed. Furnish at least one of each type.
 - 4. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

1.8 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with NFPA 70.

1.9 COORDINATION

- A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.
- B. Fire rated assemblies: Fixtures installed in fire rated assemblies shall maintain the fire rating of said assembly. Contractor is required to coordinate with Architectural draws to verify assembly ratings.
- C. Insulated ceiling space: Fixtures installed in an insulated ceiling be IC rated or manufacturer recommended clearances between fixture and insulation. Contractor is required to coordinate with Architectural draws to verify insulated areas above ceilings.

- D. Coordinate bollard and pole light locations with civil drawings, utility maps and grading plans, including any/all contractual clarifications or changes. Lighting fixtures on site plans are shown in schematic form and are not to scale.
 - 1. Verify finish grade height prior to setting bases.
 - 2. Pole light locations are based on accurate lighting calculations, but may need to be shifted slightly to properly align the fixtures aesthetically and to avoid encroachment on travel lanes, parking spots, curbs, sidewalks, overhead utility lines, traffic signals, etc.
 - 3. Bollard locations may be shifted as required to allow for aesthetic alignment and to appropriately light and follow the sidewalk, trail or other landscaping features as noted on the plans.

1.10 FIELD CONDITIONS

- A. Mark locations of exterior luminaires for approval by Architect prior to the start of luminaire installation.
- B. All exterior lighting shall be coordinated and placed by civil drawings.

1.11 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
- B. Warranty Period: Five years from date of Substantial Completion.
- C. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Luminaires shall withstand the effects of earthquake motions as noted in 260548, "Seismic Controls for Electrical Systems".
- B. Seismic Performance: Luminaires and lamps shall be labeled vibration and shock resistant.
 - 1. The term "withstand" means "the luminaire will remain in place without separation of any parts when subjected to the seismic forces specified and the luminaire will be fully operational during and after the seismic event."
 - 2. Component Importance Factor: 1.5.
- C. Light Pole Requirements
 - 1. Structural Characteristics: Comply with AASHTO LTS-6-M.

2. Dead Load: Weight of luminaire and its horizontal and vertical supports, lowering devices, and supporting structure, applied according to AASHTO LTS-6-M.
3. Live Load: Single load of 500 lbf (2200 N) distributed according to AASHTO LTS-6-M.
4. Ice Load: Load of 3 lbf/sq. ft. (145 Pa), applied according to AASHTO LTS-6-M for applicable areas on the Ice Load Map.
5. Wind Load: Pressure of wind on pole and luminaire, calculated and applied according to AASHTO LTS-6-M. Basic wind speed for calculating wind load for poles is 100 mph (45 m/s).
 - a. Wind Importance Factor: 1.0.
 - b. Minimum Design Life: 25 years.
 - c. Velocity Conversion Factor: 1.0.
6. Strength Analysis: For each pole, multiply the actual EPA of luminaires and brackets by a factor of 1.1 to obtain the EPA to be used in pole selection strength analysis.
7. Luminaire Attachment Provisions: Comply with luminaire manufacturers' mounting requirements. Use stainless-steel fasteners and mounting bolts unless otherwise indicated.

2.2 GENERAL LUMINAIRE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Standards - Where noted on plans, comply with the following:
 1. ENERGY STAR certified.
 2. Design Lights Consortium (DLC) certified.
 3. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by an NRTL.
 4. UL Listing: Listed for damp and/or wet locations as required.
 5. Recessed luminaires shall comply with NEMA LE 4.
- C. Indoor fixtures shall have a minimum CRI of 80 UNO and a CCT of 4000 K UNO.
- D. Outdoor fixtures shall have a minimum CRI of 65 UNO and a CCT of 3000 K UNO.
- E. Outdoor fixtures shall have mounting type and distribution as noted on plans.
- F. Minimum rated LED lamp life of 50,000 hours to L70.
- G. Lamps dimmable from 100 percent to 10 percent of maximum light output.
- H. Internal ballast/driver, UNO.
- I. Nominal Operating Voltage: As noted on the plans.
- J. Lens Thickness: At least 0.125 inch (3.175 mm) minimum UNO.
- K. Reflecting surfaces shall have minimum reflectance as follows unless otherwise indicated:
 1. White Surfaces: 85 percent.

2. Specular Surfaces: 83 percent.
 3. Diffusing Specular Surfaces: 75 percent.
- L. Lens and Refractor Gaskets for Exterior Luminaires: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.
- M. Source Limitations: For luminaires, obtain each color, grade, finish, type, and variety of luminaire from single source with resources to provide products of consistent quality in appearance and physical properties.
- N. Housings:
1. Rigidly formed, light-tight enclosure that will not warp, sag, or deform in use.
 2. Provide weather-tight enclosure with filter/breather for enclosed exterior luminaires.
- O. Metal Parts:
1. Free of burrs and sharp corners and edges.
 2. Indoor applications: Sheet metal components shall be steel unless otherwise indicated.
 3. Exterior applications: Sheet metal components shall be corrosion-resistant aluminum.
 4. Form and support to prevent warping and sagging
- P. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses.
- Q. Diffusers, and Globes - Tempered glass, acrylic or polycarbonate as noted on plans.
1. Acrylic: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
 - a. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless otherwise indicated.
 - b. UV stabilized.
 2. Glass: Annealed crystal glass unless otherwise indicated.
- R. Electromagnetic-Interference Filters: Factory installed to suppress conducted electromagnetic interference as required by MIL-STD-461E. Fabricate lighting fixtures with one filter on each ballast/driver indicated to require a filter.
- 2.3 METAL FINISHES
- A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.
- B. Source Limitations: For luminaires, obtain each color, grade, finish, type, and variety of luminaire from single source with resources to provide products of consistent quality in appearance and physical properties.

- C. Factory-Applied, powder-coat finish, UNO, with standard color chosen by Architect or as noted on plans. Where indicated, match finish process and color of pole or support materials.
1. Factory-Applied Finish for Aluminum Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - a. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
 - b. Class I, Color-Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: Medium satin; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker), complying with AAMA 611.
 2. Factory-Applied Finish for Steel Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - a. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1 or SSPC-SP 8.
 - b. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.

2.4 LED ASSEMBLIES

- A. Products UL rated for 40 degree C (104 degrees F) ambient environments.
- B. Minimum 3000K color temperature unless noted otherwise in the drawings.
- C. 50,000 hour fixture life including driver, 5 year warranty.
- D. All products compliant with EISNA LM-79 and LM-80 standards.

2.5 EMERGENCY POWER UNIT

- A. Internal Type: Self-contained, modular, battery-inverter unit, factory mounted within lighting fixture body and compatible with ballast. Comply with UL 924.
 1. Emergency Connection: Operate all or a portion of LED lamps continuously at an output of 1100 lumens. Connect unswitched circuit to battery-inverter unit and switched circuit to fixture ballast.
 2. Operation: Relay automatically turns lamp on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.

3. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 - a. Ambient Temperature: Less than 0 deg F (minus 18 deg C) or exceeding 104 deg F (40 deg C), with an average value exceeding 95 deg F (35 deg C) over a 24-hour period.
 - b. Ambient Storage Temperature: Not less than minus 4 deg F (minus 20 deg C) and not exceeding 140 deg F (60 deg C).
 - c. Humidity: More than 95 percent (condensing).
 - d. Altitude: Exceeding 3300 feet (1000 m).
 4. Test Push Button and Indicator Light: Visible and accessible without opening fixture or entering ceiling space.
 - a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 - b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 5. Battery: Sealed, maintenance-free, nickel-cadmium type.
 6. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
 7. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.
- B. External Type: Self-contained, modular, battery-inverter unit, suitable for powering LED lamps, remote mounted from lighting fixture. Comply with UL 924.
1. Emergency Connection: Connect unswitched circuit to battery-inverter unit and switched circuit to fixture ballast.
 2. Nightlight Connection: Operate lamp in a remote fixture continuously.
 3. Battery: Sealed, maintenance-free, nickel-cadmium type.
 4. Charger: Fully automatic, solid-state, constant-current type.
 5. Housing: NEMA 250, Type 1 enclosure. Listed for installation remote from luminaire. Remote assembly shall be located no more than half the distance recommended by the emergency power unit manufacturer
 6. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 7. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 8. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

2.6 EXIT SIGNS

- A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.
- B. Internally Lighted Signs:

1. Lamps for AC Operation: LEDs, 50,000 hours minimum rated lamp life.
2. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.
 - a. Battery: Sealed, maintenance-free, nickel-cadmium type.
 - b. Charger: Fully automatic, solid-state type with sealed transfer relay.
 - c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
 - d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 - e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 - f. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

2.7 EMERGENCY LIGHTING UNITS

- A. General Requirements for Emergency Lighting Units: Self-contained units complying with UL 924.
 1. Battery: Sealed, maintenance-free, lead-acid type.
 2. Charger: Fully automatic, solid-state type with sealed transfer relay.
 3. Operation: Relay automatically turns lamp on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
 4. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 5. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 6. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

2.8 LUMINAIRE SUPPORTS

- A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.
- B. Single-Stem Hangers: 1/2-inch (13-mm) steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.
- C. Twin-Stem Hangers: Two, 1/2-inch (13-mm) steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.

- D. Wires: ASTM A 641/A 641 M, Class 3, soft temper, zinc-coated steel, 12 gauge (2.68 mm).
- E. Rod Hangers: 3/16-inch (5-mm) minimum diameter, cadmium-plated, threaded steel rod.
- F. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

2.9 STEEL POLES

- A. Source Limitations: For poles, obtain each color, grade, finish, type, and variety of pole from single source with resources to provide products of consistent quality in appearance and physical properties.
- B. Minimum yield of 46,000 psig (317 MPa); one-piece construction up to 40 feet (12 m) in height with access handhole in pole wall.
 - 1. Shape: Round or Square to best match light fixture.
 - 2. Straight for poles 25 feet (7.5 m) and less and tapered for pole greater than 25 feet (7.5 m).
 - 3. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.
- C. Brackets for Luminaires: Detachable, cantilever, without underbrace.
 - 1. Adaptor fitting welded to pole, allowing the bracket to be bolted to the pole-mounted adaptor, then bolted together with stainless-steel bolts.
 - 2. Arm: Quantity, angles, length and shape in accordance with drawings and manufacturer's guidelines to accommodate luminaire. Match pole material and finish.
- D. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.
- E. Fasteners: Galvanized steel, size and type as determined by manufacturer. Corrosion-resistant items compatible with support components.
 - 1. Materials: Compatible with poles and standards as well as the substrates to which poles and standards are fastened and shall not cause galvanic action at contact points.
 - 2. Anchor Bolts, Leveling Nuts, Bolt Caps, and Washers: Hot-dip galvanized after fabrication unless otherwise indicated.
- F. Grounding and Bonding Lugs: Welded 1/2-inch (13-mm) threaded lug, complying with requirements in Section 260526 "Grounding and Bonding for Electrical Systems," listed for attaching grounding and bonding conductors of type and size indicated, and accessible through handhole.
- G. Handhole: Oval shaped, with minimum clear opening of 2-1/2 by 5 inches (65 by 130 mm), with cover secured by stainless-steel captive screws.
- H. Cable Support Grip: Wire-mesh type with rotating attachment eye, sized for diameter of cable and rated for a minimum load equal to weight of supported load multiplied by a 5.0 safety factor.
- I. Galvanized Finish: After fabrication, hot-dip galvanize according to ASTM A 123/A 123M.

- J. Powder-Coat Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" recommendations for applying and designating finishes.
 - 1. Surface Preparation: Clean surfaces according to SSPC-SP 1 to remove dirt, oil, grease, and other contaminants that could impair powder coat bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, according to SSPC-SP 5/NACE No. 1 or SSPC-SP 8.
 - 2. Powder Coat: Comply with AAMA 2604.
 - a. Electrostatic-applied powder coating; single application and cured to a minimum 2.5- to 3.5-mils dry film thickness. Coat interior and exterior of pole for equal corrosion protection.
 - b. Color: To match luminaire.
- K. Anchor Bolts: Manufactured to ASTM F 1554, Grade 55, with a minimum yield strength of 55,000 psi (380,000 kPa).
 - 1. Length and diameter in accordance with manufacturer's guidelines for pole and loading factors noted above
 - 2. Galvanizing: Hot dip galvanized according to ASTM A 153, Class C.
- L. Nuts: ASTM A 563, Grade A, Heavy-Hex
 - 1. Galvanizing: Hot dip galvanized according to ASTM A 153, Class C.
 - 2. Two nuts provided per anchor bolt.
- M. Washers: ASTM F 436, Type 1.
 - 1. Galvanizing: Hot dip galvanized according to ASTM A 153, Class C.
 - 2. One washer provided per anchor bolt.
- N. Base Covers: Manufacturers' standard metal units, finished same as pole, and arranged to cover pole's mounting bolts and nuts.
- O. Vibration dampers: Provide vibration dampening for any poles over 16' tall.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION

- A. Comply with NECA 1.
- B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.
- C. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.
- D. Fasten luminaire to structural support.
- E. Supports:

1. Sized and rated for luminaire weight, and weight of emergency power unit where applicable.
 2. Able to maintain luminaire position after cleaning, while relamping and when testing emergency power unit.
 3. Provide support for luminaire and emergency power unit without causing deflection of ceiling or wall.
 4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire and emergency power unit weight and vertical force of 400 percent of fixture weight.
 5. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.
- F. Flush-Mounted Luminaire Support: Secured to outlet box.
- G. Wall-Mounted Luminaire Support:
1. Attached to structural members in walls or to a minimum 20 gauge backing plate attached to wall structural members.
 2. Do not attach luminaires directly to gypsum board.
- H. Ceiling-Mounted Luminaire Support:
1. Secure to any required outlet box and attach to structural member in ceiling or to a minimum 20 gauge backing plate attached to ceiling structural members.
 2. Do not attach luminaires directly to gypsum board.
 3. Provide offset from ceiling as required by luminaire manufacturer.
 4. Secure emergency power unit using approved fasteners in a minimum of four locations, spaced near corners of emergency power unit.
- I. Suspended Luminaire Support:
1. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.
 2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
 3. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of luminaire chassis, including one at each end.
 4. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.
- J. Lay-in Ceiling Lighting Fixtures Supports: Use grid as a support element.
1. Install ceiling support system rods or wires, independent of the ceiling suspension devices, for each fixture. Locate not more than 6 inches (150 mm) from lighting fixture corners.
 2. Support Clips: Fasten to lighting fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
 3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch (20-mm) metal channels spanning and secured to ceiling tees.

- 4. Install at least two independent support rods or wires from structure to a tab on lighting fixture. Wire or rod shall have breaking strength of the weight of fixture at a safety factor of 3.
- K. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.
- L. Temporary Lighting: If it is necessary, and approved by Architect, to use permanent luminaires for temporary lighting, install and energize the minimum number of luminaires necessary. When construction is sufficiently complete, remove the temporary luminaires, disassemble, clean thoroughly and reinstall.
- M. Remote Mounting of Ballasts/Drivers: Distance between the driver and fixture shall not exceed that recommended by luminaire manufacturer.

3.2 EXTERIOR LIGHTING INSTALLATION

- A. Where applicable, install luminaires at heights and aiming angles as indicated on drawings.
- B. Adjust luminaires that require field adjustment or aiming. Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources, favoring a north orientation.
- C. Wiring Method: Install cables in raceways. Conceal raceways and cables.
- D. GROUND-MOUNTED LUMINAIRES - Install on concrete base with top 4 inches (100 mm) above finished grade or surface at luminaire location. Cast conduit into base, and finish by troweling and rubbing smooth.
- E. CORROSION PREVENTION
 - 1. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.
 - 2. Steel Conduits: Comply with Section 260533 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch- (0.254-mm-) thick, pipe-wrapping plastic tape applied with a 50 percent overlap.
- F. Concrete Pole Foundations: Cast in place, with anchor bolts set in accordance with anchor-bolt templates furnished by pole manufacturer. Structural steel complying with ASTM A 36/A 36M and hot-dip galvanized according to ASTM A 123/A 123 M. Ensure that foundation meets or exceeds strength required to support pole, luminaire, and accessories.
- G. Foundation-Mounted Poles: Mount pole with leveling nuts and tighten top nuts to torque level according to pole manufacturer's written instructions.
- H. Poles and Pole Foundations Set in Concrete-Paved Areas: Install poles with a minimum 6-inch- (150-mm-) wide, unpaved gap between the pole or pole foundation and the edge of the adjacent concrete slab. Fill unpaved ring with pea gravel. Insert material to a level 1 inch (25 mm) below top of concrete slab.

- I. Raise and set pole using web fabric slings (not chain or cable) at locations indicated by manufacturer.
- J. Grounding of Lighting Fixture Poles: Do not install a grounding electrode and a separate insulated equipment grounding conductor at these locations. Bond the equipment grounding conductor installed with branch-circuit conductors to the grounding terminal at the pole base.

3.3 IDENTIFICATION

- A. Install labels with panel and circuit numbers on concealed junction and outlet boxes. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.4 INSULATED CEILING SPACES

- A. Provide IC rated fixture assemblies or manufacturer recommended clearances between fixture and insulation.

3.5 FIRE RATED ASSEMBLIES

- A. Provide fire rated fixture assemblies or a third party fire rated cover.
 - 1. Fire rated covers
 - a. Provide manufacturer recommended clearances for all non IC rated fixtures.

3.6 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
 - 2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.
- B. For exterior fixtures, measure light intensities at night. Use photometers with calibration referenced to NIST standards.
- C. Luminaire will be considered defective if it does not pass operation tests and inspections.
- D. Prepare test and inspection reports.

END OF SECTION 265119

SECTION 271500 – COMMUNICATIONS HORIZONTAL CABLING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. UTP cabling.
 - 2. Cable connecting hardware, patch panels, and cross-connects.
 - 3. Telecommunications outlet/connectors.
 - 4. Cabling system identification products.
- B. Related Requirements:
 - 1. Section 260533 for pathways.

1.2 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate layout and installation of telecommunications cabling with Owner's telecommunications and LAN equipment and service suppliers.
- B. Coordinate telecommunications outlet/connector locations with location of power receptacles at each work area.
- C. A 24 hour notice to MSU ITC is required prior to accessing existing MSU telecommunications rooms.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings:
 - 1. System Labeling Schedules: Electronic copy of labeling schedules that are part of the cabling and asset identification system of the software.
 - 2. Wiring diagrams to show typical wiring schematics, including the following:
 - a. Cross-connects.
 - b. Patch panels.
 - c. Patch cords.
 - 3. Cross-connects and patch panels. Detail mounting assemblies, and show elevations and physical relationship between the installed components.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer, qualified layout technician, installation supervisor, and field inspector.

- B. Source quality-control reports.
- C. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Cabling Installer must have personnel certified by TE-ND&I on staff.
 - 1. Layout Responsibility: Preparation of Shop Drawings and Cabling Administration Drawings by an RCDD.
 - 2. Installation Supervision: Installation shall be under the direct supervision of Registered Technician, who shall be present at all times when Work of this Section is performed at Project site.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Test cables upon receipt at Project site. Test each pair of UTP cable for open and short circuits.

PART 2 - PRODUCTS

2.1 HORIZONTAL CABLING DESCRIPTION

- A. Horizontal cable and its connecting hardware provide the means of transporting signals between the telecommunications outlet/connector and the horizontal cross-connect located in the communications equipment room. This cabling and its connecting hardware are called a "permanent link," a term that is used in the testing protocols.
 - 1. TIA/EIA-568-B.1 requires that a minimum of two telecommunications outlet/connectors be installed for each work area.
 - 2. Horizontal cabling shall contain no more than one transition point or consolidation point between the horizontal cross-connect and the telecommunications outlet/connector.
 - 3. Bridged taps and splices shall not be installed in the horizontal cabling.

2.2 PERFORMANCE REQUIREMENTS

- A. General Performance: Horizontal cabling system shall comply with transmission standards in TIA/EIA-568-B.1 when tested according to test procedures of this standard.
- B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: 25 or less.
 - 2. Smoke-Developed Index: 50 or less.

- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. Grounding: Comply with J-STD-607-A.

2.3 BACKBOARDS

- A. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 48 inches (19 by 1220 by 1220 mm). Comply with requirements in Section 061000 "Rough Carpentry" for plywood backing panels.

2.4 UTP CABLE

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. Tyco Electronics Corporation; AMP Products.
 - a. TE Non-plenum Category 6 cable – gray: TE620R-GYRB
 - b. TE Plenum Category 6 cable – gray: TE620P-GYRB
- B. Description: 100-ohm, four-pair UTP, formed into 25-pair, binder groups covered with a gray thermoplastic jacket.
 - 1. Comply with ICEA S-90-661 for mechanical properties.
 - 2. Comply with TIA/EIA-568-B.1 for performance specifications.
 - 3. Comply with TIA/EIA-568-B.2, Category 6.
 - 4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:
 - a. Communications, General Purpose: Type CM or CMG; or MPP, CMP, MPR, CMR, MP, or MPG.
 - b. Communications, Plenum Rated: Type CMP or MPP, complying with NFPA 262.
 - c. Communications, Riser Rated: Type CMR; or MPP, CMP, or MPR, complying with UL 1666.
 - d. Communications, Limited Purpose: Type CMX; or MPP, CMP, MPR, CMR, MP, MPG, CM, or CMG.
 - e. Multipurpose: Type MP or MPG; or MPP or MPR.
 - f. Multipurpose, Plenum Rated: Type MPP, complying with NFPA 262.
 - g. Multipurpose, Riser Rated: Type MPR or MPP, complying with UL 1666.

2.5 UTP CABLE HARDWARE

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. Tyco Electronics Corporation; AMP Products.
- B. General Requirements for Cable Connecting Hardware: Comply with TIA/EIA-568-B.2, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher.
- C. Connecting Blocks: 110-style IDC for Category 5e Provide blocks for the number of cables terminated on the block, plus 25 percent spare. Integral with connector bodies, including plugs and jacks where indicated.
- D. Cross-Connect: Modular array of connecting blocks arranged to terminate building cables and permit interconnection between cables.
 - 1. Number of Terminals per Field: One for each conductor in assigned cables.
- E. Patch Panel: Modular panels housing multiple-numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables.
 - 1. Number of Jacks per Field: One for each four-pair UTP cable indicated
 - 2. Part Number: TE High Density 48 Port Patch Panel Kit: 1375015-2
 - 3. Part Number: TE High Density 24 Port Patch Panel Kit: 1375014-2
 - 4. Telephone Patch Panel: TE 48 Port: 557411-1
- F. Jacks and Jack Assemblies: Modular, color-coded, eight-position modular receptacle units with integral IDC-type terminals.
 - 1. Part Number: TE Category 6 Modular Insert: 1375055-1
 - 2. Part Number: TE SL Series Blank Insert: 1116412-1
- G. Patch Cords: Patch cables should be 14 feet or shorter at the workstation outlet location (the preferred length is 10 feet). A 3' to 14' patch cable shall be used in the telecommunications room from the AMP patch panel to the network switches (the preferred length is one that is just the right length from the network switches to the patch panel port after dressing in wire managers). Part Numbers are as follows:
 - 1. TE Category 6 Patch Cord – Bootless – 1 foot – black: TCPC-6RUVB-BK-01F
 - 2. TE Category 6 Patch Cord – Bootless – 3 feet – black: TCPC-6RUVB-BK-03F
 - 3. TE Category 6 Patch Cord – Bootless – 5 feet – black: TCPC-6RUVB-BK-05F
 - 4. TE Category 6 Patch Cord – Bootless – 7 feet – black: TCPC-6RUVB-BK-07F
 - 5. TE Category 6 Patch Cord – Bootless – 10 feet – black: TCPC-6RUVB-BK-10F
 - 6. TE Category 6 Patch Cord – Bootless – 14 feet – black: TCPC-6RUVB-BK-14F

2.6 CONSOLIDATION POINTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Tyco Electronics Corporation; AMP Products.
- B. Description: Consolidation points shall comply with requirements for cable connecting hardware.
 - 1. Number of Terminals per Field: One for each conductor in assigned cables.
 - 2. Number of Connectors per Field:
 - a. [One] for each four-pair UTP cable indicated.
 - b. [One] for each four-pair conductor group of indicated cables, plus [25] percent spare positions.
 - 3. Mounting: [Recessed in ceiling].
 - 4. NRTL listed as complying with UL 50 and UL 1863.
 - 5. When installed in plenums used for environmental air, NRTL listed as complying with UL 2043.

2.7 TELECOMMUNICATIONS OUTLET/CONNECTORS

- A. Jacks: 100-ohm, balanced, twisted-pair connector; four-pair, eight-position modular. Comply with TIA/EIA-568-B.1.
- B. Workstation Outlets: Two-port-connector assemblies mounted in single faceplate.
 - 1. TE Single Gang 4 port Faceplate: 558088-1
 - a. Coordinate color with Section 262726 "Wiring Devices."
 - 2. TE Double Gang 4 port Faceplate: 83935-1
 - a. Coordinate color with Section 262726 "Wiring Devices."
 - 3. For use with snap-in jacks accommodating any combination of UTP work area cords.
 - a. Flush mounting jacks, positioning the cord at a 45-degree angle.
 - 4. Legend: Machine printed, in the field, using adhesive-tape label.
 - 5. Legend: Snap-in, clear-label covers and machine-printed paper inserts.
- C. Testing: As-built drawings and test results are required on each link with an OTDR in accordance with ND&I requirements.

2.8 GROUNDING

- A. Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems" for grounding conductors and connectors.
- B. Comply with J-STD-607-A.

2.9 IDENTIFICATION PRODUCTS

- A. Comply with TIA/EIA-606-A and UL 969 for labeling materials, including label stocks, laminating adhesives, and inks used by label printers.
- B. Comply with requirements in Section 260553 "Identification for Electrical Systems."

2.10 SOURCE QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to evaluate cables.
- B. Factory test UTP cables on reels according to TIA/EIA-568-B.1.
- C. Factory test UTP cables according to TIA/EIA-568-B.2.
- D. Cable will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 ENTRANCE FACILITIES

- A. Coordinate backbone cabling with MSU.

3.2 WIRING METHODS

- A. Install cables in pathways and cable trays except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Conceal pathways and cables except in unfinished spaces.
 - 1. Install plenum cable in environmental air spaces, including plenum ceilings.
 - 2. Comply with requirements in Section 260533 for pathways.
- B. Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
- C. Wiring within Enclosures:
 - 1. Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.
 - 2. Install lacing bars and distribution spools.
 - 3. Install conductors parallel with or at right angles to sides and back of enclosure.

3.3 INSTALLATION OF CABLES

- A. Comply with NECA 1.
- B. General Requirements for Cabling:
 - 1. Comply with TIA/EIA-568-B.1.
 - 2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."

3. Install 110-style IDC termination hardware unless otherwise indicated.
 4. MUTOA shall not be used as a cross-connect point.
 5. Consolidation points may be used only for making a direct connection to telecommunications outlet/connectors:
 - a. Do not use consolidation point as a cross-connect point, as a patch connection, or for direct connection to workstation equipment.
 - b. Locate consolidation points for UTP at least 49 feet (15 m) from communications equipment room.
 6. Terminate conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
 7. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
 8. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
 9. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
 10. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
 11. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
 12. In the communications equipment room, install a 10-foot long service loop on each end of the main telephone cable and main fiber feed. Install a 24-inch slack loop for all Category 6 cables in the room.
 13. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.
- C. UTP Cable Installation:
1. Comply with TIA/EIA-568-B.2.
 2. Do not untwist UTP cables more than 1/2 inch (12 mm) from the point of termination to maintain cable geometry.
 3. No run shall be over 250-feet from the patch panel to the jack location.
- D. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
 2. Suspend UTP cable not in a wireway or pathway a minimum of 8 inches (200 mm) above ceilings by cable supports not more than [60 inches (1524 mm)] apart.
 3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.
- E. Installation of Cable Routed Exposed under Raised Floors:
1. Install plenum-rated cable only.
 2. Install cabling after the flooring system has been installed in raised floor areas.
 3. Coil cable 6 feet long not less than 12 inches in diameter below each feed point.
- F. Group connecting hardware for cables into separate logical fields.
- G. Separation from EMI Sources:
1. Comply with BICSI TDMM and TIA-569-B for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
 2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches (127 mm).
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches (300 mm).
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches (610 mm).
 3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches (64 mm).
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches (150 mm).
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches (300 mm).
 4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: No requirement.

- b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches (76 mm).
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches (150 mm).
- 5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches (1200 mm).
 - 6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).

3.4 FIRESTOPPING

- A. Comply with requirements in Section 078413 "Penetration Firestopping."
- B. Comply with TIA-569-B, Annex A, "Firestopping."
- C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.5 GROUNDING

- A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
- B. Comply with J-STD-607-A.
- C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch (50-mm) clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.
- D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

3.6 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
 - 1. Administration Class: [1].
 - 2. Color-code cross-connect fields. Apply colors to voice and data service backboards, connections, covers, and labels.
- B. Comply with requirements in Section 099123 "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.
- C. Paint and label colors for equipment identification shall comply with TIA/EIA-606-A for Class 1 level of administration, including optional identification requirements of this standard.
- D. Each outlet and patch panel pair of ports shall be clearly labeled in both the telecommunications room and the workstation location with the workstation room

number. If there are multiple jacks in a room, the numbering shall include a hyphen suffix designation, such as 232-1, 232-2, and will begin at the closest jack to the left of the main doorway (standing in the doorway, looking in), and proceed clockwise around the room. Single jacks in a room shall be labeled with just the room number and will not have a hyphen suffix designation (e.g., 233, 234). If there are jacks located in the center of the room, after going around the exterior of the room, go up the middle from the main doorway. The label at the outlet will be placed on either the top of the faceplate (if difficult to see the front of the faceplate), or on the top label indentation on the front of the faceplate. Four-plex or greater density jack plates will be labeled as two (or more) jacks rather than one, such as 101-1, 101-2. Each jack consists of 2 cables.

- E. Cable Schedule: Post in prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.
- F. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, backbone pathways and cables, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors. Follow convention of TIA/EIA-606-A. Furnish electronic record of all drawings, in software and format selected by Owner.
- G. Cable and Wire Identification:
 - 1. Label each cable within 4 inches (100 mm) of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
 - 2. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.
 - 3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet (4.5 m).
 - 4. Label each terminal strip and screw terminal in each cabinet, rack, or panel.
 - a. Individually number wiring conductors connected to terminal strips, and identify each cable or wiring group being extended from a panel or cabinet to a building-mounted device shall be identified with name and number of particular device as shown.
 - b. Label each unit and field within distribution racks and frames.
 - 5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.
 - 6. Uniquely identify and label work area cables extending from the MUTOA to the work area. These cables may not exceed the length stated on the MUTOA label.

- H. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA/EIA-606-A.
 - 1. Cables use flexible vinyl or polyester that flex as cables are bent.

3.7 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Visually inspect UTP jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA/EIA-568-B.1.
 - 2. Visually confirm Category 6, marking of outlets, cover plates, outlet/connectors, and patch panels.
 - 3. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
 - 4. Test UTP backbone copper cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.
 - a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
 - 5. UTP Performance Tests:
 - a. Test for each outlet and MUTOA. Perform the following tests according to TIA/EIA-568-B.1 and TIA/EIA-568-B.2:
 - 1) Wire map.
 - 2) Length (physical vs. electrical, and length requirements).
 - 3) Insertion loss.
 - 4) Near-end crosstalk (NEXT) loss.
 - 5) Power sum near-end crosstalk (PSNEXT) loss.
 - 6) Equal-level far-end crosstalk (ELFEXT).
 - 7) Power sum equal-level far-end crosstalk (PSELFEXT).
 - 8) Return loss.
 - 9) Propagation delay.

- 10) Delay skew.
 - 11) OTDR test.
6. Final Verification Tests: Perform verification tests for UTP systems after the complete communications cabling and workstation outlet/connectors are installed.
- a. Voice Tests: These tests assume that dial tone service has been installed. Connect to the network interface device at the demarcation point. Go off-hook and listen and receive a dial tone. If a test number is available, make and receive a local, long distance, and digital subscription line telephone call.
 - b. Data Tests: These tests assume the Information Technology Staff has a network installed and is available to assist with testing. Connect to the network interface device at the demarcation point. Log onto the network to ensure proper connection to the network.
- B. Document data for each measurement. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.
- C. End-to-end cabling will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

3.8 DEMONSTRATION

- A. Train Owner's maintenance personnel in cable-plant management operations, including changing signal pathways for different workstations, rerouting signals in failed cables, and keeping records of cabling assignments and revisions when extending wiring to establish new workstation outlets.

END OF SECTION 271500

SECTION 283111 - DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Fire-alarm control unit.
 - 2. Manual fire-alarm boxes.
 - 3. System smoke detectors.
 - 4. Heat detectors.
 - 5. Notification appliances.
 - 6. Remote annunciator.
 - 7. Addressable interface device.

1.3 DEFINITIONS

- A. LED: Light-emitting diode.
- B. NICET: National Institute for Certification in Engineering Technologies.

1.4 SYSTEM DESCRIPTION

- A. Noncoded, UL-certified addressable system, with multiplexed signal transmission, dedicated to fire-alarm service only.

1.5 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Fire-alarm control unit and raceways shall withstand the effects of earthquake motions determined according to SEI/ASCE 7 .
 - 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

- B. Shop Drawings: For fire-alarm system. Include plans, elevations, sections, details, and attachments to other work.
1. Comply with recommendations in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72.
 2. Include voltage drop calculations for notification appliance circuits.
 3. Include battery-size calculations.
 4. Include performance parameters and installation details for each detector, verifying that each detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
 5. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale and coordinating installation of duct smoke detectors and access to them. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators. Locate detectors according to manufacturer's written recommendations.
 6. Include voice/alarm signaling-service equipment rack or console layout, grounding schematic, amplifier power calculation, and single-line connection diagram.
 7. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits.
- C. General Submittal Requirements:
1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Architect.
 2. Shop Drawings shall be prepared by persons with the following qualifications:
 - a. Trained and certified by manufacturer in fire-alarm system design.
 - b. NICET-certified fire-alarm technician, Level III minimum.
 - c. Licensed or certified by authorities having jurisdiction.
- D. Delegated-Design Submittal: For smoke and heat detectors indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
1. Drawings showing the location of each smoke and heat detector, ratings of each, and installation details as needed to comply with listing conditions of the detector.
 2. Design Calculations: Calculate requirements for selecting the spacing and sensitivity of detection, complying with NFPA 72.

1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Seismic Qualification Certificates: For fire-alarm control unit, accessories, and components, from manufacturer.
1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- C. Field quality-control reports.

1.8 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," deliver copies to authorities having jurisdiction and include the following:
1. Comply with the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
 2. Provide "Record of Completion Documents" according to NFPA 72 article "Permanent Records" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter.
 3. Record copy of site-specific software.
 4. Provide "Maintenance, Inspection and Testing Records" according to NFPA 72 article of the same name and include the following:
 - a. Frequency of testing of installed components.
 - b. Frequency of inspection of installed components.
 - c. Requirements and recommendations related to results of maintenance.
 - d. Manufacturer's user training manuals.
 5. Manufacturer's required maintenance related to system warranty requirements.
 6. Abbreviated operating instructions for mounting at fire-alarm control unit.
- B. Software and Firmware Operational Documentation:
1. Software operating and upgrade manuals.
 2. Program Software Backup: On magnetic media or compact disk, complete with data files.
 3. Device address list.
 4. Printout of software application and graphic screens.

1.9 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Lamps for Remote Indicating Lamp Units: Quantity equal to 10 percent of amount installed, but no fewer than 1 unit.
 2. Lamps for Strobe Units: Quantity equal to 10 percent of amount installed, but no fewer than 1 unit.
 3. Smoke Detectors, Fire Detectors: Quantity equal to 10 percent of amount of each type installed, but no fewer than 1 unit of each type.
 4. Detector Bases: Quantity equal to 2 percent of amount of each type installed, but no fewer than 1 unit of each type.
 5. Keys and Tools: One extra set for access to locked and tamperproofed components.

6. Audible and Visual Notification Appliances: One of each type installed.
7. Fuses: Two of each type installed in the system.

1.10 QUALITY ASSURANCE

- A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.
- B. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm Level III technician.
- C. Source Limitations for Fire-Alarm System and Components: Obtain fire-alarm system from single source from single manufacturer. Components shall be compatible with, and operate as, an extension of existing system.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- E. NFPA Certification: Obtain certification according to NFPA 72 by an NRTL.
- F. NFPA Certification: Obtain certification according to NFPA 72 by a UL-listed alarm company.

1.11 SOFTWARE SERVICE AGREEMENT

- A. Comply with UL 864.
- B. Technical Support: Beginning with Substantial Completion, provide software support for two years.
- C. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.
 1. Provide 30 days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Faraday; Siemens Building Technologies, Inc.
 2. Fire Lite Alarms; a Honeywell company.
 3. GAMEWELL; a Honeywell company.
 4. GE Infrastructure; a unit of General Electric Company.
 5. NOTIFIER; a Honeywell company.

6. Silent Knight; a Honeywell company.
7. SimplexGrinnell LP; a Tyco International company.

2.2 SYSTEMS OPERATIONAL DESCRIPTION

A. Fire-alarm signal initiation shall be by one or more of the following devices and systems:

1. Manual stations.
2. Heat detectors.
3. Smoke detectors.
4. Duct smoke detectors.
5. Verified automatic alarm operation of smoke detectors.

B. Fire-alarm signal shall initiate the following actions:

1. Continuously operate alarm notification appliances.
2. Identify alarm at fire-alarm control unit and remote annunciators.
3. Transmit an alarm signal to the remote alarm receiving station.
4. Activate voice/alarm communication system.
5. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.
6. Close smoke dampers in air ducts of designated air-conditioning duct systems.
7. Record events in the system memory.

C. System trouble signal initiation shall be by one or more of the following devices and actions:

1. Open circuits, shorts, and grounds in designated circuits.
2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
3. Loss of primary power at fire-alarm control unit.
4. Ground or a single break in fire-alarm control unit internal circuits.
5. Abnormal ac voltage at fire-alarm control unit.
6. Break in standby battery circuitry.
7. Failure of battery charging.
8. Abnormal position of any switch at fire-alarm control unit or annunciator.

D. System Trouble and Supervisory Signal Actions: Initiate notification appliance and annunciate at fire-alarm control unit and remote annunciators. Record the event on system printer.

2.3 FIRE-ALARM CONTROL UNIT

A. General Requirements for Fire-Alarm Control Unit:

1. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864 and listed and labeled by an NRTL.
 - a. System software and programs shall be held in flash electrically erasable programmable read-only memory (EEPROM), retaining the information through failure of primary and secondary power supplies.

- b. Include a real-time clock for time annotation of events on the event recorder and printer.
 - 2. Addressable initiation devices that communicate device identity and status.
 - a. Smoke sensors shall additionally communicate sensitivity setting and allow for adjustment of sensitivity at fire-alarm control unit.
 - b. Temperature sensors shall additionally test for and communicate the sensitivity range of the device.
 - 3. Addressable control circuits for operation of mechanical equipment.
- B. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.
 - 1. Annunciator and Display: Liquid-crystal type, 3 line(s) of 80 characters, minimum.
 - 2. Keypad: Arranged to permit entry and execution of programming, display, and control commands.
- C. Circuits:
 - 1. Initiating Device, Notification Appliance, and Signaling Line Circuit Classifications: NFPA 72
 - a. Initiating Device Circuits: Class B
 - b. Notification Appliance Circuits: Class B
 - c. Signaling Line Circuits: Class B
 - 1. Install no more than 50 addressable devices on each signaling line circuit.
 - 2. Serial Interfaces: Two RS-232 ports for printers.
- D. Smoke-Alarm Verification:
 - 1. Initiate audible and visible indication of an "alarm-verification" signal at fire-alarm control unit.
 - 2. Activate an NRTL-listed and -approved "alarm-verification" sequence at fire-alarm control unit and detector.
 - 3. Sound general alarm if the alarm is verified.
 - 4. Cancel fire-alarm control unit indication and system reset if the alarm is not verified.
- E. Notification Appliance Circuit: Operation shall sound in a Siren pattern.
- F. Door Controls: Door hold-open devices that are controlled by smoke detectors at doors in smoke barrier walls shall be connected to fire-alarm system.
- G. Remote Smoke-Detector Sensitivity Adjustment: Controls shall select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and change those settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-

adjustment schedule changes in system memory, and print out the final adjusted values on system printer.

- H. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.
- I. Voice/Alarm Signaling Service: Central emergency communication system with redundant microphones, preamplifiers, amplifiers, and tone generators provided **as a special module that is part of fire-alarm control unit.**
 - 1. Indicated number of alarm channels for automatic, simultaneous transmission of different announcements to different zones or for manual transmission of announcements by use of the central-control microphone. Amplifiers shall comply with UL 1711 and be listed by an NRTL.
 - a. Allow the application of and evacuation signal to indicated number of zones and, at same time, allow voice paging to the other zones selectively or in any combination.
 - b. Programmable tone and message sequence selection.
 - c. Standard digitally recorded messages for "Evacuation" and "All Clear."
 - d. Generate tones to be sequenced with audio messages of type recommended by NFPA 72 and that are compatible with tone patterns of notification appliance circuits of fire-alarm control unit.
 - 2. Status Annunciator: Indicate the status of various voice/alarm speaker zones and the status of firefighters' two-way telephone communication zones.
 - 3. Preamplifiers, amplifiers, and tone generators shall automatically transfer to backup units, on primary equipment failure.
- J. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, supervisory and digital alarm communicator transmitters shall be powered by 24-V dc source.
 - 1. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.
- K. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.
 - 1. Batteries: Sealed lead calcium.
- L. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

2.4 MANUAL FIRE-ALARM BOXES

- A. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show

visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.

1. Double-action mechanism requiring two actions to initiate an alarm, pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
2. Station Reset: Key- or wrench-operated switch.
3. Indoor Protective Shield: Factory-fabricated clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm. Lifting the cover actuates an integral battery-powered audible horn intended to discourage false-alarm operation.
4. Weatherproof Protective Shield: Factory-fabricated clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm.

2.5 SYSTEM SMOKE DETECTORS

A. General Requirements for System Smoke Detectors:

1. Comply with UL 268; operating at 24-V dc, nominal.
2. Detectors shall be four -wire type.
3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
4. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
6. Integral Visual-Indicating Light: LED type indicating detector has operated and power-on status.
7. Remote Control: Unless otherwise indicated, detectors shall be analog-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by fire-alarm control unit.
 - a. Rate-of-rise temperature characteristic shall be selectable at fire-alarm control unit for 15 or 20 deg F (8 or 11 deg C) per minute.
 - b. Fixed-temperature sensing shall be independent of rate-of-rise sensing and shall be settable at fire-alarm control unit to operate at 135 or 155 deg F (57 or 68 deg C).
 - c. Provide multiple levels of detection sensitivity for each sensor.

B. Photoelectric Smoke Detectors:

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
 - a. Primary status.
 - b. Device type.
 - c. Present average value.
 - d. Present sensitivity selected.
 - e. Sensor range (normal, dirty, etc.).

C. Ionization Smoke Detector:

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
 - a. Primary status.
 - b. Device type.
 - c. Present average value.
 - d. Present sensitivity selected.
 - e. Sensor range (normal, dirty, etc.).

D. Duct Smoke Detectors: Photoelectric type complying with UL 268A.

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
 - a. Primary status.
 - b. Device type.
 - c. Present average value.
 - d. Present sensitivity selected.
 - e. Sensor range (normal, dirty, etc.).
3. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector.
4. Each sensor shall have multiple levels of detection sensitivity.
5. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
6. Integral Visual-Indicating Light: LED type. Indicating detector has operated and power-on status. **Provide remote status and alarm indicator and test station for each detector.**
7. Relay Fan Shutdown: Rated to interrupt fan motor-control circuit.

2.6 HEAT DETECTORS

A. General Requirements for Heat Detectors: Comply with UL 521.

B. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F (57 deg C) or a rate of rise that exceeds 15 deg F (8 deg C) per minute unless otherwise indicated.

1. Mounting: Twist-lock base interchangeable with smoke-detector bases.
2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

2.7 NOTIFICATION APPLIANCES

- A. General Requirements for Notification Appliances: Individually addressed, connected to a signaling line circuit, equipped for mounting as indicated and with screw terminals for system connections.
- B. General Requirements for Notification Appliances: Connected to notification appliance signal circuits, zoned as indicated, equipped for mounting as indicated and with screw terminals for system connections.
 - 1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated and with screw terminals for system connections.
- C. Chimes, Low-Level Output: Vibrating type, 75-dBA minimum rated output.
- D. Chimes, High-Level Output: Vibrating type, 81-dBA minimum rated output.
- E. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet (3 m) from the horn, using the coded signal prescribed in UL 464 test protocol.
- F. Visible Notification Appliances: Xenon strobe lights comply with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- (25-mm-) high letters on the lens.
 - 1. Rated Light Output:
 - a. 15/30/75/110 cd, selectable in the field.
 - 2. Mounting: Wall mounted unless otherwise indicated.
 - 3. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
 - 4. Flashing shall be in a temporal pattern, synchronized with other units.
 - 5. Strobe Leads: Factory connected to screw terminals.
 - 6. Mounting Faceplate: Factory finished, red/white.
- G. Voice/Tone Notification Appliances:
 - 1. Appliances shall comply with UL 1480 and shall be listed and labeled by an NRTL.
 - 2. High-Range Units: Rated 2 to 15 W.
 - 3. Low-Range Units: Rated 1 to 2 W.
 - 4. Mounting: surface mounted and bidirectional.
 - 5. Matching Transformers: Tap range matched to acoustical environment of speaker location.

2.8 REMOTE ANNUNCIATOR

- A. Description: Annunciator functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit, including acknowledging, silencing, resetting, and testing.

1. Mounting: Flush cabinet, NEMA 250, Type 1.

B. Display Type and Functional Performance: Alphanumeric display and LED indicating lights shall match those of fire-alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.

2.9 DIGITAL ALARM COMMUNICATOR TRANSMITTER

A. Digital alarm communicator transmitter shall be acceptable to the remote central station and shall comply with UL 632 and be listed and labeled by an NRTL.

B. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit and automatically capture two telephone line(s) and dial a preset number for a remote central station. When contact is made with central station(s), signals shall be transmitted. If service on either line is interrupted for longer than 45 seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. Transmitter shall automatically report telephone service restoration to the central station. If service is lost on both telephone lines, transmitter shall initiate the local trouble signal.

C. Local functions and display at the digital alarm communicator transmitter shall include the following:

1. Verification that both telephone lines are available.
2. Programming device.
3. LED display.
4. Manual test report function and manual transmission clear indication.
5. Communications failure with the central station or fire-alarm control unit.

D. Digital data transmission shall include the following:

1. Address of the alarm-initiating device.
2. Address of the supervisory signal.
3. Address of the trouble-initiating device.
4. Loss of ac supply or loss of power.
5. Low battery.
6. Abnormal test signal.
7. Communication bus failure.

E. Secondary Power: Integral rechargeable battery and automatic charger.

F. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

2.10 DEVICE GUARDS

A. Description: Welded wire mesh of size and shape for the manual station, smoke detector, gong, or other device requiring protection.

1. Factory fabricated and furnished by manufacturer of device.

2. Finish: Paint of color to match the protected device.

2.11 CABLES AND RACEWAYS

- A. All conductors associated with fire alarm system shall be installed in conduit. Minimum raceway size: ¾".
- B. Conductors for all initiating and signal circuits shall be solid copper, with minimum gauge of #18. All conductors shall terminate under screw terminal.
- C. Conductors for all notification appliance circuits (NACs) shall be sized for distance and current load, in strict accordance with manufacturer's recommendations. Minimum wire size shall be #14 AWG. Whenever practical, NAC wiring should not be larger than #12 AWG wire. Where larger size is required to serve load, additional circuit module shall be provided to split load current.
- D. To minimize voltage drop, conductors serving activation devices shall be #12 AWG minimum. Conductors for external control circuits and annunciator panels should be sized according to applicable code requirements and manufacturer's recommendations.
- E. Fire alarm raceways shall not contain any conductors not part of fire alarm system.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

- A. Comply with NFPA 72 for installation of fire-alarm equipment.
- B. Install wall-mounted equipment, with tops of cabinets not more than 72 inches (1830 mm) above the finished floor.
 1. Comply with requirements for seismic-restraint devices specified in Section 260548 "Vibration and Seismic Controls for Electrical Systems."
- C. Smoke- or Heat-Detector Spacing:
 1. Comply with NFPA 72, "Smoke-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for smoke-detector spacing.
 2. Comply with NFPA 72, "Heat-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for heat-detector spacing.
 3. Smooth ceiling spacing shall not exceed 30 feet (9 m).
 4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Appendix A in NFPA 72.
 5. HVAC: Locate detectors not closer than 5 feet (1.5 m) from air-supply diffuser or return-air opening.
 6. Lighting Fixtures: Locate detectors not closer than 12 inches (300 mm) from any part of a lighting fixture.
- D. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct.

- E. Remote Status and Alarm Indicators: Install near each smoke detector and each sprinkler water-flow switch and valve-tamper switch that is not readily visible from normal viewing position.
- F. Audible Alarm-Indicating Devices: Install not less than 6 inches (150 mm) below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille.
- G. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches (150 mm) below the ceiling.
- H. Device Location-Indicating Lights: Locate in public space near the device they monitor.
- I. Fire-Alarm Control Unit: Surface mounted, with tops of cabinets not more than 72 inches (1830 mm) above the finished floor.
- J. Annunciator: Install with top of panel not more than 72 inches (1830 mm) above the finished floor.

3.2 CONNECTIONS

- A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in Section 087100 "Door Hardware." Connect hardware and devices to fire-alarm system.
 - 1. Verify that hardware and devices are NRTL listed for use with fire-alarm system in this Section before making connections.
- B. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 3 feet (1 m) from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.
 - 1. Alarm-initiating connection to smoke-control system (smoke management) at firefighter smoke-control system panel.
 - 2. Alarm-initiating connection to stairwell and elevator-shaft pressurization systems.
 - 3. Smoke dampers in air ducts of designated air-conditioning duct systems.
 - 4. Alarm-initiating connection to elevator recall system and components.
 - 5. Alarm-initiating connection to activate emergency lighting control.
 - 6. Alarm-initiating connection to activate emergency shutoffs for gas and fuel supplies.

3.3 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- B. Install framed instructions in a location visible from fire-alarm control unit.

3.4 GROUNDING

- A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.

3.5 FIELD QUALITY CONTROL

- A. Field tests shall be witnessed by authorities having jurisdiction.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- C. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- D. Tests and Inspections:
 - 1. Visual Inspection: Conduct visual inspection prior to testing.
 - a. Inspection shall be based on completed Record Drawings and system documentation that is required by NFPA 72 in its "Completion Documents, Preparation" Table in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter.
 - b. Comply with "Visual Inspection Frequencies" Table in the "Inspection" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.
 - 2. System Testing: Comply with "Test Methods" Table in the "Testing" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
 - 3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
 - 4. Test audible appliances for the private operating mode according to manufacturer's written instructions.
 - 5. Test visible appliances for the public operating mode according to manufacturer's written instructions.
 - 6. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
- E. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.
- F. Fire-alarm system will be considered defective if it does not pass tests and inspections.
- G. Prepare test and inspection reports.

- H. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.
- I. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

3.6 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

END OF SECTION 283111