# PROJECT MANUAL
SPECIFICATIONS
DRAWINGS

# MAINTENANCE BUILDING
## DEER CREEK FISH AND WILDLIFE AREA
## DEPARTMENT OF NATURAL RESOURCES

2001 W. COUNTY ROAD 600 S
GREENCASTLE, IN 46135

Owner:

**Indiana Department of Natural Resources**
**Division of Fish and Wildlife**
Indiana Government Center South
402 W. Washington Street, Rm. W267
Indianapolis, IN 46204

Designed and Prepared By:

**Indiana Department of Natural Resources**
**Division of Engineering**

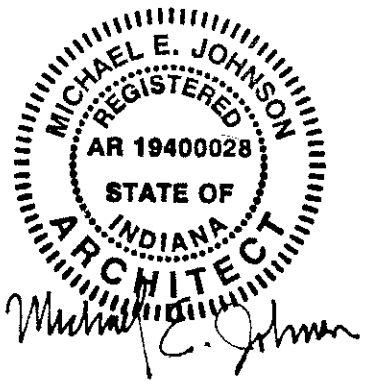
**MAY 24, 2023** **IDNR Project: ENG2002905497**

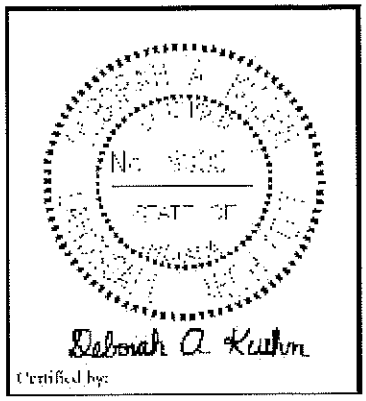
# MAINTENANCE BUILDING

## DEER CREEK FISH AND WILDLIFE AREA

## DEPARTMENT OF NATURAL RESOURCES

2001 W. COUNTY ROAD 600 S
GREENCASTLE, IN 46135




---

Architectural

Civil


DNR

Indiana Department of Natural Resources

Division of Engineering
402 W. Washington Street, Rm W299
Indianapolis, IN 46204-2739

Mechanical, Electrical, Plumbing

# MAINTENANCE BUILDING
## DEER CREEK FISH AND WILDLIFE AREA
## DEPARTMENT OF NATURAL RESOURCES

2001 W. COUNTY ROAD 600 S
GREENCASTLE, IN 46135

Structural:

TLF

3901 West 86th Street, Suite 200
Indianapolis, Indiana 46268
Phone: 317-334-1500
Fax: 317-334-1552
TLF Job No. 2021-324

# OVER $150,000
# TABLE OF CONTENTS

## A. BIDDING AND CONTRACT REQUIREMENTS

## B. LIST OF DRAWINGS



## C. SPECIFICATIONS

END OF SECTION

TABLE OF CONTENTS

**STATE OF INDIANA**
ERIC J. HOLCOMB, Governor

**DEPARTMENT OF ADMINISTRATION**
Public Works Division
402 West Washington Street, Room W462
Indiana Government Center – South
Indianapolis, Indiana 46204-2746
PHONE: (317) 232-3001

# NOTICE TO BIDDERS

**BY STATE OF INDIANA DEPARTMENT OF ADMINISTRATION, PUBLIC WORKS DIVISION FOR A PUBLIC WORKS CONSTRUCTION PROJECT ESTIMATED AT ONE HUNDRED FIFTY THOUSAND DOLLARS OR ABOVE**

**SECURED ELECTRONIC BIDS FOR:**

**Public Works Project No. XXX-XXX**
**XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX**
**XXXXXXXXXXXXXXXXXXX**

**will be received from Contractors, holding a current Certificate of Qualification, at Department of Administration, Public Works Division Email Bid Box-**publicworksbids@idoa.in.gov
**(note, do not cc: any other party)**
**Subject line MUST contain "Bid- xxxxxxxx-xx-xxx-xx; - (Project Name) - (Your firm)"**

**Bid File (PDF) MUST be named-"(Bidding Firm name) Bid-xxxxxxxx-xx-xxx-xx; - (Proj Name)" and not exceed 9Mb**

**Until 1:31 P.M (Indianapolis Time), (Day), (Date), 202?, after which all bids will be publicly opened and read online in a Microsoft Teams Live Event-** ***(PM to insert Teams Live event info/Link here-PM to set MS Live event for 30 mins following Bid due to allow time to verify certifications and permit electronic bids to clear IOT/State Virus Detection software)***

**Minority Contractors are encouraged to submit bids on this project as a prime contractor or through a prime contractor.**

**Copies of the detailed Instructions to Bidders and Drawings and/or Specifications dated XXXXX, 2020 may be obtained from: Reprographix.com ePlanroom (Construction Document Distribution)** link **for a cost of $XX.00 per set, or from the office of: (*Insert designer's contact information*)**

**Bids shall be taken from Prime Contractors pre-qualified by the Public Works Certification Board in the following classification(s): XXXXXXXXXX, or xxxxxxxxxxxxxxx**

**The Specified construction period is XXX calendar days. The State of Indiana reserves the right to reject any and all bids.**

**Project Goal of 7% MBE, 5% WBE and 3% IVOSB. Link: https://www.in.gov/idoa/mwbe/2494.htm**

**Project Manager**: _____
Associate State XXXXXX DAPW

**Director of Public Works**: _____
Director

Pre-Bid Information **XXXXX**
**xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx**
**xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx**
**xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx**

INSTRUCTIONS TO BIDDERS

PROJECT ESTIMATED BY DEPARTMENT OF ADMINISTRATION, PUBLIC WORKS DIVISION
TO BE BID AT ONE HUNDRED FIFTY THOUSAND DOLLARS ($150,000) AND ABOVE

01 GENERAL

A. This project is estimated by the Public Works Division, Indiana Department of Administration (the Owner), as stated in the Notice to Bidders, at One Hundred Fifty Thousand Dollars ($150,000) and above.

B. QUALIFICATION BY THE CERTIFICATION BOARD IS REQUIRED FOR THIS PROJECT PRIOR TO BID OPENING DATE. For information and procedure contact Executive Secretary, Certification Board, Indiana Department of Administration, 402 W. Washington St., Room W462, Indianapolis, Indiana 46204, E-mail: _____ or phone (317) 232-3005.

02 PROJECT NUMBER, DESCRIPTION AND LOCATION is as stated in the Notice to Bidders.

03 TITLE AND DEFINITIONS

Said building and/or land upon which it stands is the property of the State of Indiana. All references to the title owner of said property hereinafter will be by the term "State" and all references to the person, firm, or corporation awarded the contract for the project will be by the term "Contractor". All references to Designer shall refer to the consulting person or firm employed to contract with the Public Works Division, Indiana Department of Administration to provide architectural, engineering or other consulting services for the project, or to the Public Works Division. The preparation and issuance of contracts for this project are the responsibility of the Commissioner of the Indiana Department of Administration acting with approval of the Governor.

Contract: A written agreement between two or more parties enforceable by law.

Contractor: A person who has entered into or seeks to enter into a contract with Public Works Division.

Prime Contractor: A person or business which is primarily responsible for providing goods and service or performing a specific service, etc. under contract. A prime contractor can also be a Minority Business Enterprise, a Women's Business Enterprise or an Indiana Veteran Owned Small Business Enterprise.

Subcontractor: A person or a business who has a direct contract with a prime contractor who is under contract to provide goods and services or perform a specific service.

Joint Venture: An association of two or more businesses to carry out a single business enterprise for profit for which purpose they combine their property, capital, efforts, skills and knowledge.

Manufacturer: A supplier that produces goods from raw materials or substantially alters them before resale.

Minority Business Enterprise (MBE) and Women's Business Enterprise (WBE): A business concern which is certified as at least fifty-one percent (51%) owned and controlled by one or more of the individuals classified as a minority group which includes: African Americans, Hispanic Americans, Native Americans, Hispanic Americans, Asian Americans, and other racial minority groups as defined by 13 CFR 124.103, or at least fifty-one percent (51%) owned and controlled by a woman or women.

Supplier: Any person or entity engaged to furnish goods, materials and/or equipment, but no on-site labor, is capable of furnishing such goods, materials and/or equipment either directly from its own stock or by ordering materials and/or equipment directly from a manufacturer, and is engaged to furnish such goods, materials and/or equipment directly to a prime contractor or one of its subcontractors.

Indiana Veteran Owned Small Business Enterprise (IVOSB): means an Indiana small business enterprise which is certified as at least fifty-one percent (51%) owned and controlled by a veteran.

04 PRE-BIDDING, BIDDING AND POST BIDDING REQUIREMENTS

A. The Director, Public Works Division, will authorize the Designer to issue bidding documents, construction documents and addenda to bidders.

B. It is recommended that all Bidders visit the site prior to submitting bid and become thoroughly familiar with the existing site conditions and work to be performed, as indicated in the bidding documents, construction documents and addenda. Extra compensation or extension of time will not be allowed for failure to examine the site prior to bidding.

C. During the bidding period, should questions arise as to the meaning of any part of the bidding documents, construction documents or addenda that may affect the Bidder, the Bidder shall contact the Designer and/or Public Works Division and

submit a written request for clarification. The Designer and/or Public Works Division will make such clarification only by written Addendum that will be emailed to each document holder or may be obtained at the office of the Designer and/or Public Works Division. By submitting a bid, the Bidder acknowledges procurement of all Addenda. No written request for clarification will be accepted by the Designer and/or Public Works Division later than fourteen (14) calendar days prior to the scheduled bid date.

D. Bid as described in Contractor's Bid (DAPW 13) shall include Base Bid (in figures and in words) and Alternates as specified in Section entitled Alternates. In verifying bids, word amounts shall have precedence over figure amounts.

E. Alternate amount(s) shall be listed where indicated. Add Alternates are not to be included in the Base Bid Scope of Work. Deduct Alternates are to be included in the Base Bid Scope of Work. The bid form must be signed. Note that by signing the bid document, the Bidder is acknowledging the procurement of all addenda and is a certifying that the bid recognizes all items in all addenda.

F. A bid by a corporation shall be in the legal name of the corporation followed by the word "by" and the signature of the president. The secretary of the corporation shall sign indicating his/her authority to sign. A Certificate of Corporate Resolution (DAPW 41) is required with and as a part of the bid if anyone other than the president of the corporation is signing bid documents.

G. *The Form 96A-Questionnaire and Financial Statement is no longer required to be submitted.* The Director, Public Works Division reserves the right to request additional financial information or contractor experience as a basis for rejection of bid or award of contract.

H. Each Bidder must file with his bid a Non-Collusion Statement (DAPW-121) signed by the same authorized person(s) who signed the bid.

I. Each Bidder must file with his bid a completely filled in and executed Bid Bond (DAPW 15A) in accordance with IC 4-13.6-7-5. The bid bond penal sum shall be the minimum amount of five percent (5%) of the bid including all additive alternates.

J. Each Bidder must file with his bid a completed MBE/WBE/IVOSB Participation Plan (DAPW 26) and Good Faith Effort Work Sheet (DAPW 26 SUP2). Refer to the Supplement to the General Conditions for MBE/WBE/IVOSB Participation Policy (DAPW 26 SUP1) for specific requirements.

K. Each Bidder must file with his bid, the completed Contractor's Affidavit of Subcontractors Employed (DAPW 12) only if he proposes to perform any work with a subcontract amount of $150,000.00 or more.

L. Each bidder must file with his bid an Employee Drug Testing Plan (DAPW 150A) in accordance with IC 4-13-18 or evidence that the contractor is subject to a collective bargaining agreement containing drug testing requirements that comply with IC 4-13-18.

M. Each Bidder must include his Federal ID number or Social Security number on page 1 of 3 of the Bid Form (DAPW 13). All required bid documents must contain original handwritten signatures.

N. All documents required by statute, rule or these instructions to be included in the bid must be submitted together in a single email fie, plainly marked on the subject line and in the email file with the Name of Bidder, Project Identification, Project Number, Bid Time and Bid Date. Bids shall be rejected if all required documents are not in the single email file.

O. A Bidder with proper identification may withdraw his bid at any time prior to the scheduled time for receipt of the bids; however, no bid may be withdrawn without written consent of the Director, Public Works Division for a *period of sixty (60) days after the date of the bid opening*, or unless extended in accordance with IC 4-13.6-6-4. Bids received after the designated due time for any reason, shall be rejected and returned unopened to the Bidder. The Director, Public Works Division, reserves the right to reject any or all bids.

P. Subcontractors whose work will equal or exceed One Hundred Fifty Thousand Dollars ($150,000.00) must attain a Certificate of Qualification by the Certification Board before commencing any work on this project. Note paragraph 01. (B) above.

Q. All Bidders (corporations or other business entities) must be in good standing with the Indiana Secretary of State.

05 SIGNATURE AFFIDAVIT

A. A Signature Affidavit (DAPW 14) containing the Bidder's authorized signature(s), properly notarized, may be submitted as a signature supplement to all other bid documents, except the bid bond, including:

1. Contractor's Bid (DAPW 13)
2. Non-Collusion Statement (DAPW121)
3. Contractor’s Affidavit of Subs Employed (DAPW 12)
4. MBE/WBE/IVOSB Participation Plan and Good Faith Effort Worksheet (DAPW 26 SUP 2)

B. All documents herein before required with the bid may be unsigned if the signature affidavit is submitted, except for the BID BOND. BIDDER MUST SIGN THE BID BOND.

NOTE: SIGNING THE SIGNATURE AFFIDAVIT OR BID FORM IS ACKNOWLEDGMENT OF PROCUREMENT OF ALL ADDENDA AND CERTIFICATION BY BIDDER THAT THE BID RECOGNIZES ALL ITEMS IN ALL ADDENDA.

06 WORK BY CONTRACTOR

The Contractor shall perform a minimum of 15% of the value of work (measured in dollars of the total contract price) with his own forces, and not more than 85% of the value of work is to be subcontracted.

07 SUBSTITUTIONS

The materials, products, systems and equipment described in the bidding documents, construction documents andaddenda establish a standard or required function, dimension, appearance and quality that shall also be met by any proposed substitution. No substitution by manufacturer, or trade name of product named, or of a quality specified will be considered unless written request for approval has been submitted by the Bidder and has been received by the Designer and/or Public Works Division at least fourteen (14) calendar days prior to the date for receipt of bids. Each such request shall include the name of the material or equipment for which it is to be substituted and a complete description of the proposed substitute including drawings, cuts, performance and test data and any other information necessary for an evaluation. A statement setting forth any changes in other materials, equipment or work that incorporation of the substitutewould require shall be included. The burden of proof of the merit of the proposed substitute is upon the proposer. The Designer and/or Public Works Division decision of approval or disapproval of the proposed substitution shall be final. Products, materials or systems not specified or approved prior to bidding, shall not be accepted for use in this project. All such substitutions accepted shall be acknowledged by addendum. See paragraph. 04 (C).

08 NONDISCRIMINATION

Pursuant to IC 22-9-1-10, the Contractor and subcontractors, if any, shall not discriminate against any employee or applicant for employment, to be employed in the performance of this contract, with respect to his hire, tenure, terms, conditions or privileges of employment, or any matter directly or indirectly related to employment, because of his race, religion, color, sex, disability, national origin, or ancestry. Breach of this covenant may be regarded as a material breach of the contract. Pursuant to IC 5-16-6-1, the contractor agrees:

A. that in the hiring of employees for the performance of work under this contract or any subcontract hereunder, no contractor, or subcontractor, nor any person acting on behalf of such contractor or subcontractor shall, by reason of race, religion, color, sex, disability, national origin or ancestry, discriminate against any citizen of the State of Indiana who is qualified andavailable to perform the work to which the employment relates; and

B. that no contractor, subcontractor, nor any person on his behalf shall, in any manner, discriminate against or intimidate any employee hired for the performance of work under this contract on account of race, religion, color, sex, national origin or ancestry; and

C. that there may be deducted from the amount payable to the contractor by the State of Indiana or by any municipal corporation thereof, under this contract, a penalty of five dollars ($5.00) for each person for each calendar day during which such person was discriminated against or intimidated in violation of the provisions of the contract; and

D. that this contract may be canceled or terminated by the State of Indiana or by any municipal corporation thereof, and all money due or to become due hereunder may be forfeited, for a second or any subsequent violation of the terms or conditions of this section of the contract.

09 EMPLOYMENT ELIGIBILITY VERIFICATION

The Contractor affirms under the penalties of perjury that he/she/it does not knowingly employ an unauthorized alien.

The Contractor shall enroll in and verify the work eligibility status of all his/her/its newly hired employees through the E-Verify program as defined in IC 22-5-1.7-3. The Contractor is not required to participate should the E-Verify program cease to exist. Additionally, the Contractor is not required to participate if the Contractor is self-employed and does not employ any employees.

The Contractor shall not knowingly employ or contract with an unauthorized alien. The Contractor shall not retain an employee or contract with a person that the Contractor subsequently learns is an unauthorized alien.

The Contractor shall require his/her/its subcontractors, who perform work under this contract, to certify to the Contractor that the subcontractor does not knowingly employ or contract with an unauthorized alien and that the subcontractor has enrolled and is participating in the E-Verify program. The Contractor agrees to maintain this certification throughout the duration of the term of a contract with a subcontractor.

The State may terminate for default if the Contractor fails to cure a breach of this provision no later than thirty (30) days after being notified by the State.

The contractor shall submit, before work begins the E-Verify case verification number for each individual who is required to be verified under IC 22-5-1.7. An individual who is required to be verified under IC 22-5-1.7 whose final case result is final non-confirmation may not be employed on the public works project.

A contractor may not pay cash to any individual employed by the contractor for work done by the individual on the public works project.

A contractor must follow the federal Fair Labor Standards Act of 1938, as amended (29 U.S.C. 201-209) and IC 22-2-2. A contractor must be in compliance with IC 22-3-5-1 and IC 22-3-7-34. A contractor must be in compliance with IC 22-4-1 through IC 22-4-39.5. A contractor must be in compliance with IC 4-13-18.

10 NOTICE OF AWARD

A. Prior to execution of the Contract, in accordance with IC 4-13.6-5-2, the Director of Public Works may require additional submittals from Bidder/s to clarify contractor's experience and plans for performing the proposed work. Submittals which may be required include a critical path construction schedule which coordinates all significant tasks sequences and durations; schedule of values, and documentation of efforts to include minority, woman, and veteran owned businesses in the proposed work. The Director may require Bidder/s to provide a comprehensive list of subcontractors and suppliers within 24 hours of receipt of bids.

B. Prior to execution of the Contract, the successful Bidder shall furnish a completed Domestic Steel Affidavit (DAPW 11) to Public Works Division, Indiana Department of Administration as part of the contract. The Domestic Steel Affidavit is included for Bidder's review but need not be submitted at the time of the bid opening. Definition of Steel Products:

"Steel products" means products rolled, formed, shaped, drawn, extruded, forged, cast, fabricated, or otherwise similarly processed, or processed by a combination of two (2) or more of such operations, from steel made in the United States by the open hearth, basic oxygen, electric furnace, Bessemer or other steel making process.

C. Prior to execution of the Contract, the successful Bidder shall furnish a completed Contractor's Bond for Construction (DAPW 15) (combined performance and payment bond) to Public Works Division, Department of Administration as part of the contract. The Bond form is included for Bidder's review but need not be submitted at the time of the bid opening.

D Prior to execution of the Contract, the successful Bidder shall furnish a completed Contractor's Certificate of Insurance (DAPW 16) to Public Works Division, Department of Administration as part of the contract. The Insurance form is included for Bidder's review but need not be submitted at the time of the bid opening.

E. Prior to execution of the Contract, the State of Indiana will issue to the successful Bidder an email letter stating that its bid was the lowest responsible and responsive bid and that the attached electronic format contract document is submitted to Contractor for its consideration. If Contractor finds it in accordance with the bid documents, Contractor will electronically sign the contract within ten (10) calendar days after receipt. Further state agency approvals are required, and Contractor is cautioned that a contract is not binding on the State until it is approved by all signatories required. Failure to execute the proper contract and furnish the ancillary documents shall constitute reason to surrender the bid bond.

F. Concurrent with execution of the Contract, the successful Bidder may be required to furnish executed copies of Contractor-Subcontractor agreements as required in Article 5 of the General Conditions.

11 SUMMARY

All required bid documents must contain original handwritten signatures. Complete documents to be submitted with this bid:

A. The Bid Bond (DAPW 15A) must be signed by both the Bidder and Bonding Company. The Bonding Company must also attach a Power of Attorney. Bid bond information, may be on the Bonding Company's standard form.

B. The Contractor's Bid (DAPW 13)

Page 1: State the amount of the bid in figures and words.

Page 2: State the amount of the alternate(s), indicate add, deduct or no change (READ CAREFULLY).

Page 3: Authorized signature of the Company. If the signature affidavit is completed and submitted with the bid, this page must be submitted but need not be signed or notarized.

C. The Signature Affidavit (DAPW 14) must contain the completed authorized signatures properly notarized and submitted with the bid as a supplement.

This Signature Affidavit shall fulfill all of the signature requirements. NOTE: The Signature Affidavit does not apply to the Bid Bond (DAPW 15A). The Bid Bond document must be fully completed with all required signatures and submitted with the bid.

D. The Non-Collusion Statement (DAPW 121) must be signed by the same authorized person(s) who signed the bid documents. If the signature affidavit is completed and submitted with bid, this form shall be submitted, but need not be signed.

E. For corporations, if anyone other than the president of the corporation signs, a Certificate of Corporate Resolution (DAPW 41) giving signature authority for the signer must be included.

F. MBE/WBE/IVOSB Participation Plan and MBE/WBE/IVOSB Good Faith Effort Worksheet (DAPW 26 SUP2) must be completed and signed by the same authorized person who signed the bid documents.

G. The completed Contractor's Affidavit of Subcontractors Employed (DAPW 12) whose subcontract amount will be $150,000.00 or more.

H. The completed plan for Contractor's Employee Drug Testing Plan (or statement of collective bargaining agreement).

I. One copy only of the Bid Documents is required. Bidders may remove and use the Documents included in the project specifications or use reproductions of the Documents.

12 INDIVIDUAL BIDS SHALL BE REJECTED BY THE DIRECTOR, PUBLIC WORKS DIVISION, FOR THE FOLLOWING REASONS (IC 4-13.6-5-2; IC 4-13.6-6-1; 25 IAC 2-6-5)

A. If the bid email subject line and bid form heading does not clearly identify the project number and description; if the name of the Bidder is not clearly indicated in the email and/or if the email is not received and date stamped within the Public Works Division electronic bid receipt mailbox prior to the stated time for receipt of bids.

B. If the estimated base bid cost exceeds $150,000.00 and the bidding contractor is not certified by Public Works Certification Board to offer bids in one of the specified categories.

C. If the bidding contractor is under suspension by the Director of Public Works or by the Public Works Certification Board.

D. If the bidding contractor is a trust and does not identify all beneficiaries and empowered settlors of the trust.

E. If the contractor's drug plan is not included in the bid documents pursuant to and complies with IC 4-13-18.

13 INDIVIDUAL BIDS MAY BE REJECTED BY THE DIRECTOR, PUBLIC WORKS DIVISION, FOR THE FOLLOWING REASONS (25 IAC 2-6-5)

A. If the Contractor's Bid (DAPW 13), Non-Collusion Statement (DAPW 121), and/or Bid Bond (DAPW 15A) are not signed and notarized as required by these instructions, or the Signature Affidavit (DAPW 14) and the Bid Bond (DAPW 15A) are not signed and notarized as allowed as an alternative.

B. If all required bid or alternate(s) amounts, or unit prices are not submitted with the bid when specifically called for by the specifications issued for the project.

C. When the Bidder adds any provision reserving the right to accept or reject the award, or if the Bidder adds conditions or alternates to his bid not requested (voluntary alternates), or if there are unauthorized additions or irregularities of any kind which tend to make the proposal incomplete, indefinite or ambiguous as to its meaning or amount.

D. When no bids received are under or within funds that can be appropriated, or within the Designer's estimate or when situations develop which make it impossible or not practical to proceed with the proposed work.

E. If, subsequent to the opening of the bids, facts exist which would disqualify the Bidder, or that such Bidder is not deemed by the Director, Public Works Division, to be responsive or responsible.

F. If an out-of-state contractor is not registered with the Indiana Secretary of State or if any bidding contractor is not in good standing with the Secretary of State.

CONTRACTOR'S AFFIDAVIT OF SUBS EMPLOYED

Public Works Project Number: _____ Date: _____

Project Description: _____

Prime Contractor: _____

Form Submitted for Bid:_____Contract:_____ or Payment No.:_____

The following companies are subcontractors on this project for the amount indicated:

| Subcontractor Name | Subcontract For | Subcontract Amount | Revised Amount | DAPW Certified Y/N | MBE WBE | On Site Y/N |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

_____being duly sworn upon oath, deposes and says that he is _____ of the firm of _____ and is familiar with the affidavit herewith and that these entries are complete and true.

---

STATE OF }
} SS:
COUNTY OF }

_____ personally appeared before me, a Notary Public, in and for said County and State, this___day of_____,20__, after being duly sworn upon his oath, says that the facts alleged in the foregoing affidavit are true.

_____
NOTARY PUBLIC - SIGNATURE

My Commission Expires: _____

_____
NOTARY PUBLIC PRINTED NAME

(SEAL)

GENERAL BID FOR PUBLIC WORKS

CONTRACTOR'S BID

For_____
(Insert class of work)

Project Number_____

Project Description (Title)_____

_____

_____

Date_____

To: Department of Administration, Public Works Division
Room W467
402 West Washington Street
Indianapolis, Indiana 46204

Pursuant to notices given, the undersigned proposes to furnish and install work in accordance with the construction documents prepared by:

_____
(Designer Name, Address, Telephone)

---

for the sum of_____
(State amount in words)

_____$_____
(State amount in figures)

If required add attachment for all unit prices called for in the Specifications.

_____ Federal I.D. Number or Social Security Number

Contractor's Email address_____
(Contract and Purchase Order will be sent to email address provided)

Bidder ID Number _____

(If you do not have an Indiana Department of Administration Bidder ID Number, please obtain one online at: http://www.in.gov/idoa/2464.htm )

ALTERNATE BIDS

Add Alternates Are Not to be included as part of the Base Bid Scope of Work.

Deduct Alternates are items of work that Are to be included in the Base Bid Scope of Work, and deducted from the project as described herein.

The work shall be as described in Section, ALTERNATES.

Bidder shall provide a response to each alternate specified. Response must indicate the amount to be ADDED to the base bid, DEDUCTED from the base bid, or that there is NO CHANGE.

Failure to respond to all alternates may cause the bid to be rejected.

BIDDER SHALL CHECK APPLICABLE BOX for each listed alternate.

Alternate No.___ ADD _____ DEDUCT _____ NO CHANGE _____ AMOUNT $_____

Alternate No.___ ADD _____ DEDUCT _____ NO CHANGE _____ AMOUNT $_____

Alternate No.___ ADD _____ DEDUCT _____ NO CHANGE _____ AMOUNT $_____

Alternate No.___ ADD _____ DEDUCT _____ NO CHANGE _____ AMOUNT $_____

Alternate No.___ ADD _____ DEDUCT _____ NO CHANGE _____ AMOUNT $_____

Alternate No.___ ADD _____ DEDUCT _____ NO CHANGE _____ AMOUNT $_____

Ethics Compliance. The Contractor and its agents shall abide by all ethical requirements that apply to persons who have a business relationship with the State, as set forth in Indiana Code § 4-2-6 et seq., the regulations promulgated there under, and Executive Order 04-08, dated April 27, 2004. If the Contractor is not familiar with these ethical requirements, the Contractor should refer any questions to the Indiana State Ethics Commission, or visit the Indiana State Ethics Commission website at <<<http://www.in.gov/ethics/>>>. If the Contractor or its agents violate any applicable ethical standards, the State may, in its sole discretion, terminate this contract immediately upon notice to the Contractor. In addition, the Contractor may be subject to penalties under Indiana Code § 4-2-6-12.

Pursuant to IC 22-9-1-10, the Contractor and subcontractors, if any, shall not discriminate against any employee or applicant for employment, to be employed in the performance of this contract, with respect to his hire, tenure, terms, conditions or privileges of employment, or any matter directly or indirectly related to employment, because of his race, religion, color, sex, disability, national origin, or ancestry. Breach of this covenant may be regarded as a material breach of the contract.

---

IN TESTIMONY WHEREOF, the Bidder (a sole proprietor) has hereunto set his hand this ___ day of_____, 20__.

_____
Proprietorship (Company Name)

(INDIVIDUAL)

_____
Bidder (Owner)

---

IN TESTIMONY WHEREOF, the Bidder (a partnership) has hereunto set their hands this ___ day of _____, 20__.

_____
Company Name

_____
Partner

_____
Partner

---

IN TESTIMONY WHEREOF, the Bidder (a corporation) has caused this proposal to be signed by its President or other authorized signatory and Secretary this _____ day of _____, 20__.

_____
Corporation Name

_____
By President or Other Authorized Signatory

_____
Secretary

If the bid is signed by other than the President, a Corporation Resolution designating other authorized signatory shall be submitted with this bid unless already on file with the Certification Board of the Public Works Division.

---

BY SIGNING THIS BID THE BIDDER ACKNOWLEDGES PROCUREMENT OF ALL ADDENDA AND CERTIFIES THAT THIS BID RECOGNIZES ALL ITEMS IN ALL ADDENDA.

**SIGNATURE AFFIDAVIT**

PROJECT NO:_____

STATE OF }
} SS:
COUNTY OF }

Before me, the undersigned notary public, appeared_____and being duly
(name of bidder)

sworn, on his oath says that he/she is_____
(president, general partner, owner)

of_____, bidder on Project No._____, and
(name of company)

Affirmed that:

1. This bid is submitted in good faith in the amount stated herein, and will be fulfilled according to the Contract Documents (contract, general and supplemental conditions, technical specification, drawings and addenda thereto), if this bid is accepted; and
2. The statements are true contained in the Non-Collusion Statement, and as applicable, the Contractor's Affidavit of Subs Employed and the MBE, WBE and IVOSB Participation Plan and Good Faith Efforts Worksheet.

By: _____
(Signature)

_____
(Printed name)

_____
(Printed or typed name of company)

(must be signed by principal of organization)

---

STATE OF }
} SS:
COUNTY OF }

_____ personally appeared before me, a Notary Public, in and for said County and State, this_____day of_____, 20_____, after being duly sworn upon his oath, says that the facts alleged in the foregoing affidavit are true.

My Commission Expires:

_____

_____
NOTARY PUBLIC – SIGNATURE

_____
NOTARY PUBLIC PRINTED NAME

(SEAL)

BID BOND

KNOW ALL MEN BY THESE PRESENTS, that we_____
(Contractor's Name and Address)

as Principal, hereinafter called the Principal, and the_____
(Bonding Company Name)

a corporation duly organized under the laws of the State of _____
as Surety, hereinafter called the Surety, are held and firmly bound unto Public Works Division/Department of Administration, State of Indiana, as Obligee, hereinafter called the Obligee,

in the sum of **TEN THOUSAND Dollars ($10,000.00)**
for the payment of which sum well and truly to be made, the said Principal and the said Surety, bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has submitted a bid for: (insert State Project Number, Description and Location)

Project No. _____

Project Description: _____

Project Location: _____

NOW THEREFORE, if the Obligee shall accept the bid of the Principal and the Principal shall enter into a contract with the Obligee in accordance with the terms of such bid, and give such bond or bonds as may be specified in the bidding or contract documents with good and sufficient surety for the faithful performance of such contract and for the prompt payment of labor and material furnished in the prosecution thereof, or in the event of the failure of the Principal to enter such contract and give such bond or bonds, if the Principal shall pay to the Obligee the difference not to exceed the penalty hereof between the amount specified in said bid and such larger amount for which the Obligee may in good faith contract with another party to perform the work covered by said bid, then this obligation shall be null and void, otherwise to remain in full force and effect.

Signed and sealed this_____day of_____,20___.

_____ _____
(Witness) (Principal)

By: _____
(Title)

_____
(Surety)

_____ _____
Witness) (Attorney-in-fact)

# Indiana Department of Administration
# MBE/WBE and IVOSB Participation Policy for Public Works Projects

## I. Introduction

The Indiana Department of Administration ("IDOA") in its commitment to Minority, Women's and Indiana Veteran Owned Small Business participation in the state's procurement and contracting process, expects MBE, WBE and IVOSB participation in bids for construction services $150,000 and over with subcontracting opportunities.

## II. Definitions

"Certification for MBE and WBE" means certification by the Indiana Department of Administration, Minority and Women's Business Enterprises Division. ("MWBED").

"Certification for IVOSB" means certification by the Indiana Department of Administration.

"Commercially useful function" Determination that an enterprise performs a commercially useful function will be made based on the following considerations:

(1) An MBE or a WBE performs a commercially useful function when it is responsible for execution of the work of the contract and is carrying out its responsibilities by actually performing, managing, and supervising the work involved. To perform a commercially useful function, the MBE or WBE must also be responsible, with respect to materials and supplies used on the contract, for negotiating price, determining quality and quantity, ordering the material, and installing (where applicable) and paying for the material itself. To determine whether an MBE or a WBE is performing a commercially useful function, one must evaluate the following:

(A) The amount of work subcontracted.

(B) Industry practices.

(C) Whether the amount the enterprise is to be paid under the contract is commensurate with the work it is actually performing.

(D) The credit claimed for its performance of the work.

(E) Other relevant factors.

(2) An MBE or a WBE does not perform a commercially useful function if its role is limited to that of an extra participant in a transaction, contract, or project through which funds are passed in order to obtain the appearance of MBE or WBE participation. In determining whether an MBE or a WBE is such an extra participant, one must examine similar transactions, particularly those in which MBEs or WBEs do not participate.

(3) In the case of construction contracts, if:

(A) an MBE or a WBE does not perform or exercise responsibility for at least the agency's requisite percent of the total cost of its contract with its own workforce; or

(B) the MBE or WBE subcontracts a greater portion of the work of a contract than would be expected on the basis of normal industry practice for the type of work involved;

it is presumed that the enterprise is not performing a commercially useful function.

(4) IVOSB contractors and suppliers must perform a commercially useful function. A commercially useful function is generally deemed to be when an IVOSB contractor or supplier is responsible for execution of the work of the contract and is carrying out its responsibilities by actually performing, managing, and supervising the work involved. To perform a commercially

useful function, an IVOSB contractor or supplier must also be responsible, with respect to materials and supplies used on the contract, for negotiating price, determining quality and quantity, ordering the material, and installing (where applicable) and paying for the material itself. An IVOSB contractor or supplier does not perform a commercially useful function if its role is limited to that of an extra participant in a transaction, contract, or project through which funds are passed in order to obtain the appearance of IVOSB participation.

"Letter of Commitment" means a letter obtained from the MBE, WBE and IVOSB by the Bidders. The Letter of Commitment is a signed letter(s), on company letterhead, from the minority, women's and/or Indiana Veteran Owned certified business. It must be produced no later than 24 hours after the bid due date and time. This letter(s) shall state and will serve as acknowledgement from the minority, women and/or Indiana Veteran Owned certified business of their level of participation in this solicitation, the dollar amount of the commitment, the scope of service or product to be provided and the anticipated dates of utilization.

"Minority and Women Business Enterprises Division (MWBED)" means the Division which acts on behalf of the State to actively promote, monitor, and enforce the MBE and WBE program. MWBED is the final authority on all matters pertaining to the maintenance and administration of the MBE and WBE program and compliance thereto.

"Minority Business Enterprise (MBE) and Women's Business Enterprise (WBE)" means a business concern which is certified as at least fifty-one percent (51%) owned and controlled by a woman or women or one or more of the individuals classified as a minority group which includes: African Americans, Hispanic Americans, Asian Americans, American Indians and other racial minorities. The MBE and WBE must meet the eligibility requirements of 25 IAC 5.

"Indiana Veteran Owned Small Business Enterprise (IVOSB)" means an Indiana business which is certified as at least fifty-one percent (51%) owned and controlled by a veteran.

"Participation Plan" means the IDOA prescribed document that sets forth the MBE, WBE and IVOSB subcontractors that will perform work under the contract.

## III. Minority and Women Business Enterprise Certification

MBE and WBEs must be listed on the IDOA directory of certified firms at the time the bid is submitted to be eligible to meet the contract goals. The bidder should verify that a firm is certified before the bid is submitted.

Questions regarding Certification should be addressed to the following:

Indiana Department of Administration
Minority and Women's Business Enterprises Division
402 West Washington Street, Room W469
Indianapolis, IN 46204
(317) 232-3061
mwbe@idoa.in.gov

## IV. Indiana Veteran Owned Small Business Enterprise

IVOSBs must be listed on the IDOA directory of certified firms at the time the bid is submitted to be eligible to meet the contract goals. The bidder should verify that a firm is certified before the bid is submitted.

Questions regarding Certification should be addressed to the following:

Indiana Department of Administration
402 W. Washington St., Room W478
Indianapolis, IN 46204
(317) 233-1494
Indianaveteranspreference@idoa.in.gov

## V. Bidding Process

IDOA will review projects for viable subcontracting opportunities. All projects will be governed by this policy unless otherwise stated.

A representative from MWBED may attend most pre-bid meetings to discuss and answer questions related to the MBE, WBE and IVOSB participation goals. The MWBED will be available to assist Bidders in locating MBE, WBE or IVOSB firms to engage in the contract.

The 2018-2019 Contract Goals for construction projects are 7% for MBE's, 5% for WBE's and 3% for IVOSBs.

The following procedures will be implemented in the acceptance and evaluation of responsive and responsible bids.

Bidders are expected to submit a Participation Plan on the approved form listing the utilization of MBE, WBE and IVOSB subcontractors who will be providing a commercially useful function on the project and a Letter of Commitment from MBE, WBE and IVOSB firms they plan to engage in the contract, if successful on the bid.

By submission of a bid, a bidder thereby acknowledges and agrees to be bound by the regulatory process set forth in 25 IAC 5.

A bidder who knowingly or intentionally misrepresents the truth about either the status of a firm that is being proposed as an MBE and WBE or who misrepresents the level of the nature of the amount to be subcontracted to the MBE and WBE may suffer penalties pursuant to Indiana Code 5-16-6.5-5.

A Contractor who knowingly or intentionally misrepresents the truth about his/her status as an MBE and WBE or who misrepresents the level or the nature of the amount subcontracted to his/her firm may suffer penalties pursuant to Indiana Code 35-44.1-2-1.

## VI. Compliance

Contractors shall contract with all MBE, WBE and IVOSB firms listed on the Participation Plan. The subcontract or purchase order shall be for an amount that is equal to, or greater than, the total dollar amount listed on the form.

Contractors shall notify MWBED immediately if any firm listed on the Participation Plan refuses to enter into a subcontract or fails to perform according to the requirements of the subcontract.

The Contractor's proposed MBE, WBE and IVOSB Contract Goals will become incorporated into and a requirement of the Contract. Contractors shall not substitute, replace or terminate any MBE, WBE and IVOSB firm without prior written authorization from MWBED and the Owner.

Contractors shall cooperate and participate in compliance reviews as determined necessary by MWBED. Contractors shall provide all necessary documentation to show proof of compliance with the requirements as requested by MWBED.

## VII. Non Compliance

When a Respondent submits a Minority, Women and Indiana Veteran Owned Business Enterprises Participation Plan in accordance with IC 4-13-16.5, 25 IAC 5 and 25 IAC 9, (the "Plan"), Respondent will be held to those commitments.

After the bid is awarded, and if it is determined by MWBED that the Contractor is not in compliance with its Participation Plan, MWBED will notify the Contractor within ten (10) days after the initial compliance review or the site visit and will identify the deficiencies found and the required corrective action that should be taken to remedy the deficiencies within a specific time period.

If a Contractor is found non-compliant, the Contractor must submit, in writing, a specific commitment, in writing, to correct the deficiencies. The commitment must include the precise action to be taken and the date for completion.

If MWBED determines the Contractor has failed to comply with the provisions of this Participation Program, Contractor's Utilization Statement, 25 IAC 5, or 25 IAC 9, IDOA may impose any or all of the following sanctions:

a. Withholding payment on the Contract until such time that satisfactory corrective measures are made.

b. Adjustment to payments due or the permanent withholding of retainages of the Contract.

c. Suspension or termination of the specific Contract in which the deficiency is known to exist. In the event this sanction is employed, the Contractor will be held liable for any consequential damages arising from the suspension or termination of the Contract, including damages caused as a result of the delay or from increased prices incurred in securing the performance of the balance of the work by other Contractors.

d. Recommendation to the certification board to revoke the contractor's certification status with the Public Works Division of IDOA. This recommendation may result in the suspension or revocation of the contractor's ability to perform on future state contracts for a period no longer than thirty-six (36) months.

e. Continued non-compliance may be deemed a material breach of the agreement between MWBED and Contractor, whereupon MWBED shall have all the rights and remedies available to it under the Contract or at law.

f. Suspension, revocation, or denial of the MBE, WBE or IVOSB certification and eligibility to participate in the MBE, WBE or IVOSB program for a period of not more than thirty-six (36) months.

## VIII. Forms and Attachments

Minority, Women's and Indiana Veteran Owned Business Enterprises Participation Plan

## I. MINORITY, WOMEN'S AND INDIANA VETERAN OWNED BUSINESS ENTERPRISES PARTICIPATION PLAN

When a Respondent submits a Minority, Women's and Indiana Veteran Owned Business Enterprises Participation Plan in accordance with IC 4-13-16.5, 25 IAC 5 and 25 IAC 9, (the "Plan"), Respondent will be held to those commitments. The Plan must show that there are, participating in the proposed contract, Minority Business Enterprises (MBE), Women's Business Enterprises (WBE), and Indiana Veteran Owned Small Business Enterprises (IVOSB) listed in the Minority and Women's Business Enterprises Division (MWBED) directory and the IVOSB directory of certified firms. Respondents must indicate the name of the MBE, WBE and IVOSB with which it will work, the contact name and phone number at the firm(s), the service supplied by the firm(s), the specific dollar amount from this contract that will be directed toward each firm, and the approximate date these products and/or services will be utilized. If participation is met through use of vendors who supply products and/or services, the Respondent must also indicate the vendor's tax ID number as well as provide a description of products and/or services provided to the Respondent that are directly related to this proposal and the cost of direct supplies for this proposal. All prime contractors, including MBE, WBE and IVOSB prime contractors, are expected to meet the contract goals through use of subcontractors.

The Indiana Department of Administration ("IDOA") in its commitment to Minority, Women's and Indiana Veteran Owned Small Business participation in the state's procurement and contracting process, expects MBE, WBE and IVOSB participation in bids for public works projects with subcontracting opportunities. The Department reserves the right to verify all information included in the Plan.

Respondents may contact MWBED if they have any questions regarding their Participation Plan. A complete list of all currently certified MBE's and WBE's is located at this link: http://www.in.gov/idoa/mwbe/2743.htm. The complete list of certified IVOSBs can be found at this link http://www.in.gov/idoa/files/ivbe_certification_list.xls.

### Minority, Women's and Indiana Veteran Owned Business Enterprises Participation Letter of Commitment

A signed letter(s), on company letterhead, from the MBE, WBE and/or IVOSB must accompany the Plan. This letter(s) shall state and will serve as acknowledgement from the MBE, WBE and/or IVOSB of its amount of participation, the scope of products and/or services, and approximate date these products and/or services will be utilized.

By submission of the Proposal, the Respondent acknowledges and agrees to be bound by the regulatory processes involving the State's MBE, WBE and IVOSB Programs. Questions involving the regulations governing the Plan should be directed to MWBED's Compliance Unit at 317/232-3061 or to IDOA at 317-233-1494.

### MBE/WBE and IVOSB PARTICIPATION PLAN

RFP # / Bid # / Quote # _____ DUE DATE_____

(Circle One)

RFP / BID / QUOTE NAME _____

(Circle One)

RESPONDENT _____

ADDRESS _____

CITY/STATE/ZIP _____

PHONE ( ) _____

The following MBEs and/or WBEs listed in the MWBED directory will be participating in the contract:

| MBE/WBE | PHONE | COMPANY NAME | SCOPE OF PRODUCTS/SERVICES | UTILIZATION DATE | AMOUNT |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

The following IVOSBs listed in the IVOSB directory will be participating in the contract:

| IVOSB | PHONE | COMPANY NAME | SCOPE OF PRODUCTS/SERVICES | UTILIZATION DATE | AMOUNT |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

***If additional room is necessary, indicate here_____. Please attach a separate page.**

Corporate Resolution Form
Approved by Attorney General

CERTIFICATE OF CORPORATE RESOLUTION

I,_____, do hereby certify that I am the Secretary
Type Name
of_____, a corporation duly organized and existing under and by virtue of the Laws of the State of Indiana;

I further certify that a regular/special meeting of the members of the Board of Directors of said corporation, duly called held and convened in conformity with the Charter and By Laws of said corporation, on the __day of_____, 20___, a quorum being present and voting thereon, the following resolution was duly adopted, to-wit:

I further certify that the foregoing resolution is a full, true, and complete copy as the same appears on record in the Minute Record Book of said corporation of which I am the legal custodian; that the same has not been altered, amended or repealed and is now in full force and effect.

In Witness Whereof, I have hereunto set my hand for said corporation this_____day of_____ _____, 20_____.

By:_____
(Signature)

---

(must be signed by principal of organization)

STATE OF }
} SS:
COUNTY OF }

_____

_____personally appeared before me, a Notary Public, in and for said County and State, this_____day of_____, 20___, after being duly sworn upon his oath, says that the facts alleged in the foregoing affidavit are true.

My Commission Expires:

_____
NOTARY PUBLIC - SIGNATURE

_____

(SEAL)

_____
NOTARY PUBLIC PRINTED NAME

NON-COLLUSION STATEMENT

The undersigned attests, subject to the penalties for perjury, that the undersigned is the Contractor, or that the undersigned is the properly authorized representative, agent, member or officer of the Contractor. Further, to the undersigned's knowledge, neither the undersigned nor any other member, employee, representative, agent or officer of the Contractor, directly or indirectly, has entered into or been offered any sum of money or other consideration for the execution of this Contract other than that which appears upon the face hereof. **Furthermore, if the undersigned has knowledge that a state officer, employee, or special state appointee, as those terms are defined in IC 4-2-6-1, has a financial interest in the Contract, the Contractor attests to compliance with the disclosure requirements in IC 4-2-6-10.5.**

_____
Signature

_____
Printed Name

_____
Title

_____
Company

_____
Date

# STATE OF INDIANA DRUG-FREE WORKPLACE CERTIFICATION

State Form 44260 (R2 / 12-22)

Pursuant to Executive Order No. 90-5, April 12, 1990, issued by Governor Evan Bayh, the Indiana Department of Administration requires the inclusion of this certification in all contracts with and grants from the State of Indiana in excess of $25,000. No award of a contract or grant shall be made, and no contract, purchase order or agreement, the total amount of which exceeds $25,000, shall be valid unless and until this certification has been fully executed by the Contractor or Grantee and attached to the contract or agreement as part of the contract documents. False certification or violation of the certification may result in sanctions including, but not limited to, suspension of contract payments, termination of the contract or agreement and/or debarment of contracting opportunities with the State for up to three (3) years.

The Contractor/Grantee certifies and agrees that it will provide a drug-free workplace by:

(a) Publishing and providing to all of its employees a statement notifying employees that the unlawful manufacture, distribution, dispensing, possession or use of a controlled substance is prohibited in the Contractor's workplace and specifying the actions that will be taken against employees for violations of such prohibition; and

(b) Establishing a drug-free awareness program to inform employees about (1) the dangers of drug abuse in the workplace; (2) the Contractor's policy of maintaining a drug-free workplace; (3) any available drug counseling, rehabilitation, and employee assistance programs; and (4) the penalties that may be imposed upon an employee for drug abuse violations occurring in the workplace;

(c) Notifying all employees in the statement required by subparagraph (a) above that as a condition of continued employment the employee will (1) abide by the terms of the statement; and (2) notify the employer of any criminal drug statute conviction for a violation occurring in the workplace no later than five (5) days after such conviction;

(d) Notifying in writing the contracting State Agency and the Indiana Department of Administration within ten (10) days after receiving notice from an employee under subdivision (c) (2) above, or otherwise receiving actual notice of such conviction;

(e) Within thirty (30) days after receiving notice under subdivision (c) (2) above of a conviction, imposing the following sanctions or remedial measures on any employee who is convicted of drug abuse violations occurring in the workplace: (1) take appropriate personnel action against the employee, up to and including termination; or (2) require such employee to satisfactorily participate in a drug abuse assistance or rehabilitation program approved for such purposes by a Federal, State or local health, law enforcement, or other appropriate agency; and

(f) Making a good faith effort to maintain a drug-free workplace through the implementation of subparagraphs (a) through (e) above.

THE UNDERSIGNED AFFIRMS, UNDER PENALTIES OF PERJURY, THAT HE OR SHE IS AUTHORIZED TO EXECUTE THIS CERTIFICATION ON BEHALF OF THE DESIGNATED ORGANIZATION.

THE UNDERSIGNED ALSO AGREES THAT BY TYPING THEIR NAME ONTO THIS FORM, THEY AGREE TO THE USE OF THEIR DIGITAL NAME AS A LEGAL SIGNATURE

| | |
|---|---|
| _____ | _____ |
| Printed Name of Organization | Contract/Grant ID Number |
| _____ | _____ |
| Authorized Representative | Date |
| _____ | |
| Title | |

# CONTRACTOR'S EMPLOYEE DRUG TESTING

**IC 4-13-18 Chapter 18. Drug Testing of Employees of Public Works Contractors**



**IC 4-13-18-1 Applicability**

Sec. 1. This chapter applies only to a public works contract awarded after June 30, 2006.

*As added by P.L.160-2006, SEC.2.*

IC 4-13-18-2 "**Bid**"

Sec. 2. As used in this chapter, "bid" includes a quotation.

*As added by P.L.160-2006, SEC.2.*

**IC 4-13-18-3 "Contractor"**

Sec. 3. (a) As used in this chapter, "contractor" refers to a person who:

(1) submits a bid to do work under a public works contract; or

(2) does any work under a public works contract.

(b) The term includes a subcontractor of a contractor.

*As added by P.L.160-2006, SEC.2.*

**IC 4-13-18-4 "Public works contract"**

Sec. 4. As used in this chapter, "public works contract" refers to:

(1) a public works contract covered by IC 4-13.6;

(2) a public works contract covered by IC 5-16 and entered into by a state agency; or

(3) a state highway contract covered by IC 8-23-9;

(4) a public works contract covered by IC 36-1-12;

when the estimated cost of the public works project is one hundred fifty thousand dollars ($150,000) or more.

*As added by P.L.160-2006, SEC.2. Amended by P.L.72-2018, SEC.10.*

**IC 4-13-18-5 Employee drug testing plan required in bid; collective bargaining agreements**

Sec. 5. (a) A solicitation for a public works contract must require each contractor that submits a bid for the work to submit with the bid a written plan for a program to test the contractor's employees for drugs.

(b) A public works contract may not be awarded to a contractor whose bid does not include a written plan for an employee drug testing program that complies with this chapter.

(c) A contractor that is subject to a collective bargaining agreement shall be treated as having an employee drug testing program that complies with this chapter if the collective bargaining agreement establishes an employee drug testing program that includes the following:

(1) The program provides for the random testing of the contractor's employees.
(2) The program contains a five (5) drug panel that tests for the substances identified in section 6(a)(3) of this chapter.
(3) The program imposes disciplinary measures on an employee who fails a drug test. The disciplinary measures must include at a minimum, all the following:
(A) The employee is subject to suspension or immediate termination.
(B) The employee is not eligible for reinstatement until the employee tests negative on a five (5) drug panel test certified by a medical review officer.
(C) The employee is subject to unscheduled sporadic testing for at least one (1) year after reinstatement.
(D) The employee successfully completes a rehabilitation program recommended by a substance abuse professional if the employee fails more than one (1) drug test.

A copy of the relevant part of the collective bargaining agreement constitutes a written plan under this section.

*As added by P.L.160-2006, SEC.2.*

**IC 4-13-18-6 Employee drug testing program requirements**

Sec. 6. (a) A contractor's employee drug testing program must satisfy all of the following:
(1) Each of the contractor's employees must be subject to a drug test at least one (1) time each year.
(2) Subject to subdivision (1), the contractor's employees must be tested randomly. At least two percent (2%) of the contractor's employees must be randomly selected each month for testing.
(3) The program must contain at least a five (5) drug panel that tests for the following:
(A) Amphetamines.
(B) Cocaine.
(C) Opiates (2000 ng/ml).
(D) PCP.
(E) THC.
(4) The program must impose progressive discipline on an employee who fails a drug test.

The discipline must have at least the following progression: (A) After the first positive test, an employee must be:

(i) suspended from work for thirty (30) days;
(ii) directed to a program of treatment or rehabilitation; and
(iii) subject to unannounced drug testing for one (1) year, beginning the day the employee returns to work.

(B) After a second positive test, an employee must be:
(i) suspended from work for ninety (90) days;
(ii) directed to a program of treatment or rehabilitation; and
(iii) subject to unannounced drug testing for one (1) year, beginning the day the employee returns to work.

(C) After a third or subsequent positive test, an employee must be:
(i) suspended from work for one (1) year;
(ii) directed to a program of treatment or rehabilitation; and
(iii) subject to unannounced drug testing for one (1) year, beginning the day the employee returns to work.

The program may require dismissal of the employee after any positive drug test or other discipline more severe than is described in this subdivision.

(b) An employer complies with the requirement of subsection (a) to direct an employee to a program of treatment or rehabilitation if the employer does either of the following:

(1) Advises the employee of any program of treatment or rehabilitation covered by insurance provided by the employer.
(2) If the employer does not provide insurance that covers drug treatment or rehabilitation programs, the employer advises the employee of agencies known to the employer that provide drug treatment or rehabilitation programs.

*As added by P.L.160-2006, SEC.2.*

**IC 4-13-18-7 Contract cancellation for noncompliance**

Sec. 7. (a) The public works contract must provide for the following:

(1) That the contractor implement the employee drug testing program described in the contractor's plan.

(2) Cancellation of the contract by the agency awarding the contract if the contractor:

(A) fails to implement its employee drug testing program during the term of the contract;
(B) fails to provide information regarding implementation of the contractor's employee drug testing program at the request of the agency; or
(C) provides to the agency false information regarding the contractor's employee drug testing program.

(b) The provisions of the public works contract relating to cancellation of the contract by the agency awarding the contract apply to cancellation of the public works contract under this section.

*As added by P.L.160-2006, SEC.2.*

**DOMESTIC STEEL AFFIDAVIT**

STATE OF }
} SS:
COUNTY OF } PROJECT NO:_____

I hereby swear, under penalties of perjury, that the steel products furnished for this project shall conform to the following Indiana Code Definitions and contract provisions:

5-16-8-1 Definitions:

"Steel products" means products rolled, formed, shaped, drawn, extruded, forged, cast, fabricated, or otherwise similarly processed, or processed by a combination of two (2) or more of such operations, from steel made in the United States by the open hearth, basic oxygen, electric furnace, Bessemer or other steel making process.

"United States" means the United States of America and includes all territory, continental or insular, subject to the jurisdiction of the United States.

5-16-8-2 Public agency contract provisions; rules for determining reasonable pricing.

Sec. 2. (a) Each public agency shall require that every contract for the construction, alteration, repair, improvement or maintenance of Public Works contain a provision that, if any steel products are to be used or supplied in the performance of the contract or subcontract, only steel products as defined by this chapter shall be used or supplied in the performance of the contract or any of the subcontracts unless the head of the public agency determines, in writing, that the cost of steel products is deemed to be unreasonable.

_____
(Signature)

_____
(Printed name)

_____ _____
(Attest) (Printed or typed name of company)
(Vice President/Secretary/Treasurer)

---

STATE OF }
} SS:
COUNTY OF }

_____ personally appeared before me, a Notary Public, in and for said County and State, this_day of_____,20__, after being duly sworn upon his oath, says that the facts alleged in the foregoing affidavit are true.

My Commission Expires: _____
NOTARY PUBLIC - SIGNATURE

_____ _____
NOTARY PUBLIC PRINTED NAME

(SEAL)

STATE FORM DAPW 11
12125R3 Rev. 1/00

# CONTRACTOR'S BOND FOR CONSTRUCTION

KNOW ALL MEN BY THESE PRESENT, that _____
(Contractor)
_____ of _____
(Address) (City, State)
as principal and _____
(Bonding Company)
_____
(Address) (City, State) (Zip Code)

as surety, are firmly bound unto the State of Indiana in the penal sum of $_____ Dollars, for the payment of which, well and truly to be made, we bind ourselves, jointly and severally, and our joint and several heirs, executors, administrators and assigns, firmly by these present, this _____ day of _____, 20_____.

THE CONDITIONS OF THE ABOVE OBLIGATION ARE SURE, THAT, WHEREAS the State of Indiana acting by and through the Commissioner, Department of Administration, has entered into a certain written contract dated _____ of _____

_____
(Project Number and Description)

_____ situated in _____
Indiana, in accordance with the construction documents approved and adopted by said Commissioner, Department of Administration, which are made a part of this bond.

NOW THEREFORE, if the said _____
(Contractor)
_____, shall well and faithfully do and perform the same in all respects according to the plans and specifications adopted by said Commissioner, Department of Administration, and according to the time, terms and conditions specified in said contract and incurred by him or any subcontractor in the prosecution of said work, including labor, service and materials furnished, then this obligation shall be void; otherwise to remain in full force, virtue and effect. This bond shall adhere to the requirements of IC 4-13.6-7-6 and IC 4-13.6-7-7.

IN WITNESS WHEREOF, we hereunto set our hands and seals this _____ day of _____ , 20_____.

By: _____ (Seal)
(Contractor)

By: _____ (Seal)
(Bonding Company)

By: _____
(Attorney-in-fact)

# CONTRACTOR'S CERTIFICATE OF INSURANCE

This certifies to the addressee shown below that the following described policies, subject to their terms, conditions, and exclusions, have been issued to:

NAME AND ADDRESS OF INSURED: _____

COVERING (show State project number, name and location) _____

ADDRESSEE: **PUBLIC WORKS DIVISION/DEPARTMENT OF ADMINISTRATION** DATE: _____

| TYPE OF INSURANCE | POLICY NUMBER | EFFECTIVE DATE | EXPIRATION DATE | LIMITS | |
|---|---|---|---|---|---|
| 1. General Liability<br>a. Bodily Injury Including Personal Injury | | | | Each Person - Premises and Operations<br>Each Person - Elevators<br>Each Person - Independent Contractor<br>Each Person - Products Completed Including Operations<br>Each Person - Contractual<br>Each Occurrence -<br>Aggregate - Products Completed Including Operations | $<br>$<br>$<br>$<br>$<br>$<br>$ |
| b. Property Damage | | | | Each Occurrence - Premises and Operations<br>Each Occurrence - Elevators<br>Each Occurrence - Independent Contractor<br>Each Occurrence - Products Completed Including Operations<br>Each Occurrence - Contractual<br>Aggregate -<br>Aggregate - Operations Protective Products and Contractual | $<br>$<br>$<br>$<br>$<br>$<br>$ |
| 2. Automobile Liability<br>a. Bodily Injury<br>b. Property Damage | | | | Each Person<br>Each Occurrence<br>Each Accident | $<br>$<br>$ |
| 3. Excess Liability Umbrella | | | | | $ |
| 4. a. Workmen s Compensation<br>b. Employer s Liability | | | | Statutory Workmen s Compensation<br>One Accident And Aggregate Disease | $<br>$ |
| 5. Builder s Risk | | | | | $ |

| UNDER GENERAL LIABILITY POLICY OR POLICIES | YES | NO |
|---|---|---|
| 1. Does Property Damage Liability Insurance shown include coverage for **XC** and **U** hazards? | | |
| 2. Is Occurrence Basis Coverage provided under Property Damage Liability?.. | | |
| 3, Is Broad Form Property Damage Coverage provided for this Project?..... | | |
| 4. Is Personal Injury Coverage included?..... | | |
| 5. Is coverage provided for Contractual Liability (including indemnification provision) assumed by insured?..... | | |
| UNDER AUTOMOBILE LIABILITY POLICY OR POLICIES ..... | | |
| 1. Does coverage shown above apply to non-owned and hired automobiles?.... | | |
| 2. Is Occurrence Basis Coverage provided under Property Damage Liability?.. | | |

In the event of cancellation, fifteen (15) days written notice shall be given to the party to whom this certificate is addressed.

_____
NAME OF INSURANCE COMPANY

_____
ADDRESS

_____
SIGNATURE OF AUTHORIZED REPRESENTATIVE

# INDIANA DEPARTMENT OF ADMINISTRATION

# PUBLIC WORKS DIVISION

# GENERAL CONDITIONS

Indiana Department of Administration
Public Works Division
402 W. Washington Street, W462
Indianapolis, Indiana 46204

**TABLE OF CONTENTS**

**STATE OF INDIANA**

**GENERAL CONDITIONS**

## ARTICLE 1 CONTRACT DOCUMENTS

1.1 Definitions

1.1.1 Contract Documents

The Contract Documents consist of the Contract, the Instructions to Bidders, the Contractor's Proposal (Bid), the Conditions of the Contract (General and Supplementary), Drawings, Specifications, and Addenda issued prior to bidding, Change Orders, any written interpretation issued as a field order by the Designer pursuant to Article 1.2, and all field orders for minor changes in the Work by the Designer pursuant to Article 12.3.

1.1.2 Contract

The Contract Documents form the Contract for construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes all prior negotiations, representations, or agreements, either written or oral.

1.1.3 Work

All labor, material, equipment, systems and services necessary to produce the result called for in the Contract Documents.

1.1.4 Project

The Project is the total construction project designed by the Designer of which the Work performed under the Contract Documents may be the whole or a part of the whole Project.

1.2 Execution, Correlation, Intent and Interpretations

1.2.1 The Contract Documents shall be signed by the Owner and the Contractor. The signature process may be done electronically at the discretion of the Owner.

1.2.2 By executing the Contract, the Contractor represents that Contractor has visited the site and correlated its observations with the requirements of the Contract Documents and has no major question pertaining thereto.

1.2.3 The Contract Documents are complementary, and what is called for by any one shall be as binding as if called for by all. The intention of the Contract Documents is to include all labor, equipment, supervision and materials, for the proper execution and completion of the Work, and also to include those things that may be reasonably inferable from the Contract Documents as being necessary to produce the intended results. Words that have a well-known technical or trade meaning are used herein, in accordance with such recognized meaning.

1.2.4 Written interpretations necessary for the proper execution of the Work, in the form of drawings or otherwise will be issued with reasonable promptness by the Designer. Such interpretations shall be consistent with and reasonably inferable from the Contract Documents, and may be issued by field order subject to Owner's approval.

1.3 Copies Furnished and Ownership

1.3.1 The Contractor will be furnished 5 copies of drawings and specifications and any other information necessary for the execution of the Work.

1.3.2 All drawings, specifications, and copies thereof furnished by the Designer are the Designer's property. They are not to be used on any other Project, and, with the exception of one Contract set for each party to the Contract, are to be returned on request to the Designer at the completion of the Work.

## ARTICLE 2 DESIGNER

2.1 Definition

2.1.1. The Designer is the person or organization identified as Designer of the Project and is referred to throughout the Contract Documents as if singular in number and, in some places, masculine in gender. The terms Designer, Engineer, Architect, (and in certain projects Director, Public Works Division, or his/her authorized representative), shall mean the Designer.

2.2 Administration of the Contract

2.2.1 The Designer will provide general administration of the Contract, including the functions hereinafter described.

2.2.2 Unless stated otherwise, the Designer shall be the Owner's representative during the construction phase. Designer shall have authority to act on behalf of the Owner only to the extent expressly provided in the Contract Documents or otherwise in writing, which will be shown to the Contractor. The Designer will advise and consult with the Owner and all of the Owner's instructions to the Contractor shall be issued through the Designer.

2.2.3 The Designer shall have access to the Work at all times wherever it is in storage, preparation and progress. The Contractor shall provide facilities for such access so that the Designer and Owner's Site Representative may perform their functions under the Contract Documents.

2.2.4 The Designer will make no less than weekly visits to the site when work is in progress to familiarize itself generally with the progress and quality of the Work and to determine in general if the Work is proceeding in accordance with the Contract Documents. Designer will not be required to make exhaustive or continuous on-site inspection to check the quality or quantity of the Work. On the basis of Designer's on-site observations, Designer will keep the Owner informed of the progress of the Work and will endeavor to guard the Owner against defects and deficiencies in the Work of the Contractor.

2.2.5 Based on such observation and the Contractor's applications for payment, the Designer will determine the amount owed to the Contractor and will issue Certificates for Payment in such amounts.

2.2.6 The Designer will be, in the first instance, the interpreter of the requirements of the Contract Documents and the judge of the performance thereunder. Designer will promptly render such interpretations as Designer may deem necessary for the proper execution or progress of the Work.

2.2.7 All interpretations and decisions of the Designer will be consistent with the intent of the Contract Documents. Designer will exercise its best efforts to insure faithful performance by the Contractor.

2.2.8 Claims, disputes and other matters in question relating to the execution or progress of the Work or interpretation of the Contract Documents shall be referred initially to the Designer for decision and be subject to written appeal within fifteen (15) days by the Contractor. The Designer's decision shall be submitted promptly in writing to the Director, Public Works Division, who shall have full authority to render the final and binding decision.

2.2.9 The Designer will have responsibility to recommend to the Owner the rejection of work that does not conform to the Contract Documents. Whenever the Designer considers it necessary or advisable, Designer shall recommend to the Owner the stoppage of the Work or any portion thereof, and to recommend special examination or testing of the Work (whether or not fabricated, installed, or completed).

2.2.10 The Designer 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 conformance with the design concept of the Work and with the information given in the Contract Documents. Such action shall be taken with reasonable promptness so as to cause no delay. The Designer's approval of a specific item shall not indicate approval of all assembly of which the item is a component.

2.2.11 The Designer will prepare change orders in accordance with Article 12.

2.2.12 The Designer will conduct reviews to determine the dates of Substantial Completion and Final Completion, will receive and forward to the Owner for the Owner's review 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 Article 9.7.

2.2.13 The Designer, together with representatives from the Contractor and the Owner will conduct a review of the Work nine (9) months after the date of substantial completion to determine any work not in compliance with the Contract Documents at that time. A list of items to be corrected or completed will be forwarded to the Contractor for corrective action prior to the expiration of the one year warranty period.

2.2.14 The duties, responsibilities and limitations of authority of the Designer as the Owner's representative during construction as set forth in Articles 1 through 14 of these General Conditions shall not be modified or extended without written consent of the Owner.

2.2.15 The Designer will not be responsible for the acts or omissions of the Contractor, Subcontractor, or any of their superintendents, supervisory staffs, agents or employees, or any other persons performing any of the Work.

2.2.16 In case of the termination of the employment of the Designer, the Owner shall appoint a Designer against whom the Contractor makes no reasonable objections, whose status under the Contract shall be that of Designer.

**ARTICLE 3 OWNER**

3.1 Definition

3.1.1 The Owner is the State of Indiana, represented by the Commissioner, Department of Administration, acting through the Director, Public Works Division, and the Director's designated project manager.

3.2 Information and Service Required of the Owner

3.2.1 The Owner will furnish, through the Designer, surveys, describing known physical characteristics, legal limits and utility locations for the property on which the Project is to be erected, if in the Owner's possession.

3.2.2. Information or services under the Owner's control shall be furnished by the Owner with promptness to avoid delay in the orderly progress of the Work.

3.2.3 The Owner shall issue all instructions to the Contractor through the Designer unless specified elsewhere in these documents.

3.2.4 If the Contractor fails to correct defective work as required by Article 13 or persistently fails to carry out the Work in accordance with the Contract Documents, the Owner, by a written order may order the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of the Owner to stop the Work shall not give rise to any 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 Article 6.1.

3.3 Owner's Site Representative

3.3.1 Notwithstanding the obligations of the Designer as Owner's representative during construction, the Owner may employ an on-site representative to observe the progress of the Work.

3.3.2 The Owner's Site Representative shall function as an observer only. Owner's Site Representative shall report his/her findings to the Designer for review and any required further action. The Owner's Site Representative is not authorized to make changes in the Work or to interpret the Contract Documents.

3.3.3 The Owner's Site Representative shall have at all times access to the Work wherever it is in storage, preparation and progress. Owner's Site Representative may attend meetings at the site and he/she may review and approve the Contractor payment requests.

**ARTICLE 4 CONTRACTOR**

4.1 Definition

4.1.1 The Contractor is the person or organization identified as such in the Contract. The Contractor is referred to throughout the Contract Documents as if singular in number and, in some places, masculine in gender. The term Contractor means the Contractor or its authorized representative.

4.2 Review of Contract Documents

4.2.1 The Contractor shall carefully study and compare the Contract Documents and shall at once report to the Designer and the Owner any error, inconsistency or omission Contractor may discover. The Contractor shall perform no portion of the Work at any time without Contract Documents or, where required, approved shop drawings, product data or samples for such portion of the Work.

4.3 Supervision and Construction Procedures

4.3.1 The Contractor shall supervise and direct the Work, using its best skill and attention. Contractor shall be solely responsible for the quality of the Work and for all construction techniques, sequences, and procedures, and for coordinating all portions of the Work.

4.3.2 The Contractor shall not be relieved from its obligations to perform the Work in accordance with the Contract Documents either by the activities or duties of the Designer in administration of the Contract, or by inspections, tests or approvals required or performed under Paragraph 7.9 by persons other than the Contractor.

4.4 Labor and Materials

4.4.1 Unless otherwise specified in Division 1, the Contractor shall provide and pay for all labor, material, equipment, tools, construction equipment, machinery, transportation, and other facilities and services necessary for the proper execution of the Work.

4.4.2 Unless otherwise specified in Division 1, the Contractor shall provide and pay for all electric current, water, heat, and

telephone services and shall maintain necessary discipline to prevent waste.

4.4.3 If any item of work shall be the subject of a jurisdictional dispute as to the craft to be used for said work, the Contractor shall aid in such inter-craft resolution and if arbitrated, abide by the decision, holding the Owner free of involvement in the dispute, and if time is lost by the dispute, extra work days will only be considered through the provisions of Article 12.2. Contractor will endeavor to eliminate any embarrassment to the Owner caused by the dispute.

4.4.4. The Contractor shall at all times enforce strict discipline and good order among its employees and shall not employ on the Work any unfit person or any one employee unskilled in the Work assigned or unqualified as a tradesman in the trade involved.

4.5 Warranty and Guarantee

4.5.1 The Contractor warrants and guarantees that all materials and equipment incorporated in the Project shall be new unless otherwise specified, and all work will be of the highest quality, free from faults and defects, and in strict conformance with the Contract Documents for a period of one year from the date of substantial completion. All work not so conforming to the Contract Documents may be considered defective. If required by the Designer, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment. The warranties and guarantees provided in this Article and elsewhere in the Contract Documents shall be in addition to and not in limitation of any other warranty or guarantee or remedy called for the Contract Documents or otherwise prescribed by law. The Contractor, together with the Designer and representatives from the Owner, shall review the Work nine (9) months after the date of substantial completion to determine any work not in compliance with the Contract Documents. The Contractor shall correct such non-complying work prior to the expiration of the one year warranty.

4.6 Permits, Fees and Notices

4.6.1 The Contractor shall secure and pay for all permits, fees and licenses necessary for the execution of the Work.

4.6.2 The Contractor and Subcontractors must submit an “Exemption Certificate for Construction Contractors” (Form ST-105) to each supplier in order to obtain exemption from the Indiana Gross Tax (i.e., sales and use tax).

4.6.3 The Contractor shall give all notices and comply with all laws, ordinances, rules, regulations, and orders of any public authority bearing on the conduct of the Work. If Contractor observes that any of the Contract Documents are at variance therewith in any respect, Contractor shall promptly notify the Designer in writing, and any necessary changes shall be adjusted by change order. If Contractor performs any work knowing it to be contrary to such laws, ordinances, rules and regulations, and without such notice to the Designer, Contractor shall bear all cost arising from such non-conformance.

4.7 Cash Allowances

4.7.1 The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. These allowances cover the net cost of the materials and equipment delivered and unloaded at the site which cost shall be determined by the Owner through proper procedures for receiving quotes or bids as required by law. The Contractor’s handling costs on the site, labor, installation costs, overhead, profit**,** and other expenses shall be included in the Contract sum and not in the allowance. The Contractor shall cause the Work required by these allowances to be performed by such persons as the Designer may direct, but Contractor will not be required to employ persons against whom Contractor has a reasonable objection. If the net cost above, when determined, is more than or less than the allowance, the Contract Sum will be adjusted accordingly by change order.

4.8 Superintendent

4.8.1 The Contractor shall keep on the Project, during the entire contract time, a competent superintendent and necessary assistants, all satisfactory to the Designer, and the superintendent shall not be changed, except with the consent of the Owner, unless the superintendent proves to be unsatisfactory to the Contractor and ceases to be in Contractor’s employ. The superintendent shall represent the Contractor and shall have full authority to act on its behalf. All communications given the superintendent shall be as binding as if given by the Contractor. Important communications shall be confirmed in writing.

4.9 Responsibility for Those Performing the Work

4.9.1 The Contractor shall be responsible for the quality of the Work, for acts and omissions of all the Subcontractors, their superintendents, their supervisory staffs, agents, or employees and of all other persons performing any of the Work under a Contract with the Contractor.

4.10 Progress Schedule

4.10.1 Unless otherwise indicated in Division 1, the Contractor, immediately after being awarded the Contract, shall prepare and submit for the Designer's approval a progress schedule for the Work in relation to the entire Project. This schedule in bar graph form, or other form approved by the Owner, shall indicate the dates for the starting and completion of the various stages of construction, and in addition, will state the contractual completion date. The contract completion date, based on the construction period stated in the notice to bidders, shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by change order. A more detailed schedule may be required elsewhere in the documents.

4.11 Record Documents at the Site

4.11.1 The Contractor shall maintain for the Owner as part of the Contract one record copy of all drawings, specifications, addenda, shop drawings, change orders and other modifications at the site in good order, and marked to record all changes made during construction. These shall be available to the Designer and the Owner's Site Representative at all times while Work is in progress. All changes made during construction shall be recorded monthly and reviewed by the Designer before approval of each partial progress payment. The record documents shall be submitted to the Designer prior to the Contractor's final payment.

4.12 Shop Drawings and Samples

4.12.1 Shop drawings are all drawings, diagrams, illustrations, schedules, brochures, and other data, which are prepared by the Contractor, or any Subcontractor, manufacturer, supplier, or distributor, and which illustrate the Work.

4.12.2 The Contractor shall submit all shop drawings and samples required by the Contract or by the Designer in a timely manner, allowing sufficient time for the Designer's review so as not to cause any delay in the Work or in work by any other Contractor.

4.12.3 At the time of such submission, the Contractor shall furnish or verify all field measurements, field construction criteria, materials, catalog numbers, and the like and shall individually check, coordinate and stamp with its approval each submission, and shall in writing call the Designer's attention to any deviations in the shop drawings or samples from the requirements of the Contract Documents.

4.12.4 The Designer will check and approve, with reasonable promptness so as to cause no delay, these shop drawings and samples only for conformance with the design concept of the Project, and with the information given in the Contract Documents. The Designer's approval of a separate item will not indicate approval of the assembly in which the item functions.

4.12.5 The Designer's approval of shop drawings or samples shall not relieve the Contractor of responsibility for any deviation from the requirements of the Contract Documents unless the Contractor has in writing called the Designer's attention to such deviation at the time of submission and the Designer has given written approval to the specific deviation, nor shall this relieve the Contractor from errors or omissions in the shop drawings or samples.

4.12.6 No work requiring a shop drawing or sample submission shall be commenced until the submission has been approved by the Designer. All such work shall be in accordance with approved shop drawings and samples.

4.13 Use of Premises

4.13.1 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 premises with any materials or equipment.

4.14 Cutting and Patching

4.14.1 The Contractor shall do all cutting, fitting or patching of its work that may be required to make its several parts come together properly and shall not endanger any work by cutting, excavating, or otherwise altering the Work or any part of it. Costs caused by defective or ill-timed work shall be borne by the party responsible therefore.

4.15 Cleaning Up

4.15.1 The Contractor shall at all times keep the premises free from accumulation of waste materials or rubbish caused by its operations. At the completion of the Work, Contractor shall remove all waste material and rubbish from and about the building as well as all its tools, scaffolding and surplus materials. Contractor shall clean all glass surfaces, lights and fixtures, ceilings, walls and shall leave the Work dusted, swept and wet mopped clean, unless more exactly specified.

4.15.2 In case of dispute the Owner may remove the rubbish and charge the cost to the several Contractors as the Designer shall determine to be just.

**ARTICLE 5 SUBCONTRACTORS**

5.1 Definition

As used in this article "contractor tier" refers collectively to the following classes of contractors on a public works project:

(1) "Tier 1 contractor" includes each person that has a contract with the public agency to perform some part of the work on, supply some of the materials for, or supply a service for, a public works project. A person included in this tier is also known as a "prime contractor" or a "general contractor".

(2) "Tier 2 contractor" includes each person that has a contract with a tier 1 contractor to perform some part of the work on, supply some of the materials for, or supply a service for, a public works project. A person included in this tier is also known as a "subcontractor".

(3) "Tier 3 contractor" includes each person that has a contract with a tier 2 contractor to perform some part of the work on, supply some of the materials for, or supply a service for, a public works project. A person included in this tier is also known asa "sub-subcontractor".

(4) "Lower tier contractor" includes each person that has a contract with a tier 3 contractor or lower tier contractor to perform some part of the work on, supply some of the materials for, or supply a service for, a public works project. A person included in this tier is also known as a "lower tier subcontractor".

A Subcontractor is a person or entity who has a direct Contract with the Contractor to perform any of the Work at the site. The term Subcontractor is referred to throughout the Contract Documents as if singular in number and, in some places, masculine in gender and means a Subcontractor or its authorized representative. The term Subcontractor does not include any separate Contractor or its Subcontractors.

5.2 Award of Subcontracts and Other Contracts for Portions of the Work

5.2.1 Unless otherwise required by the Contract, the Contractor shall furnish to the Owner, with its bid on the prescribed form, the names of all persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for each of the principal portions of the Work with an installed value of $150,000.00 or more. The Designer will promptly reply to the Contractor in writing stating whether or not the Owner or the Designer, after due investigation, has reasonable objection to any such proposed person or entity. Failure of the Owner or Designer to reply within fourteen (14) days shall constitute notice of no reasonable objection.

5.2.2 The Contractor shall not subcontract with any such proposed person or entity to which the Owner or the Designer has made reasonable objection. The Contractor shall not be required to subcontract with anyone to whom Contractor has a reasonable objection.

5.2.3 If the Owner or the Designer has reasonable objection to any such proposed person or entity, the Contractor shall submit a substitute to whom the Owner or the Designer has no reasonable objection.

5.2.4 The Contractor shall make no substitution of any Subcontractor, person or entity previously selected, if the Owner or Designer makes reasonable objection to such substitution.

5.2.5 The Contractor and its subcontractors shall employ only licensed plumbers and shall provide to the Owner the names and license numbers of all plumbers engaged in the Work. The Contractor shall submit this documentation with any monthly progress payment request that includes plumbing labor.

5.3 Sub Contractual Relations

5.3.1 By an appropriate written agreement, 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 the terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities which the Contractor, by these Documents, assumes toward the Owner. Said agreement shall preserve and protect the rights of the Owner 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 the benefit of all rights, remedies and redress against the Contractor that the Contractor, by these Documents, has against the Owner. Provisions of Article 9 for progress payments, retainage and payment for stored material shall be incorporated without modification in all Contractor-Subcontractor agreements. The Contractor shall require each Subcontractor to enter into similar agreements with Subcontractor's Sub-subcontractors. Prior to execution of the Contractor-Subcontractor agreement, the Contractor shall provide all Subcontractors a complete copy of all proposed Contract Documents for the Project to which the Subcontractor will be bound by this Paragraph 5.3. Each Subcontractor shall similarly make available to its Sub-Subcontractors copies of such Documents. Executed copies of all

agreements shall remain on file with the Contractor and be available for review by the Owner at the Owner's discretion.

**ARTICLE 6 SEPARATE CONTRACTS**

6.1 Owner's Right to Let Separate Contracts

6.1.1 The Owner reserves the right to let other contracts in connection with other portions of the Project under these or similar General Conditions.

6.1.2 When separate contracts are awarded for different portions of the Project, the "Contractor" in the Contract Documents in each case shall be the Contractor who signs each separate contract with the Owner.

6.1.3 When separate contracts are awarded for portions of the Project, the General Construction Contractor shall be responsible for the overall coordination of all separate contracts for the Project.

6.2 Mutual Responsibility of Contractors

6.2.1 The Contractor shall afford each other Contractor reasonable opportunity for the introduction and storage of their materials and equipment and the execution of their work, and each shall properly connect and coordinate its work with all others as coordinated by the General Contractor.

6.2.2 If any part of the Contractor's work depends on proper execution or results upon the work of any other separate Contractor, the Contractor shall inspect and promptly report to the Designer any discrepancies or defects that shall cause its work to fail or be non-conforming. Failure of the Contractor to so inspect and report shall constitute an acceptance of the other Contractor's work as fit and proper for the reception of its work.

6.2.3 Should the Contractor cause damage to any separate Contractor on the Project, the General Contractor agrees, upon due notice, to settle with such other Contractor by agreement, if at all possible, without involving the Owner. The Owner will be involved only after evidence is presented that sureties cannot settle the problem.

6.2.4 Any costs caused by defective or ill-timed work shall be borne by the party responsible.

**ARTICLE 7 MISCELLANEOUS PROVISIONS**

7.1 Delinquent State Taxes (IC. 4-13-2-14.5). The Public Works Division may allow the Department of State Revenue access to the name of each person who is either:

(1) Bidding on a Contract to be awarded under this chapter; or
(2) A Contractor or Subcontractor under this chapter.

If the Public Works Division is notified by the Department of State Revenue that a bidder is on the most recent tax warrant list, a Contract may not be awarded to that bidder until the bidder provides a statement from the Department of State Revenue that the Bidder's delinquent tax liability has been satisfied. The Department of State Revenue may notify:

(1) The Department of Administration; and
(2) The Auditor of State;

that a Contractor or Subcontractor under this chapter is on the most recent tax warrant list, including the amount owed in delinquent taxes. The Auditor of State shall deduct from the Contractor's or Subcontractor's payment the amount owed in delinquent taxes. The Auditor of State shall remit this amount to the Department of State Revenue and pay the remaining balance to the Contractor or Subcontractor.

7.2 Choice of Law

7.2.1 The Contract shall be governed by the laws of the State of Indiana.

7.3 Assignment

7.3.1 The Contractor shall not assign the Contract or sublet it as a whole without the written consent of the Owner, nor shall the Contractor assign any monies due or to become due to it hereunder, without the previous written consent of the Owner.

7.4 Written Notice

7.4.1 Written notice shall be deemed to have been duly served if delivered in person to the individual or member of the firm or to an officer of the corporation for whom it was intended, or sent by electronic mail (email), or by registered or certified mail to the last business address known to the person who gives the notice.

7.5 Claims for Damages

7.5.1 Should either party to the Contract suffer injury or damage to person or property because of any act or omission of the other party or any of its employees, agents or others for whose acts the party is legally liable, claim shall be made in writing to such other party within seven (7) days of the first observance of such injury or damage.

7.6 Performance Bond and Labor and Material Payment Bond

7.6.1 For projects advertised with an estimated base bid amount of One Hundred Fifty Thousand Dollars ($150,000) or more, the Contractor shall furnish and pay for an approved one hundred percent (100%) combination performance and payment bond (Contractor's Bond for Construction, Public Works Division Form DAPW 15). This bond shall adhere to the requirements of IC. 4-13.6-7-6 and IC. 4-13.6-7-7 as amended and shall cover the faithful performance of the Contract and the payment of all obligations arising thereunder, including reimbursement for any stored materials paid for but returned to materialmen, with such sureties as the Owner may approve. The combination bond shall remain in effect throughout the entire construction period and in addition for a period of one year from the date of final acceptance. The Contractor shall deliver the required bonds to the Owner prior to execution of the Contract by the Owner unless authorized to the contrary in writing by the Owner. All bonds must be issued by bonding companies, which are licensed and approved by the Indiana Insurance Commission.

7.7 Owner's Right to Carry Out the Work

7.7.1 If the Contractor should default or neglect to carry out the Work properly or fail to perform any provision of the Contract, the Owner may, after giving seven (7) days written notice to the Contractor, without prejudice to any other remedy it may have, make good such deficiencies. In such case, an appropriate change order shall be issued deducting the cost thereof including the cost of the Designer's additional service made necessary by such default, neglect, or failure of the Contractor, from the payments then or thereafter due the Contractor, provided, however, that the Designer shall approve both such action and the amount charged to the Contractor. If such payments due to the Contractor are not sufficient to cover such amount, the Contractor shall pay the difference to the Owner.

7.8 Royalties and Patents

7.8.1 The Contractor shall pay all royalties and license fees. Contractor shall defend all suits or claims for infringement of any patent rights and shall save the Owner harmless from liability of any nature or find including costs and expenses for or on account of any patented or unpatented invention, process, article or appliance manufactured or used in the performance of this Contract, including its use by the Owner.

7.9 Tests & Substitution of Materials

7.9.1 If the Contract Documents, laws, ordinances, rules, regulations, or orders of any public authority having jurisdiction require any work to be inspected, tested, or approved, the Contractor will give the Designer timely notice of its readiness and of the date fixed for such inspection, testing, or approval so that the Designer may observe the same. The Contractor shall bear all cost of such inspections, tests, and approvals unless otherwise provided.

7.9.2 If, after the commencement of the Work, the Designer, with approval of the Owner in writing, determines that the Work requires special inspection, testing, or approval for which subparagraph 7.9.1 does not provide, Designer will, upon written authorization from the Owner, order such special inspection, testing or approval. If such special inspection or test reveals a failure of the Work to fulfill the requirements of the Contract Documents, laws, ordinances, rules, regulations or orders of any public authority having jurisdiction, the Contractor shall bear all costs thereof; otherwise, the Owner shall bear such costs. An appropriate change order shall be issued.

7.9.3 Required certificates of inspection, testing or approval shall be secured by the Contractor and promptly delivered by Contractor to the Designer.

7.9.4 Observations by the Designer of the inspections, tests, or approvals required by Article 7 will be promptly made, and where practicable at the source of supply at no additional cost to the Owner.

7.9.5 Neither the observations of the Designer in its administration of the Contract, nor inspections, tests or approvals by persons other than the Contractor shall relieve the Contractor from its obligations to perform the Work in accordance with the Contract Documents.

7.9.6 All building construction and work, alterations, repairs, plumbing, mechanical, and electrical installations and appliances connected therewith, shall comply with the Rules and Regulations of the Indiana Department of Homeland Security, the Indiana Department of Health, local ordinances, Rules for Licensure of Building Trades, and other statutory provisions pertaining to this class of work; such rules and regulations and local ordinances to be considered as a part of these specifications.

7.9.7 Where in these specifications, one or more certain materials, trade names, or articles of certain manufacture are mentioned, it is done for the express purpose of establishing a basis of durability and efficiency and not for the purpose of limiting competition. Approval of other acceptable products for those specified may be obtained by requesting to the Designer no later than fourteen (14) days in advance of bid date with all documentation required for the Designer to evaluate any approval. If approval is granted, the subject product will be added by addendum.

7.9.8 Should there be a reason for change of materials after award of the Contract, the following criteria shall apply:

a. Original material no longer manufactured,
b. Delivery not possible within time specified for job, and/or
c. Unavailability due to causes beyond the control of the Contractor.

7.9.9 After agreement by the Designer and the Owner that a change is necessary, the Contractor shall present a request for substitution to the Designer. The burden of proof of the merit of the proposed substitute is upon the proposing party. The decision of the Designer and the Owner regarding the substitution shall be final.

7.10 Certificate of Qualification

7.10.1 In accordance with IC. 4-13.6-4 as amended, all Contractors and Subcontractors performing work for the State of Indiana on projects estimated to be in excess of one hundred fifty thousand dollars ($150,000.00), must hold a valid Certificate of Qualification issued by the Public Works Certification Board. The Instructions to Bidders define the procedure for certification and bidding.

7.10.2 The Contractor must perform at least fifteen (15) percent of the total Contract Sum of the Work with its own forces. The Contractor shall submit copies of its payroll records, if requested by the Owner, showing the hours, rates and total costs for all personnel on its payroll detailed to the degree to ensure compliance with this paragraph and any Wage Determination provisions, if required.

7.11 Appropriation

7.11.1 The Contract specifically limits payments to be made in accordance with appropriations made and funds made available under laws of the State of Indiana.

7.12 Federal Wage Determination, if required

7.12.1 If a Davis-Bacon wage determination is included in the Contract Documents, it shall be used as the minimum wage and benefits to be paid for the trades indicated.

7.12.2 Contractor shall submit a schedule of hourly wages to be paid to each employee (including those of its subcontractors) engaged in work on the site. This submittal shall be on Contractor’s letterhead stationery and shall be signed by the Contractor and notarized. A copy of this submittal shall be conspicuously posted at the site.

7.12.3 Said rates shall in no case be less than those set out in the Davis-Bacon wage schedule a copy of which is herein bound or is on file with the Owner if it is required.

7.12.4 The Contractor shall provide (and require each Subcontractor to provide) weekly payroll records listing employees engaged in work on the site for the week and the hourly rates for base pay and benefits paid to each employee listed. The payroll record form shall include a statement by the Contractor/Subcontractor certifying the accuracy and completeness of the information provided. Payroll records shall be maintained by the Contractor during the course of the Work until the end of the required warranty period.

7.13 Out-of-State Contractors

7.13.1 Out-of-State business entities must be authorized to do business in the State, pursuant to Indiana Code Title 23, prior to submitting bids. Forms may be obtained by contacting the Secretary of State, State of Indiana, Indianapolis, Indiana.

7.14 Material Delivery

7.14.1 Shipments of material to be used by the Contractor or any Subcontractor under this Contract should be delivered to the job site only during the regular working hours of the Contractor or Subcontractor. If a delivery is made during other than the normal working hours of the Contractor or Subcontractor, its authorized agent must be on duty to receive such material. No employee of the Owner is authorized to receive any shipments designated for the Contractor or Subcontractor.

7.15 Weather

7.15.1 The Contractor shall at all times provide protection against weather, rain, wind, storms, frost or heat, so as to maintain all work, materials, apparatus and fixtures free from injury or damage. At the end of the day's work, all new work likely to be damaged shall be covered.

7.15.2 During cold weather, the Contractor shall protect all work from damage. If low temperature makes it impossible to continue operations safely, in spite of cold weather precaution, the Contractor shall cease work and shall so notify the Owner and Designer.

7.15.3 Any work damaged by failure to provide protection above required, shall be removed and replaced with new work at the Contractor's expense.

7.15.4 The Contractor shall provide and maintain on the premises, where directed, watertight storage shed (or sheds) for storage of all materials, which might be damaged by exposure to weather.

7.16 Fire Hazards

7.16.1 Wherever and whenever any burning, welding, cutting or soldering operation is in progress, or equipment is in use, or any work involving a fire hazard, is performed, the Contractor responsible for such operation shall have at all times acceptable fire extinguisher or protection within five (5) feet of the operation.

7.17 Dismissal

7.17.1 Any foreman or workman employed by the Contractor or by any Subcontractor who, in the opinion of the Director, Public Works Division and/or the Designer, does not perform his/her work in a proper and skillful manner, or is disrespectful, intemperate, disorderly, intoxicated or otherwise objectionable shall at the written request of either of the above, be forthwith discharged by the Contractor or Subcontractor employing such foreman or workman and said employee shall not be employed again on any portion of the Work without the written consent of the Director of the Division of Public Works and the Designer. Should the Contractor fail to furnish suitable and sufficient machinery, equipment or personnel for the proper prosecution of the Work, the Owner or Designer may withhold all payments that are or may become due, or may suspend the Work until such orders are upheld.

**ARTICLE 8 TIME**

8.1 Definitions

8.1.1 Unless otherwise provided, the Contract Time is the period of time allotted in the Contract Documents for Substantial Completion of the Work as defined herein, including authorized adjustments thereto.

8.1.2 The date of commencement of the Work is the date established in a notice to proceed. If there is no notice to proceed, it shall be the date of the approval by the final state approving agency on the Owner-Contractor Contract or such other date as may be established therein.

8.1.3 The Date of Substantial Completion of the Work, or designated portion thereof, is the date certified by the Director, Public Works Division, when construction is sufficiently complete, in accordance with the Contract Documents, so the Owner may occupy or utilize the Work, or designated portion thereof, for the use for which it is intended.

8.1.4 The term day as used in the Contract Documents shall mean calendar day unless otherwise specifically designated.

8.2 Progress and Completion

8.2.1 All time limits stated in the Contract Documents are of the essence of the Contract.

8.2.2 The Contractor shall begin the Work on the date of commencement as defined herein. Contractor shall carry the Work forward expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time.

8.2.3 The Owner fully expects the Contractor to employ any and all means necessary to complete the Work within the Contract Time. Conduct of the Owner's affairs, such as unforeseen site conditions or delay in processing change orders, shall <u>not</u> be viewed as justification for delaying the Project unless the Owner can be shown to have breached the Contract. Contractor must employ all reasonable means to execute the Project in a timely manner and in conformance with the Contract Documents even if the Contractor or Designer seeks legal remedy against the Owner for claim of damage.

8.3 Delays and Extensions of Time

8.3.1 If the Contractor is delayed at any time in the progress of the Work by any act or neglect of the Owner or the Designer, or by any employee of either, or by any separate Contractor employed by the Owner, or by changes ordered in the Work, or by labor disputes, fire, unusual delay in transportation, adverse weather conditions not reasonable to anticipate, unavoidable casualties, or

any causes beyond the Contractor's control, or by delay authorized by the Owner pending arbitration, or by any other cause which the Designer determines may justify the delay, then the Contract Time shall be extended by a Change Order for such reasonable time as the Designer may determine.

8.3.2 Claims for extension of time shall be made in writing to the Designer. In case of a continuing delay only one claim is necessary. The Contractor shall provide an estimate of the probable effect of such delay on the progress of the Work.

8.3.3 If no agreement is made stating the dates upon which interpretations as provided in Article 2.2 shall be furnished, then no claim for delay shall be allowed on account of failure to furnish such interpretations until fifteen days after written request is made for them, and not unless such claim is reasonable.

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

**ARTICLE 9 PAYMENTS AND COMPLETION**

9.1 Contract Sum

9.1.1 The Contract Sum is the total amount payable by the Owner for the 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 Owner a schedule of various parts of the Work, including quantities if required by the Owner, aggregating the total Contract Sum, divided so as to facilitate payments to Subcontractors in accordance with Article 5.3, made out in such form as the Owner and the Contractor may agree upon, and supported by such data to substantiate its correctness as the Owner may require. Each item in the Schedule of Values shall include its proper share of overhead, profit, and other general charges. This schedule, when approved by the Owner, shall be used as a basis for the Contractor's Applications for Progress and Final Payments.

9.3 Progress Payments

9.3.1 Completed work: The Contractor shall submit to the Designer an itemized Application for Payment, supported by such data substantiating the Contractor's right to payment as the Designer may direct. The Owner shall make payments on account of the Contract, upon issuance of Certificates of Payment certified by the Designer and the Owner's Representative, for labor and materials incorporated into the Work at the rate of ninety-four (94%) percent of such value until fifty (50%) percent of the value of the Work is completed. After that fifty (50%) percent, no further retainage will be deducted. The Director, Public Works Division has the option to require that three (3%) percent of the value of the Work be retained throughout the duration of the entire Contract. The retainage schedule shall be determined prior to award of Contract. Retainage may be paid with final payment at the discretion of the Director, Public Works Division, but shall not be paid in any event until a minimum of sixty-one (61) days after all work is completed.

9.3.2 Materials Stored: Payments may be made on account for materials or equipment not incorporated in the Work, but delivered and suitably stored at the site. With written approval of the Owner, materials may be stored at another location other than the Work site if properly identified as the property of the Owner and properly protected. Storage of material at the place of business of the vendor is not acceptable (25 IAC 2-9-2). Such payments shall be conditional upon the submission by the Contractor of one of the following: 1) receipts marked by the supplier as paid; 2) supplier's final waiver of lien listing specific materials involved; 3) invoice with copy of canceled check showing payment; or 4) such other evidence of payment as the Owner may require in lieu thereof to establish ownership of all items except those listed as miscellaneous materials below. For the aggregate of miscellaneous stored materials for which payment is requested and above proof of payment is not available, a complete list will be provided along with the affidavit of payment. Upon certification by the Owner's representative that the listed materials are suitably stored, payment can be made. Miscellaneous materials are defined as pipe, fittings, wire, conduit, etc., normally stored as stock items in Contractor's warehouse. For materials stored other than at the construction site applicable insurance and transportation to the site shall be provided by the Contractor.

9.3.3 As stored materials are incorporated into the Work, the value shall be removed from the total value of stored materials requested in successive payments. Proof of ownership through one of the above methods will be required for additional materials. When, in the judgment of the Owner, retainage for completed work is not sufficient in relation to excessive amounts requested for stored materials or equipment, the Owner may elect to place the retainage for such materials or equipment in escrow. This retainage shall apply as a credit toward retainage due to be held for completed work on future payments.

9.3.4 The Contractor warrants that title to all work, materials and equipment covered by an Application for Payment will pass to the Owner either by incorporation in the construction or upon the receipt by the Contractor of payment, whichever occurs first, free and clear of all liens, claims, security interest or encumbrances, hereinafter referred to in this Article 9 as "liens"; and that no Work, materials or equipment covered by an Application for Payment will have been acquired by the Contractor, or by any other person performing work at the site or furnishing materials and equipment for the Project, subject to an agreement under which an interest

therein or an encumbrance thereon is retained by the seller or otherwise imposed by the Contractor or such other person.

9.3.5 The Contractor shall accompany each application for payment request with a certification that all Subcontractors (fabricators) have been paid within ten (10) days of receipt of payment that pro rata amount of funds Contractor has received from the Owner for the value of work or services (fabricated materials or equipment) performed by the Subcontractor (supplied by fabricator) contained in previous progress payments. The Contractor's inclusion of a value of subcontract work in its progress pay estimate is prima facie evidence of acceptance of work having such a value; therefore, if the Owner receives a certification from a Subcontractor that Subcontractor has not been paid such amounts as were included in the Contractor's partial billing and subsequently paid to the Contractor by the Owner, then the Owner will hold all subsequent partial payment requests until satisfactory evidence is received from the Subcontractor that Subcontractor has been paid such amounts presented to the Owner by the Contractor, paid to the Contractor by the Owner, and not distributed by the Contractor to the Subcontractor. The making of an incorrect certification of either partial payment or final payment may be considered by the Owner to be a breach of contract, and Owner may exercise all of its prerogatives set out in the Contract in addition to the remedies for falsifying an affidavit. Such an action could result in a suspension of qualification with the State Certification Board for a period of up to two (2) years.

9.4 Certificates for Payment

9.4.1 When the Contractor has made application for payment as above, the Designer will issue a Certificate of Payment to the Owner for such amount as Designer determines to be properly due, or state in writing its reasons for withholding a certificate as provided in Articles 9.5.1.

9.4.2 The issuance of a Certificate for Payment will constitute a representation by the Designer to the Owner, based on the Designer's observations at the site as provided in Article 2.2.4 and the data comprising the Application for Payment, that the Work has progressed to the point indicated, and that, to the best of its knowledge, information and belief, the quality of work is in accordance with the Contract Documents subject to an evaluation of the Work as a functioning whole upon substantial completion, to the results of any subsequent tests called for in the Contract documents, to minor deviations correctable prior to the next certificate for payment and to any specific qualifications stated in its certificate, and that the Contractor is entitled to payment in the amount certified.

9.4.3 The Designer's final Certificate for Payment will constitute a further representation that the conditions precedent to the Contractor's being entitled to final payment as set forth in Article 9.7 have been fulfilled. However, by issuing a Certificate, the Designer shall not thereby be deemed to represent that Designer has made any examination to ascertain how or for what purpose the Contractor has used the monies paid on account of the Contract Sum.

9.4.4 The Owner shall make payment as soon as the fiscal procedure of the State can process same after receipt from the Designer of the Certificate for Payment. The fiscal procedure by the State can include, but not be limited to, review by the Owner's using agency, verification of the Certificate by the Owner's Site Representative, review for accuracy of form and calculation by the Owner's accountant, review by the Owner's project management and execution by the Director, Public Works Division, and others.

9.4.5 No certificate for a progress payment or progress payment for partial or entire occupancy of the Project by the Owner shall constitute an acceptance of work not in accordance with the Contract Documents.

9.4.6 Pursuant to IC. 4-13.6-7-2 all Contract awards of One Million Dollars ($1,000,000) or above, if elected by the Contractor, an escrow agent will be selected by the State with whom the retainage funds for this Contract will be deposited and held until receipt of notice from the Director, Public Works Division (Escrow Form DAPW 32A) and from all other necessary parties as specified in and in accordance with the procedures and provisions of said Act.

9.5 Payments Withheld

9.5.1 The Designer (or Owner) will not approve an application in whole or in part, if in Designer's opinion, Designer is unable to make representations to the Owner as provided in Article 9.4. The Designer (or Owner) will not approve Application for Payment or, because of subsequent inspections, may nullify the whole or any part of the Certificate for Payment previously issued to such extent as may be necessary in Designer's opinion to protect the Owner from loss because of:

A. defective work not remedied,
B. claim filed or reasonable evidence indicating probable filing of claims,
C. failure of the Contractor to make payments properly to Subcontractors or for materials, equipment or labor,
D. reasonable doubt that the Contract can be completed for the unpaid balance,
E. damage to another Contractor,
F. reasonable indication that the Owner may be damaged by delay in receiving use of the Work as scheduled, or,
G. unsatisfactory prosecution of the Work by the Contractor.

9.5.2 When the above grounds are removed, payment shall be processed for amounts withheld.

9.6 Failure of Payment

9.6.1 If the Designer should fail to issue any Certificate for Payment, through no fault of the Contractor, or if the Owner should fail to pay the Contractor in a reasonable time considering the fiscal procedures of the State for processing same after receipt from the Designer the amount certified by the Designer, then the Contractor may, after seven (7) additional days, give written notice to the Owner and Designer, that work will stop until payment of the amount owing has been received.

9.7 Substantial Completion and Final Payment

9.7.1 When advised by the Contractor that the Work or a designated portion thereof is substantially complete, the Designer; the Director, Public Works Division, and the Contractor shall determine jointly by inspection that the Work is substantially complete. If they determine that the Work is substantially complete, the Contractor shall then prepare a Certificate of Substantial Completion with an accompanying list of incomplete items of work (punch list) and submit it to the Designer for its signature and subsequent forwarding for approval by the Director, Public Works Division. The Certificate shall fix the date of Substantial Completion and shall state the responsibilities of the Owner and the Contractor for maintenance, heat, utilities and insurance.

9.7.2 Upon approval of the above, and notice that the Work is ready for final acceptance, the Designer, the Contractor and Owner will promptly make final review, and when they find the Work acceptable under the Contract and the Contract fully performed, the Contractor shall promptly submit the final Certificate for Payment with all other required documents, showing that the Work has been completed in accordance with the terms and conditions of the Contract, and that the entire balance in said final certificate, is due and payable.

9.7.3 Neither the final payment nor any part of the retained percentage shall become due until the Contractor shall submit to the Designer releases or waivers of all liens arising out of the Contract; an affidavit that the releases and waivers include all the labor, materials, and equipment for which a lien could be filed and that all payrolls, material bills, and other indebtedness connected with the Work for which the Owner or its property might in any way be responsible have been paid or otherwise satisfied; and such other data establishing payment or satisfaction of all such obligations as the Owner may require. If any such lien or claim remains unpaid, the Contractor shall refund to the Owner all monies that the latter may be compelled to pay in discharging such lien or claim, including all costs.

9.7.4 If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor, and the Designer so confirms, the Owner shall, upon certification by the Designer, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed and accepted, or such portion as may be available from funds not already released to an escrow agent pursuant to IC 4-13.6-7. Such payment shall be made under the terms and conditions governing final payment, except that it shall not constitute a waiver of claims.

9.7.5 The making of final payment shall constitute a waiver of all claims by the Owner except those arising from:

A. unsettled liens,
B. faulty work appearing after Substantial Completion,
C. failure of the Work to comply with the requirements of the Contract Documents,
D. terms of any special guarantees required by the Contract Documents.

9.7.6 If upon Substantial Completion of the Work there are any remaining uncompleted minor items, the Owner shall withhold, until those items are completed, an amount equal to two hundred percent (200%) of the value of each item as determined by the Designer or Owner.

9.7.7 The acceptance of final payment shall constitute a waiver of all claims by the Contractor, except those previously made in writing and still unsettled and covered by other agreed arrangements.

**ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY**

10.1 Safety Precautions and Programs

10.1.1 The Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work.

10.2 Safety of Person and Property

10.2.1 The Contractor shall take all necessary precautions for the safety of, and will provide all necessary protection to prevent damage, injury, or loss to:

A. all employees on the Project and all other persons who may be affected thereby,
B. all the Work and all materials and equipment to be incorporated therein, whether in storage on or off the site, and,
C. other property at the site or adjacent thereto, including trees, shrubs, lawns, pavements, roadways, structures and

utilities not designated for removal, relocation or replacement in the course of construction.

10.2.2 The Contractor shall comply with all applicable laws, ordinances, rules, regulations and orders of any public authority having jurisdiction for the safety of persons or property or to protect them from damage, injury, or loss. Contractor shall erect and maintain, as required by the conditions and progress of the Work, all necessary safeguards for safety and protection, including posting danger signs and other warnings against hazards, promulgating safety regulations, and notifying owners and users of adjacent utilities.

10.2.3 All damage or loss to all property specified herein caused directly or indirectly, in whole or in part, by the Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable, shall be remedied by the Contractor, except damage or loss attributable solely to faulty Contract Documents or to the acts or omissions of the Owner, or Designer or their employees, or for those whose acts either of them may be liable.

10.2.4 The Contractor shall designate a responsible member of its organization on the Work whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent, unless otherwise designated in writing by the Contractor to the Owner and the Designer.

10.2.5 When the use or storage of explosives or other hazardous materials or equipment is necessary for the prosecution of the Work, the Contractor shall carry on such activities under the supervision of properly qualified personnel.

10.2.6 The Contractor shall not overload, or permit any part of the Work to be loaded so as to endanger its safety.

10.2.7 All excavations creating a trench of five (5) or more feet in depth shall strictly adhere to the shoring and other safety requirements called for and described under Indiana OSHA Regulation 29 C.F.R. 1926, Subpart "P", for trench safety systems.

10.3 Emergencies

10.3.1 In an emergency affecting the safety of persons or property, the Contractor shall act, at its discretion, to prevent threatened damage, injury or loss. Any additional compensation or extension of time claimed by the Contractor because of emergency work shall be determined as provided for in Article 12, Changes in the Work, and Contractor shall notify the Owner of such a decision within seven (7) days of the event giving rise to such claim.

## ARTICLE 11 INSURANCE

11.1 General Requirements for Insurance

11.1.1 The Contractor will be required to furnish to the Owner, evidence of its compliance with all items of insurance listed herein and in the Contract. All insurance policies/certificates shall be on file with the Owner prior to release of the signed Contract and commencement of work.

11.1.2 The Contractor shall purchase and maintain, with a company or companies licensed to do business in Indiana, such insurance as will protect Contractor from claims set forth below, arising out of or resulting from the Contractor's operations under the Contract, whether such operations be by the Contractor or by any Subcontractor or by anyone directly or indirectly employed by any of them:

A. claims under Workmen's Compensation Acts and other employee benefit acts;
B. claims for damages because of bodily injury, personal injury, occupational sickness or disease, or death of its employees;
C. claims for damages because of bodily injury, personal injury, sickness, disease or death of any person other than its employees;
D. claims for damages to tangible property, including loss of use thereof.

11.1.3 This insurance shall be written for not less than any limits of liability specified herein, or required by law, whichever is greater. Policies or certificates of insurance, acceptable to the Owner, shall be filed with the Owner prior to execution of the Contract. These Certificates shall contain a provision that coverages afforded under the policies will be for the life of the Work.

11.1.4 Policies (certificates) shall show name and complete address of the Company, expiration date or dates, and policy number or numbers. Policies shall not be canceled until at least thirty (30) days prior written notice has been given to the Owner and acknowledged by the Owner in writing.

11.2 Property Insurance

11.2.1 The Contractor shall furnish and maintain, at the Contractor's expense, Fire, Extended Coverage, Vandalism, and Malicious Mischief Insurance (Builder's Risk), in the sum of 100% of the Contract amount. Builder's Risk insurance shall cover the structure on/in which the Work of this Contract is to be done including items of labor and material connected therewith, whether in or adjacent to the structure insured; material in place or to be used as part of the permanent construction, including surplus materials; shanties, protective fences, bridges, or temporary structures; miscellaneous materials and supplies incident to the Work; scaffolding, staging, towers, forms, and equipment, if included in the cost of the Work. This insurance need not cover any tools owned by mechanics, or any tools, equipment, scaffolding, staging, towers, and forms owned or rented by the Contractor, the capital value of which is not included in the cost of the Work.

11.2.3 Any loss under this Article 11.2 is to be adjusted with the Owner and made payable to the Owner as trustee for the insured, as their interests may appear.

11.3 Liability Insurance

11.3.1 The Contractor and their subcontractors (if any) shall secure and keep in force during the term of this Contract the following insurance coverages (if applicable) covering the Contractor for any and all claims of any nature which may in any manner arise out of or result from Contractor's performance under this Contract:

A. Commercial general liability, including contractual coverage, and products or completed operations coverage (if applicable), with minimum liability limits not less than $700,000 per person and $5,000,000 per occurrence unless additional coverage is required by the State. The State is to be named as an additional insured on a primary, non-contributory basis for any liability arising directly or indirectly under or in connection with this Contract.

B. Automobile liability for owned, non-owned and hired autos with minimum liability limits of $700,000 per person and $5,000,000 per occurrence. The State is to be named as an additional insured on a primary, non-contributory basis.

C. The Contractor shall provide proof of such insurance coverage by tendering to the undersigned State representative a certificate of insurance prior to the commencement of this Contract and proof of workers' compensation coverage meeting all statutory requirements of IC §22-3-2. In addition, proof of an "all states endorsement" covering claims occurring outside the State is required if any of the services provided under this Contract involve work outside of Indiana.

D. The Contractor's insurance coverage must meet the following additional requirements:

1. The insurer must have a certificate of authority or other appropriate authorization to operate in the state in which the policy was issued.

2. Any deductible or self-insured retention amount or other similar obligation under the insurance policies shall be the sole obligation of the Contractor.

3. The State will be defended, indemnified and held harmless to the full extent of any coverage actually secured by the Contractor in excess of the minimum requirements set forth above. The duty to indemnify the State under this Contract shall not be limited by the insurance required in this Contract.

4. The insurance required in this Contract, through a policy or endorsement(s), shall include a provision that the policy and endorsements may not be canceled or modified without thirty (30) days' prior written notice to the undersigned State agency.

5. The Contractor waives and agrees to require their insurer to waive their rights of subrogation against the State of Indiana.

E. Failure to provide insurance as required in this Contract may be deemed a material breach of contract entitling the State to immediately terminate this Contract. The Contractor shall furnish a certificate of insurance and all endorsements to the State before the commencement of this Contract.

F. Boiler and Machinery Explosion Insurance shall be required when the Work includes boiler, other pressure

vessels or steam piping installation or repair.

G. After June 30, 2015, this entire Article will apply to **any** contractor that will be on the construction site pursuant to IC 5-16-13 and an acceptable certificate of insurance will be provided by each and every contractor.

**ARTICLE 12 CHANGES IN THE WORK**

12.1 Change Orders

12.1.1 The Owner, without invalidating the Contract, may order changes in the Work consisting of additions, deletions, or modifications, with the Contract Sum and the Contract Time being adjusted accordingly. All such changes in the Work shall be authorized by Change Order, and shall be executed under the applicable conditions of the Contract Documents.

12.1.2 A Change Order is a written order to the Contractor compiled and reviewed by the Designer, prepared by the Owner and then signed by the Owner and the Contractor. The order is issued after the execution of the Contract authorizing a change in the Work, and documenting any adjustment in the Contract Sum and/or the Contract Time. The Contract Sum may be changed only by change order.

12.1.3 The value of any work involved in a change in the Work shall be determined in one or more of the following ways, in order of priority listed:

A. by mutual acceptance of a lump sum. For all amounts over $500, the Contractor shall provide a complete listing of quantities and unit prices of materials, hours of labor with cost per hour, and separate agreed percentages for any overhead and profit. The maximum aggregate increase for overhead and profit (including all home office and field office overhead) for any Subcontractor or for the Contractor performing its own work is fifteen (15%) percent; the maximum increase for a Contractor on work performed by a Subcontractor is five (5%) percent. If the cost of performance and payment bond(s) is shown as a separate line item in the Contractor's schedule of values for the project, then an increase will be permitted to provide for the additional cost of the bond(s). If the cost of the bond(s) is not indicated on the Contractor's schedule of values for the Project, any increase in cost for bond(s) shall be included in the Contractor's allowed overhead. For listings under $500, list lump sum for each item, or,
B. by unit prices named in the Contract or subsequently agreed upon, or,
C. by cost plus a mutually acceptable fixed or percentage fee.

12.1.4 Should conditions be encountered below the surface of the ground that are:

A. at variance with the conditions indicated by the Contract Documents, and
B. different than could be expected after a reasonable viewing of the site by the bidders, and
C. not evident from available soil samples,

then the Contract sum may be equitably adjusted by Change Order upon claim by Contractor made within a reasonable time after the first observance of the conditions.

12.1.5 If the Contractor claims that a written interpretation issued pursuant to Article 1.2 or a written order for a minor change issued pursuant to Article 12.3 involves additional cost or time, the Contractor shall make such claim as provided in Article 12.2.

12.2 Claims for Additional Cost or Time

12.2.1 If the Contractor wishes to make a claim under the provisions of the Contract Documents for an increase in the Contract Sum or an extension in the Contract Time, Contractor shall give the Designer written notice thereof within fifteen (15) days after the occurrence of the event giving rise to such claim. This notice shall be given by the Contractor and authority received in writing from the Owner before proceeding to execute the Work, except in an emergency endangering life or property. No such claim shall be valid unless so made. Any approved change in the Contract Sum or Contract Time resulting from such claim shall be incorporated in a Change Order, initiated by the Designer and executed by the Owner. If the Designer does not initiate or the Owner execute a Change Order within a reasonable time in response to the request, such lack of action shall be construed as prima facie evidence of rejection of the request. For the purpose of this section "reasonable time" is expected not to exceed 30 days after receipt by the Owner.

12.3 Minor Changes in the Work

12.3.1 The Designer shall have authority, with Owner's approval, to order minor changes in the Work not involving an increase in the Contract Sum or an extension of the Contract Time and not inconsistent with the intent of the Contract Documents. Such change may be affected by written field order, with copy transmitted to the Owner. Such minor changes need not be approved in writing by the Owner; however, the Owner may provide written approval of any substitution of significant materials or equipment.

12.4 Field Orders

12.4.1 The Designer may issue written field orders, which interpret the Contract Documents in accordance with Article 1.2.4 without change in Contract Sum or Contract Time. The Contractor shall carry out such field orders promptly. The Designer shall

transmit copies of field orders to the Owner.

**ARTICLE 13 EXAMINATION AND CORRECTION OF WORK**

13.1 Examination of Work

13.1.1 If any portion of the Work should be covered contrary to the request of the Designer or to requirements specifically expressed in the Contract Documents, it must, if required in writing by the Designer, be uncovered for Designer's observation and shall be replaced at the Contractor's expense.

13.1.2 Examination of questioned work may be ordered by the Designer with the approval of the Owner, and if so ordered the Work must be uncovered by the Contractor. If such work were found in accordance with the Contract Documents, the cost of re- examination and replacement shall, by appropriate change order, be charged to the Owner. If such work be found not in accordance with the Contract Documents, the Contractor shall pay such costs, unless it is found that the defect in the Work was caused by a separate Contractor employed as provided in Article 6 and in that event, the separate Contractor shall pay such costs.

13.2 Correction of Work before Substantial Completion

13.2.1 The Contractor shall promptly remove from the site all work rejected by the Designer as failing to conform to the Contract Documents, whether or not incorporated in the Project, and the Contractor shall promptly replace and re-execute its own work in accordance with the Contract Documents and without cost to the Owner and shall bear the cost of repair to or replacement of all work of separate Contractors destroyed or damaged by such removal or replacement.

13.2.2 If the Contractor does not remove such rejected work within a reasonable time, fixed by written notice from the Designer, the Owner may remove and store the material at the expense of the Contractor. If the Contractor does not agree to pay or credit the Contract with the cost of such removal within ten days thereafter, the Owner may acquire a lien upon such property and materials. If proceeds of lien foreclosure do not cover all costs, which the Owner has then borne, the difference shall be deducted from the amount to be paid to the Contractor.

13.3 Correction of Work after Substantial Completion

13.3.1 The Contractor shall correct all faults and deficiencies in the Work which appear within one year of the date of substantial completion or such longer period of time as may be prescribed by the terms of any special guarantees called for by the Contract Documents, and Contractor shall pay for all damage to other work caused thereby. The Contractor shall remove all defective work where necessary.

13.3.2 If the Contractor does not correct such faulty or defective work and remove defective work where necessary, within a reasonable time fixed by the Designer in writing, the Owner may do the corrective work and remove the defective work, as described in Article 13.2 above.

13.3.3 All costs attributable to correcting and removing faulty or defective work shall be borne by the Contractor.

13.3.4 The obligations of the Contractor under this Article 13.3 shall be in addition to and not a limitation of any obligations imposed upon Contractor by special guarantees called for by the Contract Documents or otherwise prescribed by law.

**ARTICLE 14 TERMINATION OF THE CONTRACT**

14.1 Termination by the Contractor

14.1.1 If the Work is stopped for a period of thirty days under an order of any court or other public authority through no act of fault of the Contractor or of anyone employed by the Contractor, or if the Work should be stopped for a period of thirty days by the Contractor for the Designer's failure to issue a Certificate for payment as provided in Article 9.6, or for the Owner's failure to make payment thereon as provided in said Article, then the Contractor may, upon seven days' written notice to the Owner and the Designer, terminate the Contract and recover from the Owner, in satisfaction of all claims of the Contractor, payment for all work executed, except those items involved in Designer's failure to issue Certificate, or Owner's failure to make payment.

14.2 Termination by the Owner

14.2.1 If the Contractor should be adjudged bankrupt, or if Contractor should make a general assignment for the benefit of its creditors, or if a receiver should be appointed on account of Contractor's insolvency, or if Contractor should persistently or repeatedly refuse or should fail, except in cases for which extension of time is provided, to supply enough properly skilled workmen or proper materials, or if Contractor should fail to make prompt payment to Subcontractors for materials or labor, or persistently disregard laws, ordinances, rules, regulations or orders of any public authority or otherwise be guilty of a substantial violation of a provision of the Contract Documents, then the Owner, upon certification by the Designer that sufficient cause exists to justify such action, may without prejudice to any right or remedy against the Contractor or its surety and after giving the Contractor and its surety seven days written

notice, terminate the employment of the Contractor and take possession of the site and of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor and finish the Work by whatever method the Owner deems expedient. In such case the Contractor shall not be entitled to receive any further payment until the Work is completed, and an accounting made as set out below.

14.2.2 If the unpaid balance of the Contract sum exceeds the cost of finishing the Work, including compensation for the Designer's additional services such excess shall be paid to the Contractor. If such cost exceeds such unpaid balance, the Contractor shall pay the difference to the Owner. The Designer shall certify the cost incurred by the Owner as herein provided.

END

**STATE OF INDIANA'S**
**STANDARD CONTRACT FOR PUBLIC WORKS CONSTRUCTION PROJECT**
**(For projects estimated more than $150,000)**

**Contract # _____**

**THIS PUBLIC WORKS CONSTRUCTION CONTRACT** ("Contract"), entered into by and between the Indiana Department of Administration's Public Works Division ("State") and **XXXXXXXXXX** ("Contractor"), is executed pursuant to the terms and conditions set forth herein and is governed by Indiana Code 4-13.6, *et seq*. In consideration of those mutual undertakings and covenants, the parties agree as follows for the following Public Works Project:

| | |
|---|---|
| Project Number: | **XXXXXXXXX** |
| Project Name: | **XXXXXXXXX** |
| Designer (if applicable): | **XXXXXXXXX** |
| Purchase Order Number: | **XXXXXXXXX** |
| Institution/Department: | **XXXXXXXXX** |
| Req. No: | **XXXXXXXXX** |

**1. Definitions.** The following definition of "Contract Documents" applies throughout this Contract for the State's Public Works Project Number **XXXXX** ("Project").

The term "Contract Documents" shall mean and include the following: this Contract and the Project Bid Package, which includes but is not limited to the Contractor's Application for Pre-Qualification, the Public Work's Solicitation for Quotation (DAPW 30), Bid Documentation, Pre-Contract Document, General Conditions (DAPW 26), Supplementary Conditions, Instructions to Bidders, Drawings, Specifications, and Addenda issued by the State in connection with the Project and prior to the submission of the Contractor's Proposal.

Subject to Section 39, *Order of Precedence, Incorporation by Reference*, of this Contract, Contract Documents shall also consist of the Contractor's Proposal and Response, as well as any other documentation submitted by it in response to the Project (hereinafter collectively referred to as "Contractor's Proposal").

Additionally, Contract Documents shall include any subsequent amendments, change orders and any written interpretations issued as field orders by the Designer pursuant to General Conditions, Article 1.2 (DAPW 26) and all field orders for minor changes by the Designer pursuant to General Conditions, Article 12.3 (DAPW 26). Change orders and amendments shall be executed in the manner authorized by Section 35, *Merger and Modification*, of this Contract.

When applicable, Contract Documents shall include the Performance Bond and/or the Labor and Materials Payment Bond, as required by IC 4-13.6-7-6 and IC 4-13.6-7-7, and fully described and captured in the General Conditions (DAPW 26).

The Contract Documents are specifically and collectively incorporated herein by reference.

**2. Duties of Contractor.** The Contractor shall furnish all labor and materials, perform all of the work, and otherwise fulfill all of its obligations in conformance with the Contract Documents. These duties are described and captured in the Contract Documents. The Contractor agrees that not less than fifteen percent (15%) of the work, measured in dollar volume, will be performed by its own forces. Any subcontractor

employed for any part of this Contract awarded in excess of One Hundred Fifty Thousand Dollars ($150,000.00) shall be qualified with the State of Indiana's Public Works Division Certification Board and shall have a valid Certificate of Qualification in the prime classification of work for this Contract.

**3. Consideration.** All payments provided herein are subject to appropriations made and funds allocated as provided by laws of the State of Indiana. The State shall pay the Contractor for performance of this Contract in current funds as follows:

BASE BID: **$XXXXXX.XX**
ALTERNATE(S):
TOTAL CONTRACT PRICE: **$XXXXXX.XX**

**4. Term.** The term of this Contract is [X year(s) and/or xx month(s)] commencing on the date of the last state signatory to this Contract.

**5. Licensing Standards.** The Contractor and its employees and subcontractors shall comply with all applicable licensing standards, certification standards, accrediting standards and any other laws, rules or regulations governing services to be provided by the Contractor pursuant to this Contract. The State shall not be required to pay the Contractor for any services performed when the Contractor, its employees or subcontractors are not in compliance with such applicable standards, laws, rules or regulations. If licensure, certification or accreditation expires or is revoked, or if disciplinary action is taken against the applicable licensure, certification or accreditation, the Contractor shall notify the State immediately and the State, at its option, may immediately terminate this Contract.

**6. Escrow Agreement.** Contemporaneously with the execution of this Contract, the parties may provide for the escrow of retained portions of payments to the Contractor by entering into a separate Escrow Agreement, pursuant to IC 4-13.6-7, with an escrow agent described in IC 4-13.6-7-2(b). Should the Contractor elect to escrow retainage, the Escrow Agreement will become a part of this contract as if fully contained herein.

**7. Contractor's Certification.** The Contractor certifies that it has been pre-qualified by the State of Indiana's Public Works Division Certification Board to perform the work and furnish the services required by this Project. The Contractor further certifies that all information and documentation submitted by it in its Application for Prequalification Certification, the Contractor's Proposal and submitted in response to the Project, is true, accurate and complete as of the date of this Contract's effectiveness. The Contractor shall immediately notify the State of any material change to such information. The Contractor shall immediately notify the State if, during the course of performance of this Contract, it or any of its principals are proposed for debarment or ineligibility, or become debarred or declared ineligible, from entering into contracts with the federal government or any department, agency or political subdivision of the State.

**8. Contractor Employee Drug Testing.** Pursuant to IC 4-13-18, the Contractor shall implement the employee drug testing program submitted as part of its Contractor's Proposal. The State may cancel this Contract if it determines that the Contractor:

A. Has failed to implement its employee drug testing program during the term of this Contract;

B. Has failed to provide information regarding implementation of the Contractor's employee drug testing program at the request of the State; or

C. Has provided to the State false information regarding the Contractor's employee drug testing program.

**9. Access to Records**. The Contractor and its subcontractors, if any, shall maintain all books, documents, papers, accounting records, and other evidence pertaining to all costs incurred under this Contract. They shall make such materials available at their respective offices at all reasonable times during this Contract, and for three (3) years from the date of final payment under this Contract, for inspection by the State or its authorized designees. Copies shall be furnished at no cost to the State if requested.

**10. Assignment; Successors**.
A. The Contractor binds its successors and assignees to all the terms and conditions of this Contract. The Contractor may assign its right to receive payments to such third parties as the Contractor may desire without the prior written consent of the State, provided that the Contractor gives written notice (including evidence of such assignment) to the State thirty (30) days in advance of any payment so assigned. The assignment shall cover all unpaid amounts under this Contract and shall not be made to more than one party.

B. The Contractor shall not assign or subcontract the whole or any part of this Contract without the State's prior written consent. Additionally, the Contractor shall provide prompt written notice to the State of any change in the Contractor's legal name or legal status so that the changes may be documented and payments to the successor entity may be made.

**11. Assignment of Antitrust Claims.** As part of the consideration for the award of this Contract, the Contractor assigns to the State all right, title and interest in and to any claims the Contractor now has, or may acquire, under state or federal antitrust laws relating to the products or services which are the subject of this Contract.

**12. Audits**. The Contractor acknowledges that it may be required to submit to an audit of funds paid through this Contract. Any such audit shall be conducted in accordance with IC § 5-11-1, *et seq.*, and audit guidelines specified by the State.

The State considers the Contractor to be a "Contractor" under 2 C.F.R. 200.331 for purposes of this Contract. However, if it is determined that the Contractor is a "subrecipient" and if required by applicable provisions of 2 C.F.R. 200 (Uniform Administrative Requirements, Cost Principles, and Audit Requirements), Contractor shall arrange for a financial and compliance audit, which complies with 2 C.F.R. 200.500 *et seq*.

**13. Authority to Bind Contractor**. The signatory for the Contractor represents that he/she has been duly authorized to execute this Contract on behalf of the Contractor and has obtained all necessary or applicable approvals to make this Contract fully binding upon the Contractor when his/her signature is affixed, and accepted by the State.

**14. Changes in Work**. The Contractor shall not commence any additional work or change the scope of the work until authorized in writing by the State. The Contractor shall make no claim for additional compensation in the absence of a prior written approval and amendment executed by all signatories hereto. This Contract may only be amended, supplemented or modified by a written document executed in the same manner as this Contract.

**15. Compliance with Laws.**

A. The Contractor shall comply with all applicable federal, state, and local laws, rules, regulations, and ordinances, and all provisions required thereby to be included herein are hereby incorporated by reference. The enactment or modification of any applicable state or federal statute or the promulgation of rules or regulations thereunder after execution of this Contract shall be reviewed by the State and the Contractor to determine whether the provisions of this Contract require formal modification.

B. The Contractor and its agents shall abide by all ethical requirements that apply to persons who have a business relationship with the State as set forth in IC § 4-2-6, *et seq*., IC § 4-2-7, *et seq*. and the regulations promulgated thereunder. **If the Contractor has knowledge, or would have acquired knowledge with reasonable inquiry, that a state officer, employee, or special state appointee, as those terms are defined in IC § 4-2-6-1, has a financial interest in the Contract, the Contractor shall ensure compliance with the disclosure requirements in IC § 4-2-6-10.5 prior to the execution of this Contract.** If the Contractor is not familiar with these ethical requirements, the Contractor should refer any questions to the Indiana State Ethics Commission, or visit the Inspector General's website at http://www.in.gov/ig/. If the Contractor or its agents violate any applicable ethical standards, the State may, in its sole discretion, terminate this Contract immediately upon notice to the Contractor. In addition, the Contractor may be subject to penalties under IC §§ 4-2-6, 4-2-7, 35-44.1-1-4, and under any other applicable laws.

C. The Contractor certifies by entering into this Contract that neither it nor its principal(s) is presently in arrears in payment of taxes, permit fees or other statutory, regulatory or judicially required payments to the State of Indiana. The Contractor agrees that any payments currently due to the State of Indiana may be withheld from payments due to the Contractor. Additionally, further work or payments may be withheld, delayed, or denied and/or this Contract suspended until the Contractor is current in its payments and has submitted proof of such payment to the State.

D. The Contractor warrants that it has no current, pending or outstanding criminal, civil, or enforcement actions initiated by the State, and agrees that it will immediately notify the State of any such actions. During the term of such actions, the Contractor agrees that the State may delay, withhold, or deny work under any supplement, amendment, change order or other contractual device issued pursuant to this Contract.

E. If a valid dispute exists as to the Contractor's liability or guilt in any action initiated by the State or its agencies, and the State decides to delay, withhold, or deny work to the Contractor, the Contractor may request that it be allowed to continue, or receive work, without delay. The Contractor must submit, in writing, a request for review to the Indiana Department of Administration (IDOA) following the procedures for disputes outlined herein. A determination by IDOA shall be binding on the parties. Any payments that the State may delay, withhold, deny, or apply under this section shall not be subject to penalty or interest, except as permitted by IC § 5-17-5.

F. The Contractor warrants that the Contractor and its subcontractors, if any, shall obtain and maintain all required permits, licenses, registrations, and approvals, and shall comply with all health, safety, and environmental statutes, rules, or regulations in the performance of work activities for the State. Failure to do so may be deemed a material breach of this Contract and grounds for immediate termination and denial of further work with the State.

G. The Contractor affirms that, if it is an entity described in IC Title 23, it is properly registered and owes no outstanding reports to the Indiana Secretary of State.

H. As required by IC § 5-22-3-7:

(1) The Contractor and any principals of the Contractor certify that:

(A) the Contractor, except for de minimis and nonsystematic violations, has not violated the terms of:

(i) IC §24-4.7 [Telephone Solicitation Of Consumers];

(ii) IC §24-5-12 [Telephone Solicitations]; or

(iii) IC §24-5-14 [Regulation of Automatic Dialing Machines];

in the previous three hundred sixty-five (365) days, even if IC § 24-4.7 is preempted by federal law; and

(B) the Contractor will not violate the terms of IC § 24-4.7 for the duration of the Contract, even if IC §24-4.7 is preempted by federal law.

(2) The Contractor and any principals of the Contractor certify that an affiliate or principal of the Contractor and any agent acting on behalf of the Contractor or on behalf of an affiliate or principal of the Contractor, except for de minimis and nonsystematic violations,

(A) has not violated the terms of IC § 24-4.7 in the previous three hundred sixty-five (365) days, even if IC §24-4.7 is preempted by federal law; and

(B) will not violate the terms of IC § 24-4.7 for the duration of the Contract, even if IC §24-4.7 is preempted by federal law.

**16. Condition of Payment**. All services provided by the Contractor under this Contract must be performed to the State's reasonable satisfaction, as determined at the discretion of the undersigned State representative and in accordance with all applicable federal, state, local laws, ordinances, rules and regulations. The State shall not be required to pay for work found to be unsatisfactory, inconsistent with this Contract or performed in violation of and federal, state or local statute, ordinance, rule or regulation.

**17. Confidentiality of State Information**. The Contractor understands and agrees that data, materials, and information disclosed to the Contractor may contain confidential and protected information. The Contractor covenants that data, material, and information gathered, based upon or disclosed to the Contractor for the purpose of this Contract will not be disclosed to or discussed with third parties without the prior written consent of the State.

The parties acknowledge that the services to be performed by Contractor for the State under this Contract may require or allow access to data, materials, and information containing Social Security numbers maintained by the State in its computer system or other records. In addition to the covenant made above in this section and pursuant to 10 IAC 5-3-1(4), the Contractor and the State agree to comply with the provisions of IC § 4-1-10 and IC § 4-1-11. If any Social Security number(s) is/are disclosed by Contractor, Contractor agrees to pay the cost of the notice of disclosure of a breach of the security of the system in addition to any other claims and expenses for which it is liable under the terms of this contract.

**18. Continuity of Services.**

A. The Contractor recognizes that the service(s) to be performed under this Contract are vital to the State and must be continued without interruption and that, upon Contract expiration, a successor, either the State or another contractor, may continue them. The Contractor agrees to:

1. Furnish phase-in training; and
2. Exercise its best efforts and cooperation to effect an orderly and efficient transition to a successor.

B. The Contractor shall, upon the State's written notice:

1. Furnish phase-in, phase-out services for up to sixty (60) days after this Contract expires; and
2. Negotiate in good faith a plan with a successor to determine the nature and extent of phase-in, phase-out services required. The plan shall specify a training program and a date for transferring responsibilities for each division of work described in the plan, and shall be subject to the State's approval. The Contractor shall provide sufficient experienced personnel during the phase-in, phase-out period to ensure that the services called for by this Contract are maintained at the required level of proficiency.

C. The Contractor shall allow as many personnel as practicable to remain on the job to help the successor maintain the continuity and consistency of the services required by this Contract. The Contractor also shall disclose necessary personnel records and allow the successor to conduct on-site interviews with these employees. If selected employees are agreeable to the change, the Contractor shall release them at a mutually agreeable date and negotiate transfer of their earned fringe benefits to the successor.

D. The Contractor shall be reimbursed for all reasonable phase-in, phase-out costs (i.e., costs incurred within the agreed period after contract expiration that result from phase-in, phase-out operations).

**19. Debarment and Suspension.**

A. The Contractor certifies by entering into this Contract that neither it nor its principals nor any of its subcontractors are presently debarred, suspended, proposed for debarment, declared ineligible or voluntarily excluded from entering into this Contract by any federal agency or by any department, agency or political subdivision of the State of Indiana. The term "principal" for purposes of this Contract means an officer, director, owner, partner, key employee or other person with primary management or supervisory responsibilities, or a person who has a critical influence on or substantive control over the operations of the Contractor.

B. The Contractor certifies that it has verified the state and federal suspension and debarment status for all subcontractors receiving funds under this Contract and shall be solely responsible for any recoupment, penalties or costs that might arise from use of a suspended or debarred subcontractor. The Contractor shall immediately notify the State if any subcontractor becomes debarred or suspended, and shall, at the State's request, take all steps required by the State to terminate its contractual relationship with the subcontractor for work to be performed under this Contract.

**20. Default by State**. If the State, sixty (60) days after receipt of written notice, fails to correct or cure any material breach of this Contract, the Contractor may cancel and terminate this Contract and institute measures to collect monies due up to and including the date of termination.

**21. Disputes.**

A. Should any disputes arise with respect to this Contract, the Contractor and the State agree to act immediately to resolve such disputes. Time is of the essence in the resolution of disputes.

B. The Contractor agrees that, the existence of a dispute notwithstanding, it will continue without delay to carry out all of its responsibilities under this Contract that are not affected by the dispute. Should the Contractor fail to continue to perform its responsibilities regarding all non-disputed work, without delay,

any additional costs incurred by the State or the Contractor as a result of such failure to proceed shall be borne by the Contractor, and the Contractor shall make no claim against the State for such costs.

C. If the parties are unable to resolve a contract dispute between them after good faith attempts to do so, a dissatisfied party shall submit the dispute to the Commissioner of the Indiana Department of Administration for resolution. The dissatisfied party shall give written notice to the Commissioner and the other party. The notice shall include: (1) a description of the disputed issues, (2) the efforts made to resolve the dispute, and (3) a proposed resolution. The Commissioner shall promptly issue a Notice setting out documents and materials to be submitted to the Commissioner in order to resolve the dispute; the Notice may also afford the parties the opportunity to make presentations and enter into further negotiations. Within thirty (30) business days of the conclusion of the final presentations, the Commissioner shall issue a written decision and furnish it to both parties. The Commissioner's decision shall be the final and conclusive administrative decision unless either party serves on the Commissioner and the other party, within ten (10) business days after receipt of the Commissioner's decision, a written request for reconsideration and modification of the written decision. If the Commissioner does not modify the written decision within thirty (30) business days, either party may take such other action helpful to resolving the dispute, including submitting the dispute to an Indiana court of competent jurisdiction. If the parties accept the Commissioner's decision, it may be memorialized as a written Amendment to this Contract if appropriate.

D. The State may withhold payments on disputed items pending resolution of the dispute. The unintentional nonpayment by the State to the Contractor of one or more invoices not in dispute in accordance with the terms of this Contract will not be cause for the Contractor to terminate this Contract, and the Contractor may bring suit to collect these amounts without following the disputes procedure contained herein.

E. With the written approval of the Commissioner of the Indiana Department of Administration, the parties may agree to forego the process described in subdivision C. relating to submission of the dispute to the Commissioner.

F. This paragraph shall not be construed to abrogate provisions of IC § 4-6-2-11 in situations where dispute resolution efforts lead to a compromise of claims in favor of the State as described in that statute. In particular, releases or settlement agreements involving releases of legal claims or potential legal claims of the state should be processed consistent with IC § 4-6-2-11, which requires approval of the Governor and Attorney General.

**22. Drug-Free Workplace Certification.** As required by Executive Order No. 90-5 dated April 12, 1990, issued by the Governor of Indiana, the Contractor hereby covenants and agrees to make a good faith effort to provide and maintain a drug-free workplace. The Contractor will give written notice to the State within ten (10) days after receiving actual notice that the Contractor, or an employee of the Contractor in the State of Indiana, has been convicted of a criminal drug violation occurring in the workplace. False certification or violation of this certification may result in sanctions including, but not limited to, suspension of contract payments, termination of this Contract and/or debarment of contracting opportunities with the State for up to three (3) years.

In addition to the provisions of the above paragraph, if the total amount set forth in this Contract is in excess of $25,000.00, the Contractor certifies and agrees that it will provide a drug-free workplace by:

A. Publishing and providing to all of its employees a statement notifying them that the unlawful manufacture, distribution, dispensing, possession or use of a controlled substance

is prohibited in the Contractor's workplace, and specifying the actions that will be taken against employees for violations of such prohibition;

B. Establishing a drug-free awareness program to inform its employees of (1) the dangers of drug abuse in the workplace; (2) the Contractor's policy of maintaining a drug-free workplace; (3) any available drug counseling, rehabilitation and employee assistance programs; and (4) the penalties that may be imposed upon an employee for drug abuse violations occurring in the workplace;

C. Notifying all employees in the statement required by subparagraph (A) above that as a condition of continued employment, the employee will (1) abide by the terms of the statement; and (2) notify the Contractor of any criminal drug statute conviction for a violation occurring in the workplace no later than five (5) days after such conviction;

D. Notifying the State in writing within ten (10) days after receiving notice from an employee under subdivision (C)(2) above, or otherwise receiving actual notice of such conviction;

E. Within thirty (30) days after receiving notice under subdivision (C)(2) above of a conviction, imposing the following sanctions or remedial measures on any employee who is convicted of drug abuse violations occurring in the workplace: (1) taking appropriate personnel action against the employee, up to and including termination; or (2) requiring such employee to satisfactorily participate in a drug abuse assistance or rehabilitation program approved for such purposes by a federal, state or local health, law enforcement, or other appropriate agency; and

F. Making a good faith effort to maintain a drug-free workplace through the implementation of subparagraphs (A) through (E) above.

**23. Employment Eligibility Verification** As required by IC § 22-5-1.7, the Contractor swears or affirms under the penalties of perjury that the Contractor does not knowingly employ an unauthorized alien. The Contractor further agrees that:

A. The Contractor shall enroll in and verify the work eligibility status of all his/her/its newly hired employees through the E-Verify program as defined in IC § 22-5-1.7-3. The Contractor is not required to participate should the E-Verify program cease to exist. Additionally, the Contractor is not required to participate if the Contractor is self-employed and does not employ any employees.

B. The Contractor shall not knowingly employ or contract with an unauthorized alien. The Contractor shall not retain an employee or contract with a person that the Contractor subsequently learns is an unauthorized alien.

C. The Contractor shall require his/her/its subcontractors, who perform work under this Contract, to certify to the Contractor that the subcontractor does not knowingly employ or contract with an unauthorized alien and that the subcontractor has enrolled and is participating in the E-Verify program. The Contractor agrees to maintain this certification throughout the duration of the term of a contract with a subcontractor.

The State may terminate for default if the Contractor fails to cure a breach of this provision no later than thirty (30) days after being notified by the State.

**24. Employment Option**. If the State determines that it would be in the State's best interest to hire an employee of the Contractor, the Contractor will release the selected employee from any non-competition agreements that may be in effect. This release will be at no cost to the State or the employee.

**25. Force Majeure**. In the event that either party is unable to perform any of its obligations under this Contract or to enjoy any of its benefits because of natural disaster or decrees of governmental bodies not the fault of the affected party (hereinafter referred to as a "Force Majeure Event"), the party who has been so affected shall immediately give notice to the other party and shall do everything possible to resume performance. Upon receipt of such notice, all obligations under this Contract shall be immediately suspended. If the period of nonperformance exceeds thirty (30) days from the receipt of notice of the Force Majeure Event, the party whose ability to perform has not been so affected may, by giving written notice, terminate this Contract.

**26. Funding Cancellation**. As required by Financial Management Circular 3.3 and IC § 5-22-17-5, when the Director of the State Budget Agency makes a written determination that funds are not appropriated or otherwise available to support continuation of performance of this Contract, this Contract shall be canceled. A determination by the Director of State Budget Agency that funds are not appropriated or otherwise available to support continuation of performance shall be final and conclusive.

**27. Governing Law**. This Contract shall be governed, construed, and enforced in accordance with the laws of the State of Indiana, without regard to its conflict of laws rules. Suit, if any, must be brought in the State of Indiana.

**28. HIPAA Compliance.** If this Contract involves services, activities or products subject to the Health Insurance Portability and Accountability Act of 1996 (HIPAA), the Contractor covenants that it will appropriately safeguard Protected Health Information (defined in 45 CFR 160.103), and agrees that it is subject to, and shall comply with, the provisions of 45 CFR 164 Subpart E regarding use and disclosure of Protected Health Information.

**29. Indemnification**. The Contractor agrees to indemnify, defend, and hold harmless the State, its agents, officials, and employees from all claims and suits including court costs, attorney's fees, and other expenses caused by any act or omission of the Contractor and/or its subcontractors, if any, in the performance of this Contract. The State shall **not** provide such indemnification to the Contractor.

**30. Independent Contractor; Workers' Compensation Insurance.** The Contractor is performing as an independent entity under this Contract. No part of this Contract shall be construed to represent the creation of an employment, agency, partnership or joint venture agreement between the parties. Neither party will assume liability for any injury (including death) to any persons, or damage to any property, arising out of the acts or omissions of the agents, employees or subcontractors of the other party. The Contractor shall provide all necessary unemployment and workers' compensation insurance for the Contractor's employees, and Contractor shall provide the State with a Certificate of Insurance evidencing such coverage prior to starting work under this Contract.

**31. Indiana Veteran Owned Small Business Enterprise Compliance**. Award of this Contract was based, in part, on the Indiana Veteran Owned Small Business Enterprise ("IVOSB") participation plan, as detailed in the IVOSB Subcontractor Commitment Form, commonly referred to as "Attachment A-1" in the procurement documentation and incorporated by reference herein. Therefore, any changes to this information during the Contract term must be approved by IDOA's Division of Supplier Diversity and may require an amendment. It is the State's expectation that the Contractor will meet the subcontractor

commitments during the Contract term. The following certified IVOSB subcontractor(s) will be participating in this Contract: **[Add additional IVOSBs using the same format.]**

| IVOSB | COMPANY NAME | PHONE | EMAIL OF CONTACT PERSON | PERCENT |
|---|---|---|---|---|

_____

*Briefly describe the IVOSB service(s)/product(s) to be provided under this Contract and include the estimated date(s) for utilization during the Contract term:*

_____

_____

A copy of each subcontractor agreement must be submitted to the Division of Supplier Diversity within thirty (30) days of the effective date of this Contract. The subcontractor agreements may be uploaded into Pay Audit (Indiana's subcontractor payment auditing system), emailed to IndianaVeteransPreference@idoa.IN.gov, or mailed to IDOA, 402 W. Washington Street, Room W-462, Indianapolis, IN 46204. Failure to provide a copy of any subcontractor agreement may be deemed a violation of the rules governing IVOSB procurement and may result in sanctions allowable under 25 IAC 9-5-2. Requests for changes must be submitted to IndianaVeteransPreference@idoa.IN.gov for review and approval before changing the participation plan submitted in connection with this Contract.

The Contractor shall report payments made to certified IVOSB subcontractors under this Contract on a monthly basis using Pay Audit. The Contractor shall notify subcontractors that they must confirm payments received from the Contractor in Pay Audit. The Pay Audit system can be accessed on the IDOA webpage at: www.in.gov/idoa/mwbe/payaudit.htm. The Contractor may also be required to report IVOSB certified subcontractor payments directly to the Division of Supplier Diversity, as reasonably requested and in the format required by the Division of Supplier Diversity.

The Contractor's failure to comply with the provisions in this clause may be considered a material breach of the Contract.

**32. Information Technology Enterprise Architecture Requirements.** If this Contract involves information technology-related products or services, the Contractor agrees that all such products or services are compatible with any of the technology standards found at https://www.in.gov/iot/2394.htm that are applicable, including the assistive technology standard. The State may terminate this Contract for default if the terms of this paragraph are breached.

**33. Insurance**

A. The Contractor and their subcontractors ( if any) shall secure and keep in force during the term of this Contract the following insurance coverages (if applicable) covering the Contractor for any and all claims of any nature which may in any manner arise out of or result from Contractor's performance under this Contract. The required limits of liability can be obtained with a combination of primary and excess liability policies.

1. Commercial general liability, including contractual coverage, and products or completed operations coverage (if applicable), with minimum liability limits not less than $700,000 per person and $5,000,000 per occurrence unless additional

coverage is required by the State. The State is to be named as an additional insured on a primary, non-contributory basis for any liability arising directly or indirectly under or in connection with this Contract.

2. Automobile liability for owned, non-owned and hired autos with minimum liability limits of $700,000 per person and $5,000,000 per occurrence. The State is to be named as an additional insured on a primary, non-contributory basis.

3. The Contractor shall secure the appropriate Surety or Fidelity Bond(s) as required by the state department served or by applicable statute.

4. The Contractor and their subcontractors shall provide proof of such insurance coverage by tendering to the undersigned State representative a certificate of insurance prior to the commencement of this Contract and proof of workers' compensation coverage meeting all statutory requirements of IC §22-3-2. In addition, proof of an "all states endorsement" covering claims occurring outside the State is required if any of the services provided under this Contract involve work outside of Indiana.

B. The Contractor's insurance coverage must meet the following additional requirements:

1. The insurer must have a certificate of authority or other appropriate authorization to operate in the state in which the policy was issued.

2. Any deductible or self-insured retention amount or other similar obligation under the insurance policies shall be the sole obligation of the Contractor.

3. The State will be defended, indemnified and held harmless to the full extent of any coverage actually secured by the Contractor in excess of the minimum requirements set forth above. The duty to indemnify the State under this Contract shall not be limited by the insurance required in this Contract.

4. The insurance required in this Contract, through a policy or endorsement(s), shall include a provision that the policy and endorsements may not be canceled or modified without thirty (30) days' prior written notice to the undersigned State agency.

5. The Contractor waives and agrees to require their insurer to waive their rights of subrogation against the State of Indiana.

C. Failure to provide insurance as required in this Contract may be deemed a material breach of contract entitling the State to immediately terminate this Contract. The Contractor shall furnish a certificate of insurance and all endorsements to the State before the commencement of this Contract.

**34. Key Person(s)**.

A. If both parties have designated that certain individual(s) are essential to the services offered, the parties agree that should such individual(s) leave their employment during the term of this Contract for whatever reason, the State shall have the right to terminate this Contract upon thirty (30) days' prior written notice.

B. In the event that the Contractor is an individual, that individual shall be considered a key person and, as such, essential to this Contract. Substitution of another for the Contractor shall not be permitted without express written consent of the State.

Nothing in Sections A and B, above shall be construed to prevent the Contractor from using the services of others to perform tasks ancillary to those tasks which directly require the expertise of the key person. Examples of such ancillary tasks include secretarial, clerical, and common labor duties. The Contractor shall, at all times, remain responsible for the performance of all necessary tasks, whether performed by a key person or others.

Key person(s) to this Contract is/are:

**35. Merger & Modification**. This Contract constitutes the entire agreement between the parties. No understandings, agreements, or representations, oral or written, not specified within this Contract will be valid provisions of this Contract. This Contract may not be modified, supplemented, or amended, except by written agreement signed by all necessary parties.

**36. Minority and Women's Business Enterprises Compliance.** Award of this Contract was based, in part, on the Minority and/or Women's Business Enterprise ("MBE" and/or "WBE") participation plan as detailed in the Minority and Women's Business Enterprises Subcontractor Commitment Form, commonly referred to as "Attachment A" in the procurement documentation and incorporated by reference herein**.** Therefore, any changes to this information during the Contract term must be approved by the Division of Supplier Diversity and may require an amendment. It is the State's expectation that the Contractor will meet the subcontractor commitments during the Contract term.

The following Division of Supplier Diversity certified MBE and/or WBE subcontractors will be participating in this Contract: **[Add additional MBEs and WBEs using the same format.]**

| MBE or WBE | COMPANY NAME | PHONE | EMAIL OF CONTACT PERSON | PERCENT |
|---|---|---|---|---|

*Briefly describe the MBE and/or WBE service(s)/product(s) to be provided under this Contract and include the estimated date(s) for utilization during the Contract term:*

A copy of each subcontractor agreement must be submitted to the Division of Supplier Diversity within thirty (30) days of the effective date of this Contract. The subcontractor agreements may be uploaded into Pay Audit (Indiana's subcontractor payment auditing system), emailed to MWBECompliance@idoa.IN.gov, or mailed to Division of Supplier Diversity, 402 W. Washington Street, Indianapolis IN 46204. Failure to provide a copy of any subcontractor agreement may be deemed a violation of the rules governing MBE/WBE procurement and may result in sanctions allowable under 25 IAC 5-7-8. Requests for changes must be submitted to MWBECompliance@idoa.IN.gov for review and approval before changing the participation plan submitted in connection with this Contract.

The Contractor shall report payments made to Division of Supplier Diversity certified subcontractors under this Contract on a monthly basis using Pay Audit. The Contractor shall notify subcontractors that

they must confirm payments received from the Contractor in Pay Audit. The Pay Audit system can be accessed on the IDOA webpage at: www.in.gov/idoa/mwbe/payaudit.htm. The Contractor may also be required to report Division of Supplier Diversity certified subcontractor payments directly to the Division of Supplier Diversity, as reasonably requested and in the format required by the Division of Supplier Diversity.

The Contractor's failure to comply with the provisions in this clause may be considered a material breach of the Contract.

**37. Nondiscrimination**. Pursuant to the Indiana Civil Rights Law, specifically including IC § 22-9-1-10, and in keeping with the purposes of the federal Civil Rights Act of 1964, the Age Discrimination in Employment Act, and the Americans with Disabilities Act, the Contractor covenants that it shall not discriminate against any employee or applicant for employment relating to this Contract with respect to the hire, tenure, terms, conditions or privileges of employment or any matter directly or indirectly related to employment, because of the employee's or applicant's race, color, national origin, religion, sex, age, disability, ancestry, status as a veteran, or any other characteristic protected by federal, state, or local law ("Protected Characteristics"). Contractor certifies compliance with applicable federal laws, regulations, and executive orders prohibiting discrimination based on the Protected Characteristics in the provision of services. Breach of this paragraph may be regarded as a material breach of this Contract, but nothing in this paragraph shall be construed to imply or establish an employment relationship between the State and any applicant or employee of the Contractor or any subcontractor.

The State is a recipient of federal funds, and therefore, where applicable, Contractor and any subcontractors shall comply with requisite affirmative action requirements, including reporting, pursuant to 41 CFR Chapter 60, as amended, and Section 202 of Executive Order 11246 as amended by Executive Order 13672.

**38. Notice to Parties.** Whenever any notice, statement or other communication is required under this Contract, it will be sent by E-mail or first-class U.S. mail service to the following addresses, unless otherwise specifically advised. Such notice, statement or other communication shall include the Public Works Project Number in the subject line of the E-mail and the body of the notice or other communication.

A. Notices to the State shall be sent to:

Public Works Division, Director
Indiana Department of Administration
402 W Washington St Room W462
Indianapolis, IN 46204
E-mail: rgrossman@idoa.IN.gov

B. Notices to the Contractor shall be sent to:

**[INSERT CONTRACTOR NAME]**
**[INSERT CONTRACTOR'S ADDRESS]**
**E-mail:** _____

As required by IC § 4-13-2-14.8, payments to the Contractor shall be made via electronic funds transfer in accordance with instructions filed by the Contractor with the Indiana Auditor of State.

**39. Order of Precedence; Incorporation by Reference.** Any inconsistency or ambiguity in this Contract shall be resolved by giving precedence in the following order: (1) this Contract, (2) the Project Bid Package, (3) attachments prepared by the State; (4) Contractor's Proposal; and (5) attachments prepared by the

Contractor. All of the foregoing are incorporated fully by reference. All attachments, and all documents referred to in this paragraph are hereby incorporated fully by reference.

**40. Ownership of Documents and Materials.**

A. All documents, records, programs, applications, data, algorithms, film, tape, articles, memoranda, and other materials (the "Materials") not developed or licensed by the Contractor prior to execution of this Contract, but specifically developed under this Contract shall be considered "work for hire" and the Contractor hereby transfers and assigns any ownership claims to the State so that all Materials will be the property of the State. If ownership interest in the Materials cannot be assigned to the State, the Contractor grants the State a non-exclusive, non-cancelable, perpetual, worldwide royalty-free license to use the Materials and to use, modify, copy and create derivative works of the Materials.

B. Use of the Materials, other than related to contract performance by the Contractor, without the prior written consent of the State, is prohibited. During the performance of this Contract, the Contractor shall be responsible for any loss of or damage to the Materials developed for or supplied by the State and used to develop or assist in the services provided while the Materials are in the possession of the Contractor. Any loss or damage thereto shall be restored at the Contractor's expense. The Contractor shall provide the State full, immediate, and unrestricted access to the Materials and to Contractor's work product during the term of this Contract.

**41. Payments**.

A. All payments shall be made thirty five (35) days in arrears in conformance with State fiscal policies and procedures and, as required by IC §4-13-2-14.8, the direct deposit by electronic funds transfer to the financial institution designated by the Contractor in writing unless a specific waiver has been obtained from the Indiana Auditor of State. No payments will be made in advance of receipt of the goods or services that are the subject of this Contract except as permitted by IC § 4-13-2-20.

B. If the Contractor is being paid in advance for the maintenance of equipment, software or a service as a subscription, then pursuant to IC § 4-13-2-20(b)(14), the Contractor agrees that if it fails to fully provide or perform under this Contract, upon receipt of written notice from the State, it shall promptly refund the consideration paid, pro-rated through the date of non-performance.

**42. Penalties/Interest/Attorney's Fees**. The State will in good faith perform its required obligations hereunder and does not agree to pay any penalties, liquidated damages, interest or attorney's fees, except as permitted by Indiana law, in part, IC § 5-17-5, IC § 34-54-8, IC § 34-13-1 and IC § 34-52-2.

Notwithstanding the provisions contained in IC § 5-17-5, any liability resulting from the State's failure to make prompt payment shall be based solely on the amount of funding originating from the State and shall not be based on funding from federal or other sources.

**43. Progress Reports**. The Contractor shall submit progress reports to the State upon request. The report shall be oral, unless the State, upon receipt of the oral report, should deem it necessary to have it in written form. The progress reports shall serve the purpose of assuring the State that work is progressing in line with the schedule, and that completion can be reasonably assured on the scheduled date.

**44. Public Record.**
The Contractor acknowledges that the State will not treat this Contract as containing confidential information, and the State will post this Contract on the transparency portal as required by Executive

Order 05-07 and IC § 5-14-3.5-2. Use by the public of the information contained in this Contract shall not be considered an act of the State.

**45. Renewal Option**. This Contract may be renewed under the same terms and conditions, subject to the approval of the Commissioner of the Department of Administration and the State Budget Director in compliance with IC § 5-22-17-4. The term of the renewed contract may not be longer than the term of the original contract.

**46. Severability**. The invalidity of any section, subsection, clause or provision of this Contract shall not affect the validity of the remaining sections, subsections, clauses or provisions of this Contract.

**47. Substantial Performance.** This Contract shall be deemed to be substantially performed only when fully performed according to its terms and conditions and any written amendments or supplements.

**48. Taxes**. The State is exempt from most state and local taxes and many federal taxes. The State will not be responsible for any taxes levied on the Contractor as a result of this Contract.

**49. Termination for Convenience**. This Contract may be terminated, in whole or in part, by the State, which shall include and is not limited to the Indiana Department of Administration and the State Budget Agency whenever, for any reason, the State determines that such termination is in its best interest. Termination of services shall be effected by delivery to the Contractor of a Termination Notice at least thirty (30) days prior to the termination effective date, specifying the extent to which performance of services under such termination becomes effective. The Contractor shall be compensated for services properly rendered prior to the effective date of termination. The State will not be liable for services performed after the effective date of termination. The Contractor shall be compensated for services herein provided but in no case shall total payment made to the Contractor exceed the original contract price or shall any price increase be allowed on individual line items if canceled only in part prior to the original termination date. For the purposes of this paragraph, the parties stipulate and agree that the Indiana Department of Administration shall be deemed to be a party to this agreement with authority to terminate the same for convenience when such termination is determined by the Commissioner of IDOA to be in the best interests of the State.

**50. Termination for Default.**

A. With the provision of thirty (30) days' notice to the Contractor, the State may terminate this Contract in whole or in part if the Contractor fails to:

1. Correct or cure any breach of this Contract; the time to correct or cure the breach may be extended beyond thirty (30) days if the State determines progress is being made and the extension is agreed to by the parties;
2. Deliver the supplies or perform the services within the time specified in this Contract or any extension;
3. Make progress so as to endanger performance of this Contract; or
4. Perform any of the other provisions of this Contract.

B. If the State terminates this Contract in whole or in part, it may acquire, under the terms and in the manner the State considers appropriate, supplies or services similar to those terminated, and the Contractor will be liable to the State for any excess costs for those supplies or services. However, the Contractor shall continue the work not terminated.

C. The State shall pay the contract price for completed supplies delivered and services accepted. The Contractor and the State shall agree on the amount of payment for manufacturing materials delivered and accepted and for the protection and preservation of the property. Failure to agree will be a dispute under the Disputes clause. The State may withhold from these amounts any sum the State determines to be necessary to protect the State against loss because of outstanding liens or claims of former lien holders.

D. The rights and remedies of the State in this clause are in addition to any other rights and remedies provided by law or equity or under this Contract.

**51. Travel**. No expenses for travel will be reimbursed unless specifically authorized by this Contract. Permitted expenses will be reimbursed at the rate paid by the State and in accordance with the *Indiana Department of Administration's Travel Policies and Procedures* in effect at the time the expenditure is made. Out-of-state travel requests must be reviewed by the State for availability of funds and for conformance with *Travel Policy* guidelines.

**52. Waiver of Rights**. No right conferred on either party under this Contract shall be deemed waived, and no breach of this Contract excused, unless such waiver is in writing and signed by the party claimed to have waived such right. Neither the State's review, approval or acceptance of, nor payment for, the services required under this Contract shall be construed to operate as a waiver of any rights under this Contract or of any cause of action arising out of the performance of this Contract, and the Contractor shall be and remain liable to the State in accordance with applicable law for all damages to the State caused by the Contractor's negligent performance of any of the services furnished under this Contract.

**53. Work Standards**. The Contractor shall execute its responsibilities by following and applying at all times the highest professional and technical guidelines and standards. If the State becomes dissatisfied with the work product of or the working relationship with those individuals assigned to work on this Contract, the State may request in writing the replacement of any or all such individuals, and the Contractor shall grant such request.

**THE REMAINDER OF THIS PAGE HAS BEEN INTENTIONALLY LEFT BLANK.**

**Non-Collusion and Acceptance**

The undersigned attests, subject to the penalties for perjury, that the undersigned is the Contractor, or that the undersigned is the properly authorized representative, agent, member or officer of the Contractor. Further, to the undersigned's knowledge, neither the undersigned nor any other member, employee, representative, agent or officer of the Contractor, directly or indirectly, has entered into or been offered any sum of money or other consideration for the execution of this Contract other than that which appears upon the face hereof. **Furthermore, if the undersigned has knowledge that a state officer, employee, or special state appointee, as those terms are defined in IC 4-2-6-1, has a financial interest in the Contract, the Contractor attests to compliance with the disclosure requirements in IC 4-2-6-10.5.**

**Agreement to Use Electronic Signatures**

I agree, and it is my intent, to sign this Contract by accessing State of Indiana Supplier Portal using the secure password assigned to me and by electronically submitting this Contract to the State of Indiana. I understand that my signing and submitting this Contract in this fashion is the legal equivalent of having placed my handwritten signature on the submitted Contract and this affirmation. I understand and agree that by electronically signing and submitting this Contract in this fashion I am affirming to the truth of the information contained herein. I understand that this Contract will not become binding on the State until it has been approved by the Department of Administration, the State Budget Agency, and the Office of the Attorney General, which approvals will be posted on the Active Contracts Database: https://secure.in.gov/apps/idoa/contractsearch/

**IN WITNESS WHEREOF**, the Contractor and the State have, through their duly authorized representatives, entered into this Contract for Public Works Project Number **XXXXX**. The parties, having read and understood the foregoing terms of this Contract, do by their respective signatures dated below agree to the terms thereof.

**Contractor: XXXXXXXXXX**

By: _____
Printed Name: _____
Title: _____

Date: _____

**Department of Administration**
**Public Works Division**

By: _____
Robert Grossman, Director
*For IDOA Commissioner if less than $10,000,000*

Date: _____

**Approved by:**
Department of Administration

By: _____(for)
Rebecca Holwerda, Commissioner

Date: _____

**Approved by:**
State Budget Agency

By: _____ (for)
Zachary Q. Jackson, Director

Date: _____

**Approved as to Form and Legality:**
***Form approval has been granted by the Office of the Attorney General pursuant to IC 4-13-2-14.3(e) on October 5, 2022. FA 22-49***

This document prepared and reviewed by:

_____
Counsel, Indiana Department of Administration

**STATE OF INDIANA'S**
**PUBLIC WORKS CONSTRUCTION CONTRACT**
**CHANGE ORDER/AMENDMENT #_**
**Contract # _____**

**THIS IS AMENDMENT #_** to the Public Works Construction Contract ("Contract") entered into by and between the Indiana Department of Administration's Public Works Division ("State") and **XXXXXXXXXX** ("Contractor"), executed pursuant to the terms and conditions set forth herein, governed by Indiana Code 4-13.6, *et seq*. and approved by the last State signatory on _____.

In consideration of the mutual undertakings and covenants hereinafter set forth, the parties agree to amend the Contract as follows:

1. A written change has been requested by the Contractor, as detailed in **Amendment #_ Exhibit A,** attached hereto and incorporated herein, in connection with the following Public Works Project:

| | |
|---|---|
| Project Number: | **XXXXXXXXX** |
| Project Name: | **XXXXXXXXX** |
| Designer (if applicable): | **XXXXXXXXX** |
| Purchase Order Number: | **XXXXXXXXX** |
| Institution Department: | **XXXXXXXXX** |
| Req. No: | **XXXXXXXXX** |
| Change Order No: | **XXXXXXXXX** |

2. [ ] The Designer has recommended the Contractor's change in writing, as evidenced by **Amendment #_ Exhibit _**, attached hereto and incorporated herein.
[ ] No Designer has been contracted for this Project.

3. The State has approved the change request, as detailed in **Amendment #_ Exhibit B**, attached hereto and incorporated herein.

4. The consideration for this Amendment #_ is as follows:

| | |
|---|---|
| ORIGINAL CONTRACT VALUE | $_____ |
| TOTAL PREVIOUS AMENDMENT VALUE | $_____ |
| PRE-AMENDMENT CONTRACT TOTAL | $_____ |
| [ ] INCREASE/[ ] DECREASE THIS AMENDMENT | $_____ |
| [ ] INCREASE/[ ] DECREASE REMEDIATION ALLOWANCE | $_____ |
| **NEW CONTRACT TOTAL REMUNERATION** | $_____ |

This change represents a **$XX,XXX** [ ] increase/[ ] decrease in the original contract and a $**XX,XXX** [ ] increase/ [ ] decrease in remediation allowance, for a total [ ] increase/[ ] decrease of $**XX,XXX**.
Retainage [ ] will/ [ ] will not be withheld on this change order amount.

5. The term of this Contract is hereby [ ] extended for an additional **XXX** days.
[ ] decreased by **XXX** days.
[ ] remains the same.
Therefore, the Contract shall terminate on _____.

6. **A. Minority and Women's Business Enterprises Compliance.** ***Include one of the options, as applicable; delete the inapplicable option.***

***OPTION 1*-to be used if the MBE and/or WBE subcontractor(s) will continue to be utilized during the extension period.**

As required by 25 IAC 5-6-2(b), the following Division of Supplier Diversity certified MBE or WBE subcontractor(s) will be participating in this Contract under this Change Order/Amendment. This participation represents [ ] the same percentage or [ ] an increase of ___ % above the original MBE and/or WBE commitment. **[Add additional MBEs and WBEs using the same format.]**

| MBE or WBE | COMPANY NAME | PHONE | EMAIL OF CONTACT PERSON | PERCENT |
|---|---|---|---|---|

*Briefly describe the MBE and/or WBE service(s)/product(s) to be provided under this Amendment and include the estimated date(s) for utilization during the extension period:*

A copy of each subcontractor agreement must be submitted to the Division of Supplier Diversity within thirty (30) days of the effective date of this Amendment. The subcontractor agreements may be uploaded into Pay Audit (Indiana's subcontractor payment auditing system), emailed to MWBECompliance@idoa.IN.gov, or mailed to Division of Supplier Diversity, 402 W. Washington Street, RoomW-462, Indianapolis IN 46204. Failure to provide a copy of any subcontractor agreement may be deemed a violation of the rules governing MBE/WBE procurement and may result in sanctions allowable under 25 IAC 5-7-8. Requests for changes must be submitted to MWBECompliance@idoa.IN.gov for review and approval before changing the participation plan submitted in connection with this Amendment.

The Contractor shall report payments made to Division of Supplier Diversity certified subcontractors under this Contract on a monthly basis using Pay Audit. The Contractor shall notify subcontractors that they must confirm payments received from Contractor in Pay Audit. The Pay Audit system can be accessed on the IDOA webpage at: www.in.gov/idoa/mwbe/payaudit.htm. Contractor may also be required to report Division of Supplier Diversity certified subcontractor payments directly to the Division of Supplier Diversity, as reasonably requested and in the format required by the Division of Supplier Diversity.

Contractor's failure to comply with the provisions in this clause may be considered a material breach of the Contract.

***OPTION 2* – to be used if the original Contract identified subcontractors in this clause, but the Contractor will not be utilizing the MBE and WBE subcontractors during the extension period.**

No certified MBE or WBE subcontractors will be participating in this Contract under this Change Order/Amendment.

**B. Indiana Veteran Owned Small Business Enterprises Compliance.** ***Include one of the options, as applicable; delete the inapplicable option.***

***OPTION 1*-to be used if the IVOSB subcontractor(s) will continue to be utilized during the extension period.**

As required by 25 IAC 9-4-1(b), the following certified IVOSB subcontractors will be participating in this Contract under this Change Order/Amendment. This participation represents [ ] the same percentage or [ ] an increase of ___ % above the original IVOSB commitment. **[Add additional IVOSBs using the same format.]**

| IVOSB | COMPANY NAME | PHONE | EMAIL OF CONTACT PERSON | PERCENT |
|---|---|---|---|---|

_____

*Briefly describe the IVOSB service(s)/product(s) to be provided under this Amendment and include the estimated date(s) for utilization during the extension period:*

_____

_____

A copy of each subcontractor agreement must be submitted to IDOA's Division of Supplier Diversity within thirty (30) days of the effective date of this Amendment. The subcontractor agreements may be uploaded into Pay Audit (Indiana's subcontractor payment auditing system), emailed to IndianaVeteransPreference@idoa.IN.gov, or mailed to IDOA, 402 W. Washington Street, Room W-462, Indianapolis, IN 46204. Failure to provide a copy of any subcontractor agreement may be deemed a violation of the rules governing IVOSB procurement and may result in sanctions allowable under 25 IAC 9-5-2. Requests for changes must be submitted to IndianaVeteransPreference@idoa.IN.gov for review and approval before changing the participation plan submitted in connection with this Amendment.

The Contractor shall report payments made to certified IVOSB subcontractors under this Contract on a monthly basis using Pay Audit. The Contractor shall notify subcontractors that they must confirm payments received from Contractor in Pay Audit. The Pay Audit system can be accessed on the IDOA webpage at: www.in.gov/idoa/mwbe/payaudit.htm. The Contractor may also be required to report IVOSB certified subcontractor payments directly to the Division of Supplier Diversity, as reasonably requested and in the format required by the Division of Supplier Diversity.

The Contractor's failure to comply with the provisions in this clause may be considered a material breach of the Contract.

***OPTION 2* – to be used if the original Contract identified subcontractors in this clause, but the Contractor will not be utilizing the IVOSB subcontractors during the extension period.**

No certified IVOSB subcontractors will be participating in this Contract under this Change Order/Amendment.

_____

**All matters set forth in the original Contract and not affected by this Amendment shall remain in full force and effect.**

**Non-Collusion and Acceptance**

The undersigned attests, subject to the penalties for perjury, that the undersigned is the Contractor, or that the undersigned is the properly authorized representative, agent, member or officer of the Contractor. Further, to the undersigned's knowledge, neither the undersigned nor any other member, employee, representative, agent or officer of the Contractor, directly or indirectly, has entered into or been offered any sum of money or other consideration for the execution of this Amendment other than that which appears upon the face hereof. **Furthermore, if the undersigned has knowledge that a state officer, employee, or special state appointee, as those terms are defined in IC 4-2-6-1, has a financial interest in the Contract, the Contractor attests to compliance with the disclosure requirements in IC 4-2-6-10.5.**

**Agreement to Use Electronic Signatures**

I agree, and it is my intent, to sign this Contract by accessing State of Indiana Supplier Portal using the secure password assigned to me and by electronically submitting this Contract to the State of Indiana. I understand that my signing and submitting this Contract in this fashion is the legal equivalent of having placed my handwritten signature on the submitted Contract and this affirmation. I understand and agree that by electronically signing and submitting this Contract in this fashion I am affirming to the truth of the information contained therein. I understand that this Contract will not become binding on the State until it has been approved by the Department of Administration, the State Budget Agency, and the Office of the Attorney General, which approvals will be posted on the Active Contracts Database: https://secure.in.gov/apps/idoa/contractsearch/

**In Witness Whereof**, the Contractor and the State have, through their duly authorized representatives, entered into this Amendment for Public Works Project Number **XXXXX**. The parties, having read and understood the foregoing terms of this Amendment, do by their respective signatures dated below agree to the terms thereof.

**Contractor: XXXXXXXXXX**

By: _____
Printed Name: _____
Title: _____

Date: _____

**Department of Administration**
**Public Works Division**

By: _____
Robert Grossman, Director
*For IDOA Commissioner if less than $10,000,000*

Date: _____

**Approved by:**
Department of Administration

By: _____ (for)
Rebecca Holwerda, Commissioner

Date: _____

**Approved by:**
State Budget Agency *PURSUANT TO IC 4-13-2-14.1 APPROVAL OF THE BUDGET AGENCY IS NOT REQUIRED FOR CONTRACTS UNDER $100,000.00*

By: _____ (for)
Zachary Q. Jackson, Director

Date: _____

**Approved as to Form and Legality:**
***Form approval has been granted by the Office of the Attorney General pursuant to IC 4-13-2-14.3(e) on October 5, 2022.***
***FA 22-48***

This document prepared and reviewed by:

_____
Counsel, Indiana Department of Administration

**CONSTRUCTION CONTRACT CHANGE ORDER/AMENDMENT #_**

**AMENDMENT #_ EXHIBIT A**

**See Documents to Follow for Exhibit**

**CONSTRUCTION CONTRACT CHANGE ORDER/AMENDMENT #_**

**AMENDMENT #_ EXHIBIT B**

**See Documents to Follow for Exhibit**

# CERTIFICATE OF SUBSTANTIAL COMPLETION

State Form 1084 (R / 10-22) / DAPW 5

INDIANA PUBLIC WORKS PROJECT NUMBER: _____

PROJECT NAME: _____

TO: Department of Administration
State of Indiana

THROUGH: Director Public Works

DESIGNER: _____

CONTRACTOR: _____

CONTRACT FOR: _____
(GENERAL, MECHANICAL, ELECTRICAL, OTHER)

CONTRACT DATE: _____ CONTRACTOR P.O.NO: _____

PROJECT OR DESIGNATED AREA SHALL INCLUDE: _____

The contractor hereby certifies the Work of this project to be in complete conformance to the Contract Documents and to be substantially complete, enabling the Owner to make use of the Work as intended.

By his signature below the Contractor further requests Designer and Owner to inspect the Work and to concur in the Work's substantial completion by their signature and/or to provide in a timely manner to Contractor a listing of work items adjudged by them as remaining to be completed or corrected. Contractor agrees to complete and correct all work items representative of such listing within ___ days from date of receipt from designer.

Contractor Company Name _____ By *(written) (typed or printed)* _____ Date
*(Shall be signed by same representative who signed Contract)*

A list of items to be completed or corrected, verified by the Designer and Owner, is (is not) appended hereto. Failure to include any incomplete items on such list does not alter the responsibility of the Contractor to provide all Work in complete conformance with the Contract Documents.

Designer Company Name _____ By *(written) (typed or printed)* _____ Date
*(Shall be signed by Designer of Record with Certification Responsibility to the State of Indiana)*

The Work performed under this Contract has been reviewed and found to be substantially complete by the Director of Public Works who has hereby established the Date of Substantial Completion as _____ which is also the date of commencement of all warranties and guarantees required by the Contract Documents. The Date of Substantial Completion of the Work or designated portion thereof is the date established by the Director of Public Works when construction is sufficiently complete, in accordance with the Contract Documents, so the Owner may occupy the Work, or designated portion thereof, for the use for which it is intended.

The Owner accepts the Work or designated portion thereof as substantially complete and assumes full possession thereof, in accordance with the contract documents.

STATE OF INDIANA _____ _____
Owner By: Director Public Works Date
*(Shall be signed by Director of Public Works as Owner's representative)*

The responsibilities of the Owner and the Contractor for maintenance, heat, utilities, and insurance shall be as set out in the Contract Documents.

# DOCUMENT 00 31 19 - EXISTING CONDITION INFORMATION

## 1.1 EXISTING CONDITION INFORMATION

A. This Document with its referenced attachments is part of the Procurement and Contracting Requirements for Project. They provide Owner's information for Bidders' convenience and are intended to supplement rather than serve in lieu of the Bidders' own investigations. They are made available for Bidders' convenience and information, but are not a warranty of existing conditions. This Document and its attachments are not part of the Contract Documents.

B. Division of Historic Preservation & Archaeology Letter (DHPA #25912) is appended to this Document.

C. Related Requirements:
   1. Document 003132 "Geotechnical Data" for reports and soil-boring data from geotechnical investigations that are made available to bidders.

END OF DOCUMENT

DNR Indiana Department of Natural Resources

Eric Holcomb, Governor
Daniel W. Bortner, Director

Division of Historic Preservation & Archaeology·402 W. Washington Street, W274·Indianapolis, IN 46204-2739
Phone 317-232-1646·Fax 317-232-0693·dhpa@dnr.IN.gov

January 25, 2022

Darren Egbert
IDNR, Fish and Wildlife Area
402 W. Washington Street, Room 2
Indianapolis, Indiana 46204

Federal Agency: US Fish and Wildlife Service

State Agency: Department of Natural Resources, Division of Fish and Wildlife

Re: Phase Ia archaeological field reconnaissance report (12/10/2021) for the construction of new shop buildings at Deer Creek Fish and Wildlife Area (DHPA #25912)

Dear Mr. Egbert:

Pursuant to Section 106 of the National Historic Preservation Act (54 U.S.C. § 306108), 36 C.F.R. Part 800, IC 14-21-1-18, and 312 IAC 20-4, the staff of the Indiana State Historic Preservation Officer ("Indiana SHPO") has conducted an analysis of the materials received by the DHPA on December 30, 2021 for the above indicated project at Deer Creek Fish and Wildlife areas in Putnam County, Indiana.

In terms of archaeology, thank you for the archaeological report for the Deer Creek project location. No currently known archaeological resources have been recorded within this proposed project area. No further archaeological investigations appear necessary. If any archaeological artifacts or human remains are uncovered during construction, state law (Indiana Code 14-21-1) requires that the discovery must be reported to the IDNR within two (2) business days. In that event, please call (317) 232-1646.

*A copy of the revised 36 C.F.R. Part 800 that went into effect on August 5, 2004, may be found on the Internet at www.achp.gov for your reference.* If you have questions about archaeological issues please contact Cathy Draeger-Williams at (317) 234-3791 or cdraeger-williams@dnr.IN.gov. Additionally, in all future correspondence regarding the above indicated project, please refer to DHPA #25912.

Very truly yours,

Beth K. McCord
Deputy State Historic Preservation Officer

BKM:CDW:cdw

emc: Darren Egbert, DNR

# DOCUMENT 00 31 32 - GEOTECHNICAL DATA

## 1.1 GEOTECHNICAL DATA

A. This Document with its referenced attachments is part of the Procurement and Contracting Requirements for Project. They provide Owner's information for Bidders' convenience and are intended to supplement rather than serve in lieu of Bidders' own investigations. They are made available for Bidders' convenience and information. This Document and its attachments are not part of the Contract Documents.

B. Because subsurface conditions indicated by the soil borings are a sampling of areas at another location on the property and for other reasons, the Owner, the Architect, the Architect's consultants, and the firm reporting the subsurface conditions do not warranty the conditions of the site. Any party using the information described in the soil borings and geotechnical report shall accept full responsibility for its use.

C. Two geotechnical investigation reports, prepared by Terracon, dated 02-19-2021 and 10-05-21, are appended to this Document.

1. The opinions expressed in this report are those of a geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by a geotechnical engineer. Owner is not responsible for interpretations or conclusions drawn from the data.
2. Any party using information described in the geotechnical report shall make additional test borings and conduct other exploratory operations that may be required to determine the character of subsurface materials that may be encountered.

D. Related Requirements:
1. Document 003119 "Existing Condition Information" for information about existing conditions that is made available to bidders.

END OF DOCUMENT

# Geotechnical Engineering Report

**Deer Creek Storage Facility**
**Greencastle, Indiana**
February 19, 2021
Terracon Project No. CJ205540

**Prepared for:**
Indiana Department of Natural Resources
Indianapolis, Indiana

**Prepared by:**
Terracon Consultants, Inc.
Indianapolis, Indiana

February 19, 2021

Indiana Department of Natural Resources
402 West Washington Street, Room W-299
Indianapolis, IN 46204

Attn: Ms. Deborah A. Kuehn
P: (574) 360 5839
E: DKuehn1@dnr.in.gov

Re: Geotechnical Engineering Report
Deer Creek Storage Facility
Deer Creek Fish & Wildlife
Greencastle, Indiana
Terracon Project No. CJ205540

Dear Ms. Kuehn:

In accordance with your request, we have completed our Geotechnical Engineering services for the referenced project. This evaluation was performed in general accordance with Terracon Proposal No. PCJ205540, dated December 15, 2020. This report presents the results of our subsurface exploratory and laboratory testing programs and provides geotechnical recommendations concerning earthwork and the design and construction of foundations.

We have enjoyed working with you on this project. If you have any questions concerning this report or require further assistance, feel free to contact us.

Sincerely,
**Terracon Consultants, Inc.**

Yongwan Kwon, P.E.
Project Engineer

Tanner Hill, P.E.
Project Engineer

## REPORT TOPICS



## ATTACHMENTS



**Note:** Refer to each individual Attachment for a listing of contents.

# Geotechnical Engineering Report

## Deer Creek Storage Facility
## Deer Creek Fish & Wildlife
## Greencastle, Indiana

**Terracon Project No. CJ205540**
**February 19, 2021**

## INTRODUCTION

This report presents the results of our subsurface exploration and geotechnical engineering services performed for the proposed storage facility within the Deer Creek Fish & Wildlife area in Greencastle. The purpose of these services is to provide information and geotechnical engineering recommendations relative to:

- Subsurface conditions
- Groundwater conditions
- Site preparation and earthwork
- Foundation design and construction
- Dewatering considerations
- Seismic site classification per IBC
- Excavation considerations

The geotechnical engineering Scope of Services for this project included the advancement of two test borings to a depth of approximately 19¼ ft below existing site grades.

Maps showing the site and boring location are shown in the **Site Location** and **Exploration Plan** sections, respectively. The results of the laboratory testing performed on soil samples obtained from the site during the field exploration are included on the boring logs and/or as separate graphs in the **Exploration Results** section.

## SITE CONDITIONS

The following description of site conditions is derived from our site visit in association with the field exploration and our review of publicly available geologic and topographic maps.

| Item | Description |
|---|---|
| **Parcel Information** | ■ The project site is located within the Deer Creek Fish & Wildlife area in Greencastle.<br>■ Approximate center of project area is located near:<br>o Latitude: 39.55742<br>o Longitude: -86.8872<br>■ See **Site Location**. |

| Item | Description |
|---|---|
| **Existing Improvements** | The project area is currently occupied by the existing Deer Creek Fish and Wildlife facility. |
| **Current Ground Cover** | Topsoil (4 in.) |
| **Existing Topography** | Based on topographic information obtained from the Indiana Map GIS System, the project area Ground surface elevations at the boring locations ranged from El. 760 to 762. The ground surface generally slopes down from south to north. |

## PROJECT DESCRIPTION

Our understanding of the project is as follows:

| Item | Description |
|---|---|
| **Information Provided** | Information for the project was provided by Deborah Kuehn of Indiana Department of Natural Resources (IDNR) in an email dated December 11, 2020.<br>■ Scope of Work<br>■ Deer Creek Conceptual Site plan<br>■ Fish & Wildlife Structure Surveys<br>■ Deer Creek Site Map |
| **Project Description** | We understand the project consists of the construction of a new single-story building. |
| **Proposed Structures** | We anticipate the proposed structure to consist of a single-story wood frame building with a slab-on-grade floor system. |
| **Maximum Loads** | Information was not available at the time of this report. |
| **Finished Floor Elevation** | Information was not available at the time of this report. |
| **Grading/Slopes** | Based on our observations of the site and our understanding of the project, we anticipate less than about 2 to 3 ft of earth cuts/fills will be required to achieve finished grades. |
| **Estimated Start of Construction** | The construction schedule was not available at the time of this report. |

## GEOTECHNICAL CHARACTERIZATION

We have developed a general characterization of the subsurface conditions based upon our review of the subsurface exploration, laboratory data, geologic setting and our understanding of the project. This characterization, termed GeoModel, forms the basis of our geotechnical calculations and evaluation of site preparation and foundation options. Conditions encountered at

each exploration point are indicated on the logs. The logs can be found in the **Exploration Results** section, and the GeoModel can be found in the **Figures** section of this report.

As part of our analyses, we identified the following model layers within the subsurface profile. For a more detailed view of the model layer depths at each boring location, refer to the GeoModel.

| Model Layer | Layer Name | General Description |
|---|---|---|
| **1** | **Lean Clay** | With sand, trace gravel; brown; medium stiff to hard |
| **2** | **Lean Clay** [1] **(Residual)** | Gray; hard |

1. Residual soils are formed in-place by complete mechanical disintegration and/or chemical weathering of their parental rock.

Groundwater level observations were made during and at completion of the sampling process. No groundwater was observed during the relatively short time frame of our field activities.

A review of the *Soil Survey of Putnam County, Indiana* indicates that the soils in the project area are prone to a seasonal high water level (i.e., perched) within about 2½ ft below the surface. As additional input, a review of publicly available water well information from the Indiana Map GIS system (https://maps.indiana.edu) indicated the groundwater level is typically near 30 ft below the surface at an Indiana Department of Natural Resources (IDNR) well site (Well Reference No.:292389) located about 500 ft west of the project area.

It should be recognized that groundwater levels will fluctuate due to changes in precipitation, infiltration, surface run-off, and other hydrogeological factors. Therefore, groundwater levels during construction or at other times in the life of the structure may be higher or lower than the levels indicated on the boring logs. The possibility of groundwater level fluctuations should be considered when developing the design and construction plans for the project.

## GEOTECHNICAL OVERVIEW

The final site layout and foundation elevations were not available at the time of this report. This information may have a significant impact on the geotechnical recommendations, therefore, we recommend that the Geotechnical Engineer be retained to review the geotechnical recommendations and assist the design engineers in developing the final design plans when the aforementioned information is available. Based on the test boring information and our understanding of the foundation types considered for design, our geotechnical recommendations for the design of foundations for the planned building are provided below.

The **General Comments** section provides an understanding of the report limitations.

# EARTHWORK

Earthwork is anticipated to include clearing, excavations, and minimal fill placement. The following sections provide recommendations for use in the preparation of specifications for the work. Recommendations include critical quality criteria, as necessary, to render the site in the state considered in our geotechnical engineering evaluation for foundations.

## Site Preparation

1. As an initial step in preparing the site, we recommend the removal of all topsoil within the limits of the proposed construction. Based on the test boring logs, the topsoil was observed to be about 4 in. in thickness. However, the thickness of the surficial conditions will vary. In our opinion, these removal activities should extend a minimum of 5 ft beyond the limits of the proposed construction. In addition, we recommend associated underground utilities be completely removed from the project area.
2. Following these excavation and removal activities, we anticipate that moisture-sensitive cohesive soils will be exposed. To reduce the risk of softening of the near-surface soils especially when exposed to excessive moisture, we recommend that proper site drainage be provided at the time of construction (via the use of ditches and/or piping) and only stripping of the surface conditions in those areas which will be immediately developed.
3. Because otherwise relatively stiff cohesive subgrades will deteriorate when exposed to excessive moisture and repeated construction traffic, construction traffic over completed subgrades should be avoided.
4. We recommend that the Geotechnical Engineer be on-site during construction to evaluate the subgrade conditions following the removal of surficial conditions.
5. Following these activities, we recommend the exposed soil subgrades be evaluated via proofrolling using a heavy rubber-tired vehicle. The purpose of proofrolling is to provide a first-order evaluation of how the subgrade is anticipated to react to construction traffic and gain an additional understanding of the conditions for support of the planned improvements. Based on our review of the moisture contents and hand penetrometer values, we expect the subgrade near the area of Boring B-2 will not pass a proofroll.
6. Where yielding areas are delineated and are not improved with moisture conditioning and compaction, they should be stabilized via large-sized aggregate or undercut and replaced with structural fill.
7. Typically, the final decision regarding stabilization is made at the time of construction based on actual conditions and site grades. However, it should be noted that during certain times of the year (i.e., cooler temperatures and high humidity and/or precipitation), stabilization of the existing subgrade is likely to be required. As such, we recommend quantities for excavation and replacement with structural fill be included in the construction documents to address the subgrade as necessary.

## Fill Material Types

Fill required to achieve design grade should be classified as structural fill and general fill. Structural fill is material used below, or within 10 ft of structures, pavements or constructed slopes. General fill is material used to achieve grade outside of these areas. Earthen materials used for structural and general fill should meet the following material property requirements:

| Soil Type [1] | USCS Classification | Acceptable Fill Designation |
|---|---|---|
| Low Plasticity Cohesive | CL, CL-ML | Structural or General |
| High Plasticity Cohesive [2] | CH, MH | General |
| Granular | GW, GP, SW, SP, SW-SM, SP-SM | Structural or General |
| On-Site Soils | CL | Structural or General |

1. Structural and general fill should consist of approved materials free of organic matter and debris. Frozen material should not be used, and fill should not be placed on a frozen subgrade. A sample of each material type should be submitted to the Geotechnical Engineer for evaluation prior to use on this site.
2. Not observed in the borings. Soils classified as CH or MH should not be used within 2 ft below the base of footings and 1 ft below finished grade in other structural fill areas.

## Fill Compaction Requirements

Structural and general fill should meet the following compaction requirements.

| Item | Recommendation | |
|---|---|---|
| **Fill Designation** | **Structural Fill** | **General Fill** |
| **Maximum Lift Thickness** [1, 2] | 8 in. or less in loose thickness when heavy, self-propelled compaction equipment is used.<br>4 in. in loose thickness when hand guided equipment (i.e., jumping jack or plate compactor) is used. | |
| **Minimum Compaction Requirements** [1, 2] | 95 percent of the modified Proctor density (ASTM D 1557) | 90 percent of the modified Proctor density (ASTM D 1557) |
| **Water Content Range** | ±2 percent of optimum | |

1. The acceptable thickness of loose lifts of fill and/or number of passes required by the compaction equipment to achieve compaction to the density recommended in this report will be a function of the type of compaction equipment and techniques used, the soil type, as well as proper control of the soil moisture content and the season in which construction takes place.
2. Periodic field density tests performed by the Geotechnical Engineer during fill placement are recommended to determine the adequacy of the compaction effort.

### Construction Observation and Testing

The earthwork efforts should be observed by the Geotechnical Engineer. These observations should include documentation of adequate removal of surficial conditions, proofrolling, and remediation of areas delineated by the proofroll to require stabilization.

Each lift of compacted fill should be tested, evaluated, and reworked, as necessary, until approved by the Geotechnical Engineer prior to placement of additional lifts. Each lift of fill should be tested for density and water content.

In areas of foundation excavations, the bearing subgrade should be evaluated under the direction of the Geotechnical Engineer. If unanticipated conditions are encountered, the Geotechnical Engineer should recommend stabilization options.

In addition to the documentation of the essential parameters necessary for construction, the continuation of the Geotechnical Engineer into the construction phase of the project provides the continuity to maintain the Geotechnical Engineer's evaluation of subsurface conditions including assessing variations and associated design changes.

## SHALLOW FOUNDATIONS

Provided the subgrades are prepared and fill placed in accordance with the recommendations noted in the **Earthwork** section, the following design parameters are applicable for shallow foundations.

### Design Parameters – Compressive Loads

| Item | Description |
|---|---|
| **Maximum Net Allowable Bearing pressure for naturally occurring soils** [1] | 2,000 psf when founded on required bearing stratum as described below. |
| **Required Bearing Stratum** [2] | Shallow foundations should bear on stiff or greater consistency cohesive soils or new structural fill placed on suitable soils. Bearing stratum should be observed by the Geotechnical Engineer. |
| **Ultimate Coefficient of Sliding Friction** [3] | 0.35 |
| **Minimum Foundation Dimensions** | Columns: 30 in. wide<br>Continuous: 18 in. wide |
| **Minimum Embedment below Finished Grade** [4] | 36 in. |

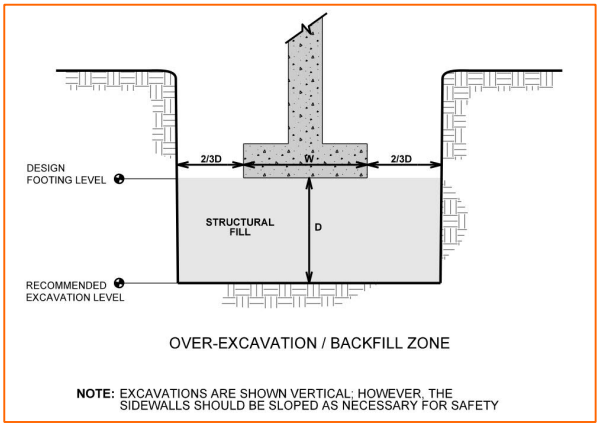
| Item | Description |
|---|---|
| **Estimated Total Settlement from Structural Loads** [5] | Not anticipated to exceed 1 in. |
| **Estimated Differential Settlement** [5] | Not anticipated to exceed ½ in. |

1. The maximum net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation. Maximum net allowable bearing pressure based on a Factor of Safety (FS) = 3.
2. Soft soils should be removed and replaced with compacted granular fill, or the foundations could be lowered to a suitable bearing stratum. Structural fill should meet the USCS classification and compaction requirements provided in the **Earthwork** section of this report.
3. Ultimate coefficient of sliding friction can be used to compute sliding resistance where foundations are placed on suitable soil/materials. Sliding friction should be neglected for foundations subject to net uplift conditions.
4. Embedment necessary to minimize the effects of frost and/or seasonal water content variations. For sloping ground, maintain depth below the lowest adjacent exterior grade within 5 horizontal ft of the structure.
5. Settlements were estimated assuming relatively light to moderate structural loads, and our experience with similar construction. Actual settlements will depend on actual loads and construction methods.

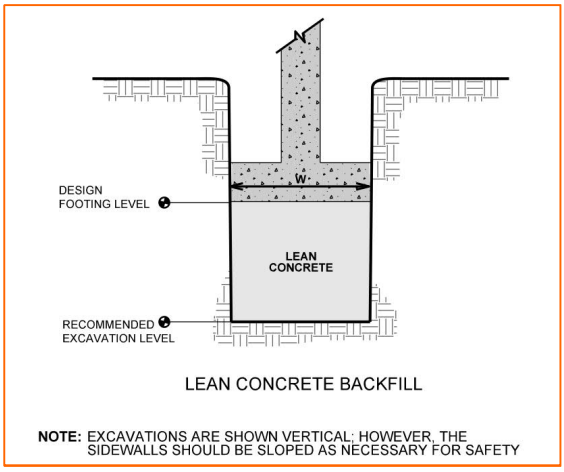
## Foundation Construction Considerations

As noted in **Earthwork**, the footing excavations should be evaluated under the direction of the Geotechnical Engineer. The base of all foundation excavations should be free of water and loose soil, prior to placing concrete. Concrete should be placed soon after excavating to reduce the risk of disturbance to the soil. Care should be taken to prevent wetting or drying of the bearing materials during construction. Excessively wet or dry material or any loose/disturbed material in the bottom of the footing excavations should be removed/reconditioned before foundation concrete is placed.

If unsuitable bearing soils such as soft cohesive soils are encountered during foundation excavation activities, they should be removed and replaced with compacted structural fill, or the foundations could be lowered to a suitable bearing stratum. Where undercutting is required beneath proposed foundations, the excavation should be widened beyond the footing width a distance equal to ⅔ of the depth of undercut to provide for a uniform stress distribution as illustrated on the sketch below. We recommend compacted granular fill be utilized to reestablish undercut foundation grades (in lieu of cohesive soil fill) due to its ease of placement/compaction as compared to cohesive soils.




Consideration could also be given to the use of lean concrete in undercut areas extending to bear directly on deeper suitable soils as illustrated on the sketch below. We recommend a contingency be included in the contract to account for undercutting and fill placement and compaction as needed to address poor foundation subgrade conditions.




## Additional Construction Considerations

Based on the groundwater depths observed during our exploration and our review of the *Soil Survey of Putnam County, Indiana*, dewatering as a result of perched groundwater infiltration during shallow foundation construction may be needed. If surface water run-off or trapped/perched water enters foundation excavations, we anticipate that removal of the water can likely be performed by using a pump and filtered sump, possibly in combination with collection trenches. In addition, all excavations should conform with Occupational Safety and Health Administration (OSHA) requirements. The contractor is solely responsible for excavation safety.

## FLOOR SLABS

Provided the subgrade areas are prepared in accordance with the recommendations noted in the **Earthwork** section, the following design parameters are applicable for slab design.

| Item | Description |
|---|---|
| **Slab Support** [1] | Minimum of 6 in. of free-draining granular material compacted to 95 percent of the modified Proctor density (ASTM D 1557) [2] |
| **Modulus of Subgrade Reaction** [3] | 100 pci |

1. Floor slabs should be structurally independent of building footings and walls to reduce the possibility of floor slab cracking caused by differential movements between the slab and foundation.
2. Suitable clean, free-draining soil should contain no more than 5 percent fines, by weight, passing the No. 200 U.S. Standard sieve.
3. Note that the modulus of subgrade reaction is based on a 30-in. diameter loaded area. The modulus of subgrade reaction value should be used for a first-order approximation of the shear and moment requirements of the floor slab. The design of the slab is anticipated to be based on an iterative process involving the stiffness of the floor slab and the location and magnitude of the applied loads in relation to the soil's characteristics. Depending on the actual shear and moment considerations for the slab, it may be necessary to modify this value as a function of the location and magnitude of the applied loads.

## SEISMIC CONSIDERATIONS

The Site Classification is required to determine the Seismic Design Category for structures. Based on our observations, it is our opinion the subsurface conditions most closely resemble a Site Class D. Note that the Site Class is based on the upper 100 ft of the site profile defined by a weighted average value of either shear wave velocity, standard penetration resistance, or undrained shear strength in accordance with ASCE 7 and International Building Code (IBC), and our exploratory activities extended to a depth of 19¼ feet. The site properties below the boring depth to 100 ft were estimated based on the review of geologic conditions of the general area. Additional deeper borings or geophysical testing may be performed to confirm the conditions below the current boring depth.

## GENERAL COMMENTS

Our analysis and opinions are based upon our understanding of the project, the geotechnical conditions in the area, and the data obtained from our site exploration. Natural variations will occur between exploration point locations or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. Terracon should be retained as the Geotechnical Engineer, where noted in this report, to provide observation and testing services during pertinent construction phases. If variations appear, we can provide further evaluation and supplemental recommendations. If variations are noted in the

absence of our observation and testing services on-site, we should be immediately notified so that we can provide evaluation and supplemental recommendations.

Our Scope of Services does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

Our services and any correspondence are intended for the sole benefit and exclusive use of our client for specific application to the project discussed and are accomplished in accordance with generally accepted geotechnical engineering practices with no third-party beneficiaries intended. Any third-party access to services or correspondence is solely for information purposes to support the services provided by Terracon to our client. Reliance upon the services and any work product is limited to our client, and is not intended for third parties. Any use or reliance of the provided information by third parties is done solely at their own risk. No warranties, either express or implied, are intended or made.

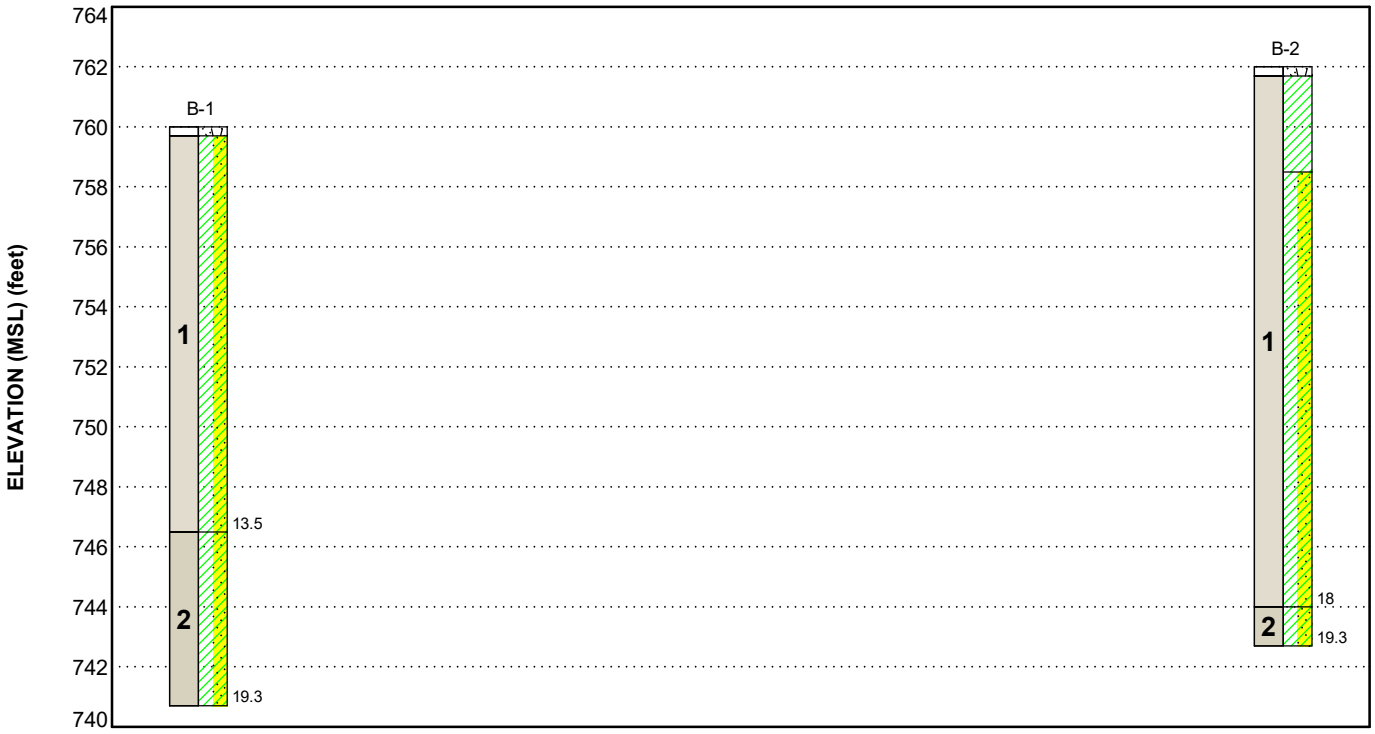
Site characteristics as provided are for design purposes and not to estimate excavation cost. Any use of our report in that regard is done at the sole risk of the excavating cost estimator as there may be variations on the site that are not apparent in the data that could significantly impact excavation cost. Any parties charged with estimating excavation costs should seek their own site characterization for specific purposes to obtain the specific level of detail necessary for costing. Site safety, and cost estimating including, excavation support, and dewatering requirements/design are the responsibility of others. If changes in the nature, design, or location of the project are planned, our conclusions and recommendations shall not be considered valid unless we review the changes and either verify or modify our conclusions in writing.

# FIGURES

**Contents:**

## GEOMODEL

**Deer Creek Storage Facility ■ Greencastle, IN**
**Terracon Project No. CJ205540**




This is not a cross section. This is intended to display the Geotechnical Model only. See individual logs for more detailed conditions.

| Model Layer | Layer Name | General Description |
|---|---|---|
| 1 | Lean Clay | Lean clay with sand, trace gravel; brown; medium stiff to hard |
| 2 | Lean Clay (Residual) | Lean clay; gray; hard |

## LEGEND

- Topsoil
- Lean Clay with Sand
- Lean Clay (Residual)

NOTES:
Layering shown on this figure has been developed by the geotechnical engineer for purposes of modeling the subsurface conditions as required for the subsequent geotechnical engineering for this project. Numbers adjacent to soil column indicate depth below ground surface.

# ATTACHMENTS

# EXPLORATION AND TESTING PROCEDURES

## Field Exploration

| Boring Nos. | Boring Depth (feet) | Planned Location |
|---|---|---|
| B-1 and B-2 | 19¼ | Building Area |

**Boring Layout and Elevations:** The boring locations were marked in the field by Terracon personnel using hand held GPS equipment with a horizontal accuracy of about 10 feet based on the coordinates obtained by overlaying the conceptual site plan provided by IDNR onto Google Earth Pro™. Furthermore, ground surface elevations at the boring locations were estimated using topographic information obtained from the Indiana Map GIS system. A topographic survey of the exploratory locations was outside the scope of this exploration. If precise locations and elevations are desired, we recommend a licensed surveyor be retained to provide ground surface elevations.

**Subsurface Exploration Procedures:** We advanced the borings using track-mounted equipment and hollow stem augers to advance the boreholes. Four samples were obtained in the upper 10 feet of each boring and 5 feet intervals thereafter. In the split-spoon sampling procedure, a standard 2-inch outer diameter split-barrel sampling spoon was driven into the ground by a 140-pound automatic hammer falling a distance of 30 inches. The number of blows required to advance the sampling spoon the last 12 inches of a normal 18-inch penetration is recorded as the Standard Penetration Test (SPT) resistance value. The SPT resistance values, also referred to as N-values, are indicated on the boring logs at the test depths. Following the completion of our exploratory activities, the boreholes were backfilled with auger cuttings and a bentonite chip plug was placed near the surface.

The sampling depths, penetration distances, and other sampling information were recorded on the field boring logs. The samples were placed in appropriate containers and taken to our soil laboratory for testing and classification. Our exploration team prepared field boring logs as part of the drilling operations. These field logs included visual classifications of the materials encountered during drilling and our interpretation of the subsurface conditions between samples.

## Laboratory Testing

The soil samples were reviewed by a geotechnical engineer who assigned laboratory tests. Soil classifications on the boring logs are according to the Unified Soil Classification System (USCS). Further details regarding the classification system are provided in **Supporting Information**. After classifying the samples, the following laboratory testing program was performed:

- Hand penetrometer readings (i.e., $q_p$, which provide an indication of the shear strength characteristics of cohesive-type soils);

- Natural moisture content tests (W%);
- Atterberg limit determinations;
- Grain size distribution; and
- Unconfined compressive strength test

Applicable ASTM standard procedures were followed in laboratory testing of the soil samples. Upon completion of our laboratory testing program, boring logs were prepared and are provided in the attachments. The results of these tests are included on the test boring logs and/or laboratory test reports. It should be mentioned that the boring logs represent the approximate boundary between soil types; although the transitions may actually be gradual.

# SITE LOCATION AND EXPLORATION PLANS

**Contents:**

Site Location
Exploration Plan

Note: All attachments are one page unless noted above.

## SITE LOCATION

Deer Creek Storage Facility ■ Greencastle, Indiana
February 19, 2021 ■ Terracon Project No. CJ205540

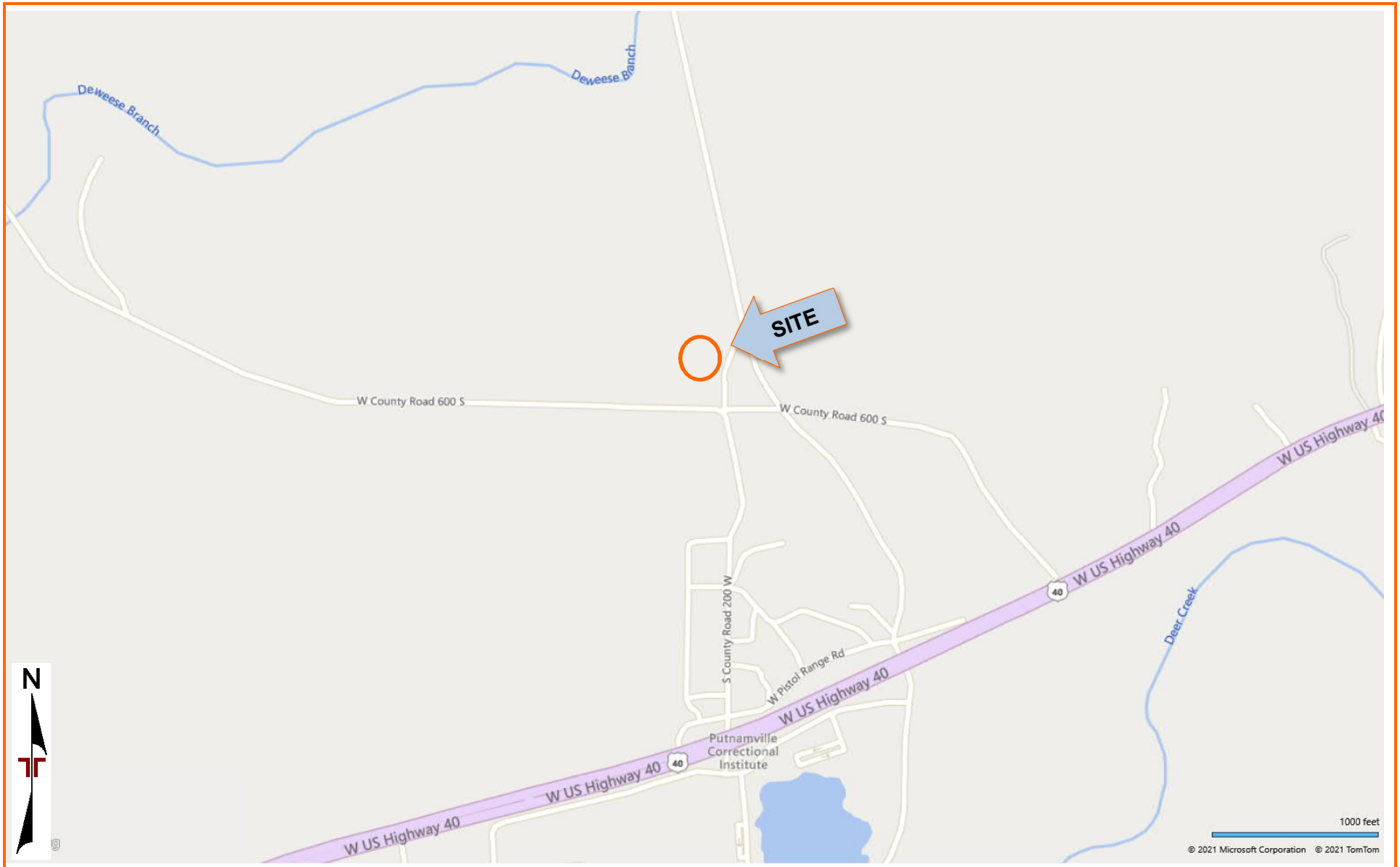



DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

## EXPLORATION PLAN

Deer Creek Storage Facility ■ Greencastle, Indiana
February 19, 2021 ■ Terracon Project No. CJ205540

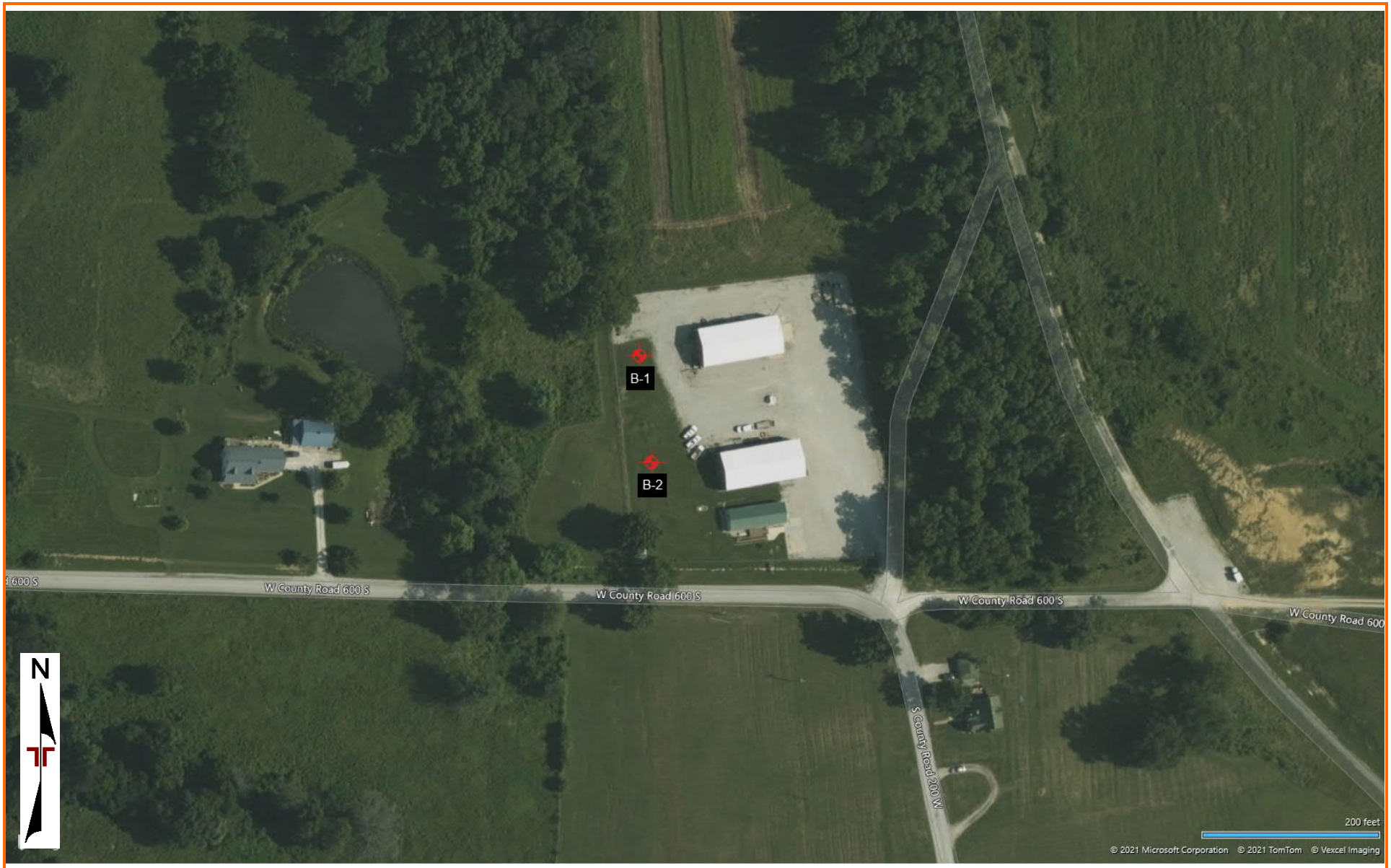



DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES, NOT SCALE

MAP PROVIDED BY MICROSOFT BING MAPS

# EXPLORATION RESULTS

**Contents:**



Note: All attachments are one page unless noted above.

# BORING LOG NO. B-1



**PROJECT: Deer Creek Storage Facility**

**CLIENT: Indiana Department of Natural Resources (IDNR)**
**Indianapolis, IN**

**SITE:**
**Greencastle, IN**

LOCATION See Exploration Plan

Latitude: 39.5743° Longitude: -86.8872°

Approximate Surface Elev.: 760 (Ft.) +/-

| MODEL LAYER | GRAPHIC LOG | DEPTH | ELEVATION (Ft.) | DESCRIPTION |
|---|---|---|---|---|
| | | 0.3 | 759.5+/- | **TOPSOIL**, (4 in) |
| 1 | | | | **LEAN CLAY WITH SAND (CL)**, trace gravel, brown, medium stiff to very stiff |
| | | 13.5 | 746.5+/- | |
| 2 | | | | **LEAN CLAY WITH SAND (CL)**, gray, hard, (residual) |
| | | 19.3 | 740.5+/- | ***Boring Terminated at 19.3 Feet*** |

| DEPTH (Ft.) | WATER LEVEL OBSERVATIONS | SAMPLE TYPE | RECOVERY (In.) | FIELD TEST RESULTS | LABORATORY HP (tsf) | STRENGTH TEST: TEST TYPE | STRENGTH TEST: COMPRESSIVE STRENGTH (tsf) | STRENGTH TEST: STRAIN (%) | WATER CONTENT (%) | DRY UNIT WEIGHT (pcf) | ATTERBERG LIMITS: LL-PL-PI | PERCENT FINES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 18 | 5-4-4 N=8 | 1.5 (HP) | | | | 19.0 | | | |
| 5 | | | 18 | 4-4-5 N=9 | 1.5 (HP) | | | | 18.6 | | | |
| | | | 18 | 4-6-8 N=14 | 0.75 (HP) | | | | 17.5 | | | |
| 10 | | | 18 | 3-5-8 N=13 | 3.0 (HP) | | | | 16.5 | | | |
| | | | 6 | 33-50/4" | 4.5+ (HP) | | | | 8.6 | | | |
| 15 | | | 6 | 17-50/3" | 3.5 (HP) | | | | 9.3 | | | |

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3¼" HSA

Abandonment Method:
Backfilled with auger cuttings and bentonite chip plug at the surface.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

**WATER LEVEL OBSERVATIONS**

*Not observed during drilling*

*Not observed at completion of drilling*

*Cave-in*

Terracon
7770 W New York St
Indianapolis, IN

Boring Started: 01-18-2021 | Boring Completed: 01-18-2021

Drill Rig: CME 55 | Driller: T.M.

Project No.: CJ205540

# BORING LOG NO. B-2



**PROJECT: Deer Creek Storage Facility**

**CLIENT: Indiana Department of Natural Resources (IDNR)**
**Indianapolis, IN**

**SITE:**
**Greencastle, IN**

LOCATION See Exploration Plan

Latitude: 39.5740° Longitude: -86.8872°

Approximate Surface Elev.: 762 (Ft.) +/-

| MODEL LAYER | GRAPHIC LOG | DEPTH | ELEVATION (Ft.) | DEPTH (Ft.) | WATER LEVEL OBSERVATIONS | SAMPLE TYPE | RECOVERY (In.) | FIELD TEST RESULTS | LABORATORY HP (tsf) | STRENGTH TEST: TEST TYPE | STRENGTH TEST: COMPRESSIVE STRENGTH (tsf) | STRENGTH TEST: STRAIN (%) | WATER CONTENT (%) | DRY UNIT WEIGHT (pcf) | ATTERBERG LIMITS: LL-PL-PI | PERCENT FINES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 0.3 | 761.5+/- | | | | | | | | | | | | | |
| | | **TOPSOIL**, (4 in) | | | | | | | | | | | | | | |
| | | **LEAN CLAY (CL)**, trace sand, trace gravel, brown, very stiff | | | | X | 17 | 3-3-6 N=9 | 2.25 (HP) | | | | 28.6 | | | |
| | | 3.5 | 758.5+/- | | | | | | | | | | | | | |
| 1 | | **LEAN CLAY WITH SAND (CL)**, trace gravel, brown, stiff to hard | | 5 | | X | 18 | 4-4-4 N=8 | 1.75 (HP) | UC | 1.01 | 15 | 18.9 | 110 | 26-16-10 | 77 |
| | | | | | | X | 17 | 3-4-6 N=10 | 2.75 (HP) | | | | 21.8 | | | |
| | | | | 10 | | X | 18 | 4-7-7 N=14 | 4.5+ (HP) | | | | 20.6 | | | |
| | | | | | | X | 18 | 3-4-4 N=8 | 2.5 (HP) | | | | 14.8 | | | |
| | | | | 15 | | | | | | | | | | | | |
| | | 18.0 | 744+/- | | | | | | | | | | | | | |
| 2 | | **LEAN CLAY WITH SAND (CL)**, gray, hard, (residual) | | | | X | 15 | 33-50/3" | 4.5+ (HP) | | | | 8.4 | | | |
| | | 19.3 | 742.5+/- | | | | | | | | | | | | | |
| | | ***Boring Terminated at 19.3 Feet*** | | | | | | | | | | | | | | |

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3¼" HSA

Abandonment Method:
Backfilled with auger cuttings and bentonite chip plug at the surface.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

**WATER LEVEL OBSERVATIONS**

*Not observed during drilling*

*Not observed at completion of drilling*

*Cave-in*

Terracon
7770 W New York St
Indianapolis, IN

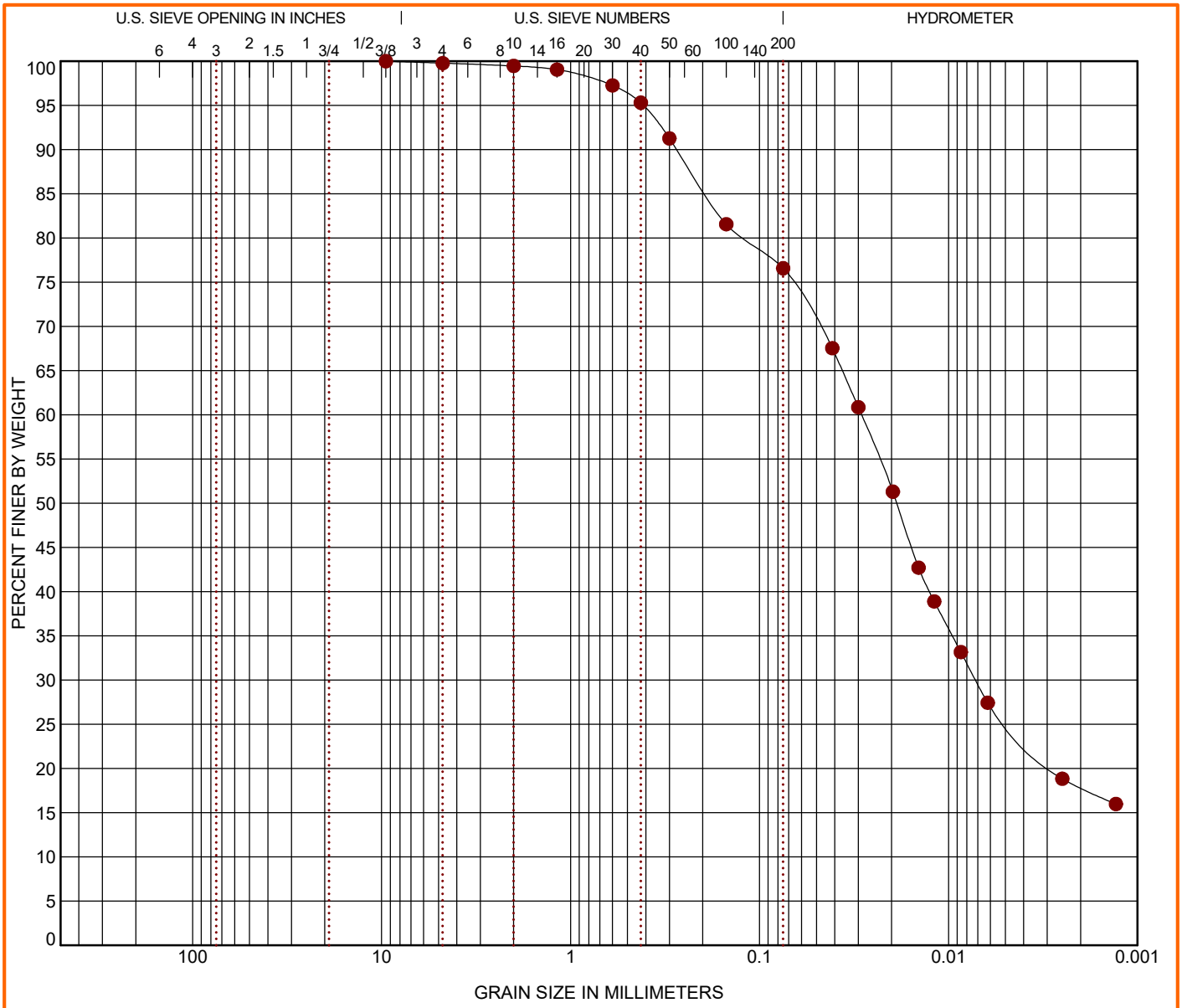
Boring Started: 01-18-2021 | Boring Completed: 01-18-2021

Drill Rig: CME 55 | Driller: T.M.

Project No.: CJ205540

# GRAIN SIZE DISTRIBUTION

**ASTM D422 / ASTM C136**




| COBBLES | GRAVEL | | SAND | | | SILT OR CLAY |
|---|---|---|---|---|---|---|
| | coarse | fine | coarse | medium | fine | |

| Boring ID | Depth | USCS Classification | WC (%) | LL | PL | PI | Cc | Cu |
|---|---|---|---|---|---|---|---|---|
| B-2 | 3.5 - 5 | LEAN CLAY with SAND (CL) | 18.9 | 26 | 16 | 10 | | |

| Boring ID | Depth | $D_{100}$ | $D_{60}$ | $D_{30}$ | $D_{10}$ | %Cobbles | %Gravel | %Sand | %Silt | %Fines | %Clay |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B-2 | 3.5 - 5 | 9.5 | 0.029 | 0.007 | | 0.0 | 0.2 | 23.2 | 51.2 | | 25.4 |

PROJECT: Deer Creek Storage Facility

SITE: Greencastle, IN

Terracon
7770 W New York St
Indianapolis, IN

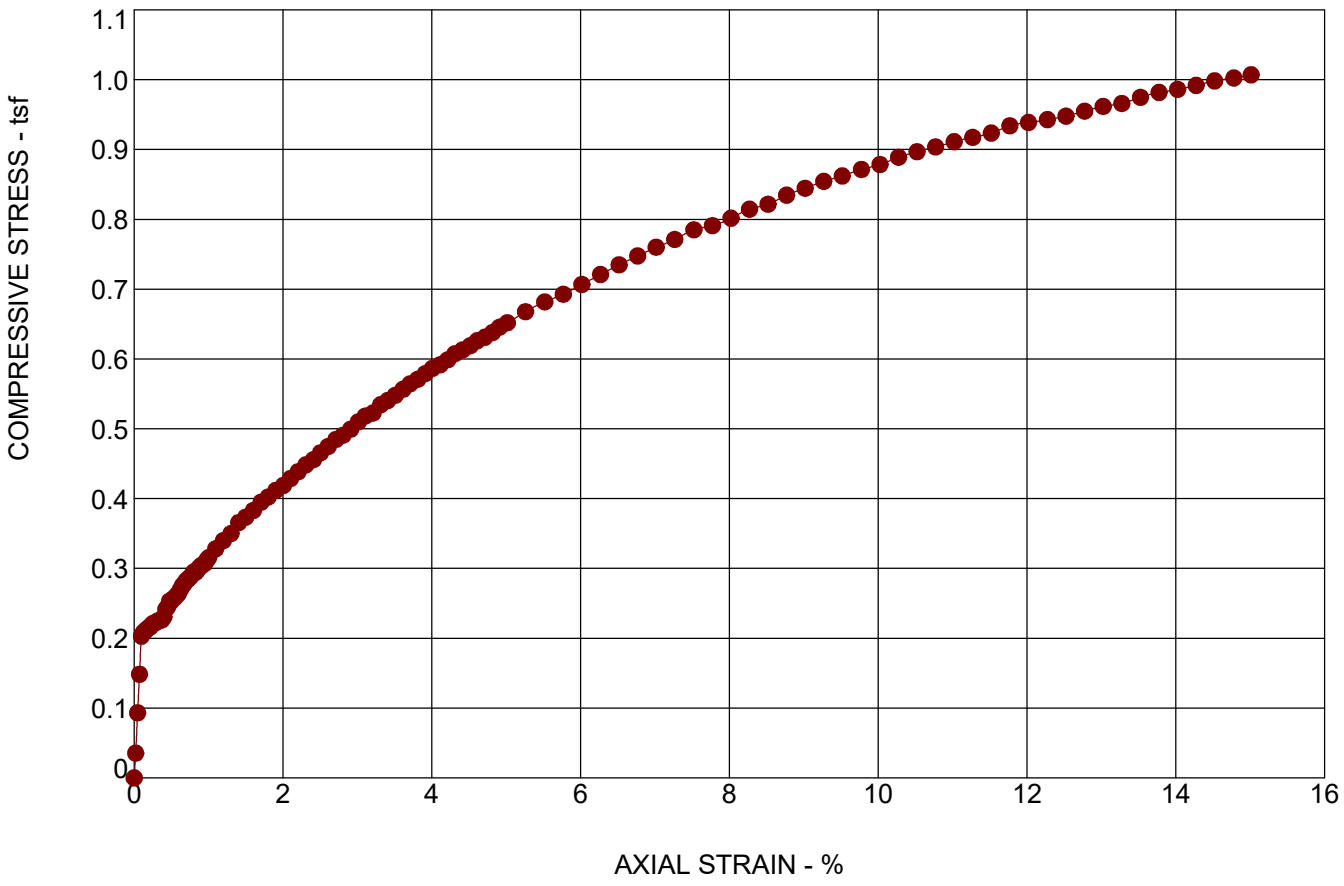
PROJECT NUMBER: CJ205540

CLIENT: Indiana Department of Natural Resources (IDNR)
Indianapolis, IN

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS-2 CJ205540 DEER CREEK STORAG.GPJ 02195238 US 50 AND CHIPMAN.GPJ 1/26/21

# UNCONFINED COMPRESSION TEST

**ASTM D2166**




| SPECIMEN FAILURE PHOTOGRAPH | SPECIMEN TEST DATA | | |
|---|---|---|---|
|  | Moisture Content: | % | 18.9 |
| | Dry Density: | pcf | 110 |
| | Diameter: | in. | 1.50 |
| | Height: | in. | 3.03 |
| | Height / Diameter Ratio: | | 2.01 |
| | Calculated Saturation: | % | 93.68 |
| | Calculated Void Ratio: | | 0.55 |
| | Assumed Specific Gravity: | | 2.72 |
| | Failure Strain: | % | 15.00 |
| | Unconfined Compressive Strength | (tsf) | 1.01 |
| | Undrained Shear Strength: | (tsf) | 0.50 |
| | Strain Rate: | in/min | 0.0303 |
| | Remarks: | | |

SAMPLE TYPE: SS

SAMPLE LOCATION: B-2 @ 3.5 - 5 feet

DESCRIPTION: LEAN CLAY with SAND(CL)

| LL | PL | PI | Percent < #200 Sieve |
|---|---|---|---|
| 26 | 16 | 10 | 77 |

PROJECT: Deer Creek Storage Facility

SITE: Greencastle, IN

Terracon
7770 W New York St
Indianapolis, IN

PROJECT NUMBER: CJ205540

CLIENT: Indiana Department of Natural Resources (IDNR)
Indianapolis, IN

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. UNCONFINED WITH PHOTOS CJ205540 DEER CREEK STORAG.GPJ 02195238 US 50 AND CHIPMAN.GPJ 1/26/21

# SUPPORTING INFORMATION

**Contents:**



Note: All attachments are one page unless noted above.

# GENERAL NOTES

## DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

**SAMPLING**


**WATER LEVEL**

**Water Initially Encountered**

**Water Level After a Specified Period of Time**

**Water Level After a Specified Period of Time**

Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.

**FIELD TESTS**

| | |
|---|---|
| **N** | **Standard Penetration Test Resistance (Blows/Ft.)** |
| **(HP)** | **Hand Penetrometer** |
| **(T)** | **Torvane** |
| **(DCP)** | **Dynamic Cone Penetrometer** |
| **(PID)** | **Photo-Ionization Detector** |
| **(OVA)** | **Organic Vapor Analyzer** |

## DESCRIPTIVE SOIL CLASSIFICATION

Soil classification is based on the Unified Soil Classification System. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; their principal descriptors are: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are principally described as clays if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

## LOCATION AND ELEVATION NOTES

Unless otherwise noted, Latitude and Longitude are approximately determined using a hand-held GPS device. The accuracy of such devices is variable. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

**STRENGTH TERMS**

| **RELATIVE DENSITY OF COARSE-GRAINED SOILS** (More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance | | **CONSISTENCY OF FINE-GRAINED SOILS** (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance | | |
|---|---|---|---|---|
| **Descriptive Term (Density)** | **Standard Penetration or N-Value Blows/Ft.** | **Descriptive Term (Consistency)** | **Unconfined Compressive Strength Qu, (tsf)** | **Standard Penetration or N-Value Blows/Ft.** |
| Very Loose | 0 - 3 | Very Soft | less than 0.25 | 0 - 1 |
| Loose | 4 - 9 | Soft | 0.25 to 0.50 | 2 - 4 |
| Medium Dense | 10 - 29 | Medium Stiff | 0.50 to 1.00 | 4 - 8 |
| Dense | 30 - 50 | Stiff | 1.00 to 2.00 | 8 - 15 |
| Very Dense | > 50 | Very Stiff | 2.00 to 4.00 | 15 - 30 |
| | | Hard | > 4.00 | > 30 |

### RELATIVE PROPORTIONS OF SAND AND GRAVEL

| Descriptive Term(s) of other constituents | Percent of Dry Weight |
|---|---|
| Trace | < 15 |
| With | 15 - 29 |
| Modifier | > 30 |

### GRAIN SIZE TERMINOLOGY

| Major Component of Sample | Particle Size |
|---|---|
| Boulders | Over 12 in. (300 mm) |
| Cobbles | 12 in. to 3 in. (300mm to 75mm) |
| Gravel | 3 in. to #4 sieve (75mm to 4.75 mm) |
| Sand | #4 to #200 sieve (4.75mm to 0.075mm |
| Silt or Clay | Passing #200 sieve (0.075mm) |

### RELATIVE PROPORTIONS OF FINES

| Descriptive Term(s) of other constituents | Percent of Dry Weight |
|---|---|
| Trace | < 5 |
| With | 5 - 12 |
| Modifier | > 12 |

### PLASTICITY DESCRIPTION

| Term | Plasticity Index |
|---|---|
| Non-plastic | 0 |
| Low | 1 - 10 |
| Medium | 11 - 30 |
| High | > 30 |

Terracon

# UNIFIED SOIL CLASSIFICATION SYSTEM

Terracon GeoReport

| Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [A] | | | | | Soil Classification | |
|---|---|---|---|---|---|---|
| | | | | | Group Symbol | Group Name [B] |
| **Coarse-Grained Soils:** More than 50% retained on No. 200 sieve | **Gravels:** More than 50% of coarse fraction retained on No. 4 sieve | **Clean Gravels:** Less than 5% fines [C] | Cu ≥ 4 and 1 ≤ Cc ≤ 3 [E] | | GW | Well-graded gravel [F] |
| | | | Cu < 4 and/or [Cc<1 or Cc>3.0] [E] | | GP | Poorly graded gravel [F] |
| | | **Gravels with Fines:** More than 12% fines [C] | Fines classify as ML or MH | | GM | Silty gravel [F, G, H] |
| | | | Fines classify as CL or CH | | GC | Clayey gravel [F, G, H] |
| | **Sands:** 50% or more of coarse fraction passes No. 4 sieve | **Clean Sands:** Less than 5% fines [D] | Cu ≥ 6 and 1 ≤ Cc ≤ 3 [E] | | SW | Well-graded sand [I] |
| | | | Cu < 6 and/or [Cc<1 or Cc>3.0] [E] | | SP | Poorly graded sand [I] |
| | | **Sands with Fines:** More than 12% fines [D] | Fines classify as ML or MH | | SM | Silty sand [G, H, I] |
| | | | Fines classify as CL or CH | | SC | Clayey sand [G, H, I] |
| **Fine-Grained Soils:** 50% or more passes the No. 200 sieve | **Silts and Clays:** Liquid limit less than 50 | **Inorganic:** | PI > 7 and plots on or above "A" | | CL | Lean clay [K, L, M] |
| | | | PI < 4 or plots below "A" line [J] | | ML | Silt [K, L, M] |
| | | **Organic:** | Liquid limit - oven dried | < 0.75 | OL | Organic clay [K, L, M, N] |
| | | | Liquid limit - not dried | | | Organic silt [K, L, M, O] |
| | **Silts and Clays:** Liquid limit 50 or more | **Inorganic:** | PI plots on or above "A" line | | CH | Fat clay [K, L, M] |
| | | | PI plots below "A" line | | MH | Elastic Silt [K, L, M] |
| | | **Organic:** | Liquid limit - oven dried | < 0.75 | OH | Organic clay [K, L, M, P] |
| | | | Liquid limit - not dried | | | Organic silt [K, L, M, Q] |
| **Highly organic soils:** | Primarily organic matter, dark in color, and organic odor | | | | PT | Peat |

[A] Based on the material passing the 3-inch (75-mm) sieve.

[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay.

[E] $Cu = D_{60}/D_{10}$ $Cc = \dfrac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains ≥ 15% sand, add "with sand" to group name.

[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H] If fines are organic, add "with organic fines" to group name.

[I] If soil contains ≥ 15% gravel, add "with gravel" to group name.

[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

[L] If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.

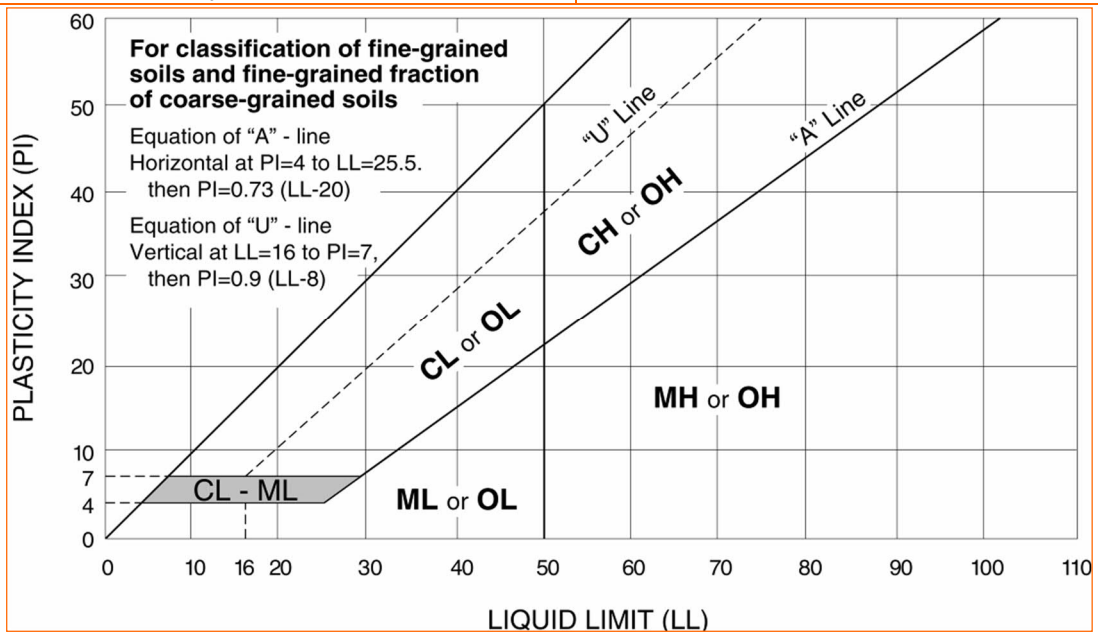
[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.

[N] PI ≥ 4 and plots on or above "A" line.

[O] PI < 4 or plots below "A" line.

[P] PI plots on or above "A" line.

[Q] PI plots below "A" line.



# Geotechnical Engineering Report

**Deer Creek Storage Facility**
**Greencastle, Indiana**

October 5, 2021
Terracon Project No. CJ215382

**Prepared for:**
Indiana Department of Natural Resources
Indianapolis, Indiana

**Prepared by:**
Terracon Consultants, Inc.
Indianapolis, Indiana

October 5, 2021

Indiana Department of Natural Resources
402 West Washington Street, Room W-299
Indianapolis, IN 46204

Attn: Ms. Deborah A. Kuehn
P: (574) 360 5839
E: DKuehn1@dnr.in.gov

Re: Geotechnical Engineering Report
Deer Creek Storage Facility
Deer Creek Fish & Wildlife Area
Greencastle, Indiana
Terracon Project No. CJ215382

Dear Ms. Kuehn:

In accordance with your request, we have completed our Geotechnical Engineering services for the referenced project. This evaluation was performed in general accordance with Terracon Proposal No. PCJ215382, dated August 17, 2021. This report presents the results of our subsurface exploratory and laboratory testing programs and provides geotechnical recommendations concerning earthwork and the design and construction of foundations.

We have enjoyed working with you on this project. If you have any questions concerning this report or require further assistance, feel free to contact us.

Sincerely,
**Terracon Consultants, Inc.**

Yongwan Kwon, P.E.
Project Engineer

Richard D. Olson, P.E.
Principal Engineer

## REPORT TOPICS



## ATTACHMENTS



**Note:** Refer to each individual Attachment for a listing of contents.

# Geotechnical Engineering Report

## Deer Creek Storage Facility
## Deer Creek Fish & Wildlife Area
## Greencastle, Indiana

**Terracon Project No. CJ215382**
**October 5, 2021**

## INTRODUCTION

This report presents the results of our subsurface exploration and geotechnical engineering services performed for the construction of a proposed storage facility within the Deer Creek Fish & Wildlife Area in Greencastle. The purpose of these services is to provide information and geotechnical engineering recommendations relative to:

- Subsurface conditions
- Groundwater conditions
- Site preparation and earthwork
- Foundation design and construction
- Dewatering considerations
- Seismic site classification per IBC
- Excavation considerations

The geotechnical engineering Scope of Services for this project included the advancement of two test borings to depths of approximately 46 to 58½ ft below existing site grades.

Maps showing the site and boring location are shown in the **Site Location** and **Exploration Plan** sections, respectively. The results of the laboratory testing performed on soil samples obtained from the site during the field exploration are included on the boring logs and/or as separate graphs in the **Exploration Results** section.

## SITE CONDITIONS

The following description of site conditions is derived from our site visit in association with the field exploration and our review of publicly available geologic and topographic maps.

| Item | Description |
|---|---|
| **Parcel Information** | The project site is located within the Deer Creek Fish & Wildlife Area in Greencastle. See **Site Location**. |
| **Existing Improvements** | The project area is currently occupied by an existing Deer Creek Fish and Wildlife Area facility. |
| **Current Ground Cover** | Grass |

| Item | Description |
|---|---|
| **Existing Topography** | Based on topographic information provided by Indiana Department of Natural Resources (IDNR), ground surface elevations at the project area ranged from El. 759 to 755. The ground surface generally slopes down from south to north. |

It should be noted that the project lies in an area of karstic topography resulting from the solutioning of the underlying limestone bedrock. Based on our review of the Indiana Map GIS system, multiple sinkholes were mapped within ¼ mile of the project area. Figure 1 below provides the approximate locations of mapped karstic features per the Indiana Map GIS system Sinkhole Inventory (2011). It is also important to recognize in areas of karst that the bedrock surface can vary significantly and abruptly over short distances (i.e., pinnacles and crevices). Based on conditions observed at the boring locations, potential karstic features (i.e., bedrock surface varies significantly over short distances) were observed.

Based on our review of the rock core samples obtained from Boring B-01, RQD values were 50 percent or greater and no voids were observed. In addition, the cohesive soil typically exhibited hand penetrometer values of 1 tons/sq ft or greater with relatively low moisture contents. The subsurface conditions suggest that the karstic features are pre-glacial and may not be of a concern with regard to the intent of this project, specifically for light loaded structures such as a storage building. However, if there is a concern for settlement due to the potential for underlying issues, consideration should be given to relocating the building such as the area previously considered.


Figure 1. Mapped karstic features near the project area per Indiana Map GIS System

## PROJECT DESCRIPTION

Our understanding of the project is as follows:

| Item | Description |
|---|---|
| **Information Provided** | Project information provided by IDNR via emails on August 11, 2021 and September 3, 2021.<br>■ Deer Creek – Updated building location<br>■ C-1 Site Plan |
| **Project Description** | We understand that the project consists of the construction of a new storage building. Previously, we had completed a geotechnical evaluation at a different location and the results of our study are presented in our report No. CJ205540, dated February 19, 2021. Based on information provided by IDNR, the proposed building is planned to be relocated to the north of the northernmost existing building. |
| **Proposed Structures** | The proposed structure is planned to include wood-frame construction with a slab-on-grade floor system. |
| **Maximum Loads** | Information was not available at the time of this report. |
| **Finished Floor Elevation** | El. 761.5 |
| **Grading/Slopes** | Based on our observations of the site and our understanding of the project, we anticipate less than about 3 to 5 ft of earth fills will be required to achieve finished grades. |
| **Estimated Start of Construction** | The construction schedule was not available at the time of this report. |

## GEOTECHNICAL CHARACTERIZATION

We have developed a general characterization of the subsurface conditions based upon our review of the subsurface exploration, laboratory data, geologic setting and our understanding of the project. This characterization, termed GeoModel, forms the basis of our geotechnical calculations and evaluation of site preparation and foundation options. Conditions encountered at each exploration point are indicated on the logs. The logs can be found in the **Exploration Results** section, and the GeoModel can be found in the **Figures** section of this report.

As part of our analyses, we identified the following model layers within the subsurface profile. For a more detailed view of the model layer depths at each boring location, refer to the GeoModel.

| Model Layer | Layer Name | General Description |
|---|---|---|
| | **Topsoil** | 4 in. in thickness |

| Model Layer | Layer Name | General Description |
|---|---|---|
| 1 | **Sandy Fat Clay** | Trace gravel; brown; stiff to very stiff |
| 2 | **Sandy Lean Clay** | Trace gravel; brown; stiff to hard |
| 3 | **Limestone** [1, 2] | Gray; moderately hard to hard |

1. Rock hardness is based on the ability to scratch or gouge rock samples with a knife or geologist's pick. Based on our laboratory tests, the uniaxial compressive strength of the limestone ranged from about 295 to 440 tsf. RQD values were between 50 and 87 percent.
2. The sound rock surface (as defined by auger refusal) was not observed up to 58½ ft below the existing ground surface at Boring B-02.

Groundwater level observations were made during and at completion of the sampling process. Groundwater was observed at Boring B-01 at a depth of approximately 4 ft below the ground surface at completion of the sampling process. The shallow depth noted upon completion after the sampling process is likely due to the introduction of water into the borehole during rock coring.

A review of the *Soil Survey of Putnam County, Indiana* indicates that the soils in the project area are prone to a seasonal high water level (i.e., perched) within about 2½ ft below the surface. As additional input, a review of publicly available water well information from the Indiana Map GIS system (https://maps.indiana.edu) indicated the groundwater level is typically near 30 ft below the surface at an Indiana Department of Natural Resources (IDNR) well site (Well Reference No.:292389) located about 500 ft west of the project area.

It should be recognized that groundwater levels will fluctuate due to changes in precipitation, infiltration, surface run-off, and other hydrogeological factors. Therefore, groundwater levels during construction or at other times in the life of the structure may be higher or lower than the levels indicated on the boring logs. The possibility of groundwater level fluctuations should be considered when developing the design and construction plans for the project.

## GEOTECHNICAL OVERVIEW

In general, the subsurface conditions observed at the boring locations are suitable for support of the proposed building, with the possible exception of potential karstic features observed at Boring B-02. However, considering the conditions observed as noted above, the potential karstic features may not be of a concern with regard to the intent of this project, specifically for light loaded structures such as a storage building. If karstic features are encountered during construction, we should be consulted for additional recommendations.

Fat clays were observed in the borings near the anticipated foundation subgrade in the borings. We recommend undercutting and replacing the fat clay soils where encountered to a depth of at least 2 ft below the foundation elevation.

Due to the moisture-sensitive nature of the cohesive soils, proper site preparation is essential in order to provide adequate support of at-grade elements. It should be noted that if the site is not properly prepared or if site preparation occurs during extended wet periods, additional stabilization and/or improvement of the subgrade may be necessary. We recommend that Terracon be present during all phases of site preparation and foundation installation activities to evaluate the subgrade conditions.

The **General Comments** section provides an understanding of the report limitations.

## EARTHWORK

Earthwork is anticipated to include clearing, excavations, and fill placement. The following sections provide recommendations for use in the preparation of specifications for the work. Recommendations include critical quality criteria, as necessary, to render the site in the state considered in our geotechnical engineering evaluation for foundations.

### Site Preparation

As stated previously, we anticipate less than about 3 to 5 ft of earth cuts and fills will be required to achieve finished grades. In at-grade areas and where fill is necessary, we recommend the removal of all topsoil within the limits of the proposed construction. Based on the test boring logs, the topsoil was observed to be about 4 in. in thickness. However, the thickness of the surficial conditions will vary. In addition, we recommend that root masses and soils containing organic matter (if any) be removed (grubbed) and the area be regraded to avoid leaving depressions and areas that may collect water. In our opinion, these removal activities should extend a minimum of 5 ft beyond the limits of the proposed construction. In addition, we recommend associated underground utilities be completely removed from the project area as necessary.

Following these removal activities, we anticipate the near surface subgrade conditions to consist of moisture-sensitive cohesive soils. To reduce the risk of softening of the near-surface soils, especially when exposed to excessive moisture, we recommend that proper site drainage be provided at the time of construction (via the use of ditches and/or piping) and only removal of the surface conditions in those areas which will be immediately developed.

Furthermore, because otherwise relatively stiff cohesive subgrades will deteriorate when exposed to excessive moisture and repeated construction traffic, we recommend avoiding excessive vehicular traffic over the exposed subgrades. In addition, we recommend that the Geotechnical Engineer be on-site during construction to evaluate the subgrade conditions following removal of the surficial conditions.

Following these activities, we recommend the exposed soil subgrades be evaluated via proof-rolling using a heavy rubber-tired vehicle. The purpose of proofrolling is to provide a first-order

evaluation of how the subgrade is anticipated to react to construction traffic and gain an additional understanding of the conditions for support of the structure. Given the moisture content of the near surface soils observed in the borings, we expect a majority of the subgrade may pass a proofroll. Where yielding areas are delineated and are not improved with moisture conditioning and compaction, they should be stabilized via chemical modification, large-sized aggregate or undercut and replaced with structural fill.

## Fill Material Types

Fill required to achieve design grade should be classified as structural fill and general fill. Structural fill is material used below, or within 10 ft of structures, pavements or constructed slopes. General fill is material used to achieve grade outside of these areas. Earthen materials used for structural and general fill should meet the following material property requirements:

| Soil Type [1] | USCS Classification | Acceptable Fill Designation |
|---|---|---|
| Low Plasticity Cohesive | CL, CL-ML | Structural or General |
| High Plasticity Cohesive [2] | CH, MH | General |
| Granular | GW, GP, SW, SP, SW-SM, SP-SM | Structural or General |
| On-Site Soils | CL | Structural or General |
| | CH [2] | General |

1. Structural and general fill should consist of approved materials free of organic matter and debris. Frozen material should not be used, and fill should not be placed on a frozen subgrade. A sample of each material type should be submitted to the Geotechnical Engineer for evaluation prior to use on this site.
2. Soils classified as CH or MH should not be used within 2 ft below the base of footings and 1 ft below slabs .

## Fill Compaction Requirements

Structural and general fill should meet the following compaction requirements.

| Item | Recommendation | |
|---|---|---|
| **Fill Designation** | **Structural Fill** | **General Fill** |
| **Maximum Lift Thickness** [1, 2] | 8 in. or less in loose thickness when heavy, self-propelled compaction equipment is used.<br>4 in. in loose thickness when hand guided equipment (i.e., jumping jack or plate compactor) is used. | |

| Item | Recommendation | |
|---|---|---|
| **Minimum Compaction Requirements** [1, 2] | 95 percent of the modified Proctor density (ASTM D 1557) | 90 percent of the modified Proctor density (ASTM D 1557) |
| **Water Content Range** | ±2 percent of optimum | |

1. The acceptable thickness of loose lifts of fill and/or number of passes required by the compaction equipment to achieve compaction to the density recommended in this report will be a function of the type of compaction equipment and techniques used, the soil type, as well as proper control of the soil moisture content and the season in which construction takes place.
2. Periodic field density tests performed by the Geotechnical Engineer during fill placement are recommended to determine the adequacy of the compaction effort.

## Grading and Drainage

Effective drainage by collection or grading away from the structures during and after construction should be maintained throughout the life of the structure. Water retained adjacent to the foundations can result in soil movements greater than those discussed in this report. Greater movements can result in unacceptable differential foundation movements. Where paving or flatwork abuts the columns, a maintenance program should be established to effectively seal and maintain joints and prevent surface water infiltration.

## Earthwork Construction Considerations

Shallow excavations are anticipated to be accomplished with conventional construction equipment. Upon completion of filling and grading, care should be taken to maintain the subgrade water content prior to construction of foundations. Construction traffic over the completed subgrades should be avoided. The site should also be graded to prevent ponding of surface water on the prepared subgrades or in excavations. Water collecting over or adjacent to construction areas should be removed. If the subgrade freezes, desiccates, saturates, or is disturbed, the affected material should be removed, or the materials should be scarified, moisture conditioned, and recompacted prior to foundation construction.

Although not anticipated based on the groundwater levels observed, perched groundwater or surface water entering excavations could affect over-excavation efforts if encountered, especially where unsuitable bearing conditions require over-excavation and replacement of lower strength soils. In this case, a temporary dewatering system could be necessary to achieve the recommended depth of over-excavation.

As a minimum, excavations should be performed in accordance with OSHA 29 CFR, Part 1926, Subpart P, “Excavations” and its appendices, and in accordance with any applicable local, and/or state regulations. Construction site safety is the sole responsibility of the contractor who controls the means, methods, and sequencing of construction operations. Under no circumstances shall the information provided herein be interpreted to mean Terracon is assuming responsibility for

construction site safety, or the contractor's activities; such responsibility shall neither be implied nor inferred.

### Construction Observation and Testing

The earthwork efforts should be observed by the Geotechnical Engineer. These observations should include documentation of adequate removal of surficial conditions, proofrolling, and remediation of areas delineated by the proofroll to require stabilization.

Each lift of compacted fill should be tested, evaluated, and reworked, as necessary, until approved by the Geotechnical Engineer prior to placement of additional lifts. Each lift of fill should be tested for density and water content.

In areas of foundation excavations, the bearing subgrade should be evaluated under the direction of the Geotechnical Engineer. If unanticipated conditions are encountered, the Geotechnical Engineer should recommend stabilization options.

In addition to the documentation of the essential parameters necessary for construction, the continuation of the Geotechnical Engineer into the construction phase of the project provides the continuity to maintain the Geotechnical Engineer's evaluation of subsurface conditions including assessing variations and associated design changes.

## SHALLOW FOUNDATIONS

In general, the subsurface conditions observed at the boring locations are suitable for support of the proposed building, with the possible exception of potential karstic features observed at Boring B-02. As indicated previously, fat clay is anticipated to be present at the foundation grade, depending on final grades. Where fat clays are observed at the foundation grade, we recommend these soils be undercut at least 2 ft and the foundation grade be reestablished with structural fill as discussed herein.

Provided the subgrades are prepared and fill placed in accordance with the recommendations noted in the **Earthwork** section, the following design parameters are applicable for shallow foundations.

### Design Parameters – Compressive Loads

| Item | Description |
|---|---|
| **Maximum Net Allowable Bearing pressure for naturally occurring soils** [1] | 2,500 psf when founded on required bearing stratum as described below. |

| Item | Description |
|---|---|
| **Required Bearing Stratum** [2, 3] | Shallow foundations should bear on stiff or greater consistency cohesive soils or new structural fill placed on suitable soils. Bearing stratum should be observed by the Geotechnical Engineer. |
| **Ultimate Coefficient of Sliding Friction** [4] | 0.35 |
| **Minimum Foundation Dimensions** | Columns: 30 in. wide<br>Continuous: 18 in. wide |
| **Minimum Embedment below Finished Grade** [5] | 36 in. |
| **Estimated Total Settlement from Structural Loads** [6] | Not anticipated to exceed 1 in. |
| **Estimated Differential Settlement** [6] | Not anticipated to exceed ½ in. |

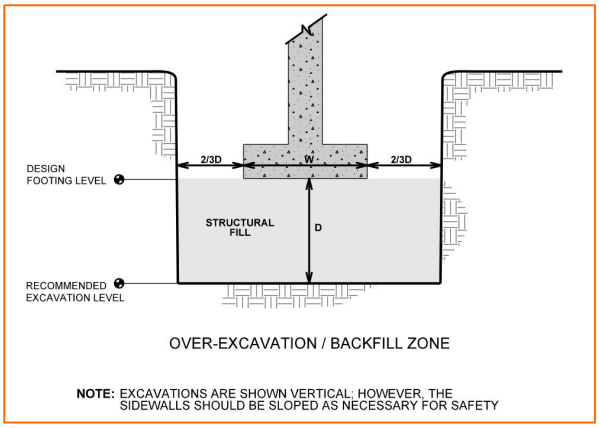
1. The maximum net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation. Maximum net allowable bearing pressure based on a Factor of Safety (FS) = 3.
2. Soft soils should be removed and replaced with compacted granular fill, or the foundations could be lowered to a suitable bearing stratum. Structural fill should meet the USCS classification and compaction requirements provided in the **Earthwork** section of this report.
3. Where fat clay is observed at the foundation grade, these soils should be undercut by 2 ft and grade be reestablished with compacted granular fill or lean concrete.
4. Ultimate coefficient of sliding friction can be used to compute sliding resistance where foundations are placed on suitable soil/materials. Sliding friction should be neglected for foundations subject to net uplift conditions.
5. Embedment necessary to minimize the effects of frost and/or seasonal water content variations. For sloping ground, maintain depth below the lowest adjacent exterior grade within 5 horizontal ft of the structure.
6. Settlements were estimated assuming relatively light to moderate structural loads, and our experience with similar construction. Actual settlements will depend on actual loads and construction methods. In addition, settlement estimates do not consider the effects of any underlying karstic features, if any.

## Foundation Construction Considerations

As noted in **Earthwork**, the footing excavations should be evaluated under the direction of the Geotechnical Engineer. The base of all foundation excavations should be free of water and loose soil, prior to placing concrete. Concrete should be placed soon after excavating to reduce the risk of disturbance to the soil. Care should be taken to prevent wetting or drying of the bearing materials during construction. Excessively wet or dry material or any loose/disturbed material in the bottom of the footing excavations should be removed/reconditioned before foundation concrete is placed.

If unsuitable bearing soils such as soft cohesive soils are encountered during foundation excavation activities, they should be removed and replaced with compacted structural fill, or the foundations could be lowered to a suitable bearing stratum. Where undercutting is required

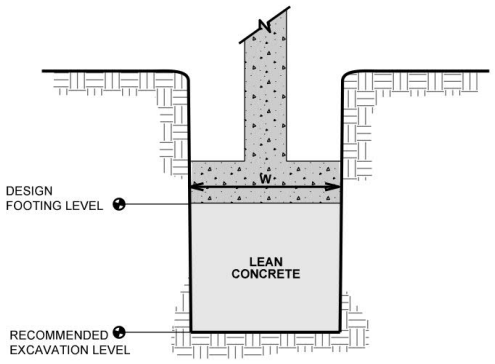
beneath proposed foundations, the excavation should be widened beyond the footing width a distance equal to ⅔ of the depth of undercut to provide for a uniform stress distribution as illustrated on the sketch below. We recommend compacted granular fill be utilized to reestablish undercut foundation grades (in lieu of cohesive soil fill) due to its ease of placement/compaction as compared to cohesive soils.




OVER-EXCAVATION / BACKFILL ZONE

**NOTE:** EXCAVATIONS ARE SHOWN VERTICAL; HOWEVER, THE SIDEWALLS SHOULD BE SLOPED AS NECESSARY FOR SAFETY

Consideration could also be given to the use of lean concrete in undercut areas extending to bear directly on deeper suitable soils as illustrated on the sketch below. We recommend a contingency be included in the contract to account for undercutting and fill placement and compaction as needed to address poor foundation subgrade conditions.




LEAN CONCRETE BACKFILL

**NOTE:** EXCAVATIONS ARE SHOWN VERTICAL; HOWEVER, THE SIDEWALLS SHOULD BE SLOPED AS NECESSARY FOR SAFETY

## Additional Construction Considerations

Based on our review of the *Soil Survey of Putnam County, Indiana*, dewatering as a result of perched groundwater infiltration during shallow foundation construction may be needed. If surface water run-off or trapped/perched water enters foundation excavations, we anticipate that removal of the water can likely be performed by using a pump and filtered sump, possibly in combination

with collection trenches. In addition, all excavations should conform with Occupational Safety and Health Administration (OSHA) requirements. The contractor is solely responsible for excavation safety.

## FLOOR SLABS

Provided the subgrade areas are prepared in accordance with the recommendations noted in the **Earthwork** section, the following design parameters are applicable for slab design.

| Item | Description |
|---|---|
| **Slab Support** [1] | Minimum of 6 in. of free-draining granular material compacted to 95 percent of the modified Proctor density (ASTM D 1557) [2] |
| **Modulus of Subgrade Reaction** [3] | 100 pci |

1. Floor slabs should be structurally independent of building footings and walls to reduce the possibility of floor slab cracking caused by differential movements between the slab and foundation.
2. Suitable clean, free-draining soil should contain no more than 5 percent fines, by weight, passing the No. 200 U.S. Standard sieve.
3. Note that the modulus of subgrade reaction is based on a 30-in. diameter loaded area. The modulus of subgrade reaction value should be used for a first-order approximation of the shear and moment requirements of the floor slab. The design of the slab is anticipated to be based on an iterative process involving the stiffness of the floor slab and the location and magnitude of the applied loads in relation to the soil's characteristics. Depending on the actual shear and moment considerations for the slab, it may be necessary to modify this value as a function of the location and magnitude of the applied loads.

The use of a vapor retarder should be considered beneath concrete slabs on grade covered with wood, tile, carpet, or other moisture sensitive or impervious coverings, or when the slab will support equipment sensitive to moisture. When conditions warrant the use of a vapor retarder, the slab designer should refer to ACI 302 and/or ACI 360 for procedures and cautions regarding the use and placement of a vapor retarder.

Saw-cut control joints should be placed in the slab to help control the location and extent of cracking. For additional recommendations refer to the ACI Design Manual. Joints or cracks should be sealed with a water-proof, non-extruding compressible compound specifically recommended for heavy duty concrete pavement and wet environments.

Where slabs are tied to perimeter walls or turn-down slabs to meet structural or other construction objectives, our experience indicates differential movement between the walls and slabs will likely be observed in adjacent slab expansion joints or slab cracks beyond the length of the structural dowels. The Structural Engineer should account for potential differential settlement through use of sufficient control joints, appropriate reinforcing or other means.

## SEISMIC CONSIDERATIONS

The Site Classification is required to determine the Seismic Design Category for structures. Based on our observations, it is our opinion the subsurface conditions most closely resemble a Site Class D. Note that the Site Class is based on the upper 100 ft of the site profile defined by a weighted average value of either shear wave velocity, standard penetration resistance, or undrained shear strength in accordance with ASCE 7 and International Building Code (IBC), and our exploratory activities extended to a depth of 58½ feet. The site properties below the boring depth to 100 ft were estimated based on the review of geologic conditions of the general area. Additional deeper borings or geophysical testing may be performed to confirm the conditions below the current boring depth.

## GENERAL COMMENTS

Our analysis and opinions are based upon our understanding of the project, the geotechnical conditions in the area, and the data obtained from our site exploration. Natural variations will occur between exploration point locations or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. Terracon should be retained as the Geotechnical Engineer, where noted in this report, to provide observation and testing services during pertinent construction phases. If variations appear, we can provide further evaluation and supplemental recommendations. If variations are noted in the absence of our observation and testing services on-site, we should be immediately notified so that we can provide evaluation and supplemental recommendations.

Our Scope of Services does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

Our services and any correspondence are intended for the sole benefit and exclusive use of our client for specific application to the project discussed and are accomplished in accordance with generally accepted geotechnical engineering practices with no third-party beneficiaries intended. Any third-party access to services or correspondence is solely for information purposes to support the services provided by Terracon to our client. Reliance upon the services and any work product is limited to our client, and is not intended for third parties. Any use or reliance of the provided information by third parties is done solely at their own risk. No warranties, either express or implied, are intended or made.

Site characteristics as provided are for design purposes and not to estimate excavation cost. Any use of our report in that regard is done at the sole risk of the excavating cost estimator as there may be variations on the site that are not apparent in the data that could significantly impact excavation cost. Any parties charged with estimating excavation costs should seek their own site

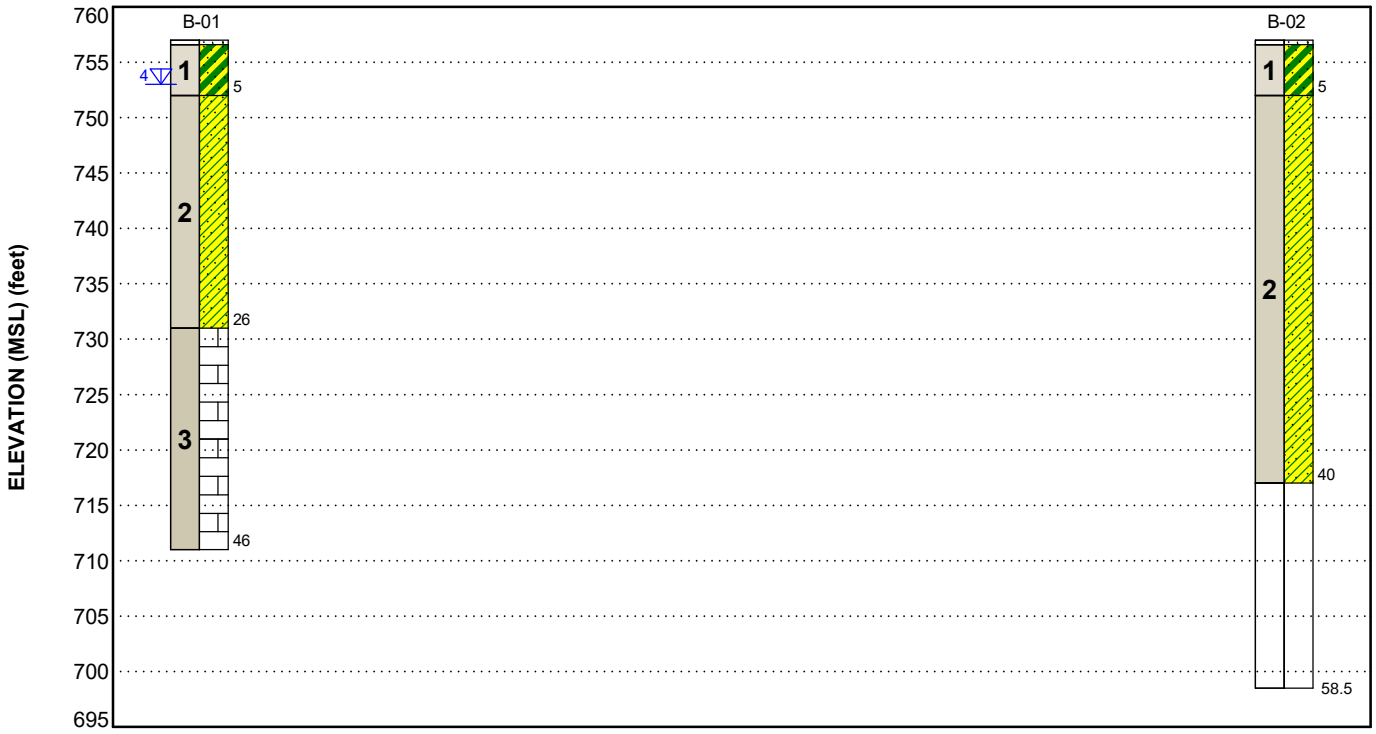
characterization for specific purposes to obtain the specific level of detail necessary for costing. Site safety, and cost estimating including, excavation support, and dewatering requirements/design are the responsibility of others. If changes in the nature, design, or location of the project are planned, our conclusions and recommendations shall not be considered valid unless we review the changes and either verify or modify our conclusions in writing.

# FIGURES

**Contents:**

## GEOMODEL

**Deer Creek Storage Facility ■ Greencastle, IN**
**Terracon Project No. CJ215382**




This is not a cross section. This is intended to display the Geotechnical Model only. See individual logs for more detailed conditions.

| Model Layer | Layer Name | General Description |
|---|---|---|
| 1 | **Sandy Fat Clay** | Trace gravel; brown; stiff to very stiff |
| 2 | **Sandy Lean Clay** | Trace gravel; brown; stiff to hard |
| 3 | **Limestone** | Gray; moderately hard to hard |

## LEGEND

Topsoil
Sandy Fat Clay
Sandy Lean Clay
Limestone with Horizontal Fracture

Second Water Observation

Groundwater levels are temporal. The levels shown are representative of the date and time of our exploration. Significant changes are possible over time. Water levels shown are as measured during and/or after drilling. In some cases, boring advancement methods mask the presence/absence of groundwater. See individual logs for details.

NOTES:
Layering shown on this figure has been developed by the geotechnical engineer for purposes of modeling the subsurface conditions as required for the subsequent geotechnical engineering for this project. Numbers adjacent to soil column indicate depth below ground surface.

# ATTACHMENTS

# EXPLORATION AND TESTING PROCEDURES

## Field Exploration

| Boring Nos. | Boring Depth (feet) | Planned Location |
|---|---|---|
| B-01 and B-02 | 46 to 58½ | Building Area |

**Boring Layout and Elevations:** The boring locations were marked in the field by Terracon personnel using hand held GPS equipment with a horizontal accuracy of about 10 feet based on the coordinates obtained by overlaying the conceptual site plan provided by IDNR onto Google Earth Pro™. Furthermore, ground surface elevations at the boring locations were estimated using topographic information provided by IDNR. A topographic survey of the exploratory locations was outside the scope of this exploration. If precise locations and elevations are desired, we recommend a licensed surveyor be retained to provide ground surface elevations.

**Subsurface Exploration Procedures:** We advanced the borings using track-mounted equipment and hollow stem augers to advance the boreholes. Four samples were obtained in the upper 10 feet of each boring and 5 feet intervals thereafter. In the split-spoon sampling procedure, a standard 2-inch outer diameter split-barrel sampling spoon was driven into the ground by a 140-pound automatic hammer falling a distance of 30 inches. The number of blows required to advance the sampling spoon the last 12 inches of a normal 18-inch penetration is recorded as the Standard Penetration Test (SPT) resistance value. The SPT resistance values, also referred to as N-values, are indicated on the boring logs at the test depths. In addition, rock core samples were obtained using diamond core drilling methods and an N-sized core barrel. Photographs of the rock samples are provided in the **Exploration Results** section. Following the completion of our exploratory activities, the boreholes were backfilled with auger cuttings and a bentonite chip plug was placed near the surface.

The sampling depths, penetration distances, and other sampling information were recorded on the field boring logs. The samples were placed in appropriate containers and taken to our soil laboratory for testing and classification. Our exploration team prepared field boring logs as part of the drilling operations. These field logs included visual classifications of the materials encountered during drilling and our interpretation of the subsurface conditions between samples.

## Laboratory Testing

The soil samples were reviewed by a geotechnical engineer who assigned laboratory tests. Soil classifications on the boring logs are according to the Unified Soil Classification System (USCS). Further details regarding the classification system are provided in **Supporting Information**. After classifying the samples, the following laboratory testing program was performed:

- Hand penetrometer readings (i.e., $q_p$, which provide an indication of the shear strength characteristics of cohesive-type soils);
- Natural moisture content tests (W%);
- Atterberg limit determinations;
- Grain size distribution; and
- Uniaxial compression tests on rock

Applicable ASTM standard procedures were followed in laboratory testing of the soil samples. Upon completion of our laboratory testing program, boring logs were prepared and are provided in the attachments. The results of these tests are included on the test boring logs and/or laboratory test reports. It should be mentioned that the boring logs represent the approximate boundary between soil types; although the transitions may actually be gradual.

# SITE LOCATION AND EXPLORATION PLANS

**Contents:**

Site Location
Exploration Plan

Note: All attachments are one page unless noted above.

## SITE LOCATION

Deer Creek Storage Facility ■ Greencastle, Indiana
October 5, 2021 ■ Terracon Project No. CJ215382

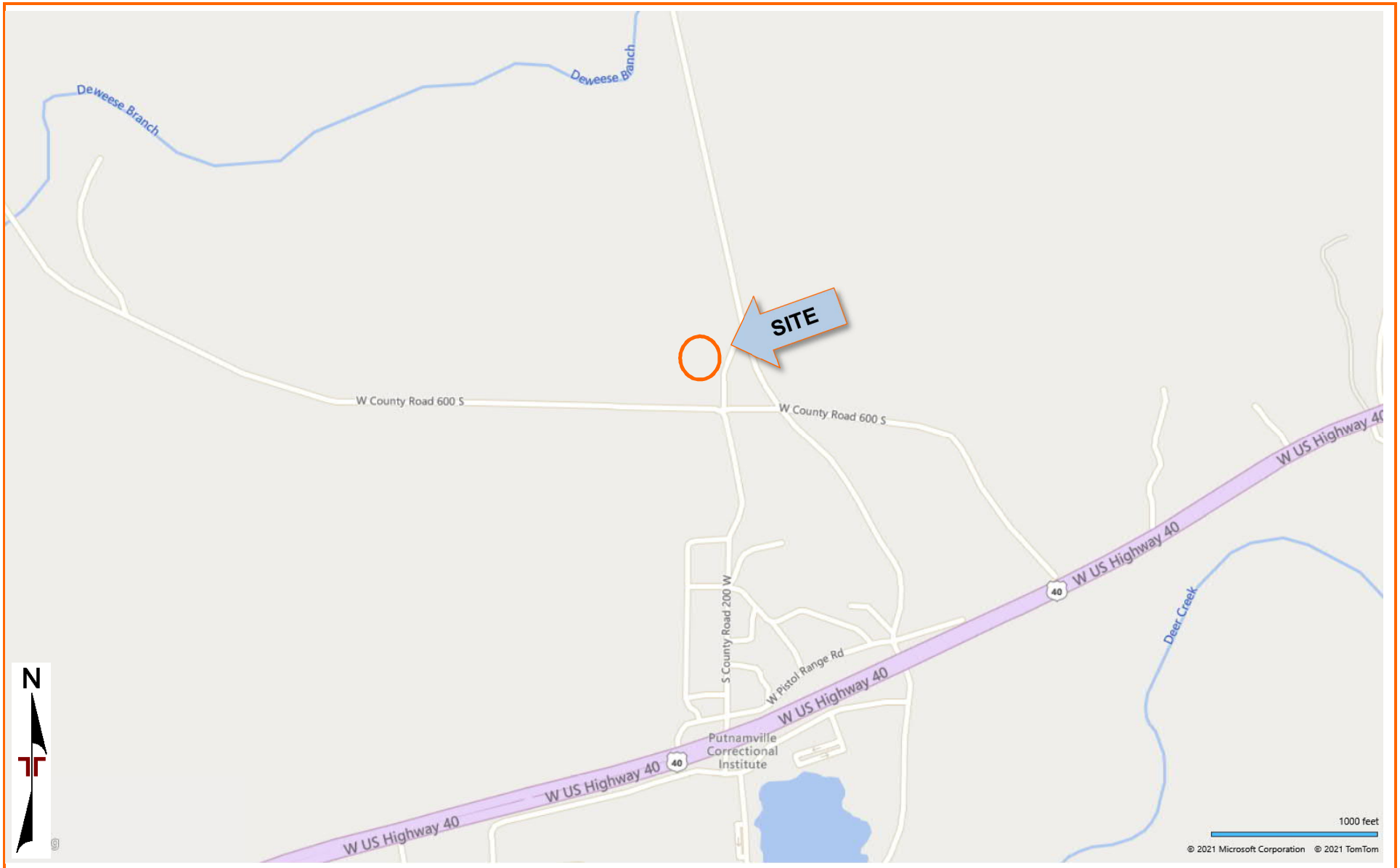



DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

## EXPLORATION PLAN

Deer Creek Storage Facility ■ Greencastle, Indiana
October 5, 2021 ■ Terracon Project No. CJ215382


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES, NOT SCALE

MAP PROVIDED BY MICROSOFT BING MAPS

# EXPLORATION RESULTS

**Contents:**



Note: All attachments are one page unless noted above.

# BORING LOG NO. B-01



**PROJECT: Deer Creek Storage Facility**

**CLIENT: Indiana Department of Natural Resources (IDNR)**
**Indianapolis, IN**

**SITE:**
**Greencastle, IN**

LOCATION See Exploration Plan

Latitude: 39.5746° Longitude: -86.8872°

Approximate Surface Elev.: 757 (Ft.) +/-

| MODEL LAYER | GRAPHIC LOG | DEPTH | ELEVATION (Ft.) | DEPTH (Ft.) | WATER LEVEL OBSERVATIONS | SAMPLE TYPE | RECOVERY (In.) | FIELD TEST RESULTS | RDQ% | LABORATORY HP (tsf) | UNCONFINED COMPRESSIVE STRENGTH (tsf) | WATER CONTENT (%) | ATTERBERG LIMITS LL-PL-PI | PERCENT FINES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 0.4 | 756.5+/- | | | | | | | | | | | |
| 1 | | | **TOPSOIL**, (4 in) | | | | | | | | | | | |
| | | | **SANDY FAT CLAY (CH)**, trace gravel, brown, very stiff | | | X | 18 | 2-4-5 N=9 | | 2.0 (HP) | | 19.8 | | |
| | | | | | ▽ | X | 7 | 2-4-6 N=10 | | 2.25 (HP) | | 20.3 | 51-17-34 | 65 |
| | | 5.0 | 752+/- | 5 | | X | 18 | 3-6-9 N=15 | | 3.5 (HP) | | 15.6 | | |
| | | | | | | X | 18 | 3-3-3 N=6 | | 1.75 (HP) | | 16.5 | | |
| 2 | | | **SANDY LEAN CLAY (CL)**, trace gravel, brown, stiff to hard | 10 | | | | | | | | | | |
| | | | | 15 | | X | 0 | 13-17-19 N=36 | | | | | | |
| | | | | 20 | | X | 18 | 4-9-9 N=18 | | 4.25 (HP) | | 13.8 | | |
| | | | | | | X | 18 | 6-20-29 N=49 | | 4.5+ (HP) | | 16.7 | | |
| | | 26.0 | 731+/- | 25 | | | | | | | | | | |
| 3 | | | **LIMESTONE**, fine grained, gray, moderately hard to hard, very low bedding planes, with interbedded shale throughout | | | | 58 | | 85 | | 440 | | | |
| | | | | 30 | | | | | | | | | | |

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3¼" HSA

Abandonment Method:
Backfilled with auger cuttings and bentonite chip plug to the surface.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

Auger refusal at 26 ft
Water introduced during rock coring

**WATER LEVEL OBSERVATIONS**

*No water observed during drilling*

▽ *4 ft At completion of drilling*

Terracon
7770 W New York St
Indianapolis, IN

Boring Started: 09-09-2021 | Boring Completed: 09-09-2021

Drill Rig: CME 55 Track | Driller: J.W.

Project No.: CJ215382

# BORING LOG NO. B-01



**PROJECT: Deer Creek Storage Facility**

**CLIENT: Indiana Department of Natural Resources (IDNR) Indianapolis, IN**

**SITE: Greencastle, IN**

LOCATION See Exploration Plan

Latitude: 39.5746° Longitude: -86.8872°

Approximate Surface Elev.: 757 (Ft.) +/-

| MODEL LAYER | GRAPHIC LOG | DEPTH | ELEVATION (Ft.) | DEPTH (Ft.) | WATER LEVEL OBSERVATIONS | SAMPLE TYPE | RECOVERY (In.) | FIELD TEST RESULTS | RDQ% | LABORATORY HP (tsf) | UNCONFINED COMPRESSIVE STRENGTH (tsf) | WATER CONTENT (%) | ATTERBERG LIMITS LL-PL-PI | PERCENT FINES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | | | | 35 | | | 58 | | 87 | | | | | |
| | | | | 40 | | | 57 | | 76 | | 295 | | | |
| | | | | 45 | | | 58 | | 50 | | | | | |

**LIMESTONE**, fine grained, gray, moderately hard to hard, very low bedding planes, with interbedded shale throughout *(continued)*

46.0 711+/-

***Boring Terminated at 46 Feet***

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3¼" HSA

Abandonment Method:
Backfilled with auger cuttings and bentonite chip plug to the surface.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

**WATER LEVEL OBSERVATIONS**

*No water observed during drilling*

*4 ft At completion of drilling*

Terracon
7770 W New York St
Indianapolis, IN

Boring Started: 09-09-2021 | Boring Completed: 09-09-2021

Drill Rig: CME 55 Track | Driller: J.W.

Project No.: CJ215382

# BORING LOG NO. B-02



**PROJECT: Deer Creek Storage Facility**

**CLIENT: Indiana Department of Natural Resources (IDNR)**
**Indianapolis, IN**

**SITE:**
**Greencastle, IN**

LOCATION See Exploration Plan

Latitude: 39.5747° Longitude: -86.8867°

Approximate Surface Elev.: 757 (Ft.) +/-

| MODEL LAYER | GRAPHIC LOG | DEPTH | ELEVATION (Ft.) | DEPTH (Ft.) | WATER LEVEL OBSERVATIONS | SAMPLE TYPE | RECOVERY (In.) | FIELD TEST RESULTS | RDQ% | LABORATORY HP (tsf) | UNCONFINED COMPRESSIVE STRENGTH (tsf) | WATER CONTENT (%) | ATTERBERG LIMITS LL-PL-PI | PERCENT FINES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 0.4 | 756.5+/- | | | | | | | | | | | |
| | | **TOPSOIL**, (4 in) | | | | | | | | | | | | |
| 1 | | **SANDY FAT CLAY (CH)**, trace gravel, brown, stiff to very stiff, with silt seam near 2 ft | | | | X | 18 | 2-3-5 N=8 | | 3.5 (HP) | | 21.4 | | |
| | | | | | | X | 18 | 3-4-5 N=9 | | 1.0 (HP) | | 26.9 | | |
| | | 5.0 | 752+/- | 5 | | X | 18 | 4-4-5 N=9 | | 1.5 (HP) | | 19.1 | | |
| | | **SANDY LEAN CLAY (CL)**, trace gravel, brown to gray around 14 ft, stiff to very stiff, with sand seam near 14 ft, with silt seam near 19 ft, with possible rock fragments around 34 ft | | | | X | 18 | 2-4-5 N=9 | | 2.0 (HP) | | 24.2 | | |
| | | | | 10 | | | | | | | | | | |
| | | | | | | X | 18 | 3-3-3 N=6 | | 1.0 (HP) | | 18.0 | | |
| 2 | | | | 15 | | | | | | | | | | |
| | | | | | | X | 18 | 6-12-22 N=34 | | | | 17.9 | | |
| | | | | 20 | | | | | | | | | | |
| | | | | | | X | 16 | 5-10-11 N=21 | | 4.0 (HP) | | 15.1 | | |
| | | | | 25 | | | | | | | | | | |
| | | | | | | X | 18 | 5-6-8 N=14 | | 2.5 (HP) | | 14.8 | 27-13-14 | 58 |
| | | | | 30 | | | | | | | | | | |

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3¼" HSA

Abandonment Method:
Backfilled with auger cuttings and bentonite chip plug to the surface.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

**WATER LEVEL OBSERVATIONS**

*No water observed during drilling*

*No water observed at completion*

Terracon
7770 W New York St
Indianapolis, IN

Boring Started: 09-09-2021 | Boring Completed: 09-09-2021

Drill Rig: CME 55 Track | Driller: J.W.

Project No.: CJ215382

# BORING LOG NO. B-02



**PROJECT: Deer Creek Storage Facility**

**CLIENT: Indiana Department of Natural Resources (IDNR)**
**Indianapolis, IN**

**SITE:**
**Greencastle, IN**

LOCATION See Exploration Plan

Latitude: 39.5747° Longitude: -86.8867°

Approximate Surface Elev.: 757 (Ft.) +/-

| MODEL LAYER | GRAPHIC LOG | DEPTH | ELEVATION (Ft.) | DEPTH (Ft.) | WATER LEVEL OBSERVATIONS | SAMPLE TYPE | RECOVERY (In.) | FIELD TEST RESULTS | RDQ% | LABORATORY HP (tsf) | UNCONFINED COMPRESSIVE STRENGTH (tsf) | WATER CONTENT (%) | ATTERBERG LIMITS LL-PL-PI | PERCENT FINES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | | | **SANDY LEAN CLAY (CL)**, trace gravel, brown to gray around 14 ft, stiff to very stiff, with sand seam near 14 ft, with silt seam near 19 ft, with possible rock fragments around 34 ft *(continued)* | 35 | | | 18 | 5-6-9 N=15 | | 2.5 (HP) | | 15.8 | | |
| | | | | 40 | | | 16 | 6-7-9 N=16 | | 1.0 (HP) | | 20.4 | | |
| | | 40.0 | 717+/- | | | | | | | | | | | |
| | | | Blank drilled to 58.5 ft to verify rock depth and the sound rock surface (i.e., defined by auger refusal) was not observed | 45 | | | | | | | | | | |
| | | | | 50 | | | | | | | | | | |
| | | | | 55 | | | | | | | | | | |
| | | 58.5 | 698.5+/- | | | | | | | | | | | |
| | | | ***Boring Terminated at 58.5 Feet*** | | | | | | | | | | | |

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3¼" HSA

Abandonment Method:
Backfilled with auger cuttings and bentonite chip plug to the surface.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

**WATER LEVEL OBSERVATIONS**

*No water observed during drilling*

*No water observed at completion*

Terracon
7770 W New York St
Indianapolis, IN

Boring Started: 09-09-2021 | Boring Completed: 09-09-2021

Drill Rig: CME 55 Track | Driller: J.W.

Project No.: CJ215382

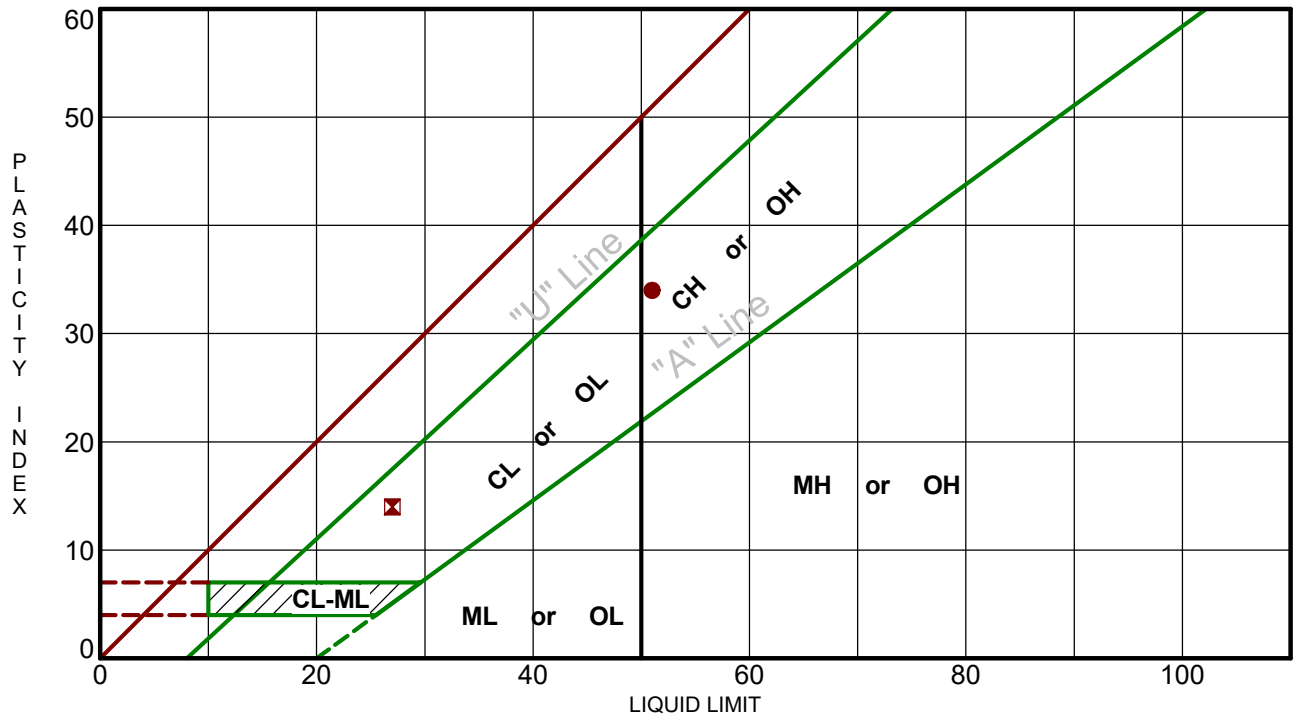
# ROCK CORE PHOTOGRAPHY LOG


**Boring B-01, Rock Core Nos. RC-1 & 2 (Depth 26’ – 36’)**


**Boring B-01, Rock Core Nos. RC-3 & 4 (Depth 36’ – 46’)**

# ATTERBERG LIMITS RESULTS

**ASTM D4318**




| Boring ID | | Depth | LL | PL | PI | Fines | USCS | Description |
|---|---|---|---|---|---|---|---|---|
| ● | B-01 | 3.5 - 5 | 51 | 17 | 34 | 64.7 | CH | SANDY FAT CLAY |
| ⊠ | B-02 | 28.5 - 30 | 27 | 13 | 14 | 58.5 | CL | SANDY LEAN CLAY |

PROJECT: Deer Creek Storage Facility

PROJECT NUMBER: CJ215382

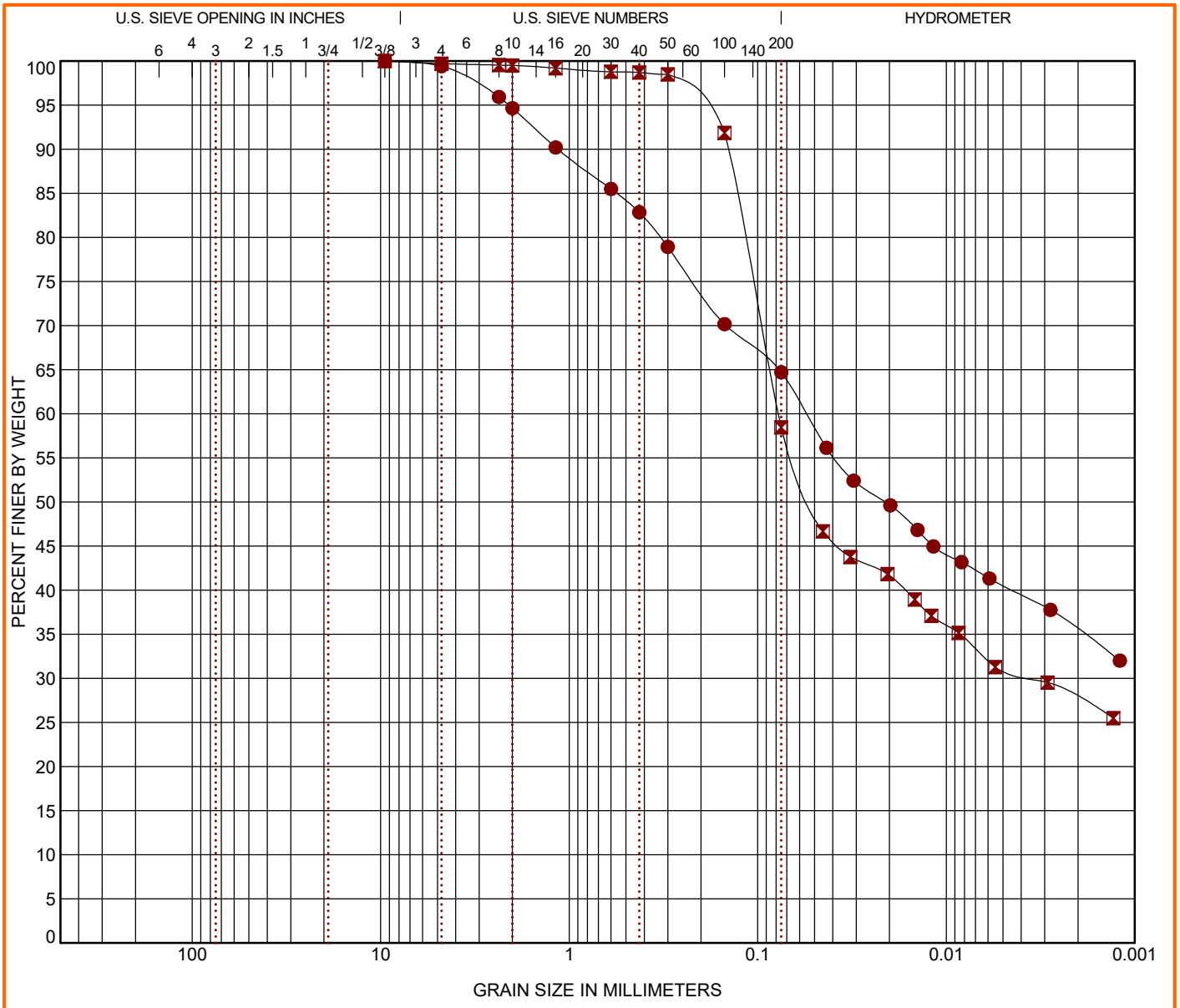
SITE: Greencastle, IN

Terracon
7770 W New York St
Indianapolis, IN

CLIENT: Indiana Department of Natural Resources (IDNR)
Indianapolis, IN

# GRAIN SIZE DISTRIBUTION

**ASTM D422 / ASTM C136**




| COBBLES | GRAVEL | | SAND | | | SILT OR CLAY |
|---|---|---|---|---|---|---|
| | coarse | fine | coarse | medium | fine | |

| Boring ID | | Depth | USCS Classification | WC (%) | LL | PL | PI | Cc | Cu |
|---|---|---|---|---|---|---|---|---|---|
| ● | B-01 | 3.5 - 5 | SANDY FAT CLAY (CH) | 20.3 | 51 | 17 | 34 | | |
| ⊠ | B-02 | 28.5 - 30 | SANDY LEAN CLAY (CL) | 14.8 | 27 | 13 | 14 | | |

| Boring ID | | Depth | $D_{100}$ | $D_{60}$ | $D_{30}$ | $D_{10}$ | %Cobbles | %Gravel | %Sand | %Silt | %Fines | %Clay |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ● | B-01 | 3.5 - 5 | 9.5 | 0.055 | | | 0.0 | 0.6 | 34.7 | 24.2 | | 40.5 |
| ⊠ | B-02 | 28.5 - 30 | 9.5 | 0.077 | 0.003 | | 0.0 | 0.3 | 41.2 | 27.4 | | 31.0 |

PROJECT: Deer Creek Storage Facility

SITE: Greencastle, IN

Terracon
7770 W New York St
Indianapolis, IN

PROJECT NUMBER: CJ215382

CLIENT: Indiana Department of Natural Resources (IDNR)
Indianapolis, IN

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS-2 CJ215382 DEER CREEK STORAG.GPJ TERRACON_DATATEMPLATE.GDT 9/29/21

# SUPPORTING INFORMATION

**Contents:**

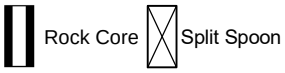


Note: All attachments are one page unless noted above.

# GENERAL NOTES

## DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

**SAMPLING**




**WATER LEVEL**

**Water Initially Encountered**

**Water Level After a Specified Period of Time**

**Water Level After a Specified Period of Time**

Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.

**FIELD TESTS**

| | |
|---|---|
| **N** | **Standard Penetration Test Resistance (Blows/Ft.)** |
| **(HP)** | **Hand Penetrometer** |
| **(T)** | **Torvane** |
| **(DCP)** | **Dynamic Cone Penetrometer** |
| **(PID)** | **Photo-Ionization Detector** |
| **(OVA)** | **Organic Vapor Analyzer** |

## DESCRIPTIVE SOIL CLASSIFICATION

Soil classification is based on the Unified Soil Classification System. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; their principal descriptors are: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are principally described as clays if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

## LOCATION AND ELEVATION NOTES

Unless otherwise noted, Latitude and Longitude are approximately determined using a hand-held GPS device. The accuracy of such devices is variable. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

**STRENGTH TERMS**

| **RELATIVE DENSITY OF COARSE-GRAINED SOILS** (More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance | | **CONSISTENCY OF FINE-GRAINED SOILS** (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance | | |
|---|---|---|---|---|
| **Descriptive Term (Density)** | **Standard Penetration or N-Value Blows/Ft.** | **Descriptive Term (Consistency)** | **Unconfined Compressive Strength Qu, (tsf)** | **Standard Penetration or N-Value Blows/Ft.** |
| Very Loose | 0 - 3 | Very Soft | less than 0.25 | 0 - 1 |
| Loose | 4 - 9 | Soft | 0.25 to 0.50 | 2 - 4 |
| Medium Dense | 10 - 29 | Medium Stiff | 0.50 to 1.00 | 4 - 8 |
| Dense | 30 - 50 | Stiff | 1.00 to 2.00 | 8 - 15 |
| Very Dense | > 50 | Very Stiff | 2.00 to 4.00 | 15 - 30 |
| | | Hard | > 4.00 | > 30 |

### RELATIVE PROPORTIONS OF SAND AND GRAVEL

| Descriptive Term(s) of other constituents | Percent of Dry Weight |
|---|---|
| Trace | < 15 |
| With | 15 - 29 |
| Modifier | > 30 |

### GRAIN SIZE TERMINOLOGY

| Major Component of Sample | Particle Size |
|---|---|
| Boulders | Over 12 in. (300 mm) |
| Cobbles | 12 in. to 3 in. (300mm to 75mm) |
| Gravel | 3 in. to #4 sieve (75mm to 4.75 mm) |
| Sand | #4 to #200 sieve (4.75mm to 0.075mm |
| Silt or Clay | Passing #200 sieve (0.075mm) |

### RELATIVE PROPORTIONS OF FINES

| Descriptive Term(s) of other constituents | Percent of Dry Weight |
|---|---|
| Trace | < 5 |
| With | 5 - 12 |
| Modifier | > 12 |

### PLASTICITY DESCRIPTION

| Term | Plasticity Index |
|---|---|
| Non-plastic | 0 |
| Low | 1 - 10 |
| Medium | 11 - 30 |
| High | > 30 |

Terracon

# UNIFIED SOIL CLASSIFICATION SYSTEM

| Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [A] | | | | | Soil Classification | |
|---|---|---|---|---|---|---|
| | | | | | Group Symbol | Group Name [B] |
| **Coarse-Grained Soils:** More than 50% retained on No. 200 sieve | **Gravels:** More than 50% of coarse fraction retained on No. 4 sieve | **Clean Gravels:** Less than 5% fines [C] | $Cu \geq 4$ and $1 \leq Cc \leq 3$ [E] | | GW | Well-graded gravel [F] |
| | | | $Cu < 4$ and/or [$Cc<1$ or $Cc>3.0$] [E] | | GP | Poorly graded gravel [F] |
| | | **Gravels with Fines:** More than 12% fines [C] | Fines classify as ML or MH | | GM | Silty gravel [F, G, H] |
| | | | Fines classify as CL or CH | | GC | Clayey gravel [F, G, H] |
| | **Sands:** 50% or more of coarse fraction passes No. 4 sieve | **Clean Sands:** Less than 5% fines [D] | $Cu \geq 6$ and $1 \leq Cc \leq 3$ [E] | | SW | Well-graded sand [I] |
| | | | $Cu < 6$ and/or [$Cc<1$ or $Cc>3.0$] [E] | | SP | Poorly graded sand [I] |
| | | **Sands with Fines:** More than 12% fines [D] | Fines classify as ML or MH | | SM | Silty sand [G, H, I] |
| | | | Fines classify as CL or CH | | SC | Clayey sand [G, H, I] |
| **Fine-Grained Soils:** 50% or more passes the No. 200 sieve | **Silts and Clays:** Liquid limit less than 50 | **Inorganic:** | PI > 7 and plots on or above "A" | | CL | Lean clay [K, L, M] |
| | | | PI < 4 or plots below "A" line [J] | | ML | Silt [K, L, M] |
| | | **Organic:** | Liquid limit - oven dried / Liquid limit - not dried | < 0.75 | OL | Organic clay [K, L, M, N] / Organic silt [K, L, M, O] |
| | **Silts and Clays:** Liquid limit 50 or more | **Inorganic:** | PI plots on or above "A" line | | CH | Fat clay [K, L, M] |
| | | | PI plots below "A" line | | MH | Elastic Silt [K, L, M] |
| | | **Organic:** | Liquid limit - oven dried / Liquid limit - not dried | < 0.75 | OH | Organic clay [K, L, M, P] / Organic silt [K, L, M, Q] |
| **Highly organic soils:** | Primarily organic matter, dark in color, and organic odor | | | | PT | Peat |

[A] Based on the material passing the 3-inch (75-mm) sieve.

[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay.

[E] $Cu = D_{60}/D_{10}$ $\quad Cc = \dfrac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains ≥ 15% sand, add "with sand" to group name.

[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H] If fines are organic, add "with organic fines" to group name.

[I] If soil contains ≥ 15% gravel, add "with gravel" to group name.

[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

[L] If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.

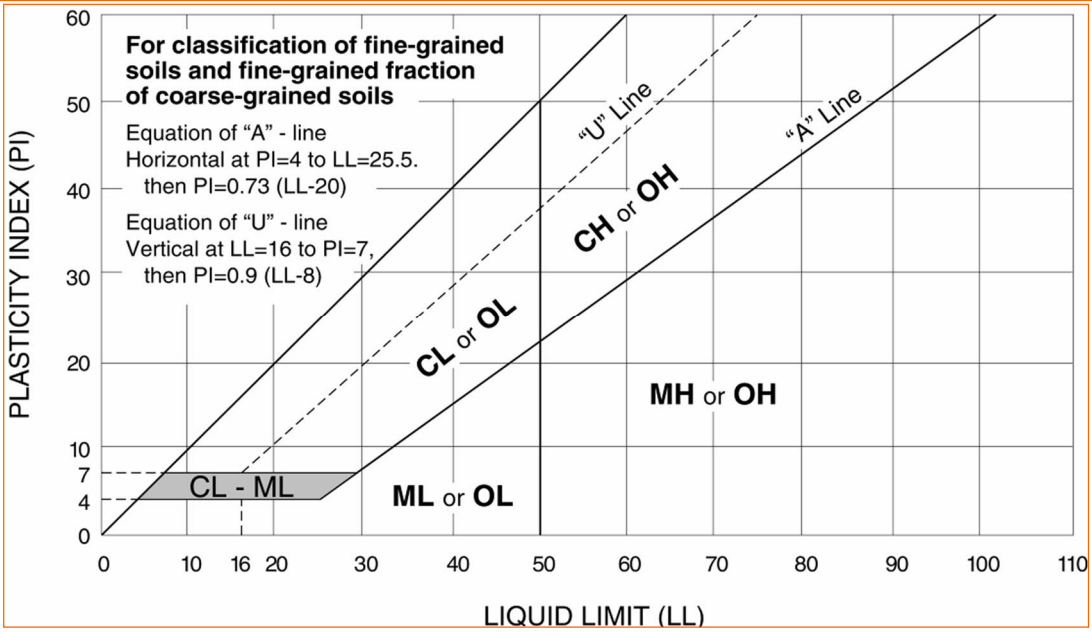
[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.

[N] PI ≥ 4 and plots on or above "A" line.

[O] PI < 4 or plots below "A" line.

[P] PI plots on or above "A" line.

[Q] PI plots below "A" line.



# DESCRIPTION OF ROCK PROPERTIES

| WEATHERING | |
|---|---|
| Fresh | Rock fresh, crystals bright, few joints may show slight staining. Rock rings under hammer if crystalline. |
| Very slight | Rock generally fresh, joints stained, some joints may show thin clay coatings, crystals in broken face show bright. Rock rings under hammer if crystalline. |
| Slight | Rock generally fresh, joints stained, and discoloration extends into rock up to 1 in. Joints may contain clay. In granitoid rocks some occasional feldspar crystals are dull and discolored. Crystalline rocks ring under hammer. |
| Moderate | Significant portions of rock show discoloration and weathering effects. In granitoid rocks, most feldspars are dull and discolored; some show clayey. Rock has dull sound under hammer and shows significant loss of strength as compared with fresh rock. |
| Moderately severe | All rock except quartz discolored or stained. In granitoid rocks, all feldspars dull and discolored and majority show kaolinization. Rock shows severe loss of strength and can be excavated with geologist's pick. |
| Severe | All rock except quartz discolored or stained. Rock "fabric" clear and evident, but reduced in strength to strong soil. In granitoid rocks, all feldspars kaolinized to some extent. Some fragments of strong rock usually left. |
| Very severe | All rock except quartz discolored or stained. Rock "fabric" discernible, but mass effectively reduced to "soil" with only fragments of strong rock remaining. |
| Complete | Rock reduced to "soil". Rock "fabric" no discernible or discernible only in small, scattered locations. Quartz may be present as dikes or stringers. |

| HARDNESS (for engineering description of rock – not to be confused with Moh's scale for minerals) | |
|---|---|
| Very hard | Cannot be scratched with knife or sharp pick. Breaking of hand specimens requires several hard blows of geologist's pick. |
| Hard | Can be scratched with knife or pick only with difficulty. Hard blow of hammer required to detach hand specimen. |
| Moderately hard | Can be scratched with knife or pick. Gouges or grooves to ¼ in. deep can be excavated by hard blow of point of a geologist's pick. Hand specimens can be detached by moderate blow. |
| Medium | Can be grooved or gouged 1/16 in. deep by firm pressure on knife or pick point. Can be excavated in small chips to pieces about 1-in. maximum size by hard blows of the point of a geologist's pick. |
| Soft | Can be gouged or grooved readily with knife or pick point. Can be excavated in chips to pieces several inches in size by moderate blows of a pick point. Small thin pieces can be broken by finger pressure. |
| Very soft | Can be carved with knife. Can be excavated readily with point of pick. Pieces 1-in. or more in thickness can be broken with finger pressure. Can be scratched readily by fingernail. |

**Joint, Bedding, and Foliation Spacing in Rock** [1]

| Spacing | Joints | Bedding/Foliation |
|---|---|---|
| Less than 2 in. | Very close | Very thin |
| 2 in. – 1 ft. | Close | Thin |
| 1 ft. – 3 ft. | Moderately close | Medium |
| 3 ft. – 10 ft. | Wide | Thick |
| More than 10 ft. | Very wide | Very thick |

1. Spacing refers to the distance normal to the planes, of the described feature, which are parallel to each other or nearly so.

**Rock Quality Designator (RQD)** [1]

| RQD, as a percentage | Diagnostic description |
|---|---|
| Exceeding 90 | Excellent |
| 90 – 75 | Good |
| 75 – 50 | Fair |
| 50 – 25 | Poor |
| Less than 25 | Very poor |

1. RQD (given as a percentage) = length of core in pieces 4 inches and longer / length of run

**Joint Openness Descriptors**

| Openness | Descriptor |
|---|---|
| No Visible Separation | Tight |
| Less than 1/32 in. | Slightly Open |
| 1/32 to 1/8 in. | Moderately Open |
| 1/8 to 3/8 in. | Open |
| 3/8 in. to 0.1 ft. | Moderately Wide |
| Greater than 0.1 ft. | Wide |

References: American Society of Civil Engineers. Manuals and Reports on Engineering Practice - No. 56. Subsurface Investigation for Design and Construction of Foundations of Buildings. New York: American Society of Civil Engineers, 1976. U.S. Department of the Interior, Bureau of Reclamation, Engineering Geology Field Manual.

SECTION 01 00 00 - GENERAL REQUIREMENTS

PART I – GENERAL

1.01 PROJECT REQUIREMENTS

A. The Contractor shall perform all work required to complete the project in accordance with the Contract Documents, to meet the design intent of the Contract Documents, and to minimize potential change orders.

B. The Contractor shall provide evidence, including a list of two (2) similar finished projects with addresses and Owner's name and telephone numbers.

C. The Contractor shall make a good faith effort to attend the pre-bid meeting. If a need exists to see the site on another date, bidder shall contact Property Manager to schedule a meeting on site.

1.02 DESCRIPTION

A. This work consists of furnishing all labor, materials, and equipment necessary to complete the following work:
   1. Public and private utility locates, protections, and coordination. Locate utilities on Record Drawings.
   2. Daily cleanup of work site. Contractor is responsible for removal of all construction waste material. All debris shall be hauled to certified landfill. Fill all ruts or soil damage to provide a smooth grade around the building. If necessary, reseed turf grass in areas of damage around the building.
   3. Porta-pot and dumpster shall be included to maintain site cleanliness.
   4. Soil compaction and concrete testing. Submit independent test reports to DNR for review.
   5. Providing shop drawings and product data for review by DNR.
   6. Providing approved submittals and 2022 AutoCAD as-builts to the Owner for 'project file'.
   7. Access to and from build site shall be through the entrance to the existing maintenance building off County Road 600S.
   8. Coordinate temporary meter installation with property manager. Electricity cost will be paid by the Owner.

B. Extent of work is shown on the construction documents.

1.03 BUILDING DESCRIPTION – MINIMUM REQUIREMENTS

A. The work of the Project described in the specifications and drawings for the new 5,848 square foot maintenance building.

1.04 BID

A. The BASE BID shall include all work and requirements indicated by the Bidding Documents.
   1. The Contractor shall not be allowed extra compensation by reason of any matter or thing concerning which the contractor could have fully informed himself/herself prior to bidding. No verbal agreement, understanding or conversation with an agent or employee of the

Owner, either before or after the execution of this contract, shall affect or modify the terms or obligations herein contained.

2. The Contractor shall submit a Schedule of Values based on various types of work in accordance with Article 9.2 of the General Conditions.

B. ALTERNATES: Refer to Section 01230 – Alternates for more information.

1. Add Maintenance Bay 107.
2. Add Storage Bay 108.
3. Use OSB in place of plywood in certain location described.

1.05 SITE ACCESS PRIOR TO BIDDING:

A. Bidders may obtain access to the construction site, for on-site inspection prior to pre-bid meeting as indicated in the "Notice to Bidders."

Property Manager:

Contact: Kevin Shettle. Property Manager
Telephone: (765) 653-0453
Email: kshettle@dnr.in.gov

Address: Deer Creek Fish & Wildlife Area
2001 W County Road 600 S
Greencastle, IN 46135
https://www.in.gov/dnr/fish-and-wildlife/properties/deer-creek-fwa

1.06 USE OF CONTRACT DOCUMENTS:

A. Contractor shall examine all Specifications and Drawings for the Work, including those that may pertain to Work Contractor does not normally perform with its own forces.

B. Contractor shall use all of the Project Drawings and Specifications:
1. For a complete understanding of the Project.
2. To determine the type of construction and systems required.
3. For coordination with other contractors.
4. To determine what other work may be involved in various parts or phases.
5. To anticipate and notify others when work by others will be required.
6. And all other relevant matters related to the project.

C. Contractor is also bound by all requirements of the Contract Documents which are applicable to, pertain to, or affect its work, as may be shown or inferred by the entire set of Project Drawings and Specifications.

1.07 COMMENCEMENT AND COMPLETION OF WORK

A. The Contractor shall commence work within 10 days after the date of execution of the Contract.

B. Work required by the Contract Documents **shall be completed within 365 days of the date of the Contract.**

C. This project, or portion thereof, will not be ready for substantial completion review until test and performance evaluations are completed, all items are installed, proper paint is dry, and area is clear of construction rubbish and debris.

D. Before Final Payment of the Contract Price, the Contractor shall submit to the Owner, on the Contracting Firm's Letterhead, the following statement signed, dated, and witnessed:
   1. "I hereby certify that to the best of my knowledge no asbestos-containing material was used as a building material during this project."

1.08 BUILDER'S RISK INSURANCE:

A. The Contractor shall, during the term of this contract and as required in Article 11.2.1 of the General Conditions, maintain a Builder's Risk Policy in the amount of 100% of the contract amount.

1.09 PAYMENT BOND:

A. Contractor **shall provide a payment bond** in an amount equal to one hundred percent (100%) of the total contract price. Payment bond shall meet the requirements of Section 7.6 of the General Conditions.

1.10 SUBMISSION OF POST-BID INFORMATION:

A. Submit the following information within ten (10) days of receipt of Notice to Proceed.
   1. Designation of the work to be performed by the Contractor with his own forces.
   2. A list of Subcontractors.
   3. A list of manufacturers and suppliers.
   4. A Progress schedule for the work in relation to the entire Project.
   5. A Schedule of Values. This schedule, when approved by the Owner shall be used as a basis for the Contractor's Applications for Progress and Final Payments.

1.11 MEASUREMENT AND PAYMENT - LUMP SUM

A. Payment for Lump Sum projects will be based on the accepted schedule of values for the project. No separate measurement for payment will be performed for Lump Sum Work. All Work described in the Specifications and/or shown on the Drawings shall be included in the Lump Sum Bid.

1.12 CODES AND STANDARDS:

A. All work shall meet or exceed all current codes and standards, all current rules and regulations and all applicable requirements of Federal, State and Local Authorities having jurisdiction, including the latest OSHA and Americans with Disabilities Act of 1990 amended to date.

B. Meet and comply with the applicable portions of the latest editions of the following standards and codes:
   1. Indiana Construction Rules and Regulations.
   2. Indiana Building Code
   3. Indiana State Construction Industry Safety Code.
   4. Indiana Electric Code.
   5. Indiana Plumbing Code.
   6. Indiana Mechanical Code.
   7. Indiana Energy Code.
   8. Indiana Fire Code
   9. Indiana Accessibility Code

C. Standards:
   1. All Materials: manufactured and tested in accordance with latest editions of UL, ANSI, and respective Association Standards. UL labeling shall be provided where specified for specific items.
   2. Owner's Requirements or Regulations, pertaining to safety, fire, conduct, parking, sanitary conditions, smoking, etc., shall be strictly adhered to by Contractors and their employees and Subcontractors on the job.

1.13 WORKING HOURS:

A. Contractor shall perform all construction activity on Monday thru Friday, excluding state holidays, between the hours of 7:00 a.m. and 5:00 p.m., unless previous arrangements are made with the Owner.

B. All work performed at other times shall be only by approval from the Owner, confirmed in writing, and shall not constitute a change in the contract amount.

1.14 PROGRESS MEETINGS:

A. Progress meetings will be held throughout progress of the Work at intervals agreed to by Owner and Contractor.

1.15 EXISTING SITE CONDITIONS:

A. Data on the drawings pertaining to present conditions, dimensions, type of construction, obstructions on or near site, location of utilities, etc. have been obtained from sources believed reliable, but accuracy of such data is not guaranteed and is furnished solely for accommodation of the Contractor.

B. The Contractor shall, prior to excavating, verify the location of all buried utilities, public and private including buried power lines and fiber optic cables.

1.16 CONSTRUCTION AND STORAGE AREA:

A. The Contractor shall confine the construction operations and storage of materials within the project construction work limits.

B. Soil disturbance outside of the construction limits is prohibited.

C. Except for permanent site improvements provided under the Contract, Contractor shall restore property disturbed during the Work to the conditions which previously existed.

D. Parking and Deliveries:
   1. Contractor is responsible for control of traffic by vehicles and persons within the limits of its operations.
   2. Parking for employees, subcontractors, and agents of Contractor shall be in areas subject to approval of Owner.
   3. Access to the site for delivery of construction material of equipment shall be subject to approval of Owner.

E. The Contractor shall be responsible for the protection of all facilities during the entire period of service. Any damages to the existing facilities, roads, lawns, driveways, or other State-owned property caused by the contractor shall be repaired by the Contractor at his/her expense and in a manner and schedule approved by the Owner.

F. The Contractor shall power wash any mechanical equipment or vehicle to be used on the job site to remove all mud and debris prior to unloading on the site. This is necessary to prevent contamination by invasive species seeds that may be attached to the equipment.

1.17 ROADWAY–SITE PROTECTION:

A. The Contractor shall, at his expense, be responsible to repair any and all damage to the State property's roads and drainage structures caused by his equipment and/or personnel from project site. Areas to be repaired shall be done by using similar material and be approved by the Engineer.

B. The ingress and egress to the project site shall be approved by the Project Manager.

1.18 SUBSTITUTIONS:

A. Request for substitutions shall be made in accordance with the requirements of paragraph 07 of the Instructions to Bidders and accordingly shall be requested at least 7 days prior to the Bid date.

B. Substitutions shall be made in accordance with the requirements of Article 7 of the General Conditions.

1.19 ARCHEOLOGICAL AND HISTORIC ARTIFACTS:

A. If any objects are uncovered during construction which could possibly be of archeological or historic importance, this shall immediately be reported to the Owner. Work at that spot shall not proceed further until the Owner has evaluated the object and the area where it was found and approved continuation of the work.
B. If any construction time is lost due to such objects being found, an equal number of calendar days will be added to the project completion time.

1.20 SALVAGE RIGHTS:

A. Unless stated otherwise in the specifications or on the plans, all equipment and materials removed as part of this project and not indicated for re-use on the project and not listed above shall become the property of the Contractor and removed from the site.

1.21 CONFINED SPACE ENTRY:

A. Written permit is required prior to entry into areas meeting the OSHA definition of a "permit required confined space". Areas meeting this definition and which are known or presumed to require access for this project are as follows:
   1. There are no known permits required for confined spaces on this project.

B. Non-listing of a confined space requiring access does not relieve the Contractor of responsibility for obtaining a permit if required by OSHA Regulations.

1.22 TEMPORARY TOILET FACILITIES:

A. Provide temporary toilet facilities for contractor use for duration of the work. Obtain approval from Property Manager for location of portable units.

END OF SECTION

SECTION 01020 - ALLOWANCES

PART 1 - GENERAL:

1.01 REMEDIATION ALLOWANCE

A. Contractor shall include an allowance of **$25,000.00** in the Base Bid for remediation of unforeseen constraints. This amount shall be included as a separate item in the Schedule of Values adding up to the total bid price.

B. Such constraints may include but are not necessarily limited to unforeseen subsurface conditions particular to this construction site; improperly recorded or unrecorded physical properties and conditions at the site; obstruction of or delays to reasonable work sequences by the Property, or the Owner; uncommon adverse weather or site conditions; and conflict within or omissions from the Contract Documents.

C. All remediation work shall be proposed to and authorized by the Director of Public Works Division prior to execution, jointly documented by Contractor and Designer, and recorded in Contractor's As-built and Designer's Project Record Documents.

D. **If any portion of the allowance is not used during the project, that portion will revert to the owner and will not be included in the contractor's final payment.**

END OF SECTION

# SECTION 01 23 00 - ALTERNATES

## PART 1 - GENERAL

### 1.01 DESCRIPTION:

A. The bids for the alternates described herein are required to obtain information necessary for setting the scope of the project in its entirety.

B. Add Alternates herein described are not to be included in the Base Bid Scope of Work.

C. Deduct Alternates herein described are to be included in the Base Bid Scope of Work and deducted from the project as described.

D. Bidder shall provide a response to each alternate specified. The response must indicate the amount to ADD to the Base Bid, DEDUCT from the Base Bid or that there is NO CHANGE. Substitution of materials or methods of work other than as called for in the documents, i.e. "voluntary alternates" shall be cause for rejections of bid as non-conforming. Refer to Page 2, DAPW 13 and Article 12(D), Instructions to Bidders, DAPW 29 or DAPW 30.

E. All Requirements of the specification shall govern the work of this section. This section describes the changes to be made under each alternate.

### 1.03 ALTERNATES:

A. Building foundations: The building foundations step down to deeper elevations at the west end of the building. The building foundation plan on sheet S-1 details the maximum building size, including Alternates No. 1 and 2. See the plan notes on sheet S-1 for treatment of the west end foundation wall for the Alternate No. 1 scope of work where Alternate No. 2 is not selected.

B. Alternate Number 1A: Add Heated Maintenance Bay 107 to the project as follows:

1. Include all labor and material associated with the addition of Heated Maintenance Bay 107 to the project and as follows:
   a. Scope to include all site / civil, structural, architectural, mechanical, electrical, plumbing and related work for fully functional, turnkey facility.
   b. The end wall of the building shall remain as an exterior end wall as shown on Section 1/A-4 and associated structural details.
   c. Note: Complete site work to accommodate the addition of this bay to the building. Tie grades into the Base Bid access drive around the building. Provide finish grading for positive drainage. Seed all disturbed areas.
2. Reference Drawings and Specifications for additional information.

C. Alternate Number 1B: OSB Wall Sheathing associated with Heated Maintenance Bay 107

1. Provide OSB in lieu of plywood sheathing at all wall locations except as noted below.
   a. On the exterior face of all exterior walls.
2. Reference Drawings and Specifications for additional information.

D. Alternate Number 2A: Add Unheated Storage Bay 108 to the project as follows:

1. Include all labor and material associated with the addition of Unheated Storage Bay 108 to the project as follows:
   a. Scope to include all site / civil, structural, architectural, mechanical, electrical, plumbing and related work for fully functional, turnkey facility.
   b. The end wall of the building shall remain as an exterior end wall as shown on Section 1/A-4 and associated structural details.
   c. Add 100 Amp Electrical Panel "B" as shown on drawing E-1.
   d. Note: Complete site work to accommodate the addition of this bay to the building. Tie grades into the Base Bid access drive around the building. Provide finish grading for positive drainage. Seed all disturbed areas.
2. Reference Drawings and Specifications for additional information.

E. Alternate Number 2B: OSB Wall Sheathing associated with Unheated Storage Bay 108

1. Provide OSB in lieu of plywood sheathing at all wall locations except as noted below.
   a. On the exterior face of all exterior walls.
   b. Locations serving as backing panels for mounting MEP equipment.
2. Reference Drawings and Specifications for additional information.

F. Alternate Number 3: Wall Sheathing at Base Bid Building

1. Provide OSB in lieu of plywood sheathing at all wall locations except as noted below.
   a. On the exterior face of all exterior walls
   b. On the interior face of all walls in the drive through wash bay
   c. Locations serving as backing panels for mounting MEP equipment.
2. Reference Drawings and Specifications for additional information.

1.03 CONTRACT AWARD:

A. Contract award shall be based on the Base Bid or combination of the Base Bid and Alternate(s) chosen to be accepted by the State.

END OF SECTION

# SECTION 01310 - CONSTRUCTION SCHEDULES

## 1.01 REQUIRED SCHEDULES:

A. Progress Schedules (Bar Charts or CPM/PERT Charts) will be required.

B. Content of Schedules:

1. Provide complete sequence of construction by activity showing dates for beginning, and completion of, each element of construction.
2. Identify work in separate phases, or other logically grouped activities.
3. Horizontal time scale: Identify first day's work of each week.
4. Scale and Spacing: To allow space for updating.

## 1.02 UPDATING:

A. Show all changes occurring since previous submission of updated schedule.

B. Indicate progress of each activity, show completion dates.

C. Include:

1. Major changes in scope.
2. Activities modified since previous updating.
3. Revised projections due to changes.
4. Other identifiable changes.

## 1.03 SUBMITTALS:

A. Submit initial schedules at the Pre-Construction Conference.

## 1.04 DISTRIBUTION:

A. Distribute copies of reviewed schedules to:

1. Job site file.
2. Subcontractors.
3. Other concerned parties.

B. Instruct recipients to report any inability to comply, and provide detailed explanation, with suggested remedies.

END OF SECTION

SECTION 01340 - SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

1.01 RELATED REQUIREMENTS SPECIFIED ELSEWHERE:

A. General Conditions
B. Section 01010 - General Requirements
C. Section 01720 - Project Record Documents

1.02 SHOP DRAWING, PRODUCT DATA & SAMPLE SUBMITTAL REQUIRED:

A. Items listed for submittal are intended to be a minimum. Non-listing of an item does not relieve the Contractor of the responsibility to verify compliance with the specifications of all products and equipment. Contractor is encouraged to submit shop drawings, product data or samples on all such items prior to their use.

B. Shop drawings, product data, samples, reports or lists shall be submitted for the following items:

1. Section 010100 - GENERAL REQUIREMENTS
2. Section 013100 - CONSTRUCTION SCHEDULES
3. Section 017200 - RECORD PROJECT DOCUMENTS
4. Section 02070 - GEOTEXTILES
5. Section 02250 - TERMITE CONTROL
6. Section 032000 - CONCRETE REINFORCING
7. Section 033000 - CAST-IN-PLACE CONCRETE
8. Section 055000 - METAL FABRICATIONS
9. Section 061753 - SHOP FABRICATED WOOD TRUSSES
10. Section 064116 - PLASTIC LAMINATE CLAD ARCHITECTURAL CABINETS
11. Section 066400 - PLASTIC PANELING\
12. Section 072100 - THERMAL INSULATION
13. Section 072500 - WEATHER BARRIERS
14. Section 073113 - ASPHALT SHINGLES
15. Section 07413.13 - PREFORMED SIDING AND ACCESSORIES
16. Section 074293 - SOFFIT PANELS
17. Section 076200 - FLASHING AND SHEET METAL
18. Section 079200 - JOINT SEALANTS
19. Section 081113 - HOLLOW METAL DOORS AND FRAMES
20. Section 083613 - SECTIONAL OVERHEAD DOORS
21. Section 085313 - ALUMINUM CLAD WOOD WINDOWS
22. Section 087100 - FINISHING HARDWARE
23. Section 092900 - GYPSUM BOARD
24. Section 099000 - PAINTING
25. Section 101423.16 -SIGNAGE
26. Section 10800 - TOILET ROOM ACCESSORIES
27. Section 220523.12 - BALL VALVES FOR PLUMBING PIPING
28. Section 220523.14 - CHECK VALVES FOR PLUMBING PIPING
29. Section 220523.15 - GATE VALVES FOR PLUMBING PIPING
30. Section 220719 - PLUMBING PIPING INSULATION
31. Section 221116 - DOMESTIC WATER PIPING
32. Section 221316 - SANITARY WASTE AND VENT PIPING
33. Section 230713 - DUCT INSULATION
34. Section 231123 - FACILITY PROPANE GAS PIPING
35. Section 232300 - REFRIGERANT PIPING
36. Section 233113 - METAL DUCTS

37. Section 238126 - SPLIT-SYSTEM PROPANE-FIRED FURNACE/AIR-CONDITIONER
38. Section 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS
39. Section 262413 – SWITCHBOARDS AND RELATED APPURTENANCES
40. Section 262416 – PANELBOARDS
41. Section 262726 - WIRING DEVICES
42. Section 265119 - LED INTERIOR LIGHTING
43. Section 265213 - EMERGENCY AND EXIT LIGHTING

1.03 CERTIFICATIONS:

A. Contractor shall certify that no asbestos-containing materials were used on this project.
   1. See Section 01010- General requirements.

END OF SECTION

SECTION 01710 - SITE CLEAN UP

PART 1 - GENERAL

1.01 DESCRIPTION:

A. Related Requirements Specified Elsewhere: Cleaning for specific products or work: Specification Section for that work.
B. All cleaning shall be the responsibility of the General Contractor unless specifically noted otherwise.
C. Maintain premises and public properties free from accumulations of waste, debris, and rubbish, caused by operations.
D. At completion of work, remove waste materials, rubbish, tools, equipment, machinery and surplus materials, and clean all sight-exposed surfaces; leave project clean and ready for occupancy.

1.02 REQUIREMENTS OF REGULATORY AGENCIES:

A. Maintain project in accord with Occupational Safety & Health Act of 1970 as amended, in terms of cleanup.
B. Conduct cleaning and disposal operations to comply with local ordinances and anti-pollution laws.
   1. Do not burn or bury rubbish and waste materials on project site.
   2. Do not dispose of volatile or toxic wastes in storm or sanitary drains.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.01 DURING CONSTRUCTION:

A. Execute cleaning to insure that grounds, and public properties are maintained free from accumulations of waste materials and rubbish.
B. Wet down materials and rubbish to lay dust and prevent blowing dust.
C. At reasonable intervals, during progress of work, clean site and public properties, and dispose of waste materials, debris and rubbish.
D. Provide on-site containers for collection of waste materials, debris and rubbish.
E. Remove waste material, debris and rubbish from site and legally dispose of at public or private dumping areas off Owner's property.
F. Handle materials in a controlled manner with as few handlings as possible; do not drop or throw materials from heights.

3.02 FINAL CLEANING:

A. Remove all foreign materials from site area.
B. Broom clean paved surfaces; rake clean other surfaces of grounds.
C. Owner will assume responsibility for cleaning as of time designated on Certificate of Substantial Completion, Conditional Acceptance or partial occupancy, whichever is first for Owner's acceptance of Project or portion thereof.

END OF SECTION

# SECTION 01720 - PROJECT RECORD DOCUMENTS

1.01 GENERAL: Related requirements specified elsewhere:

A. Shop drawings, project data, and samples: General Conditions.

1.02 MAINTENANCE OF DOCUMENTS:

A. Contractor shall maintain at the job site one copy of the project drawings and specifications, including all addenda, shop drawings and change orders, and shall make said documents available for inspection by the Owner.

B. Maintain and submit to the Designer a set of the project drawings showing all changes made during the course of the work and any differences between the existing facilities encountered and that shown on the drawings. These drawings must be submitted before the final payment.

1.03 OPERATION AND MAINTENANCE MANUAL:

A. Submit to the Designer 2 copies of an "Operation and Maintenance Manual" for all architectural specialties and mechanical and electrical equipment. The manual shall contain the following information in addition to shop drawings.

1. Index of contents of manual and reference to use and location of item.
2. Complete operation data and maintenance instructions.
3. Parts lists and diagrams with component part numbers.
4. Sequence of operation for all control systems.
5. Wiring Diagrams.
6. Names and addresses of local distributors.
7. Fully executed warranties.

B. Contractor shall perform all maintenance and retain all responsibility for required maintenance prior to submittal of the "Operation and Maintenance Manuals" to the Designer.

END OF SECTION

# SECTION 02070 - GEOTEXTILES

## PART 1 - GENERAL

### 1.01 WORK INCLUDED

A. Furnish all materials and labor as needed to install geotextile fabric under riprap as shown on the plans.

### 1.02 RELATED WORK

Section 02255 – CRUSHED STONE, RIPRAP & STRUCTURE BACKFILL

### 1.03 SUBMITTALS

A. Submit Geotextiles to be used on the project in accordance with 01300.

## PART 2 – PRODUCTS

### 2.01 MATERIALS

A. The material used shall consist of a non-woven geotextile consisting of strong, rot resistant, chemically stable long-chain synthetic polymer material dimensionally stable with distinct and measurable openings. The plastic yarn or fibers used in the geotextile, shall consist of any long-chain synthetic polymer composed of at least 85% by weight of polyolefins, polyesters, or polyamides, and shall contain stabilizers and inhibitors added to the base plastic to make the filaments resistant to deterioration due to ultraviolet and heat exposure. The geotextile shall be calendared or otherwise finished so that the yarns or fibers will retain their relative position with respect to each other. Silt film geotextiles will not be permitted unless approved.

B. Geotextiles shall meet the following requirements.

**GEOTEXTILE MATERIAL PROPERTIES**

| TEST | METHOD | REQUIREMENTS* |
|---|---|---|
| Tensile Strength Grab Tensile Strength | ASTM D 4632 | 200 LB (890 N) |
| Elongation Grab Tensile Strength | ASTM D 4632 | 15% |
| Seam Strength Grab Tensile Strength | ASTM D 4632 | 180 LB (800 N) |
| Bursting Strength | ASTM D 3786 | 320 PSI (2.2 MPA) |
| Puncture Strength | ASTM D 4833 | 80 LB (356 N) |
| Trapezoid Tear | ASTM D 4533 | 50 LB (225 N) |
| Ultraviolet Degradation | ASTM D 4355 | 70% Strength retained |
| Apparent Opening Size | ASTM D 4751 | No. 50 Standard Sieve |
| Permeability** | ASTM D 4491 | 0.01 cm/sec or greater |

## PART 3 – EXECUTION

### 3.01 GENERAL REQUIREMENTS

A. Geotextile materials shall be stored in accordance with manufacturer's recommendations. Geotextile shall be stored so that it is not exposed to sunlight, ultraviolet rays, water and temperatures exceeding 140° F. Exposure of geotextiles to the elements between lay down and cover shall be a maximum of 14 days. At the time of installation, the geotextile shall be rejected and replaced at no additional payment if defects, rips, flaws, deterioration or damage incurred during manufacture, transportation, storage or construction is evident.

### 3.02 CONSTRUCTION REQUIREMENTS

A. Subgrade where geotextile is to be installed shall be prepared to a relatively smooth condition, free of obstructions, depressions and debris within the riprap and geotextile limits shown on the construction plan sheets.

B. Geotextiles used along channels shall be placed with the machine direction of the geotextile parallel to the channel. Successive geotextile sheets shall be overlapped in such a manner that the upstream sheet is placed over the down stream sheet and the upslope sheet over the downslope sheet.

C. Geotextiles used for 2:1 slopes or greater shall be placed with the machine direction of the geotextile sheets perpendicular to the toe of slope. The geotextile sheets shall be overlapped in the direction of the anticipated movement of water.

D. Adjacent pieces of geotextile may be joined by sewing if approved, or by overlapping and pinning. The minimum overlap shall be 18 in. (460 mm) except when placed under water. When placed under water, the overlap shall be a minimum of 3 ft (0.9 m). Securing pins shall be steel, 3/16 in. (5 mm) in diameter, 18 in. (460 mm) long, pointed at one end and fabricated with a head to retain a steel washer having an outside diameter of no less than 1 1/2 in. (38 mm). Securing pins with washers shall be inserted through both strips of overlapped geotextile at spacing intervals in Table 1 along a line through the midpoint of the overlap. The geotextile strip shall be placed so that the lower strip will be overlapped by the next higher strip. Pins shall be driven until the washer bears against the geotextile and secures it firmly to the ground.

E. Whether the fabric is joined by sewing or pinning, additional pins shall be installed as necessary to prevent any slippage of the fabric regardless of location.

TABLE 1

| Slope | Pin Spacing |
|---|---|
| Steeper than 3:1 | 2 ft. |
| 3:1 to 4:1 | 3 ft. |
| 4:1 or flatter | 5 ft. |

G. The geotextile shall be placed in such a manner that placement of the overlying materials will not excessively stretch or tear the geotextile and will not pull the required overlap or seam apart. Construction equipment will not be allowed on the exposed geotextile. Placement of riprap or stone shall start from the base of the slope, moving upslope and from the center outward. Riprap shall not be allowed to roll downslope and the height of drop for riprap shall be kept to less than 2 ft.

END OF SECTION

# SECTION 02170 - EROSION AND SEDIMENT CONTROL

## PART 1 - GENERAL

### 1.01 WORK INCLUDED

A. Furnish all labor, materials and equipment required for erecting, maintaining and removing temporary erosion and sediment controls. Contractor is responsible for obtaining any permits needed for offsite stockpiling, borrow pits and waste disposal in compliance with all requirements of 327 IAC 15-3-2 and 327 IAC 15-5-5 (Rule 5)or other local, state or federal requirements.

B. Temporary erosion controls include, but are not limited to mulching, riprap check dams, seeding, watering, and reseeding on all disturbed surfaces including waste area surfaces and stockpile and borrow area surfaces; scheduling work to minimize erosion and providing interceptor ditches at those locations which will ensure that erosion during construction will be either eliminated or maintained within acceptable limits.

C. Temporary sediment controls include, but are not limited to silt fences, staked strawbale diversions and appurtenances at the foot of sloped surfaces which will ensure that sedimentation pollution will be either eliminated or maintained within acceptable limits.

D. Contractor is responsible for providing and maintaining effective temporary erosion and sediment control measures during construction or until final controls become effective.

E. The erosion and sediment controls shown on the Drawings and specified herein are intended to provide the minimum measure necessary to prevent sediment runoff into storm water runoff. IDEM and/or the local Soil and Water District may request additional erosion control measures be installed for the project if the measures shown within the plans and specifications are determined to be insufficient. Contractor shall be responsible for providing and installing any additional measures needed to adequately prevent storm water runoff from the site and erosion of constructed or disturbed slopes as determined by IDEM and/or the local Soil and Water District at no additional cost to the Owner.

### 1.02 RELATED WORK

A. Section 02923 - LANDSCAPE GRADING
B. Section 02936 - SEEDING

PART 2 - PRODUCTS

A. Mulch and fertilizer shall be as specified in Sections 02936.

B. Erosion control blanket shall be excelsior blankets consisting of 100% weed free straw matrix stitched to a single or double net. The blanket shall be rated for channel applications for slopes up to 1.5:1 and shall be for extended term (15 to 24 months) use. The blanket shall be 100% biodegradable natural netting that is wildlife friendly. Photodegradable netting is NOT acceptable.

C. Temporary silt fence fabric shall be in accordance with INDOT Specification 205.

D. Concrete Washouts shall be provided per the plan details.

PART 3 - EXECUTION

3.01 GENERAL

A. Erosion control practices shall be adequate to prevent erosion of disturbed and regraded areas.

B. Earthwork procedures shall be as specified in Section 02160.

C. Silt fences shall be located and staked as shown on the Drawings and/or as designated by the Engineer.

D. The Contractor is solely responsible for and shall provide silt fence , check dams, erosion control blanket concrete washouts and other adequate erosion control protection as required.

E. The Contractor shall maintain concrete washouts for washing of any concrete pouring or other equipment. Concrete shall not be washed into drainage or waterways or other area other than the washouts themselves.

F. The Contractor shall install all materials in accordance with the manufacturer's directives.

G. The Contractor shall provide Erosion Control blanket on all areas disturbed by Linear Ditch Grading and on constructed slopes where the final slope is equal to or steeper that 3:1.

3.02 TEMPORARY SEEDING

A. This item shall consist of seeding a temporary cover of grass, or grass and small grain, on areas disturbed on the construction site which will not be redisturbed within a 14-day period. All disturbed grass areas which will remain undisturbed for this 14 day period shall receive temporary seeding. Temporary stockpiles shall also be temporarily seeded if left undisturbed for 14 days or more.

B. The seed mixtures to be used for temporary cover will be governed by the seeding specifications listed in Section 02936. The mixture of seeding shall be as follows:

| **Scientific Name** | **Common Name** | **Ounces/Acre** |
|---|---|---|
| Avena sativa | Common Oat | 360.00 |
| Lolium multiflorum | Annual Rye | 100.00 |
| | **Total** | **460.00:** |

1. Lime will not be required for temporary seeding.
2. Fertilize at the rate of 400 pounds per acre of 10/10/10 fertilizer, or equivalent, broadcast uniformly on the area to be seeded.
3. All seed shall be broadcast evenly over the area to be seeded and cultipacked or otherwise pressed into the soil. Seed and fertilizer may be mixed together and applied after the seed has been prepared.
4. Mulch for temporary seeding will not be required except on those areas, in the Engineer's opinion that are too steep to hold the seed without protective cover.
5. Water and maintain until seeding growth is well established for temporary protection.

3.03 MAINTENANCE OF CONTROLS AND PERFORMANCE

A. Erosion and sedimentation controls shall be inspected weekly and after significant rain storms. Replace silt fencing which is damaged, filter stone which is dislodged, erosion control blanket which is damaged, and make other necessary repairs.

B. Should any of the temporary erosion and sediment control measures employed by the Contractor fail to produce results consistent with normal and acceptable standards of the industry, the Contractor shall immediately take whatever steps are necessary to correct the deficiency at his own expense.

C. Remove all temporary erosion and sediment controls as final landscaping and grading is performed.

SECTION 02221 - FILLING, EXCAVATING, BACKFILLING AND COMPACTING

PART 1 - GENERAL

1.01 WORK INCLUDED:

A. Site Preparation.

B. Structure Filling, Excavating, Backfilling and Compacting.

C. Trench Excavating, Backfilling and Compacting.

D. Rough and Finish Grading and Seeding.

E. A **geotechnical engineer** shall be present for all excavation, filling, compacting, and building footings.

1.02 PROTECTION:

A. Maintain excavation banks in a safe and stable condition.

B. Provide sheet piling, shoring and bracing as necessary to maintain excavation banks and for the protection of adjoining footings.

C. All trenches five feet or greater in depth shall utilize trench safety systems in compliance with IOSHA Regulations 29C.F.R.1926, Subpart P. All costs associated with the use of said safety systems shall be incorporated into the Contractor's lump sum bid for the project.

D. Keep open excavations free of water, both surface and subterranean by use of pumps and earth damming around such excavations to drain surface water away from the excavations.

E. Protect open excavations by lighted barricades or railings to prevent injury to personnel and public.

1.03 JOB CONDITIONS:

A. Care of existing structures and property.

1. The Contractor will be held accountable and responsible for the sufficiency of all sheeting and bracing used, and for all damages to persons and property resulting from the improper quality, strength, placing, maintaining or removing of the same. This includes damage to trees, sidewalks, and other property in the street area, as well as on private grounds. In no case shall sheeting be removed until the trench backfill has reached within two feet of the top of the trench, except that the lower course of sheeting may be removed from a double sheeted trench. In all cases, sheeting shall be driven ahead of excavation.

2. Work passing through a wooded area or near landscaping trees or shrubs shall be performed in a way to do as little damage as possible. Routes through wooded areas shall be coordinated with a representative of the Owner. Trenches shall stay at least 10 feet away from landscaping trees unless approved by the Designer.

3. Pipes, conduits, or cables encountered during the trench excavation shall be supported without damage and without interrupting their use during the progress of the work. The manner of support shall be subject to the approval of the Designer and the utility company involved.

1.05 MAINTENANCE OF TRAFFIC DURING CONSTRUCTION:

A. Contractor may, at his option, bore or open cut all pavements to be crossed, unless specified otherwise on the plans.

B. Contractor shall, at all times, maintain at least one lane of traffic for all public roads and all service roads that are two lanes wide.

C. Single lane service roads and driveways may be closed to traffic for short periods of time if the Owner is given a minimum of 12 hours advance notice. As soon as the required work is completed, temporary repairs shall be made to allow use of these roads and drives.

1.06 REFERENCE STANDARDS:

A. ASTM - American Society for Testing and Materials.

B. INDOT - (Indiana Department of Transportation Standard Specifications).

1.07 SUBMITTALS:

A. Submit documentation that soil compaction meets minimum requirements specified herein. A soil engineer or other qualified individual shall certify documentation.

PART 2 - PRODUCTS

2.01 GENERAL BACKFILL:

A. Unless specified otherwise, or unless the material excavated does not meet the requirements for a specific location, it is intended that general backfill shall be the material excavated.

B. If the material excavated does not meet the requirements, the Contractor may, at his option, modify the existing material to meet the requirements or haul in fill, which does meet the requirements.

2.02 ADDITIONAL FILL:

A. Earth that is free of vegetation, waste, humus, rocks, boulders, stones, brickbats, plaster, mortar or other debris.

B. Broken concrete, block or brick shall not be used for fill.

C. Stones greater than 4 inches in their greatest dimension shall not be used.

2.03 ENGINEERED FILL:

A. Cohesive and stable earth as described above, suitable for bearing.

2.04 GRANULAR FILL:

A. Granular fill shall be either a "B" borrow or a fine aggregate.

B. By weight, a minimum of 90% shall pass the No. 4 sieve and a maximum of 8% shall pass the 200 sieve.

2.05 PAVEMENT REPAIR MATERIALS:

A. Crushed stone or crushed gravel shall be #53 as specified in INDOT Specification Section 903.02.

B. All trenches cutting existing pavement shall be repaired with hot asphaltic concrete binder Type No. 8 as specified in INDOT Specification Section 405.

C. Filter fabric shall be non-woven filter fabric as specified in INDOT Specification Section 912.18.

2.06 TOPSOIL:

A. Topsoil may be material excavated from the site or material supplied by the Contractor and meeting the following requirements.

1. Natural, fertile, agricultural soil, capable of sustaining vigorous plant and lawn growth.

2. Soil shall be of uniform composition through out, with out admixture of subsoil.

3. Topsoil shall be free of stones, lumps, clods, sod, live plants and their roots, sticks and other extraneous material.

2.07 SEED:

A. Seed: Shall be mixed and guaranteed by the dealer to contain the following:

| % By Weight | Variety | Purity | Germination |
|---|---|---|---|
| 80% | 3 Varieties of Improved Kentucky Bluegrass | 85% | 80% |
| 20% | Improved Perennial Rye Grass | 95% | 90% |

PART 3 - EXECUTION

3.01 PREPARATION:

A. Identify required lines, levels, contours and datum.

B. Identify known below grade utilities remaining which pass through the construction area.

C. Maintain and protect existing utilities remaining which pass through the construction area.

D. Upon discovery of an unknown concealed utility, discontinue affected work, and notify Designer.

3.02 GENERAL EXCAVATION:

A. 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. Where topsoil is required for later use as topsoil, it shall be piled separately from other excavated material.

B. Open-cut trenches shall be sheeted and braced as required by governing state laws and as necessary to protect life, property, or work.

3.03 STRUCTURE EXCAVATION:

A. Excavate true to line and grade, level at bottom.

B. Excavate to undisturbed structurally stable subsoil.

C. Excavations shall be to the dimensions indicated plus sufficient space to permit erection of forms, shoring, masonry, and foundations and excavation inspection.

D. Excavation below slabs and paving shall be sufficient to permit placement of subbase material.

E. Foundations:

1. If suitable bearing is not encountered at the depth indicated on drawings for foundations, immediately notify the Designer.

2. Do not proceed further until instructions are given by the Designer and required tests are completed.

3. Under no conditions are footings to be placed on soft earth.

4. Remove soft pockets.

3.04 TRENCH EXCAVATION:

A. Excavate trenches to depth and width required to permit the installation of the work to the lines and dimensions indicated on the Drawings or as otherwise specified, except that the width of a pipeline trench shall not exceed 24 inches plus the pipe diameter at the top of the pipe.

B. Bedding shall be provided with bell holes at each joint to permit proper jointing and support of the pipeline.

C. The trench bottom shall be excavated to a minimum of 4 inches below the pipe. No extra payment will be allowed for over depth excavation.

D. Material excavated from trenches suitable for backfill shall be stockpiled in an orderly manner and deposited a sufficient distance from the trench bank to avoid overloading and to prevent slides or cave-ins.

3.05 GENERAL FILLING AND BACKFILLING:

A. Where compaction is required, fill and backfill shall be placed in successive horizontal layers of approximately 6 inch loose depth for the full width of the cross section.

B. Granular fill shall be placed and thoroughly compacted (95% Standard Proctor) under all floor slabs on grade and all excess cuts in trenches.

C. Operations of earthwork shall be suspended when satisfactory results cannot be obtained because of rain, freezing weather or other unsatisfactory conditions of the field.

D. Material placed in layers shall be of the proper moisture content before rolling to obtain the prescribed compaction. Wetting or drying of the material and manipulation to secure a uniform moisture content throughout the layer shall be required.

E. Should the material be too wet to permit proper compaction or rolling, all work on all portions thus affected shall be delayed until the material has dried to the required moisture content.

F. Sprinkling shall be done with sprinkling wagons, pressure distributors or other approved equipment that will sufficiently distribute the water. Sufficient equipment to furnish the required water shall be available at all times.

G. In the construction of filled areas, starting layers shall be placed in the deepest portion of the fill, and as placement progressed, layers shall be constructed approximately parallel to the finished grade line.

H. The Contractor shall be responsible for the stability of fills made under the contract, and shall replace any portion, which in the opinion of the Designer has become displaced due to carelessness or negligence on the part of the Contractor.

I. Boulders shall not be disposed of outside of the excavation areas, except at places, and in the manner designated by the Designer.

3.06 FILL AND BACKFILL FOR STRUCTURES:

A. All material entering the fill shall be free of organic matter such as leaves, grass, roots and other objectionable material.

B. Fill under foundations shall be either lean concrete or compacted granular fill.

C. Drainage fill under floor slabs shall be placed to indicated depths but not less than 4 inches.

D. Fill excess cuts under slabs with gravel and thoroughly compact.

E. Backfilling shall not be done until walls are braced or shored and the Designer has approved the backfilling operation. If fill is to be provided on both sides of walls, fill on both sides at the same time.

3.07 TRENCH BACKFILL:

A. Below finished pipe location to 6 inches above sewer pipe:

1. Granular fill.

2. Sufficiently damp to permit thorough compaction.

B. Six inches above pipe to 1 foot above pipe:

1. Free from rocks larger than 1".

C. One foot above pipe to finish grade:

1. Free from rocks larger than 8".

2. Top 6" to be topsoil.

D. Paved areas:

1. Trenches cutting or within 5 feet of gravel, stone, or asphalt surfaces shall be backfilled with granular fill below the surface repair material.

3.08 GENERAL COMPACTION:

A. Fill areas at structures and under paved areas shall be compacted using equipment capable of compacting each lift to its full depth. Moisture during compaction operations shall be maintained at optimum content.

B. Compacting equipment shall be approved equipment of such design, weight and quantity to obtain the required density in accordance with soil compaction requirements.

C. Water distributors equipped with a suitable sprinkling device shall be used to add moisture to the soil if required.

D. Compaction operations shall be continued until the fill is compacted to not less than 95% standard Proctor of the maximum density as determined in accordance with ASTM D-698 in fill areas under paved areas and within building lines.

E. Compact fill supporting footings and pipelines to 100% Standard Proctor, ASTM D-698.

F. Areas inaccessible to a roller shall be consolidated and compacted by mechanical tampers. The equipment shall be operated in such manner that hardpan, cemented gravel, clay, or other chunky soil material will be broken up into small particles and become incorporated with the material in the layer.

G. Compaction by flooding is not acceptable.

3.09 TRENCH COMPACTION:

A. Granular fill used in areas below the specified grade shall be placed in 4" layers and thoroughly tamped as directed by the Designer so as to provide a uniform and continuous bearing and support for the pipe between bell or coupling holes.

B. Granular backfill shall be compacted. Layers shall not exceed 4" thick after compaction. Backfill shall be sufficiently damp to permit thorough compaction under and on each side of the pipe. Special care shall be taken to work material under the pipe for support.

C. After backfilling, remove all excess material, regrade and leave the premises free, clear and in good order. The backfill may be mounded to allow for settlement.

D. Where it is indicated on the plans that compacted backfill or landscape backfilling is required, the Contractor shall compact all backfill in the trench to such an extent that mounding for settlement is not required. Finish grade shall be at the same level as adjacent areas.

E. All settlement in the backfill which takes place within one-year warranty period specified in General Conditions shall be refilled and restored by the Contractor at his expense.

3.10 PROOF ROLLING

A. Proof roll subgrades below building and paved areas with heavy equipment prior to filling, consisting of one coverage of an earthmover or scraper.

B. After completion of filling and compaction operations, roll area with smooth wheeled vehicle to leave a smooth surface sealed to shed all water.

3.11 GRADING:

A. Furnish, operate and maintain equipment necessary for proper compaction and to control uniform layers, sections and smoothness of grade for positive drainage.

B. Rough Grading:

1. Evenly grade to elevation 6 inches below finish grade topsoil elevations indicated.
2. Protect all constructed items during grading operations, and repair if damaged.
3. All areas in the project including excavated and filled sections and adjacent transition areas shall be reasonably smooth, compacted and free from irregular surface changes.
4. The degree of finish shall be that ordinarily obtainable from either blade-grader or scraper operations, except as otherwise specified.
5. The finished subgrade surface generally shall be not more than 0.3 feet above or below the established grade or approved cross-section, with due allowance for topsoil and sod.
6. The tolerance for areas within 10 feet of buildings shall not exceed 0.15 feet above or below the established sub-grade.
7. All ditches, swales and gutters shall be finished to drain readily.
8. Unless otherwise indicated on the drawings, the subgrade shall be evenly sloped to provide drainage away from the building walls in all directions at a grade not less than 2" per foot.
9. Provide rounding at top and bottom of banks and at other breaks in grade.

C. Finish Grading:

1. Proceed to finish elevations indicated.
2. Rake subsoil clean of stones and debris. Scarify to depth of 3".
3. Spread topsoil over prepared subgrade to a minimum depth of 6", and roll until suitable for seeding.
4. Maintain surfaces and replace additional topsoil necessary to repair erosion.

D. Protection:

1. Protect newly graded areas from the action of the elements.
2. Settlement or washing that occurs prior to acceptance of the work shall be repaired, and grades re-established to the required elevations and slopes.
3. Fill to required subgrade levels any areas where settlement occurs.

3.12 SEEDING:

A. Seed all disturbed areas with specified seed mixture at a rate of 9 lbs. per 1000 S.F.

1. Fertilize seeded area with 6 lbs. of 13%N - 25%K /1000 S.F.

2. Apply a weed free straw mulch to the seeded area at a rate of 1 bale/1000 S.F. to give a uniform coverage of 1/4".

3. Water as needed.

3.13 PAVEMENT REPAIR:

A. Gravel or stone surfaces shall be repaired with 6" of #53 crushed stone or crushed gravel placed on top of filter fabric.

B. Asphalt shall be saw cut 12" past the trench excavation.

C. Hot asphaltic concrete pavement repair material shall be compacted either by hand or mechanical tampers after placement.

D. Asphalt pavement surfaces shall be repaired with of 6" of #53 crushed stone or gravel placed on top of filter fabric and 330 pounds per square yard of hot asphaltic concrete binder.

END OF SECTION

# SECTION 022500 - TERMITE CONTROL

## PART 1 – GENERAL

### 1.1 SUMMARY

A. This Section includes the following:
1. Soil treatment with termiticide.

B. Related Sections include the following:
1. Division 06 Section "Rough Carpentry" for wood preservative treatment by pressure process.
2. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section

### 1.2 PERFORMANCE REQUIREMENTS

A. Service Life of Soil Treatment: Soil treatment by use of a termiticide that is effective for not less than five years against infestation of subterranean termites.

### 1.3 ACTION SUBMITTALS

A. Product Data: For termiticide.
1. Include the EPA-Registered Label for termiticide products.

B. Product Certificates: For termite control products, signed by product manufacturer.

D. Soil Treatment Application Report: After application of termiticide is completed, submit report for Owner's record information, including the following:
1. Date and time of application.
2. Moisture content of soil before application.
3. Brand name and manufacturer of termiticide.
4. Quantity of undiluted termiticide used.
5. Dilutions, methods, volumes, and rates of application used.
6. Areas of application.
7. Water source for application.

E. Warranty: Special warranty specified in this Section.

### 1.4 QUALITY ASSURANCE

A. Installer Qualifications: A specialist who is licensed according to regulations of authorities having jurisdiction to apply termite control treatment and products in jurisdiction where Project is located.

B. Regulatory Requirements: Formulate and apply termiticides according to the EPA-Registered Label.

C. Source Limitations: Obtain termite control products through one source.

### 1.5 PROJECT CONDITIONS

A. Environmental Limitations: To ensure penetration, do not treat soil that is water saturated or frozen. Do not treat soil while precipitation is occurring. Comply with requirements of the EPA-Registered Label and requirements of authorities having jurisdiction.

1.6 COORDINATION

A. Coordinate soil treatment application with excavating, filling, grading, and concreting operations. Treat soil under footings, grade beams, and ground-supported slabs before construction.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form, signed by Applicator and Contractor certifying that termite control work, consisting of applied soil termiticide treatment, will prevent infestation of subterranean termites. If subterranean termite activity or damage is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Termiticides:

a. Aventis Environmental Science USA LP; Termidor.
b. Bayer Corporation; Premise 75.
c. Dow AgroSciences LLC; Dursban TC, Equity.
d. FMC Corporation, Agricultural Products Group; Talstar, Prevail FT, Torpedo.
e. Syngenta; Demon TC.

2.2 SOIL TREATMENT

A. Termiticide: Provide an EPA-registered termiticide complying with requirements of authorities having jurisdiction, in an aqueous solution formulated to prevent termite infestation. Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to product's EPA-Registered Label.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for moisture content of soil, interfaces with earthwork, slab and foundation work, landscaping, and other conditions affecting performance of termite control.

1. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's written instructions for preparation before beginning application of termite control treatment. Remove all extraneous sources of wood cellulose and other edible materials such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil within and around foundations.

B. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil

to be treated except previously compacted areas under slabs and footings. Termiticides may be applied before placing compacted fill under slabs if recommended in writing by termiticide manufacturer.

1. Fit filling hose connected to water source at the site with a backflow preventer, complying with requirements of authorities having jurisdiction.

3.3 APPLICATION, GENERAL

A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's EPA-Registered Label for products.

3.4 APPLYING SOIL TREATMENT

A. Application:
Mix soil treatment termiticide solution to a uniform consistency. Provide quantity required for application at the label volume and rate for the maximum specified concentration of termiticide, according to manufacturer's EPA-Registered Label, to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction. Distribute treatment evenly.

1. Slabs-on-Grade:
Under ground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.
2. Foundations:
Adjacent soil including soil along the entire inside perimeter of foundation walls, along both sides of interior partition walls, around plumbing pipes and electric conduit penetrating the slab, and around interior column footers, piers, and chimney bases; also along the entire outside perimeter, from grade to bottom of footing. Avoid soil washout around footings.
3. Penetrations:
At expansion joints, control joints, and areas where slabs will be penetrated.

B. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.

C. Protect termiticide solution, dispersed in treated soils and fills, from being diluted until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.

D. Post warning signs in areas of application.

E. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

END OF SECTION 022500

# SECTION 02255 - CRUSHED STONE, RIPRAP & STRUCTURE BACKFILL

## PART 1 - GENERAL

### 1.01 SCOPE OF WORK

A. Furnish and install crushed stone, riprap and structure backfill for miscellaneous uses as shown on the Drawings, and as called for in the Specifications.

B. Sizes, types, and quality of crushed stone, riprap and structure backfill are specified in this Section and as noted in the plan details, but its use for replacement of unsuitable material, pavement base, and similar uses is specified in detail elsewhere in the Specifications. The Engineer may order the use of crushed stone for purposes other than those specified in other Sections, if, in his opinion, such use is advisable. Payment for same will be subject to negotiation.

## PART 2 - PRODUCTS

### 2.01 MATERIALS

A. Aggregate: When referred to in these Specifications, compacted aggregate shall be Compacted Aggregate # 8, #9, #11 or # 53 of the specific size as required by the plans and plan details. Aggregate gradation shall be in accordance with the following gradation chart.

| Sieve Sizes | COARSE AGGREGATE SIZES (PERCENT PASSING) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | COARSE GRADED | | | | | | | | DENSE GRADED | |
| | 2 | 5 | 8 | 9 | 11 | 12 | 43[1] | 91 | 53[1] | 73[1] |
| 4 in. (100 mm) | | | | | | | | | | |
| 3 1/2 in. (90 mm) | | | | | | | | | | |
| 2 1/2 in. (63 mm) | 100 | | | | | | | | | |
| 2 in. (50 mm) | 80-100 | | | | | | | | | |
| 1 1/2 in. (37.5 mm) | | 100 | | | | | 100 | | 100 | |
| 1 in. (25 mm) | 0-25 | 85-98 | 100 | | | | 70-90 | 100 | 80-100 | 100 |
| 3/4 in. (19 mm) | 0-10 | 60-85 | 75-95 | 100 | | | 50-70 | | 70-90 | 90-100 |
| 1/2 in. (12.5 mm) | 0-7 | 30-60 | 40-70 | 60-85 | 100 | 100 | 35-50 | | 55-80 | 60-90 |
| 3/8 in. (9.5 mm) | | 15-45 | 20-50 | 30-60 | 75-95 | 95-100 | | | | |
| No. 4 (4.75 mm) | | 0-15 | 0-15 | 0-15 | 10-30 | 50-80 | 20-40 | | 35-60 | 35-60 |
| No. 8 (2.36 mm) | | 0-10 | 0-10 | 0-10 | 0-10 | 0-35 | 15-35 | | 25-50 | |
| No. 30 (600 µm) | | | | | | 0-4 | 5-20 | | 12-30 | 12-30 |
| No. 200 (75 µm)[2] | | | | | | | 0-6.0 | | 5.0-10.0[4] | 5.0-12.0 |
| Decant (PCC)[3] | | 0-1.5 | 0-1.5 | 0-1.5 | 0-1.5 | 0-1.5 | | 0-1.5 | | |
| Decant (Non-PCC) | 0-2.5 | 0-2.5 | 0-3.0 | 0-2.5 | 0-2.5 | 0-2.0 | | 0-2.5 | | |

Notes:
1. The liquid limit shall not exceed 25 (35 if slag) and the plasticity index shall not exceed 5. The liquid limit shall be determined in accordance with AASHTO T 89 and the plasticity index in accordance with AASHTO T 90.
2. Includes the total amount passing the No. 200 (75 µm) sieve as determined by AASHTO T 11 and T 27.
3. Decant may be 0-2.5 for stone and slag.
4. When slag is used for separation layers as defined in 302.01, the total amount passing the No. 200 (75 µm) sieve shall be 10.0 to 12.0.

All aggregate and crushed stone under paved surfaces or within 5 feet of paved surfaces shall be compacted to 95% standard proctor. All aggregate in non paved areas shall be compacted to a minimum of 90% standard proctor. The procedure for determining maximum densities for compaction control shall be in accordance with AASHTO T 99. The size and type of stone to be used shall be as shown on the plan details.

B. Structure Backfill: Structure Backfill shall be INDOT Structure Backfill Type 2 which shall be a material of an acceptabe quality, free from large and frozen lumps, wood, or other extraneous matter. It shall consist of crushed stone aggregate or ACBF structure backfill that meets INDOT Specification 904.05, except No. 30, No. 4, and 2 in. nominal size aggregate which shall not be used. Alternatively, Structure Backfill Type 2 may be non-removable or removable flowable backfill in accordance with INDOT Specifiction 213.

C. Riprap: Riprap shall meet INDOT specification 904.04 of the type listed in the plans.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

A. Crushed stone shall be placed and compacted in accordance with INDOT Specification 211 and related specifications.

B. Riprap shall be installed in accordance with INDOT specification 616. Riprap used for erosion control measures may be reused on the project as needed.

C. Structure backfill shall be installed in accordance with INDOT specification 211 and 715 as applicable.

D. Crushed stone, structure backfill and riprap shall be placed in those areas as shown on the Drawings.

E. Structure backfill used shall not be open graded nor allow stormwater to run through the material.

### 3.02 BROKEN CONCRETE RESTRICTION

A. Broken Concrete shall NOT be used as riprap.

-END OF SECTION –

# SECTION 02923 - LANDSCAPE GRADING

## PART 1 - GENERAL

### 1.01 WORK INCLUDED

Final grading of topsoil for finish landscaping.

### 1.02 RELATED SECTIONS

Section 02160 - EARTHWORK

Section 02936 - SEEDING

## PART 2 - PRODUCTS

A. Topsoil: Excavated Material free of rocks, roots larger than 1/2-inch, subsoil, debris and large weeds.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

A. Verify that trench backfilling has been inspected.

B. Verify substrate base has been contoured and compacted.

### 3.02 SUBSTRATE PREPARATION

A. Eliminate uneven areas and low spots.

B. Remove debris, roots, branches, stones, in excess of 1/2-inch in size. Remove subsoil.

C. Scarify subgrade to depth of 3-inches where topsoil is scheduled. Scarify in areas where equipment is used for hauling and spreading topsoil and has compacted subsoil.

### 3.03 PLACING TOPSOIL

A. Place topsoil in areas where seeding, planting are to occur to the thickness as scheduled. Place topsoil during dry weather.

B. Fine grade topsoil eliminating rough or low areas. Maintain profile and contour of subgrade.

C. Remove roots, weeds, rocks and foreign material while spreading.

D. Manually spread topsoil close to trees, plants and building to prevent damage.

E. Lightly compact placed topsoil.

F. Remove surplus subsoil and topsoil from site.

G. Leave stockpile area and site clean and raked, ready to receive landscaping.

3.04 TOLERANCES

A. Top of topsoil; Plus or minus 1/2-inch.

3.05 PROTECTION

A. Protect landscaping and other features remaining as final work.

B. Protect utilities and paving.

3.06 SCHEDULES

A. Compacted topsoil thickness at the following areas:

1. Seeded Grass: 3-inches.
2. Sod: 2-inches.

-END OF SECTION –

# SECTION 02936 SEEDING

## PART 1 - GENERAL

### 1.01 WORK INCLUDED

A. Seeding, mulching.

B. Maintenance.

### 1.02 RELATED SECTIONS

A. Section 02160 - EARTHWORK

B. Section 02923 - LANDSCAPE GRADING

### 1.03 DEFINITIONS

A. Weeds: Includes Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Bermuda Grass, Johnson Grass, Poison Ivy, Nut Sedge, Nimber Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, and Brome Grass.

### 1.04 MAINTENANCE DATA

A. Includes maintenance instructions, cutting method and maximum grass height.

### 1.05 QUALITY ASSURANCE

A. Provide seed mixture in containers showing percentage of seed mix, year of production, net weight, date of packaging, and location of packaging.

### 1.06 REGULATORY REQUIREMENTS

A. Comply with regulatory agencies for herbicide composition.

B. Provide certificate of compliance from authority having jurisdiction indicating approval of seed mixture.

### 1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Division I.

B. Deliver grass seed mixture in sealed containers. Seed in damaged packaging is not acceptable.

C. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.

1.08 MAINTENANCE SERVICE

Maintain seeded areas immediately after placement until grass is well established and exhibits a vigorous growing condition for two cuttings.

PART 2 - PRODUCTS

2.01 SEED MIXTURES

A. Permanent Seed Mixture:

Shall be Mulch Seed Type Per 2016 INDOT specifications (150 lb acre).

C. Temporary Seed Mixture:
Shall be Mulch Seed Mix type T Per 2016 INDOT specifications

2.02 ACCESSORIES

Mulching Material: Oat or wheat straw, free from weeds, foreign matter detrimental to plant life, and dry. Hay or chopped cornstalks are not acceptable.

Water: Clean, fresh and free of substance of water or matter which could inhibit vigorous growth of grass.

Erosion Fabric: Jute matting, open weave.

Stakes: Softwood lumber, chisel pointed.

String: Inorganic fiber.

Fertilizer: 12-12-12 Commercial Mixture.

PART 3 - EXECUTION

3.01 PREPARATION

Lawn: Till soil thoroughly to a minimum depth of 2".

Apply fertilizer to soil at rate of 20 pounds per 1000 square feet immediately prior to seeding.

Rake or lightly till fertilizer into soil.

When topsoil is exceedingly dry, moisten to a depth of 4", 48 to 72 hours prior to start of seeding.

Perform watering to prevent run off.

3.02 SEEDING:

Sow seed uniformly over entire area in 2 operations at rate of 150 lbs. per acre.

Apply second seeding at right angles over the first.

Seeding operation may be by broadcast method or drill equipment.

Lightly cover seed by hand raking or dragging lawn areas to depth of 1/4".

Smooth and firm seeded areas with a 200# roller and water with a fine spray.

Cover all sloped areas (greater than 3 to 1 slopes) and other areas where erosion may occur with burlap erosion mat. Anchor securely in place.

Mulch all seeded areas at a minimum rate of 1 Ton/acre. Mulch shall be held in place as contractor will be responsible for replacing mulch which has blown away prior to adequate seeding germination. Mulch shall be held in place by one of the following methods.

1. Tilling or punching mulch into the soil.

2. Commercially produced mulch binder.

3. Binder twine fastened down with pegs spaced 6 feet or less apart.

4. Commercially produced polymetric plastic net held in place with wire staples.

3.03 LAWN ESTABLISHMENT

Provide daily maintenance until lawn is well established.

Provide necessary lawn care including fertilizing, weed eradication, watering, mowing, removal of excess clippings and replacement of unsuitable sod.

Establishment period for lawns:

Seeded Lawns: extend until uniform stand of grass established over entire area.

-END OF SECTION-

SECTION 031000

CONCRETE FORMWORK

1. PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. This Section specifies formwork for cast in place concrete and consists of furnishing all labor, equipment and services required for forming all cast-in-place concrete indicated on the drawings and subsequent removal of all such forms described in this Section.

1.2 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 03 2000 - Concrete Reinforcement

C. Section 03 3000 - Cast-in-Place Concrete

D. ACI 301, “Specifications for Structural Concrete”

1.3 QUALITY ASSURANCE

A. Design, fabrication, installation and removal of all formwork shall be in accordance with the following American Concrete Institute publications:

1. ACI 117 “Specification for Tolerances for Concrete Construction and Materials”

2. ACI 301 “Specifications for Structural Concrete”

3. ACI 347 "Guide to Formwork for Concrete"

B. The design, strength, safety, and adequacy of all formwork, shoring, bracing, and all methods of construction are the responsibility of the Contractor. No action by the Architect, Engineer, or Owner will eliminate, lessen, or restrict this responsibility in any manner.

C. Scaffold formwork systems supporting elevated work platforms shall be designed by a qualified Professional Engineer, registered in the State of Indiana.

1.4 SUBMITTALS

A. Submittal procedures and requirements shall comply with Division 01 Specification Sections.

B. For Formwork and scaffold systems supporting elevated work platforms submit formwork shop drawings. Formwork shop drawings shall be prepared by or under the supervision of a qualified Professional Engineer detailing fabrication, assembly, and support of formwork.

C. Shoring and Re-shoring: For elevated concrete beams and slabs, indicate proposed schedule and sequence of stripping formwork, shoring removal, and re-

shoring installation and removal.

D. Form Release Agent: Product Data

2. PART 2 - PRODUCTS

2.1 FORM MATERIALS AND ACCESSORIES

A. Forms for concrete shall be plywood, metal or other acceptable panel-type materials to provide continuous, straight smooth, exposed surfaces.

B. Coat steel forms with a non-staining, rust-preventative material. Rust-stained steel formwork is not acceptable.

C. Form ties shall be factory fabricated, adjustable length, snap-off metal form ties, designed to prevent form deflection and to prevent spalling of concrete upon removal. The metal after breaking should be at least 1" from the face of the wall.

D. Form Release Agent: Non-staining and compatible with indicated finishes and surfaces.

E. Formwork bracing and shoring shall be selected by the contractor consistent with safety requirements and the quality required in the finished work. The contractor is responsible for the design, safety and serviceability of all formwork.

F. All other materials not specifically described but required for proper completion of concrete formwork, shall be as selected by the Contractor subject to the advance approval of the Architect and Engineer.

3. PART 3 – EXECUTION

3.1 CONSTRUCTION OF FORMS

A. Design, erect, support, brace and maintain formwork to support vertical and lateral, static and dynamic loads that might be applied until concrete structure can support such loads.

1. Limit deflection of each formwork component to 1/360 of the component span.

B. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation, and position within the tolerance limits specified in ACI 117. Maintain formwork construction tolerances complying with ACI 347.

C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:

1. Class A, 1/8 inch as measured within a 5 foot length with a straightedge, for Smooth Form Finished surfaces, Smooth Rubbed Finish surfaces, or other surfaces exposed to view in public areas.

2. Class C, 1/2 inch as measured within a 5 foot length with a straightedge, for Rough Form Finished surfaces unless otherwise noted.

3. Variation from plumb in lines and surfaces of columns, piers, walls, and arises; 1/4 inch per 10 feet, but not more than 1 inch. For exposed corner columns, control joint grooves, and other conspicuous lines, 1/4 inch in a bay or 20 feet maximum; 1/2 inch maximum in 40 ft. or more.

4. Variation in sizes and locations of sleeves, floor openings, and wall openings, 1/4 inch.

5. Variations in footings plan dimensions, minus 1/2 inch and plus 2 inches; misplacement or eccentricity, 2 percent of footing width in direction of misplacement but not more than 2 inches; thickness reduction, minus 5 percent.

D. Construct forms to sizes, shapes, lines, and dimensions shown and to obtain accurate alignment, location, grades, level, and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in work. Use selected materials to obtain required finishes. Solidly butt joints and provide backup at joints to prevent leakage of cement paste.

E. Align and secure formwork joints to avoid offsets.

F. Earth Forming of Foundations:

1. Where footings are to be constructed in cohesive soils, the Contractor may elect to earth form footings with the approval of the Engineer. Earth forms shall be excavated to create vertical faces to the detailed dimensions within a tolerance of plus 6 inches, minus 0 inch. The Contractor responsible for foundations is responsible to verify from the Geotechnical Engineering Report included in this Project Manual that soil conditions allow the use of earth-formed foundations. If a soils report is not provided or if soil conditions do not allow earth-forming, the Contractor shall include the cost of forming foundations in his bid.

G. Set all required steel frames, angles, grilles, bolts, inserts, and other such items required to be anchored in the concrete before the concrete is placed.

H. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces.

I. Provide temporary openings where interior area of formwork is inaccessible for cleanout, for inspection before concrete placement, and for placement of concrete.

J. Chamfer all exposed corners and edges unless indicated otherwise, using wood, metal, PVC, or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints. Chamfers shall be ¾ inch by ¾ inch unless noted otherwise.

K. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses, and chases from trades providing such items. Accurately place and securely support items built into forms.

L. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before concrete is placed. Retighten forms and bracing before concrete placement as required to

prevent mortar leaks and to maintain proper alignment.

M. Coat surfaces of forms with form release agent in accordance with the manufacturer's written instructions prior to placing concrete reinforcement. Do not coat concrete reinforcement with form release agent.

3.2 REMOVAL OF FORMS

A. Forms shall be removed in an approved manner under competent supervision so as to avoid damage to the concrete. Particular care shall be taken to avoid spalling.

B. General: Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form-removal operations, and provided curing and protection operations are maintained.

C. Formwork supporting weight of concrete, such as beam soffits, joists, slabs, and other structural elements, shall not be removed in less than 14 days and until concrete has attained at least 75 percent of the specified minimum compressive strength. Determine potential compressive strength of in-place concrete by testing field-cured specimens representative of concrete location or members.

1. Formwork supporting the weight of concrete may be removed 4 days after placement only if shores and other vertical supports have been arranged to permit removal of form-facing material without loosening or disturbing shores and supports.

D. Patch or repair any holes or other damage in existing concrete surfaces or other existing construction caused by the installation, support, or removal of the formwork.

3.3 REUSE OF FORMS

A. Clean and repair surfaces of forms to be reused in the work. Split, frayed, delaminated, or otherwise damaged form-facing material shall not be used. Apply new form release agent to formwork prior to each use.

B. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joints to avoid offsets. Do not use "patched" forms for exposed concrete surfaces.

END OF SECTION

SECTION 032000

CONCRETE REINFORCING

1. PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Furnish all labor, material, equipment and services necessary to complete fabrication and installation of all concrete reinforcement and associated accessories in accordance with the Drawings and as herein specified.

1.2 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 03 1000 - Concrete Formwork.

C. Section 03 3000 - Cast-in-Place Concrete.

1.3 QUALITY ASSURANCE

A. Codes and Standards:

1. ACI 117 “Specification for Tolerances for Concrete Construction and Materials”.

2. ACI 315, "Details and Detailing of Concrete Reinforcement".

3. ACI 318, "Building Code Requirements for Structural Concrete".

4. CRSI “Manual of Standard Practice”.

1.4 SUBMITTALS

A. Submittal procedures and requirements shall comply with Division 01 Specification Sections.

B. Shop Drawings:

1. Prepare shop drawings defining fabrication details and placement. These shop drawings must be approved by the Engineer prior to any reinforcement being fabricated or placed.

2. Shop Drawings shall be checked by the Engineer for correct interpretation of the Drawings but this check shall not relieve the Contractor of his primary responsibility to provide the correct amount of properly detailed reinforcing bars in all members.

3. Refer to the typical details and general notes on the Structural Drawings. These details and notes provide additional information for the detailer and identify areas where extra reinforcing is required.

4. Provide a floor plan for all concrete slabs with the slab reinforcing and all con

struction joints shown.

5. Provide a 1/4 inch scale elevation of all walls and beams with the reinforcing shown.

6. Provide dimensioned bar bending diagrams for all bent bars.

7. Sections through walls, beams and slabs shall be provided showing bar positions and clearances to forms. On wall sections, indicate spacers used to maintain clearances for vertical wall steel. On wall sections, show clearances for vertical wall steel.

C. If mechanical bar splices are used, provide fabrication and installation details with the shop drawing submittal. Provide manufacturer's literature and certified test reports verifying compliance with this Specification. Provide ICC-ES approval reports for each type of mechanical bar splice used.

D. If mechanical bar anchorages are used, provide fabrication and installation details with the shop drawing submittal. Provide manufacturer's literature and certified test reports verifying compliance with this Specification. Provide ICC-ES approval reports for each type of mechanical bar anchorage used.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protection:

1. Use all means necessary to protect reinforcing steel before, during and after installation.

2. Store reinforcing steel on cribbing off of the ground to prevent excessive rusting and fouling with dirt, grease, and other bond-breaking coatings.

3. When storage of epoxy coated reinforcement at the jobsite exceeds 60 days, protect the epoxy coated reinforcement from sunlight, salt spray, and weather exposure. Make provisions for air circulation around epoxy coated reinforcement to minimize condensation under protective coverings.

4. Equipment for handling epoxy coated reinforcement shall have padded contact areas. Bundles of epoxy coated reinforcement shall be lifted at multiple pick up points and not dragged or dropped.

2. PART 2 - PRODUCTS

2.1 CONCRETE REINFORCEMENT

A. All concrete reinforcement materials shall comply with the following reference standards:

1. Main Reinforcing Bars: ASTM A615, Grade 60, deformed bars

2. Stirrups and Column Tie Bars: ASTM A615, Grade 60, deformed bars

3. Epoxy Coated Reinforcing Bars: ASTM A615, Grade 60, deformed bars with ASTM A775 epoxy coating with less than 2 percent damaged coating in each 12 inch bar length.

4. Wire Reinforcement: ASTM A1064

5. Welded Wire Fabric Reinforcement: ASTM A1064 fabricated in flat sheets. Do not use rolls of welded wire reinforcement.

6. Epoxy Coated Wire Reinforcement or Welded Wire Fabric Reinforcement: ASTM A1064 with ASTM A884 Type 1 epoxy coating with less than 2 percent damaged coating in each 12 inch wire length.

7. Deformed Bar Anchors: DL2 Deformed Bar Anchors by Nelson Stud Welding, Inc. or approved equal.

2.2 ACCESSORIES

A. Provide bar supports, ties, blocking and accessories in accordance with CRSI "Manual of Standard Practice".

1. Bar supports shall be plastic, stainless steel, or protected with plastic in areas that will be in contact with formwork.

2. For concrete surfaces exposed to view where the legs of bar supports contact formwork, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

3. For epoxy-coated reinforcement, use plastic, epoxy-coated, or other dielectric-polymer-coated bar supports.

4. Over waterproof membranes and vapor barriers, use precast concrete chairs to prevent penetration of the membrane.

5. For footings, trench footings, slabs on grade, and grade beams use precast concrete bricks (f'c = 3000 psi min. at 28 days). (Concrete masonry bricks are not acceptable.)

B. Tie wire shall be 16.5 gauge or heavier, black annealed steel wire. Epoxy coated reinforcing bars shall be tied with plastic coated or epoxy coated steel tie wire.

C. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating; compatible with epoxy coating on reinforcement and complying with ASTM A775.

D. Joint Dowel Bars: ASTM A615, Grade 60, smooth steel bars cut true to length with ends square and free of burrs. Joint Dowel Bars shall be epoxy coated in accordance with ASTM A775.

1. Lubricate one half of dowel length to prevent concrete bonding to one side of the joint.
2. At construction joints in new concrete provide high compressive strength cast in dowel sleeves to promote movement.
   a. Products:
      i. Speed Dowel by Sika Corporation.
      ii. Approved equal.

E. Mechanical Bar Splices: Mechanical bar splices shall conform to ACI 318 and shall develop at least 125% of the reinforcing bar specified yield strength in both tension and compression.

1. Provide mechanical bar splices that have been tested and approved by the International Code Council Evaluation Service (ICC-ES).

3. PART 3 - EXECUTION

3.1 FABRICATION

A. Fabrication shall comply with the requirements of ACI 318, ACI 315, and CRSI "Manual of Standard Practice".

B. Coat epoxy coated reinforcing steel after bending, cutting, and fabrication.

3.2 INSTALLATION

A. Clean reinforcement of loose rust and mill scale, earth, ice, form release agent, and other materials that could reduce or destroy the bond with the concrete.

B. Install reinforcement in the position shown on the Drawings and in accordance with CRSI standards. Provide all supports needed to secure every bar against displacement prior to and during concrete placement.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcing by metal chairs, runners, bolsters, spacers and hangers to adequately maintain minimum concrete cover during concrete placement.

1. Do not “float” reinforcing bars, anchor rods, or dowel bars in place during concrete placement.

D. Place reinforcement to maintain minimum coverage as indicated for concrete protection. Where minimum coverage is not indicated comply with the following.

| Concrete Exposure | Minimum Concrete Cover (inches) |
|---|---|
| Concrete cast against earth | 3 |
| Concrete exposed to earth or weather | |
| # 3 through # 5 bars | 1 ½ |
| # 6 and larger bars | 2 |
| Concrete not exposed to earth or weather | |
| Slabs, walls, & joists, #11 bars and smaller | 3/4 |
| Beams and columns | 1 1/2 |

E. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

F. Splicing of main reinforcement is not permitted unless the splices are shown on the Structural Drawings, on the approved reinforcing steel fabrication and placement drawings, or have otherwise been approved by the Engineer.

1. Minimum lap splice lengths shall be calculated in accordance with ACI 318 for Class B tension lap splices. Lap splice lengths shall not be less than the following.

| Bar Size | Minimum Lap Length (inches) |
|---|---|
| #3 | 19 |
| #4 | 25 |
| #5 | 31 |
| #6 | 37 |
| #7 | 54 |
| #8 | 62 |
| #9 | 70 |
| #10 | 79 |

a. Lap lengths shown are for grade 60 bars in 4,000 psi concrete. Increase tabulated lap lengths by 15% for 3,000 psi concrete.
b. Increase tabulated lap lengths by 30% for horizontal bars with more than 12 inches of fresh concrete placed below the lap splice.
c. Increase tabulated lap lengths by 50% for epoxy coated bars.
d. Increase tabulated lap lengths by 33% for bars placed in lightweight concrete.
e. Increase tabulated lap lengths by 50% where clear spacing between bars is less than 2 bar diameters or clear cover is less than 1 bar diameter.

2. End bearing splices are not allowed.

G. In the event conduits, piping, inserts, sleeves or any other items interfere with placing reinforcement as indicated on the Drawings or as otherwise required, immediately consult the Architect and Engineer and obtain approval of new procedure before placing concrete.

H. Install welded wire fabric reinforcement in the longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing, but not less than 6 inches. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

I. Epoxy-Coated Reinforcement: Repair cut and damaged epoxy coatings with epoxy repair coating material meeting ASTM D3963. Repairs to epoxy coatings shall be allowed to cure prior to placing concrete.

J. Do not weld reinforcing bars.

K. Do not cut or puncture under slab vapor barrier. Repair damage prior to placing concrete.

L. Provide welded wire fabric reinforcing for elevated concrete floor slabs on composite type metal deck. If not otherwise specified, welded wire fabric reinforcing shall have a minimum cross sectional area of 0.00075 times the cross sectional area of concrete above the deck but shall not be less than 6x6 W1.4 x W1.4 welded wire fabric.

3.3 NOTIFICATION

A. The Contractor shall notify the Engineer when reinforcement for a pour is nearing completion so that the reinforcing steel in place may be reviewed.

1. Allow sufficient time for setters to make adjustments or corrections so that reinforcing steel correct in size, shape and position will be in place when con

crete placement operations are started.

END OF SECTION

SECTION 033000

CAST-IN-PLACE CONCRETE

1. PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. This Section specifies cast-in-place concrete, including mix design, placement procedures, and finishes.

1. Provide all materials, labor and equipment required for placing, finishing and curing all cast-in-place concrete work as shown and indicated.

2. Provide installation of all specified items to be embedded in cast-in-place concrete.

B. Precast concrete, joint sealers, and concrete floor toppings are specified in other specification sections.

1.2 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 031 000 - Concrete Formwork.

C. Section 03 2000 - Concrete Reinforcement.

D. Section 31 2000 – Earth Moving

1.3 QUALITY ASSURANCE

A. Inspection and Testing Services: Inspection and testing services are required to verify compliance with the requirements specified or indicated. These services do not relieve the contractor of responsibility for compliance with the Contract Documents.

1. Refer to Division 01 specification sections for assignment of responsibility for providing Inspection and Testing services specified herein. If Division 01 specifications do not assign responsibility to the Owner or to the Contractor, then the Contractor shall be responsible for providing Inspection and Testing services.

B. 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.

C. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94 requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

D. Codes and Standards: Comply with provisions of following codes, specifications, and standards, except where more stringent requirements are shown or specified.

1. ACI 117, “Specification for Tolerances for Concrete Construction and Materials”.

2. ACI 301, "Specifications for Structural Concrete".

3. ACI 303.1, “Standard Specification for Cast-In-Place Architectural Concrete”.

4. ACI 305.1, "Specification for Hot Weather Concreting".

5. ACI 306.1, "Standard Specification for Cold Weather Concreting".

6. ACI 318, "Building Code Requirements for Structural Concrete".

7. ASTM C31, "Standard Practice for Making and Curing Concrete Test Specimens in the Field".

8. ASTM C33, "Standard Specification for Concrete Aggregates".

9. ASTM C39, "Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens".

10. ASTM C42, "Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete".

11. ASTM C94, "Standard Specification for Ready-Mixed Concrete"

12. ASTM C143, "Standard Test Method for Slump of Hydraulic Cement Concrete".

13. ASTM C150, "Standard Specification for Portland Cement".

14. ASTM C171, "Standard Specification for Sheet Materials for Curing Concrete".

15. ASTM C172, "Standard Practice for Sampling Freshly Mixed Concrete".

16. ASTM C173, "Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method".

17. ASTM C231, "Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method".

18. ASTM C260, "Standard Specification for Air-Entraining Admixtures for Concrete".

19. ASTM C309, "Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete".

20. ASTM C330, “Standard Specification for Lightweight Aggregates for Structural Concrete”.

21. ASTM C494, "Standard Specification for Chemical Admixtures for

Concrete".

22. ASTM C567, “Standard Test Method for Determining Density of Structural Lightweight Concrete”.

23. ASTM C618, "Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete".

24. ASTM C1064, “Standard Test Method for Temperature of Freshly Mixed Hydraulic Cement Concrete”.

25. ASTM C1116, “Standard Specification for Fiber-Reinforced Concrete”.

26. ASTM D994, "Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type)".

27. ASTM D 1751, “Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)”.

28. ASTM D1752, “Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction”.

29. ASTM E1155, “Standard Test Method for Determining $F_F$ Floor Flatness and $F_L$ Floor Levelness Numbers”.

30. ASTM E1745, “Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs”.

31. Indiana Department of Transportation, "Standard Specifications".

E. Materials:

1. Obtain materials used to manufacture cast in place concrete from the same source throughout the project.

2. Obtain aggregates from state Department of Transportation / Highways certified sources.

F. Pre-Construction Conference:

1. A pre-construction conference shall be held at least two weeks prior to commencement of work for any of the following special conditions:

a. Hot weather concrete placement

b. Cold weather concrete placement

c. Other special conditions as warranted or as requested by the Owner, Architect, or the Engineer.

G. Drilled In Adhesive Anchor Installer Training:

1. Installers of drilled in adhesive anchors shall be certified by an ACI or CRSI Adhesive Anchor Installer Certification Program or shall be trained on site by the adhesive anchor manufacturer specifically for the project.
    a. Conduct a thorough training with the manufacturer or the manufacturer's representative for the installer on the project. Training to consist of a review of the complete installation process for drilled-in anchors, to include but not limited to:
        i. hole drilling procedure
        ii. hole preparation & cleaning technique
        iii. adhesive injection technique & dispenser training / maintenance
        iv. rebar dowel preparation and installation
        v. proof loading

1.4 SUBMITTALS

A. Submittal procedures and requirements shall comply with Division 01 Specification Sections.

B. Concrete Mix Designs.

1. The Contractor shall submit a mix design for each class of concrete required for the project including:

    a. Standard deviation analysis, required average strength and documentation of average strength verifying compliance with ACI 318. Where historical strength test data for submitted mix designs is not available, the Contractor shall prepare laboratory test samples of each submitted mix design and have the samples tested.

    b. Mix proportions by weight, water-cement ratio, slump and air content.

    c. Sieve analyses of fine and coarse aggregates.

    d. Complete list of materials used in the manufacture of the concrete with product information demonstrating compliance with all specified requirements.

2. The Contractor shall submit mix designs to the Engineer allowing sufficient time for review and approval process prior to start of any concrete placement operations.

C. Shop Drawings for Concrete Work.

1. Submit complete shop drawings under the provisions of Division 01 and indicating:

    a. Locations of construction joints in supported levels.

    b. Locations of construction joints in slabs on grade.

    c. Locations of waterstops.

d. Locations of shoring to be installed to support elevated levels after formwork removal.

e. Size and location of all curbs and equipment bases including reinforcing dowels.

f. Provide coordinated layout drawings showing dimensioned sizes and locations of all sleeves, nosings, and embedments including:
   i. Embedments for curtainwall or storefront attachment.
   ii. Embedments for precast concrete wall panel attachment.
   iii. Electrical conduits and boxes.
   iv. Embedments for attachment of railings.
   v. Sleeves for service, drain, and fire protection piping.
   vi. Roof drain locations and blockout dimensions.
   vii. Size and locations of all mechanical ductwork penetrations. Coordinate final size and locations of these penetrations with the mechanical equipment.
   viii. Steel angle nosings and stair nosings.
   ix. Embedments for fabricated stairways and guardrails.

D. Product Data.

1. Contractor shall submit data for proprietary materials and items specified in Article 2 under the provisions of Division 01 and demonstrating compliance with the requirements of this specification.

E. Provide Manufacturers product data, installation instructions, and ICC-ES approval reports for each type of drilled in anchor used.

1. Provide documentation that all personnel installing drilled in anchors have been trained by the manufacturer for each anchor type being installed.

2. Submit a letter of procedure stating method of drilling, equipment to be used, the complete installation procedure, manufacturer training date, and a list of personnel that have been trained on the anchor installation for each type of drilled in anchor.

F. Field Quality Control Test Reports.

1. Submit to the Engineer Field Quality Control Reports specified in this section under the provisions of Division 01 and within 3 days after completion of the tests.

2. Submit slab finish tolerance compliance reports.

## 2. PART 2 – PRODUCTS

### 2.1 CONCRETE MATERIALS

A. Portland Cement:

1. ASTM C150, Type I or Type III.
2. ASTM C595 Type IL

B. Fly ash: ASTM C618, Type C or F

1. Maximum loss on ignition: 1.50 percent.

2. Maximum amount retained when wet sieved on No. 325 sieve: 30 percent.

C. Slag Cement: ASTM C989, Grade 100 or 120

D. Aggregates: ASTM C33.

1. Fine aggregates shall be natural sand consisting of clean, hard, durable particles well graded from coarse to fine. Fine aggregates shall come from an Indiana Department of Transportation approved source and shall meet the requirements of Indiana Department of Transportation, Standard Specifications, Fine Aggregates for Portland Cement Concrete, Size #23.

2. Coarse aggregates shall be clean gravel or crushed stone consisting of clean, hard, durable particles. Coarse aggregates shall come from an Indiana Department of Transportation approved source and shall meet the requirements of Indiana Department of Transportation, Standard Specifications, Coarse Aggregate, Class A, Size #8.

a. Crushed limestone shall be used for all exterior concrete work including concrete pads, pavement, drives, stoops, slabs and walks on grade.

b. Do not use recycled coarse aggregate materials.

c. Pea gravel coarse aggregate, where required, shall be clean gravel with hard, round, durable particles. Crushed stone aggregate shall not be used as pea gravel coarse aggregate. Pea gravel coarse aggregate shall meet the requirements of ASTM C33 and the Indiana Department of Transportation, Standard Specifications, Coarse Aggregate Class A, size #12.

E. Water: Fresh, clean, potable, free of oil, acid, alkali, salts or any other foreign matter.

F. Air-Entraining Admixture: ASTM C260.

1. Manufacturers:

a. BASF Construction Chemicals / Master Builders.
b. W. R. Grace & Co.

G. Water-Reducing Admixture: ASTM C494, Type A.

1. Manufacturers:

a. BASF Construction Chemicals / Master Builders.
b. W. R. Grace & Co.

H. Mid-Range Water Reducing Admixture: ASTM C494, Type A.

1. Manufacturers:

a. BASF Construction Chemicals / Master Builders.
b. W. R. Grace & Co.

I. Accelerating Admixture: ASTM C494, Type C.

1. Manufacturers:

a. BASF Construction Chemicals / Master Builders (Non-chloride).
b. W. R. Grace & Co. (Non-chloride).

J. Water-Reducing and Retarding Admixture: ASTM C494, Type D.

1. Manufacturers:

a. BASF Construction Chemicals / Master Builders.
b. W. R. Grace & Co.

K. High Range Water-Reducing Admixture: ASTM C494, Type F or G.

1. Manufacturers:

a. BASF Construction Chemicals / Master Builders.
b. W. R. Grace & Co.

L. Non-Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, non-set-accelerating, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete.

2. Manufacturers:

b. BASF Construction Chemicals / Master Builders.
b. W. R. Grace & Co.

M. Synthetic Micro Fibers: ASTM C1116

1. 100% Virgin (non-recycled) nylon fibers.

2. Three-quarter inch length.

3. Provide 18 denier maximum monofilament microfibers. Do not use macrofibers or a blend of microfibers and macrofibers.

4. Use in strict accordance with manufacturer's instructions.

5. Minimum dosage of 1 pound per cubic yard.

6. Standards:

a. Nycon MultiMesh by Nycon, Inc.
b. Nylo-Mono by Forta Corporation.
c. Ny-Tuf by FiberForce / ABC Polymer Industries
d. Approved equal

2.2 RELATED MATERIALS

A. Dissipating Curing Compound: ASTM C309.

1. Clear, non-staining, waterborne, acrylic, membrane forming curing compound meeting ASTM C309, Type 1, Class B.
2. Unless otherwise specified, provide a curing compound only, not a combination curing compound and sealer.
3. Compatible with applied sealers and finishes specified for the concrete surfaces to be cured.

B. Wet Curing Materials:

1. Moisture Retention Cover: ASTM C171. Use combination burlap and polyethylene sheeting.

2. Water: Clean and potable.

C. Evaporation Retardant:

1. Apply in accordance with manufacturer's instructions.

2. Evaporation retardants may be used to reduce surface moisture loss during finishing operations, particularly in hot or windy conditions. Evaporation retardants do not take the place of proper curing methods.

3. Products:

a. MasterKure ER50 by BASF Construction Chemicals / Master Builders
b. EUCOBAR by the Euclid Chemical Co.
c. Approved equal

D. Epoxy Bonding Adhesive:

1. Two-part structural epoxy adhesive.

2. Use to bond fresh, plastic concrete or patching mortar to hardened concrete.

3. Standard: Sikadur 32 Hi-Mod by Sika Corporation.

E. Drilled In Adhesive Anchors:

1. Use to anchor reinforcing steel or threaded anchor rods into hardened concrete.

2. Provide drilled in adhesive anchors that have been tested and approved by the International Code Council Evaluation Service (ICC-ES) for use in cracked concrete.

3. Anchor capacity used in design is based upon the products listed below. Substitution requests for alternate products must be approved in writing by the Engineer prior to use. The Contractor shall submit calculations sealed by a Professional Engineer demonstrating that the substituted product is capable of meeting the performance of the specified product.

4. Drilled hole size, equipment used, and installation procedure shall conform to manufacturer's written instructions.

5. Adhesives for anchoring into concrete:

   a. Products:
      i. HIT-HY 200 Safe Set System by Hilti Inc.
      ii. HIT-RE 500-SD by Hilti Inc.

6. Threaded Rods for use with anchoring adhesives.

   a. Threaded rods shall be zinc coated, galvanized, or stainless steel where installed in exterior conditions.
   b. Threaded Rods:
      i. Hilti HIT-Z Rod by Hilti Inc.
      ii. Hilti HAS-E-55 rod by Hilti, Inc
      iii. ASTM F1554 Grade 55, Supplement S1 threaded rod
      iv. ASTM A 193 Grade B7 threaded rod

F. Patching Material:

1. Use to repair honeycombed, damaged, and other defective concrete.

2. Products:

   a. Five Star Structural Concrete by Five Star Products, Inc.
   b. MasterEmaco S477 Cl by BASF Construction Chemicals / Master Builders.

3. Where patching material is being placed in thicknesses greater than 2”, it may be extended with pea gravel aggregate in accordance with the manufacturer’s recommendations.

G. Patching material for vertical or overhead surfaces.

1. Products:

   a. Five Star Structural Concrete V/O by Five Star Products, Inc.
   b. MasterEmaco S488 Cl by BASF Construction Chemicals / Master Builders.

H. Joint Filler: ASTM D1751.

1. Provide preformed, non extruding, low absorptive, bituminous type, sponge rubber, or cork joint filler.

2. Joint filler shall be a minimum of 1/2 inch thick and the width of filler shall be equal to the full depth of the concrete.

3. Provide removable plastic expansion joint caps where joints are exposed to view or are to be covered with sealant.

4. Products:

   a. Sealtight Fibre Expansion Joint by W. R. Meadows, Inc.
   b. Sponge Rubber Expansion Joint by W. R. Meadows, Inc.
   c. Deck-O-Foam Expansion Joint by W. R. Meadows, Inc.
   d. Approved equal.

J. Semi Rigid Joint Filler: ASTM D2240

1. Install in exposed interior saw cut and formed floor construction and contraction joints that do not receive a floor covering unless noted otherwise.
2. Joint filler engineered to protect joint edges from damage under wheeled traffic.
3. Semi rigid, 100 percent solids, polyurea joint filler with a Type A shore duromer hardness range of 90 to 95 in accordance with ASTM D2240.

K. Waterstops:

1. Flexible PVC flat ribbed or dumbbell type waterstops.

   a. Use where noted for sealing construction joints in new concrete work.

   b. Provide flexible polyvinylchloride waterstops with factory fabricated corners and intersections.

   c. Provide waterstops with a minimum width of six inches.

   d. Products:
      i. Greenstreak PVC Waterstops by Greenstreak Group, Inc.
      ii. Vinylex Waterstop and Accessories by Vinylex Corp.

2. Expanding or Self Adhering Waterstops (Type RX Waterstops).

   a. Use where noted for sealing joints between new concrete and old concrete.

   b. Do not use for sealing joints between new concrete surfaces.

   c. Products:
      i. Akwastop by CETCO Building Materials Group.
      ii. Waterstop RX-101T by CETCO Building Materials Group.
      iii. SF302 Synko-Flex by Henry Company

   d. Provide ¾” by 1” minimum waterstops.

   e. Install at least 4 inches from face of concrete surface.

   f. Install using manufacturer’s recommended adhesive where required.
      i. CETSEAL Adhesive by CETCO Building Materials Group for use with Akwastop and Waterstop RX.

L. Under-slab Vapor Barrier

1. ASTM E1745 Class A.

2. Minimum thickness of 15 mils.

3. Standards:

a. Moistop Ultra 15 by Fortifiber Building Systems Group.
b. Stego Wrap 15 mil Vapor Barrier by Stego Industries.

M. Repair Topping: Portland 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. Repair topping shall produce a durable, traffic resistant, and water resistant surface.

1. Cement Binder: ASTM C 150, Portland cement.

a. Repair topping shall not contain gypsum.

2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.

3. Aggregate: Pea gravel or coarse sand as recommended by topping manufacturer. Extend mix with aggregates only when placed in thickness exceeding 1 ½ inches.

4. Compressive Strength: Not less than 5000 psi at 28 days.

5. Standards:
a. “Ardex K-500”, by Ardex Engineered Cements
b. “Ardex SD-T” By Ardex Engineered Cements
c. Approved equal

2.3 PROPORTIONING AND DESIGN OF MIXES

A. Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301. Develop concrete proportions with the required average strength based upon the appropriate amount of overdesign as required by Chapter 5 of ACI 318.

1. Prepare the mix designs with sufficient lead time to allow testing and adjustment of the mix.

2. Adjust mix designs that do not prove to be satisfactory in use, subject to the Architect / Engineer’s review. Concrete that does not consistently exhibit the specified control characteristics will be considered unsatisfactory. Any additional costs incurred due to changes required in the mix are to be borne by the Contractor.

B. Use a water reducing admixture or a high-range water-reducing admixture (Super plasticizer) in all mix designs as required for placement and workability. Use in strict accordance with manufacturer's instructions.

C. Use an air-entraining admixture in mix designs for all concrete exposed to freezing and thawing during service and for all concrete which during the initial construction period will be exposed to cold weather prior to attaining its specified compressive strength. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having total air content with a tolerance of plus or minus 1 percent of the specified value.

D. Base mix design on saturated surface dry aggregates. Adjust the amount of mixing

water added at the batch plant for the moisture condition of the aggregates.

E. Limit use of cementitious materials other than Portland Cement in concrete as follows:

1. Fly ash may be added to increase the specified cement content by up to 20 percent by weight.
   a. Do not use Class F fly ash in concrete to be placed in cold weather.
   b. Do not use Class F fly ash in concrete requiring a high early strength.
2. Slag Cement may be substituted for Portland Cement at a rate of up to 20 percent by mass
3. Total fly ash plus slag cement shall not exceed 30 percent of the total cementitious material.

E. Water Soluble Chloride Ion Content.

1. Maximum percent allowed in concrete by weight of cement:

   a. 0.15 percent for reinforced concrete exposed to earth or weather.

   b. 0.30 percent for other reinforced concrete.

F. Slump Limits.

1. Proportion and design mixes to result in concrete slump at point of placement of 5 to 8 inches.

H. Concrete Mix Classes:

1. **Class A Concrete:** Use as a non-excavatable fill material underneath building foundations or where an inexpensive low strength concrete is required.

   a. ACI Exposure Class: F0 / C1
   b. Compressive strength at 28 days: 3000 psi.
   c. Minimum cement content: 423 lb/cu yd.
   d. Maximum water-cement ratio: 0.58.
   e. Air content: Optional. 6 to 8% where concrete is exposed to freeze/thaw conditions.

2. **Class B Concrete:** Use for building foundations, grade beams not exposed to freezing temperatures, and for interior equipment bases and curbs.

   a. ACI Exposure Class: F0 / C1
   b. Compressive strength at 28 days: 4000 psi.
   c. Minimum cement content: 517 lb/cu yd.
   d. Maximum water-cement ratio: 0.48.
   e. Air content: Optional
   f. Water-reducing admixture required.

3. **Class C Concrete:** Use for foundation walls and grade beams exposed to freeze/thaw conditions, exterior equipment bases and curbs, column piers,

columns, walls, elevated slabs and beams, retaining walls, and where concrete mix class is not otherwise indicated.

a. ACI Exposure Class: F2 / C1
b. Compressive strength at 28 days: 4,500 psi.
c. Minimum cement content: 564 lb/cu yd.
d. Maximum water-cement ratio: 0.40.
e. Air content: 6% to 8% where concrete is exposed to freeze/thaw conditions. Limit air content for trowel finished floors to 3%.
f. Water-reducing admixture required.

4. **Class D Concrete:** Use for interior slabs on grade and in metal pan stair systems.

a. ACI Exposure Class: F0 / C0
b. Compressive strength at 28 days: 3500 psi.
c. Minimum cement content: 470 lb/cu yd.
d. Fly Ash: 94 lb/cu yd
e. Maximum water-cement ratio: 0.45.
f. Air content: None added.
g. Water-reducing admixture required.
h. Synthetic fiber reinforcing is required where steel reinforcing is not specified.
i. Coarse Aggregate:
    i. Use #5 stone for unreinforced slabs over 8” in thickness
    ii. Substitute pea gravel coarse aggregate for concrete used to fill metal pan stair system stair treads and landings.

5. **Class E Concrete:** Use for exterior door stoops and other flatwork with reinforcing steel exposed to freeze/thaw conditions and chlorides and where indicated on the drawings.

a. ACI Exposure Class: F3 / C2
b. Compressive strength at 28 days: 5000 psi.
c. Minimum cement content: 611 lb/cu yd.
d. Maximum water to cement ratio: 0.40.
e. Air content: 6 to 8% where concrete is exposed to freeze/thaw conditions. Limit air content for trowel finished floors to 3%.
f. Water-reducing admixture required.
g. Coarse aggregate: Crushed limestone

2.4 CONCRETE MIXING

A. Batch and mix concrete in accordance with the requirements of ASTM C94, and as specified.

3. PART 3 – EXECUTION

3.1 PREPARATION

A. Install items to be embedded in concrete. Position accurately and secure against displacement.

1. Coordinate the installation of all inserts required by other trades prior to placing of reinforcing steel.

2. Install anchor rods for steel columns within the tolerances specified in the American Institute of Steel Construction “Code of Standard Practice for Steel Buildings and Bridges” as listed below. Secure anchor rods with templates against displacement.

    a. The variation in dimension between the centers of any two anchor rods within an anchor rod group shall be equal to or less than 1/8 inch.
    b. The variation in dimension between the centers of adjacent anchor rod groups shall be equal to or less than ¼ inch.
    c. The variation in elevation of the tops of anchor rods shall be equal to or less than plus or minus ½ inch.
    d. The accumulated variation in dimension between centers of anchor rod groups along a column line through multiple anchor rod groups shall be equal to or less than ¼ inch per 100 feet, but not to exceed a total of 1 inch.
    e. The variation in dimension from the center of any anchor rod group to the column line through that group shall be equal to or less than ¼ inch.

3. Do not float embedded items or anchor rods into concrete after concrete placement.

4. 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.

5. Provide steel sleeves for pipes or conduits passing through concrete.

    a. Conduits and pipes of aluminum shall not be embedded in structural concrete unless effectively coated to prevent aluminum-concrete reaction or electrolytic action between aluminum and concrete.

B. Do not place sleeves through concrete beams or structural floors unless they are shown on the drawings, or approved by the Engineer.

C. Remove ice, snow, frost, standing water and construction debris from areas in which concrete is to be placed.

D. Dampen subgrade prior to placing concrete on grade.

E. Prevent groupings of conduits, pipes and sleeves in concrete that would significantly impair the strength of the concrete.

F. Notify the Architect/Engineer when concrete placement is planned. Allow sufficient time for review of formwork, reinforcement and embedded items, and for any required corrective work.

G. Vapor Barriers: Place, protect, and repair vapor barriers according to ASTM E 1643 and manufacturer's written instructions.

1. Place vapor barrier directly below the slab and above the drainage fill.

2. Face laps away from the expected direction of the concrete pour whenever possible.

3. Extend vapor barrier over footings and seal to foundation walls and piers. Seal around penetrations such as utilities and columns in order to create a monolithic membrane between the surface of the slab and moisture sources below the slab as well as at the slab perimeter.

   a. Seal top edge with continuous bead of high-grade mildew resistant silicone sealant or manufacturer's tape.

4. Lap all joints a minimum of 6". Seal all joints and tears with compatible pressure sensitive tape from the same manufacturer as the vapor barrier.

5. Construct pipe boots for all utilities penetrating the under-slab vapor retarder out of vapor barrier material and pressure sensitive tape per the manufacturer's instructions.

6. Repair damaged areas by cutting patches of vapor barrier, overlapping damages areas 6 inches and taping all four sides with tape.

3.2 ENVIRONMENTAL REQUIREMENTS:

A. Do not place concrete during rain, sleet or snow unless adequate protection is provided. Do not place concrete on mud or debris.

B. Hot Weather: Perform work in accordance with ACI 305.1.

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.

2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3. Apply evaporation retardants or fog spray water on concrete during finishing preventing premature drying of concrete.

4. Install temporary sun shades or wind barriers as necessary to protect freshly placed concrete from high temperatures and hot dry winds. Schedule concrete placement for times of day when exposure to high temperatures may be minimized.

C. Cold Weather: Perform work in accordance with ACI 306.1.

1. Cold weather shall be as defined in Section 1.1 of ACI 306.1.

2. Do not place concrete on frozen ground, snow, or ice.

3. Type III cement shall be used for all concrete placed in cold weather.

4. Do not use ASTM C618 Class F fly ash in cold weather.

5. Do not place concrete in temperatures below 20 degrees Fahrenheit. Supporting structural steel framing, steel formwork, and embedments in concrete, including reinforcing bars, shall have a minimum temperature of 20 degrees Fahrenheit at the time of concrete placement.

6. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures.

7. Concrete temperature records shall be recorded and submitted for all concrete placed in or exposed to cold weather. Records shall be taken for the full period of protection of the concrete from cold weather. Concrete temperature measurements shall be taken at several locations as defined in ACI 306.1.

   a. Recording, monitoring, and reporting of concrete temperatures during the curing and protection period is the responsibility of the Contractor and not the Testing and Inspecting Agency. The information shall be used by the Contractor to maintain, and to correct any ineffective, concrete protection measures.

   b. It is acceptable to use temperature sensors that are cast into the concrete for monitoring and recording concrete temperatures.

8. Concrete temperatures at mixing and at the time of placement shall be in accordance with ACI 306.1. Concrete temperature at the time of placement shall be recorded and submitted.

9. Concrete placed in or exposed to cold weather after placement shall be maintained at a minimum internal temperature of 55 degrees for a period of at least four days after placement.

10. Concrete test cylinders used for the determination of early concrete strength shall be field cured in the same manner as the concrete represented by the test cylinders.

3.3 PLACING CONCRETE

A. General:

1. Comply with ACI 304, "Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete," and as herein specified.

2. Do not place concrete more than 90 minutes after the concrete has been batched.

3. Do not add water to concrete during delivery, at project site, or during placement.

4. Place concrete in a continuous operation until a section is completed. Unplanned cold joints shall be avoided. Do not place a greater area than can be properly finished.

B. Reinforcement:

1. Clean mud, ice, and other coatings from reinforcement.

2. Maintain cover conforming to ACI standard practice.

3. Maintain reinforcement in position during concrete placement.

C. Conveying Concrete:

1. Convey concrete from the mixer to the place of final deposit by methods which will prevent the loss or separation of the materials. Deposit concrete as nearly as possible to its final position to avoid segregation due to re-handling.

2. Do not use vibrators to transport concrete.

3. Where concrete is pumped, use pumping equipment with sufficient design and pumping capacity to ensure a practically continuous flow of concrete at the point of discharge without segregation.

a. Do not add water or alter the mix design to facilitate pumping.

b. Pumping concrete through aluminum pipe is prohibited.

4. Do not bear concrete conveying equipment on fresh concrete or on concrete reinforcement.

D. Placing Concrete

1. Deposit concrete continuously or in layers of such thickness than no concrete will be placed on concrete that has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as herein specified.

2. Deposit concrete to avoid segregation at its final location.

a. Limit vertical drop of concrete to 3 feet.

E. Placing Concrete in Forms:

1. Deposit concrete in forms in horizontal layers not deeper than 2 feet and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.

F. Placing Concrete Slabs:

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

2. Bring slab surfaces to correct level with straightedge and strike off. Use bull floats or darbies to smooth surface, free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.

G. Consolidation of Concrete:

1. Thoroughly consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI 309.

2. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and

into corners.

3. Do not use vibrators to transport concrete.

4. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine. Place vibrators 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 set. At each insertion limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.

3.4 FINISHING SLABS

A. Float Finish:

1. Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as hereinafter specified; slab surfaces to be covered with membrane or elastic waterproofing, membrane or elastic roofing, or sand-bed terrazzo; and as otherwise indicated.

2. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating, using float blades or float shoes only, when surface water has disappeared, when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats or by hand-floating if area is small or inaccessible to power units. Check and level surface plane to tolerances of $F_F$ 18 - $F_L$ 15. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.

B. Trowel Finish:

1. Apply trowel finish to monolithic slab surfaces to be exposed to view and slab surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile, epoxy, paint, or other thin film finish coating system.

2. After floating, begin first trowel finish operation using a power-driven trowel or hand-troweling if area is small or inaccessible to power units. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance, and with surface leveled to flatness and level tolerances specified below.

C. Trowel and Fine Broom Finish:

1. Where ceramic or quarry tile is to be installed with thin-set mortar, apply trowel finish as specified then immediately follow with slightly scarifying surface by fine brooming.

D. Nonslip Broom Finish:

1. Apply nonslip broom finish to exterior concrete platforms, walkways, drives, steps, ramps, and elsewhere as indicated.

2. Immediately after float finishing, slightly roughen concrete surface by

brooming with fiber-bristle broom perpendicular to main traffic route producing a coarse, scored, slip-resistant texture. Coordinate required final finish with Architect before application.

E. Flatness and Level Tolerances

1. Finish level slabs to conform to the following F numbers, unless specified finish materials require more stringent tolerances:

a. All slabs unless noted otherwise below; $F_F = 25$, $F_L = 20$.
b. Un-shored elevated slabs; $F_F = 25$, $F_L$ = N/A.
c. Slabs scheduled to receive thin set, resilient, linoleum, fluid applied, or resinous flooring; $F_F = 35$, $F_L = 25$.
d. Slabs scheduled to receive polished concrete or high gloss sealer finishes; $F_F = 45$, $F_L = 35$.
e. Minimum local values for $F_F$ and $F_L$ shall be at least 60 percent of the values listed above.

3.5 FINISH OF FORMED SURFACES

A. Limit surface irregularities in formed surfaces to limits specified in Section 03 1000 Concrete Formwork.

B. Rough Form Finish: For formed concrete surfaces not exposed to view in the finished work or concealed by other construction.

1. This is the concrete surface having texture imparted by form-facing material used.

2. Rub down or chip off all fins and other projections exceeding 1/4 inch in height.

3. Repair all defective areas and fill all tie holes.

C. Smooth Form Finish: For formed concrete surfaces to be buried or covered with a coating or covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, painting, or other similar system.

1. This is an as-cast concrete surface obtained with selected form-facing material arranged in an orderly and symmetrical manner with a minimum of seams.

2. Completely remove and smooth all fins and projections.

3. Repair all defective areas and fill all form tie holes. Match patching material color to surrounding concrete.

4. Apply grout clean down treatment to surface areas with light honey-combing and air holes, completely filling all voids. Match grout color with that of the surrounding concrete.

D. Smooth Rubbed Finish: For uncoated formed concrete surfaces exposed to view. Provide smooth rubbed finish to concrete surfaces which have received smooth form finish treatment, not later than one day after form removal.

1. Following the Smooth Form Finish, moisten concrete surfaces and rub with

carborundum brick or other abrasive until a uniform color and texture is produced.

2. Do not apply cement grout other than that created by the rubbing process.

E. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces.

1. Strike-off smooth and finish with a texture matching adjacent formed surfaces.

2. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.6 CONCRETE CURING AND PROTECTION

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Maintain concrete in a moist condition for at least 5 days at temperature above 70 degrees F and at least 7 days at temperatures above 50 degrees F.

B. Curing Methods: Perform curing of concrete slabs by curing compound or by moisture-retaining cover curing.

1. Apply curing compound as follows:

Apply specified curing compound to the concrete surfaces as soon as final finishing operations are complete (within 2 hours and after surface water sheen has disappeared). Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's directions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.

2. Provide moisture-retaining cover curing as follows:

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. Immediately repair any holes or tears during curing period using cover material and waterproof tape. Restrict foot and construction traffic over curing blankets during the curing period.

C. Curing Slabs and Exposed Surfaces:

1. In hot, dry, and windy weather, protect concrete from rapid moisture loss before and during finishing operations with an evaporation retardant. Apply in accordance with manufacturer's instructions after screeding and bull floating, but before power floating and troweling.

2. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing.

D. Curing Formed Surfaces:

1. Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces, by moist curing with forms in place for full

curing period or until forms are removed. During hot, dry, or windy weather keep forms moist by sprinkling with water.

2. If forms are removed prior to the end of the curing period apply curing compound to formed surfaces.

3.7 JOINTS

A. Construction Joints:

1. Locate and install construction joints so as not to impair strength and appearance of the structure, as acceptable to Engineer.

a. Locate construction joints in beams, slabs, joists, and girders near the quarter point of spans. Offset joints in girders a minimum distance of twice the beam width from a beam to girder intersection.

b. Locate horizontal construction joints in walls and columns at the underside of floors, slabs, beams or girders and at the top of footings or floor slabs.

c. Locate vertical construction joints in walls beside piers integral with walls, near corners, at wall contraction joints, or in concealed locations.

2. Use an epoxy bonding adhesive at construction joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

3. Continue reinforcement across all construction joints.

4. Provide keyways at least 1-1/2 inches deep in construction joints. Accepted bulkheads designed for this purpose may be used for slabs.

5. Thoroughly clean the concrete surface at construction joints and remove laitance before placing adjoining concrete.

6. In slabs on grade with contraction joints, locate construction joints at contraction joint locations.

B. Slab on Grade Contraction and Isolation Joints:

1. Contraction Joints in Slabs on Grade:

a. If joint pattern is not shown on the drawings, provide joints not exceeding 15 feet in either direction and located to conform to bay spacing wherever possible (at column centerlines, half bays, third bays).

b. Saw Cut Contraction Joints: Construct contraction joints in slabs on grade to form panels of patterns as shown. Use saw cuts 1/8 inch wide by 1/4 slab depth, sawing in straight and uniform lines. Install joints as soon as possible after slab finishing as may be safely done without dislodging aggregate.

c. Hand-Tooled Contraction Joints: Tool joints with hand groovers in straight lines to avoid unsightly joints. Finish each edge of joint to a radius of 1/8 inch. Tool joints to a minimum depth of 1/4 of the slab thickness.

d. Extend contraction joints all of the way to column faces, column block outs, construction joints, slab re-entrant corners, or to the edge of the slab. Do not stop contraction joints short at these locations.

e. Interrupt reinforcement at contraction joints. Provide smooth bar dowels at contraction joints where shown on the drawings.

f. Contraction joints shall be filled with self-leveling traffic grade sealant as specified in Division 07 Section “Joint Sealants”, unless otherwise noted:

2. Isolation Joints in Slabs on Grade: Construct isolation joints in slabs on grade at points of contact between slabs on grade and vertical surfaces, such as column pedestals, foundation walls, grade beams, and elsewhere as indicated.

a. Place joint filler in straight lines and vertical in position. Secure joint filler to formwork to prevent displacement during concrete placement. Do not float in isolation joints after concrete has been placed.

b. Recess top of joint filler ½ inch for sealant placement. Provide removable plastic expansion joint caps where joints are exposed to view.

## 3.8 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place, and cure concrete as herein specified, to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete the work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and steel-troweling surfaces to a hard, dense finish with corners, intersections and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations, as shown on drawings or as specified in the mechanical specifications. Set anchor bolts for machines and equipment to template at correct elevations, complying with certified diagrams or templates of manufacturer furnishing machines and equipment.

1. Coordinate sizes and locations of concrete bases with actual equipment provided.

2. Construct concrete bases 3 1/2 inches tall unless otherwise indicated. Extend equipment bases not less than six inches in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated.

D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads and landings and associated items. Cast-in safety inserts and accessories as shown on drawings. Screed, tamp and finish concrete surfaces as scheduled.

E. Waterstops: Provide waterstops where indicated on the plans. Provide dumbbell type waterstops for all construction joints between new concrete.

1. Waterstop splices, intersections, and directional changes shall be heat welded with center bulb and ribs aligned to maintain continuity. Intersections and directional changes shall be miter cut. Do not lap waterstops.

2. Position and properly secure waterstops prior to concrete placement to prevent displacement of waterstops during concrete placement.

3. Do not float waterstops into concrete after concrete placement.

4. Place expanding type waterstops a minimum of 4 inches from the concrete surface. Do not use expansive type waterstops in concrete less than 8 inches thick.

F. Chamfers: Provide ¾ inch by ¾ inch chamfers at all exposed edges of concrete surfaces.

G. Drilled in Adhesive Anchors:

1. Drill holes with rotary impact hammer drills using either carbide tipped bits or Hilti HIT-200 Safe Set System hollow drill bits and vacuum dust collection system.

a. Clean all holes per manufacturer instructions to remove loose material and drilling dust prior to installation of adhesive.
b. Holes shall be drilled perpendicular to the concrete surface.

2. Inject adhesive into 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. Follow manufacturer recommendations to ensure proper mixing of adhesive components. Sufficient adhesive shall be injected in the hole to ensure that the annular gap is filled to the surface.

3. Remove excess adhesive from the surface.

4. Do not disturb or load anchors before manufacturer specified cure time has elapsed.

## 3.9 PROTECTION

A. Protect finished concrete surfaces from damage by construction equipment, materials or methods and by rain or running water.

B. Do not load self-supporting members in such a way as to overstress the concrete.

1. Do not load elevated concrete floor slabs on composite metal decks with heavy equipment, including hydraulic lifts, which may cause delamination

between the concrete and the metal deck.

C. Protect corners, edges, and surfaces of concrete from damage. Use guards and barricades as necessary.

D. Protect concrete from staining, laitance, and contamination during the entire construction period.

E. Protect new and existing floor slabs from staining. Provide protection boards and tarps as necessary to protect floors.

F. The Owner reserves the right to have stained or damaged concrete surfaces removed and replaced.

3.10 CONCRETE SURFACE REPAIRS

A. Defective Areas:

1. Repair and patch surface defects with patching material immediately after removal of forms, when acceptable to Architect/Engineer. 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.

2. Test unformed surfaces, such as floors and slabs, for finish and verify surface flatness and level tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness.

3. Repair all cracks in concrete surfaces that are visible at a distance of 3 feet from the concrete surface and that satisfy one of the following:

a. Cracks in retaining walls or water retaining structures.

b. Cracks in basements, elevator pit walls, or other underground structures that do not have exterior membrane waterproofing.

c. Cracks in exposed or sealed concrete floors or floors with finishes that cannot bridge or conceal the cracks.

d. Cracks in elevated reinforced concrete structures, including columns, beams, joists, and elevated slabs.

e. Cracks in exterior reinforced concrete, or in reinforced concrete in corrosive or wet environments.

f. Other cracked concrete surfaces as determined by the Engineer.

4. Remove and replace concrete that cannot be repaired to the Engineer’s approval.

B. Repair of Surface Defects:

1. Cut out honeycomb, rock pockets, and voids over 1/4 inch in any dimension, and holes left by tie rods and bolts, down to solid concrete but in no case to a depth of less than 1/2 inch. Make edges of cuts perpendicular

to the concrete surface. Thoroughly clean, dampen with water, and brush-coat the area to be patched with specified bonding agent. Place patching material before bonding compound has dried.

2. For exposed-to-view surfaces, match repairs to color, texture, and uniformity of surrounding surfaces. Provide mockup repairs as a job standard for approval before proceeding with other repairs. Compact patching material in place and strike-off slightly higher than surrounding surface.

3. Repair concealed formed surfaces, where possible, that contain defects that affect the durability of concrete. If defects cannot be repaired, remove and replace concrete.

4. Apply curing to the repaired surface as soon as possible and maintain for a minimum of 2 days.

C. Repair of Uneven Surfaces:

1. After concrete has cured at least 14 days, correct high areas by grinding.

2. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching material. Finish repaired areas to blend into adjacent concrete.

3. Correct other low areas scheduled to receive floor coverings with a compatible 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.

4. 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. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.

a. Self leveling repair toppings that have been extended by the addition of coarse aggregate shall receive a second lift of ½ inch minimum thickness of un-extended material.

5. Do not place repair underlayment or repair topping in temperatures below 50 degrees or above 85 degrees.

D. Concrete Crack Repair:

1. Sufficient time shall be permitted to allow the concrete to cure and the structure to rest prior to performing concrete crack repair operations.

2. Each crack shall be evaluated individually for the type of repair procedure to be used. The Contractor shall schedule a walkthrough with the Owner, the Architect, and the Engineer to evaluate cracks to be repaired and the procedures to be used.

3. Crack repair procedures may include but may not be limited to the following:

a. Epoxy injection
b. Urethane injection
c. Routing and sealing
d. Replacement

3.11 FIELD QUALITY CONTROL

A. Testing and Inspecting Agency: Perform field test, inspections, conduct laboratory testing, and write reports as outlined in this Article under provisions of Division 01.

1. The Contractor shall coordinate construction activities with the Testing and Inspecting Agency and shall provide unrestricted access to the work.

2. The Testing and Inspecting Agency shall test and inspect concrete materials and installation as the work progresses. Failure to detect any defective work or material as it is installed shall not in any way prevent later rejection when such defect is discovered, nor shall it obligate the Owner, Architect, or Engineer to accept the defective work.

3. Additional strength tests taken to determine the early strength of placed concrete to facilitate the Contractor's operations shall be taken and tested at the Contractor's expense.

B. Inspections:

1. The Testing and Inspecting Agency shall conduct the following inspections related to concrete placement:

a. Steel reinforcement placement.
b. Installation of all drilled in adhesive anchors.
c. Verification of use of required design concrete mixture.
d. Concrete placement, including concrete conveying and depositing.
e. Curing procedures and maintenance of curing temperature.
f. Verification of concrete strength before removal of shores and forms.

2. The Testing and Inspecting Agency shall monitor concrete placement and reject batches prior to placement that do not meet the specifications including but not limited to:

a. Time limitation from batching to placement.
b. Concrete with water added after batching.
c. Incorrect concrete mix design.

C. Compressive Strength Tests:

1. During the progress of the work, take samples of concrete for strength tests in accordance with ASTM C172

2. Make and cure a minimum of 4 cylinders in accordance with ASTM C31 for each of the following:

a. Each 50 cubic yards of concrete.
b. Each 3000 square feet of surface area for slabs and walls.
c. Each class of concrete placed in a day's work.

3. Test each group of cylinders in accordance with ASTM C39 as follows:

    a. One field cured cylinder to be tested at 7 days or just before anticipated time of form removal.
    b. Two laboratory cured cylinders to be tested at 28 days.
    c. One laboratory cured cylinder to be held as spare to be tested at 56 days as required.
    d. When concrete is placed in cold weather as defined by ACI 306.1, take an additional two test cylinder for each set. The additional test cylinders shall be field cured for the full cold weather protection period under the same conditions as the concrete that it represents. Test the additional field cured cylinders at 28 days.

4. A strength test is the average of the strengths of two cylinders made from the same sample of concrete and tested at 28 days.

5. The strength level of an individual class of concrete will be considered satisfactory if both of the following requirements are met:

    a. Average of all sets of three consecutive strength tests equal or exceed the specified compressive strength.
    b. No individual strength test (average of two cylinders) falls below the specified compressive strength by more than 500 psi.

6. If the strength level of an individual class of concrete is found to be unsatisfactory, conduct core testing in accordance with ASTM C42, impactometer testing or load testing on the area of concrete in question as required by the Architect/Engineer. If such additional testing does not produce acceptable results, corrective measures will be required to ensure structural adequacy.

    a. Make appropriate adjustments to the concrete mix designs as required and as approved by the Engineer.

7. When the strength of field cured cylinders is less than 85 percent of companion laboratory cured cylinders, the Contractor shall evaluate operations and provide corrective procedures for protecting and curing in place concrete.

8. Non-destructive Testing: Impact hammer, sonoscope, or other nondestructive testing may be permitted by the Engineer, but will not be used as a sole basis for approval or rejection of concrete.

D. Slump Tests:

1. Make one slump test in accordance with ASTM C143 with each set of compressive strength test cylinders.

2. When concrete is pumped, make the slump test at the point of discharge.

3. Keep a slump cone available at the site for additional testing as required.

E. Air Content Tests: Make one air content test in accordance with ASTM C173 or ASTM C231 with each set of compressive strength test cylinders for air-entrained concrete mixes.

1. When concrete is pumped, make the air content test at the point of discharge.

F. Concrete Temperature Tests: Conduct one test for each set of compressive strength test cylinders in accordance with ASTM C1064.

G. Concrete Unit Weight: Conduct one test for each set of compressive strength test cylinders of structural light weight concrete in accordance with ASTM C567.

H. Floor Flatness Tests:

1. Testing and computation of F - numbers shall be by an independent testing laboratory and shall conform to ASTM E1155.

2. Compliance tests shall be performed using the Dipstick Floor Profiler.

I. Testing and inspection of drilled in anchors.

1. Installation of all drilled in anchors over 1/2 inch in diameter shall be observed by the testing agency.

2. 20 percent of all drilled in anchors over 1/2 inch in diameter shall be load tested after installation to the loading specified on the drawings. If no loading is specified, contact the Engineer for an appropriate testing force.

a. If more than 10 percent of the tested anchors fail to achieve the specified proof load, then all drilled in anchors shall be tested.

3. Testing shall be in accordance with ASTM E488.

4. Proof loads shall be applied with a calibrated hydraulic ram. Displacement of the adhesive and anchor at proof load shall not exceed D/10, where D is the nominal anchor diameter. Do not torque test adhesive type anchors.

J. Field Quality Control Test Reports:

1. Test reports shall be delivered to the Owner, Architect, Engineer, Contractor, and Concrete Supplier within 48 hours of testing.

2. Include the following information in test reports:

a. Project identification.
b. Name of testing and inspecting agency
c. Specific location where concrete is being placed.
d. Concrete mix class and specified compressive strength requirements.
e. Weather conditions and air temperature at time of placement.
f. Concrete temperature, slump and air content test results.
g. Concrete unit weight for lightweight concrete.
h. Dates of placing and testing.
i. Time of day that the concrete was batched.
j. Time of day that the concrete was placed.
k. Method of curing (field or laboratory).
l. Strength test results including type of break.

m. Confirmation that time between batching and placing concrete did not exceed 90 minutes and that no water was added to the concrete after batching.
n. Technician's name and certification number with expiration date.

END OF SECTION

SECTION 033500

CONCRETE FINISHING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Single application densifier for concrete floors.
2. Precautions for avoiding staining concrete before and after application.

B. Related Sections:
1. Section 033000 – Cast-In-Place Concrete

1.2 REFERENCES

A. ASTM International (ASTM):
1. ASTM C39 Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
2. ASTM C779 Standard Test Method for Abrasion Resistance of Horizontal Concrete Surfaces.
3. ASTM C805 Standard Test Method for Rebound Number of Hardened Concrete.
4. ASTM C1028 Standard Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method.
5. ASTM D3359 Standard Test Methods for Measuring Adhesion by Tape Test.

1.3 SUBMITTALS

A. Product Data: Submit product data, including manufacturer's product data, installation instructions, and technical bulletins for specified products.

B. Certificates: Manufacturer's certification that the installer is acceptable.

C. Maintenance Data: Maintenance instructions, including precautions for avoiding staining after application.

1.4 QUALITY ASSURANCE

A. Installer Qualifications:
1. Installer shall be approved by the manufacturer.
2. Installer shall have at least 5 years experience installing this product and shall have successfully completed over twenty similar projects.

B. Hold a pre-installation conference with the Owner prior to installation to review cleanliness of the floor, detailed installation procedures, and acceptable surface quality and appearance.

C. Mock Up
1. For floor areas indicated to be polished on the drawings, finish a sample area of the floor for Owner approval prior to installing and polishing the remainder of the floor.

1.5 DELIVERY, STORAGE & HANDLING

A. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

B. Storage and Protection: Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by the manufacturer.

C. Handling: Protect materials from dirt, corrosion, oil, grease and other contaminants.

## PART 2 PRODUCTS

### 2.1 MATERIALS

A. Penetrating Liquid Floor Treatments: Clear, waterborne solution of inorganic silicate or sliconate materials and proprietary components, that penetrates, reacts with, hardens, and is suitable for polishing concrete surfaces.

1. Abrasion Resistance to Revolving Disks: At least a 32.5% improvement over untreated samples when tested in accordance with ASTM C779.
2. Surface Adhesion: At least a 22% increase in adhesion for epoxy when tested in accordance with ASTM D3359.
3. Hardening: As follows when tested in accordance with ASTM C39:
   a. After 7 Days: An increase of at least 40% over untreated samples.
   b. After 28 Days: An increase of at least 38% over untreated samples.
4. Minimum Coefficient of Friction: 0.80 dry when tested in accordance with ASTM C1028.
5. Rebound Number: An increase of at least 13.3% over untreated samples when tested in accordance with ASTM C805.
6. Light Exposure Degradation: No evidence of adverse effects on treated samples when tested in accordance with ASTM G23.
7. Products:
   a. Ashford Formula, by Curecrete Distribution, Inc.
   b. Approved equal

## PART 3 EXECUTION

### 3.1 MANUFACTURER'S INSTRUCTIONS

A. Compliance: Comply with manufacturer's product data, including product technical bulletins, product catalog installation instructions and product carton instructions for installation.

### 3.2 EXAMINATION

A. Do not begin installation until substrates have been properly cleaned and prepared and are suitable for application of product.

### 3.3 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.

C. Do not use frozen material. Thaw and agitate prior to use.

D. If construction equipment must be used for application, diaper all components that might drip oil, hydraulic fluid or other liquids.

### 3.4 INSTALLATION

A. Apply penetrating liquid floor treatment to cured and prepared floors to match the accepted mock up.

B. Apply penetrating liquid floor treatment according to manufacturer's written instructions and recommendations. Allow recommended drying time between successive coats.

1. New Concrete: Apply penetrating liquid floor treatment to new concrete immediately after wet curing.
   a. Spray on at rate of 200 $ft^2$/gal (5 $m^2$/L).

b. Keep surface wet with liquid floor treatment for a minimum soak-in period of 30 minutes without allowing it to dry or become slippery. If slipperiness occurs before the 30 minute time period has elapsed, apply additional liquid floor treatment, as needed, to keep the entire surface in a non-slippery state for the first 15 minutes; for the remaining 15 minutes, mist the surface as needed with water to keep the material in a non-slippery state. In hot weather conditions, follow manufacturer's special application procedures.

c. When the treated surface becomes slippery after this period, lightly mist with water until slipperiness disappears.

d. Wait for surface to become slippery again, and then flush entire surface with water to remove all liquid floor treatment residue.

e. Squeegee surface completely dry, flushing any remaining slippery areas until no residue remains.

f. Wet vacuum or scrubbing machines can be used in accordance with manufacturer's instructions to remove residue.

2. Existing Concrete: Apply liquid floor treatment only to clean, bare concrete.

a. Thoroughly remove previous treatments, laitance, oil, and other contaminants.

b. Saturate surface with liquid floor treatment; re-spray or broom excess onto dry spots.

c. Keep surface wet with liquid floor treatment for a minimum soak-in period of 30–40 minutes.

d. If most of the material has been absorbed after the 30 minute soak-in period, remove all excess material, especially from low spots, using broom or squeegee.

e. If most of the material remains on the surface after the 30 minute soak-in period, wait until the surface becomes slippery and then flush with water, removing all liquid floor treatment residue. Squeegee completely dry, flushing any remaining slippery areas until no residue remains.

f. If water is not available, remove residue using squeegee.

## 3.5 POLISHING

A. Apply polished concrete finish, where indicated on the drawings, to cured and prepared slabs to match the accepted mock up.

B. Polish with progressively finer grit diamond polishing pads to achieve indicated gloss level and to match accepted mock up.

C. Polish Level:

1. Break Room Bay: No polishing required
2. Garage Bays: No polishing required
3. Exterior stoops and aprons: No polishing required

D. Control and dispose of waste products produced by polishing operations.

## 3.6 PROTECTION

A. Protect installed floors for at least 3 months until chemical reaction process is complete.

1. Do not allow traffic on floors for 24 hours after application.
2. Do not allow parking of vehicles on concrete slab.
3. If vehicles must be temporarily parked on slab, place drop cloths under vehicles during entire time parked.
4. Do not allow pipe cutting using pipe cutting machinery on concrete slab.

5. Do not allow temporary placement and storage of steel members on concrete slabs.
6. Clean up spills immediately and spot-treat stains with degreaser or oil emulsifier.
7. Clean floor regularly in accordance with manufacturer's recommendations.

END OF SECTION

SECTION 055000

METAL FABRICATIONS

1. PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.

1.2 SUMMARY

A. This Section includes the following metal fabrications:

1. Shop fabricated ferrous metal items.

2. Bollards, 6" ID galvanized pipe.

3. Miscellaneous steel trim.

1.3 DEFINITIONS

A. Definitions in ASTM E 985 for railing-related terms apply to this Section.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: Firm experienced in successfully producing metal fabrications similar to that indicated for this Project, with sufficient production capacity to produce required units without causing delay in the Work.

B. Installer Qualifications: Arrange for installation of metal fabrications specified in this Section by same firm that fabricated them.

1.5 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Product data for products used in miscellaneous metal fabrications, including paint products.

C. Shop drawings detailing fabrication and erection of each metal fabrication indicated. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide templates for anchors and bolts specified for installation under other Sections.

D. Samples representative of materials and finished products as may be requested by Architect.

E. Qualification data for firms and persons specified in "Quality Assurance" article to demonstrate their capabilities and experience. Include list of completed projects with project name, addresses, names of Architects and Owners, and other information specified.

1.6 PROJECT CONDITIONS

A. Field Measurements: Check actual locations of walls and other construction to which metal fabrications must fit, by accurate field measurements before fabrication; show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay of Work.

1. Where field measurements cannot be made without delaying the Work, guarantee dimensions and proceed with fabrication of products without field measurements. Coordinate construction to ensure that actual opening dimensions correspond to guaranteed dimensions. Allow for trimming and fitting.

## 2. PART 2 - PRODUCTS

### 2.1 FERROUS METALS

A. Metal Surfaces, General: For metal fabrications exposed to view upon completion of the Work, provide materials selected for their surface flatness, smoothness, and freedom from surface blemishes. Do not use materials whose exposed surfaces exhibit pitting, seam marks, roller marks, rolled trade names, roughness, and, for steel sheet, variations in flatness exceeding those permitted by reference standards for stretcher-leveled sheet.

B. Steel Plates, Shapes, and Bars: ASTM A 36 or ASTM A 992.

C. Steel Tubing: Product type (manufacturing method) and as follows:

1. Cold-Formed Steel Tubing: ASTM A 500, Grade B, Fy = 46 ksi.

2. Hot-Formed Steel Tubing: ASTM A 501.

a. For exterior installations and where indicated, provide tubing with hot-dip galvanized coating per ASTM A 53.

D. Steel Pipe: ASTM A 53; finish, type, and weight class as follows:

1. Black finish, unless otherwise indicated.

2. Galvanized finish for exterior installations and where indicated.

3. Type S, Grade A, standard weight (schedule 40), unless otherwise indicated, or another grade or weight or both required by structural loads.

E. Brackets, Flanges and Anchors: Cast or formed metal of the same type material and finish as supported rails, unless otherwise indicated.

F. Welding Rods and Bare Electrodes: Select in accordance with AWS specifications for the metal alloy to be welded.

G. Cast Iron: Either gray iron, ASTM A48/A48M, or malleable iron, ASTM A47/A47M, unless otherwise indicated.

### 2.2 FASTENERS

A. General: Provide zinc-coated fasteners for exterior use or where built into exterior walls. Select fasteners for the type, grade, and class required.

B. Bolts and Nuts: Regular hexagon head type, ASTM A325. Provide galvanized to ASTM A153 for galvanized members.

C. Anchor Rods: ASTM F1554, Grade 55, Supplement S1, of dimensions indicated; with nuts, ASTM A563 and, where indicated, flat washers.

1. Anchor rods, washers, plate washers, and nuts shall be galvanized.

D. Nuts: ASTM A563, Grade C or DH Heavy Hex Nuts.

E. Washers: ASTM F436, Type 1 Hardened Carbon Steel Washers.

F. Drilled-in Anchors:

1. Provide drilled in anchors that have been tested and approved by the International Code Council Evaluation Service (ICC-ES) for use in cracked concrete.

2. Drilled hole size, equipment used, and installation procedure shall conform to the manufacturer's written instructions.

3. Mechanical Anchors:

a. KWIK-Bolt TZ by Hilti Inc.
b. KWIK HUS-EZ by Hilti Inc.
c. HDA Undercut Anchor by Hilti Inc.

4. Adhesive Anchors for anchoring into concrete:

a. Adhesive:
i. HIT-HY 200 Safe Set System by Hilti Inc.
ii. HIT-RE 500-SD by Hilti Inc.

5. Adhesive Anchors for anchoring into hollow or grout filled CMU:

a. Adhesive:
i. HIT-HY 270 by Hilti Inc.
ii. HIT-HY 270 with HIT-SC screens when anchoring into the face shell of hollow CMU block

6. Threaded Rods for use with anchoring adhesives.
a. Threaded rods shall be zinc coated, galvanized, or stainless steel where installed in exterior conditions.
b. Threaded Rods:
i. Hilti HIT-Z Rod by Hilti Inc.
ii. Hilti HAS-E-55 rod by Hilti, Inc
iii. ASTM F1554 Grade 55 threaded rod
iv. ASTM A 193 Grade B7 threaded rod

G. Headed Concrete Anchors. Used to anchor steel plates and other steel embedments to concrete:

1. Nelson Stud Welding – H4L Headed Concrete Anchors.
2. Blue Arc Stud Welding – Headed Concrete Anchor.
3. Engineer approved equal.

2.3 FABRICATION, GENERAL

A. Form metal fabrications from materials of size, thickness, and shapes indicated but not less than that needed to comply with performance requirements indicated. Work to dimensions indicated or accepted on shop drawings, using proven details of fabrication and support. Use type of materials indicated or specified for various components of each metal fabrication.

B. Shear and punch metals cleanly and accurately. Remove burrs.

C. Ease exposed edges to a radius of approximately 1/32 inch, unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Weld corners and seams continuously to comply with AWS recommendations and 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. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and contour of welded surface matches those adjacent.

E. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flat-head (countersunk) screws or bolts. Locate joints where least conspicuous.

F. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space anchoring devices to provide adequate support for intended use.

G. Shop Assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

H. Cut, reinforce, drill and tap miscellaneous metal work as indicated to receive finish hardware, screws, and similar items.

I. Fabricate joints that will be exposed to weather in a manner to exclude water, or provide weep holes where water may accumulate.

2.4 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports for applications indicated or which are not a part of structural steel framework, as required to complete work.

B. Fabricate units to sizes, shapes, and profiles indicated and required to receive adjacent other construction retained by framing and supports. Fabricate from str

uctural steel shapes, plates, and steel bars of welded construction using mitered joints for field connection. Cut, drill, and tap units to receive hardware, hangers, and similar items.

C. Galvanize miscellaneous framing and supports in the following locations:

1. Exterior locations.

2. Interior locations where indicated.

2.5 FINISHES, GENERAL

A. Comply with NAAMM "Metal Finishes Manual" for recommendations relative to application and designations of finishes.

B. Finish metal fabrications after assembly.

2.6 STEEL AND IRON FINISHES

A. Galvanizing: For those items indicated for galvanizing, apply zinc-coating by the hot-dip process compliance with the following requirements:

1. ASTM A 153 for galvanizing iron and steel hardware.

2. ASTM A 123 for galvanizing both fabricated and unfabricated iron and steel products made of uncoated rolled, pressed, and forged shapes, plates, bars, and strip 0.0299 inch thick and heavier.

B. Preparation for Shop Priming: Prepare uncoated ferrous metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:

1. Exteriors (SSPC Zone 1B): SSPC-SP6 "Commercial Blast Cleaning."

2. Interiors (SSPC Zone 1A)" SSPC-SP3 "Power Tool Cleaning."

C. Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finish or to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with requirements of SSPC-PA1 "Paint Application Specification No. 1" for shop painting.

1. Shop Primer:

a. Zinc rich lead free urethane.
b. Volume solids: 61.0 percent minimum.
c. Dry film thickness: 2.5 to 3.5 mils
d. Standards:
i. Tneme-Zinc Series 90-97 by Tnemec Company, Inc.
ii. Engineer approved equal.

3. PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners whe

re necessary for securing miscellaneous metal fabrications to in-place construction; include through-bolts and other connectors as required.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installation of miscellaneous metal fabrications. Set metal fabrication accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measure from established lines and levels.

C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete masonry or similar construction.

D. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints, but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade the surfaces of exterior units which have been hot-dip galvanized after fabrication, and are intended for bolted or screwed field connections.

E. Field Welding: Comply with AWS Code for procedures of manual shielded metal-arc welding, appearance and quality of welds made, methods used in correcting welding work, and 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. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and contour of welded surface matches those adjacent.

## 3.2 ADJUSTING AND CLEANING

A. Touch-Up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 requirements for touch-up of field painted surfaces.

1. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. For galvanized surfaces clean welds, bolted connections and abraded areas and apply galvanizing repair paint to comply with ASTM A 780.

END OF SECTION

SECTION 061000

ROUGH CARPENTRY

1. 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. Framing with dimension lumber.
2. Framing with engineered wood products.
3. Rooftop equipment bases and support curbs.
4. Wood furring, grounds, nailers, and blocking.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Section 061753 – Shop Fabricated Wood Trusses.
2. Section 066000 – Sheathing

1.3 DEFINITIONS

A. Rough Carpentry: Carpentry work not specified in other Sections and not exposed, unless otherwise specified.

B. Exposed Framing: Dimension lumber not concealed by other construction and indicated to receive a stained or natural finish.

1.4 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product Data for the following products:

1. Engineered wood products.
2. Metal framing anchors.
3. Construction adhesives.
4. Post installed anchors

C. Material certificates for dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the American Lumber Standards Committee's (ALSC) Board of Review.

D. Wood treatment data as follows, including chemical treatment manufacturer's instructions for handling, storing, installing and finishing treated materials:

1. For each type of preservative-treated wood product, include certification by tre

ating plant stating type of preservative solution and pressure process used, net amount of preservative retained, and compliance with applicable standards.

2. For waterborne-treated products, include statement that moisture content of treated materials was reduced to levels indicated before shipment to Project site.

3. For fire-retardant-treated wood products, include certification by treating plant that treated materials comply with specified standard and other requirements as well as data relative to bending strength, stiffness and fastener-holding capacities of treated materials.

E. Material test reports from a qualified independent testing agency indicating and interpreting test results relative to compliance of fire-retardant-treated wood products with requirements indicated.

F. Warranty of chemical treatment manufacturer for each type of treatment.

G. Research or evaluation reports of the model code organization acceptable to authorities having jurisdiction that evidence the following products' compliance with building code in effect for Project.

1. Engineered wood products.

2. Metal framing anchors.

3. Power-driven fasteners.

4. Fire-retardant-treated wood.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: To qualify for approval, an independent testing agency must demonstrate to Architect's satisfaction, based on evaluation of agency-submitted criteria conforming to ASTM E 699, that it has the experience and capability to satisfactorily conduct the testing indicated without delaying the Work.

B. Single-Source Responsibility for Engineered Wood Products: Obtain each type of engineered wood product from one source and by a single manufacturer.

C. Single-Source Responsibility for Fire-Retardant-Treated Wood: Obtain each type of fire-retardant-treated wood product from one source and by a single producer.

D. Post Installed Adhesive Anchor Installer Training:

1. Installers of drilled in adhesive anchors shall be certified by an ACI or CRSI Adhesive Anchor Installer Certification Program or shall be trained on site by the adhesive anchor manufacturer specifically for the project.

a. Conduct a thorough training with the manufacturer or the manufacturer’s representative for the installer on the project. Training to consist of a review of the complete installation process for drilled-in anchors, to include but not limited to:

i. hole drilling procedure
ii. hole preparation & cleaning technique

iii. adhesive injection technique & dispenser training / maintenance
iv. rebar dowel preparation and installation
v. proof loading

1.6 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.

1. For lumber and plywood pressure treated with waterborne chemicals, place spacers between each bundle to provide air circulation.

2. PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Wood-Preservative-Treated Materials:

a. Baxter: J. H. Baxter Co.
b. Chemical Specialties, Inc.
c. Continental Wood Preservers, Inc.
d. Hickson Corp.
e. Hoover Treated Wood Products, Inc.
f. Osmose Wood Preserving, Inc.

2. Fire-Retardant-Treated Materials, Interior Type A:

a. Baxter: J. H. Baxter Co.
b. Chemical Specialties, Inc.
c. Continental Wood Preservers, Inc.
d. Hickson Corp.
e. Hoover Treated Wood Products, Inc.

3. Fire-Retardant-Treated Materials, Exterior Type:

a. American Wood Treaters, Inc.
b. Hoover Treated Wood Products, Inc.

4. Laminated-Veneer Lumber:

a. Alpine Structures.
b. Boise Cascade Corp.
c. Georgia-Pacific Corp.
d. Louisiana-Pacific Corp.
e. Trus Joist MacMillan.
f. Willamette Industries, Inc.

5. Parallel-Strand Lumber:

   a. Alpine Structures.
   b. Trus Joist MacMillan.

6. Prefabricated Wood I-Joists:

   a. Alpine Structures.
   b. Boise Cascade Corp.
   c. Georgia-Pacific Corp.
   d. Louisiana-Pacific Corp.
   e. Superior Wood Systems, Inc.
   f. Trus Joist MacMillan.
   g. Willamette Industries, Inc.

7. Metal Framing Anchors:

   a. Cleveland Steel Specialty Co.
   b. Silver Metal Products, Inc.
   c. Simpson Strong-Tie Company, Inc.
   d. Southeastern Metals Manufacturing Co., Inc.

2.2 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. NELMA - Northeastern Lumber Manufacturers Association.

   2. NLGA - National Lumber Grades Authority (Canadian).

   3. RIS - Redwood Inspection Service.

   4. SPIB - Southern Pine Inspection Bureau.

   5. WCLIB - West Coast Lumber Inspection Bureau.

   6. 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 (38-mm actual) thickness or less, unless otherwise indicated.

E. Provide lumber with 15 percent maximum moisture content at time of dressing for 2-inch nominal (38-mm actual) thickness or less, unless otherwise indicated.

2.3 WOOD-PRESERVATIVE-TREATED MATERIALS

A. General: Where lumber or plywood is indicated as preservative treated or is specified to be treated, comply with applicable requirements of AWPA C2 (lumber) and AWPA C9 (plywood). Mark each treated item with the Quality Mark Requirements of an inspection agency approved by ALSC's Board of Review.

1. Do not use chemicals containing chromium or arsenic.

2. For exposed items indicated to receive stained finish, use chemical formulations that do not bleed through, contain colorants, or otherwise adversely affect finishes.

B. Pressure treat aboveground items with waterborne preservatives to a minimum retention of 0.25 lb/cu. ft. (4.0 kg/cu. m). After treatment, kiln-dry lumber and plywood to a maximum moisture content of 19 and 15 percent, respectively. Treat indicated items and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.

2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.

3. Wood framing members less than 18 inches (460 mm) above grade.

4. Wood floor plates installed over concrete slabs directly in contact with earth.

C. Pressure treat wood members in contact with ground or freshwater with waterborne preservatives to a minimum retention of 0.40 lb/cu. ft. (6.4 kg/cu. m).

D. Complete fabrication of treated items before treatment, where possible. If cut after treatment, apply field treatment complying with AWPA M4 to cut surfaces. Inspect each piece of lumber or plywood after drying and discard damaged or defective pieces.

2.4 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated wood is indicated, comply with applicable requirements of AWPA C20 (lumber) and AWPA C27 (plywood). Identify fire-retardant-treated wood with appropriate classification marking of UL; U.S. Testing; Timber Products Inspection, Inc.; or another testing and inspecting agency acceptable to authorities having jurisdiction.

1. Research or Evaluation Reports: Provide fire-retardant-treated wood acceptable to authorities having jurisdiction and for which a current model cod

e research or evaluation report exists that evidences compliance of fire-retardant-treated wood for application indicated.

2. For exposed items indicated to receive stained finish, use chemical formulations that do not bleed through, contain colorants, or otherwise adversely affect finishes.

B. Interior Type A: For interior locations, use chemical formulation that produces treated lumber and plywood with the following properties under conditions present after installation:

1. Bending strength, stiffness, and fastener-holding capacities are not reduced below values published by manufacturer of chemical formulation under elevated temperature and humidity conditions simulating installed conditions when tested by a qualified independent testing agency.

2. No form of degradation occurs due to acid hydrolysis or other causes related to treatment.

3. Contact with treated wood does not promote corrosion of metal fasteners.

C. Exterior Type: Use for exterior locations and where indicated.

D. Inspect each piece of treated lumber or plywood after drying and discard damaged or defective pieces.

2.5 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-Load-Bearing Interior Partitions: Provide framing of the following grade and species:

1. Grade: No 2 or better

2. Species:
   a. Hem-fir (north); NLGA.
   b. Douglas fir-larch; WCLIB or WWPA.
   c. Southern pine or mixed southern pine; SPIB.
      1) Provide Grade No. 1 for 2x10 and 2x12 sizes
   d. Spruce-pine-fir; NLGA.
   e. Douglas fir-south; WWPA.
   f. Hem-fir; WCLIB or WWPA.
   g. Douglas fir-larch (north); NLGA.

C. Exterior and Load-Bearing Walls: Provide framing of the following grade and species:

1. Grade: No 2 or better

2. Species:
   a. Hem-fir (north); NLGA.
   b. Douglas fir-larch; WCLIB or WWPA.
   c. Southern pine or mixed southern pine; SPIB.
      1) Provide Grade No. 1 for 2x10 and 2x12 sizes

d. Spruce-pine-fir; NLGA.
e. Douglas fir-south; WWPA.
f. Hem-fir; WCLIB or WWPA.
g. Douglas fir-larch (north); NLGA.

D. Joists, Rafters, and Other Framing:

1. Grade: No 2 or better

2. Species:
h. Hem-fir (north); NLGA.
i. Douglas fir-larch; WCLIB or WWPA.
j. Southern pine or mixed southern pine; SPIB.
1) Provide Grade No. 1 for 2x10 and 2x12 sizes
k. Spruce-pine-fir; NLGA.
l. Douglas fir-south; WWPA.
m. Hem-fir; WCLIB or WWPA.
n. Douglas fir-larch (north); NLGA.

2.6 ENGINEERED WOOD PRODUCTS

A. General: Provide engineered wood products acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that evidence compliance with building code in effect for Project.

2. Allowable Design Stresses: Provide engineered wood products with allowable design stresses as published by manufacturer that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis, and demonstrated by comprehensive testing performed by a qualified independent testing agency.

B. Laminated-Veneer Lumber: Lumber manufactured by laminating wood veneers in a continuous press using an exterior-type adhesive complying with ASTM D 2559 to produce members with grain of veneers parallel to their lengths and complying with the following requirements:

1. Extreme Fiber Stress in Bending: 2600 psi min.

2. Modulus of Elasticity: 1,900,000 psi min.

3. Tension Parallel to Grain: 1850 psi min.

4. Compression Parallel to Grain: 1550 psi.

5. Compression Perpendicular to Grain: 400 psi perpendicular to and 500 psi parallel to glue line.

6. Horizontal Shear: 285 psi (2 MPa) perpendicular to and 190 psi (1.3 MPa) parallel to glue line.

C. Parallel-Strand Lumber: Structural composite lumber made from wood strand elements with grain primarily parallel to member lengths, evaluated and monitored according to ASTM D5456 and manufactured with an exterior-type adhesive complying with ASTM D2559.:

1. Extreme Fiber Stress in Bending: 2900 psi.

2. Modulus of Elasticity: 2,000,000 psi.

3. Tension Parallel to Grain: 2400 psi.

4. Compression Parallel to Grain: 2900 psi.

5. Compression Perpendicular to Grain: 400 psi perpendicular to and 600 psi and parallel to wide face of strands.

6. Horizontal Shear: 210 psi perpendicular to and 290 psi and parallel to wide face of strands.

2.7 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.

1. Where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with a hot-dip zinc coating per ASTM A 153 or of Type 304 stainless steel.
2. For pressure preservative treated wood, use stainless steel fasteners.

B. Nails, Brads, and Staples: ASTM F1667

C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

C. Wood Screws: ASME B18.6.1.

D. Lag Bolts: ASME B18.2.1. (ASME B18.2.3.8M)

E. Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers.

G. Post Installed Anchors:

1. Provide post installed drilled in anchors that have been tested and approved by the International Code Council Evaluation Service (ICC-ES) for use in cracked concrete.

2. Drilled hole size, equipment used, and installation procedure shall conform to the manufacturer's written instructions.

3. Mechanical Anchors:
   a. KWIK-Bolt TZ2 by Hilti Inc.
   b. KWIK HUS-EZ by Hilti Inc.
   c. HDA Undercut Anchor by Hilti Inc.

4. Adhesive Anchors for anchoring into concrete:
   a. Adhesive:
      i. HIT-HY 200 Safe Set System by Hilti Inc.
      ii. HIT-RE 500-SD by Hilti Inc.

5. Adhesive Anchors for anchoring into hollow or grout filled CMU:
   a. Adhesive:
      i. HIT-HY 270 by Hilti Inc.
      ii. HIT-HY 270 with HIT-SC screens when anchoring into the face shell of hollow CMU block

6. Threaded Rods for use with anchoring adhesives.
   a. Threaded rods shall be zinc coated, galvanized, or stainless steel where installed in exterior conditions.
   b. Threaded Rods:
      i. Hilti HIT-Z Rod by Hilti Inc.
      ii. Hilti HAS-E-55 rod by Hilti, Inc
      iii. ASTM F1554 Grade 55 Supplement S1 threaded rod
      iv. ASTM A 193 Grade B7 threaded rod

2.8 METAL FRAMING ANCHORS

A. General: Provide galvanized steel framing anchors of structural capacity, type, and size indicated and as follows:

1. Research or Evaluation Reports: Provide products for which model code research or evaluation reports exist that are acceptable to authorities having jurisdiction and that evidence compliance of metal framing anchors for application indicated with building code in effect for Project.

2. Allowable Design Loads: Provide products with allowable design loads as published by manufacturer that meet or exceed those of basis of design products. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis, and demonstrated by comprehensive testing performed by a qualified independent testing agency.

B. Galvanized Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653, G60 (ASTM A 653M, Z180) coating designation; structural, commercial, or lock-forming quality, as standard with manufacturer for type of anchor indicated.

C. Joist Hangers: U-shaped joist hangers with 2-inch- (50-mm-) long seat and 1-1/4-inch- (32-mm-) wide nailing flanges at least 85 percent of joist depth.

1. Thickness: 0.052 inch (1.3 mm).

D. Top Flange Hangers: U-shaped joist hangers, full depth of joist, formed from metal strap with tabs bent to extend over and be fastened to supporting member.

1. Strap Width: 2 inches (50 mm).
2. Thickness: 0.064 inch (1.6 mm).

E. Bridging: Rigid, V-section, nailess type, 0.064 inch (1.6 mm) thick, length to suit joist size and spacing.

F. Post Bases: Adjustable-socket type for bolting in place with standoff plate to raise post 1 inch (25 mm) above base and with 2-inch (50-mm) minimum side cover, socket 0.062 inch (1.6 mm) thick, standoff and adjustment plates 0.108 inch (2.8 mm) thick.

G. Joist Ties: Flat straps, with holes for fasteners, for tying joists together over supports.

1. Width: 1¼ inches (32 mm).
2. Thickness: 0.064 inch (1.6 mm).
3. Length: As indicated.

H. Rafter Tie-Downs (Hurricane Ties): Bent strap tie for fastening rafters or roof trusses to wall studs below, 1-1/2 inches wide by 0.052 inch thick.
1. Simpson Strong-Tie H2.5A Hurricane Tie
2. Approved equal.

2.9 MISCELLANEOUS MATERIALS

A. Sill-Sealer Gaskets:
1. Glass-fiber-resilient insulation, fabricated in strip form, for use as a sill sealer; 1-inch (25-mm) nominal thickness, compressible to 1/32 inch (0.8 mm); selected from manufacturer's standard widths to suit width of sill members indicated.
2. Closed-cell neoprene foam, 1/4 inch (6.4 mm) thick, selected from manufacturer's standard widths to suit width of sill members indicated.

B. Adhesives for Field Gluing Panels to Wood Framing: Formulation complying with APA AFG-01 that is approved for use with type of construction panel indicated by both adhesive and panel manufacturers.

C. Water-Repellent Preservative: NWWDA-tested and -accepted formulation containing 3-iodo-2-propynyl butyl carbonate (IPBC) as its active ingredient.

3. PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

B. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.

C. Set work to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.

D. Install shear wall panels to comply with manufacturer's written instructions.

E. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.

F. Install sill sealer gasket to form continuous seal between sill plates and foundation walls.

G. Do not splice structural members between supports unless otherwise indicated.

H. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.

I. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

J. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

1. Use inorganic boron for items that are continuously protected from liquid water.
2. Use copper naphthenate for items not continuously protected from liquid water.

K. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

L. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code (IBC).
2. ICC-ES evaluation report for fastener.

M. Use steel common nails unless otherwise indicated. 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. Drive nails snug but do not countersink nail heads unless otherwise indicated.

N. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced, and with adjacent rows staggered.

1. Use common nails unless otherwise indicated. Drive nails snug but do not countersink nail heads.

## 3.2 INSTALLATION OF WOOD BLOCKING AND NAILERS

A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

## 3.3 INSTALLATION OF WALL AND PARTITION FRAMING

A. General: Provide single bottom plate and double top plates using members of 2-inch nominal thickness whose widths equal that of studs, except single top plate

may be used for non-load-bearing partitions. Fasten plates to supporting construction unless otherwise indicated.

1. For exterior walls, provide 2-by-6-inch nominal size wood studs spaced 16 inches o.c. unless otherwise indicated.
2. For interior partitions and walls, provide 2-by-6-inch nominal size wood studs spaced 16 inches o.c. unless otherwise indicated.
3. Provide continuous horizontal blocking at midheight of partitions more than 96 inches high, using members of 2-inch nominal thickness and of same width as wall or partitions.

B. Construct corners and intersections with three or more studs.

C. Frame openings with multiple studs and headers. Provide nailed header members of thickness equal to width of studs. Support headers on jamb studs.

1. For non-load-bearing partitions, provide jamb and header framing as indicated, or where not indicated provide at a minimum double-jamb studs and headers not less than 4-inch nominal depth for openings 48 inches and less in width, 6-inch nominal depth for openings 48 to 72 inches in width, 8-inch nominal depth for openings 72 to 120 inches in width, and not less than 10-inch nominal depth for openings 10 to 12 feet in width.
2. For load-bearing walls, provide jamb studs and headers as indicated.

3.4 INSTALLATION OF FLOOR AND CEILING JOIST FRAMING

A. General: Install floor joists with crown edge up and support ends of each member with not less than 1-1/2 inches of bearing on wood or metal, or 3 inches on masonry. Attach floor joists as follows:

1. Where supported on wood members, by using metal framing anchors.
2. Where framed into wood supporting members, by using wood ledgers as indicated or, if not indicated, by using metal joist hangers.

B. Frame openings with headers and trimmers supported by metal joist hangers; double headers and trimmers where span of header exceeds 48 inches.

C. Do not notch in middle third of joists; limit notches to one-sixth depth of joist, one-third at ends. Do not bore holes larger than one-third depth of joist; do not locate closer than 2 inches from top or bottom.

D. Provide solid blocking of 2-inch nominal thickness by depth of joist at ends of joists unless nailed to header or band.

E. Lap members framing from opposite sides of beams, girders, or partitions not less than 4 inches or securely tie opposing members together. Provide solid blocking of 2-inch nominal thickness by depth of joist over supports.

F. Provide solid blocking between joists under jamb studs for openings.

G. Under non-load-bearing partitions, provide double joists separated by solid blocking equal to depth of studs above.

1. Provide triple joists separated as above, under partitions receiving ceramic tile and similar heavy finishes or fixtures.

H. Provide bridging of type indicated below, at intervals of 96 inches o.c., between joists.

1. Diagonal wood bridging formed from bevel-cut, 1-by-3-inch nominal size lumber, double-crossed and nailed at both ends to joists.
2. Steel bridging installed to comply with bridging manufacturer's written instructions.
3. Solid blocking of 2 inch nominal thickness by depth of joists.

3.5 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION

SECTION 061600

SHEATHING

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. Wall sheathing.
2. Roof sheathing.
3. Parapet sheathing.
4. Subflooring.

B. Related Requirements:

1. Section 061000 Rough Carpentry
2. Section 061753 Shop Fabricated Wood Trusses

1.3 QUALITY ASSURANCE

A. Pre-Installation Conference; Convene prior to commencing work of this Section. Review installation procedures and coordination required with “Related Work” and the following:
1. Review wall assemblies for potential interference and conflicts and coordinate layout and support provisions for interfacing work.
2. Review continuous insulation wall panels installation methods and procedures related to application, including manufacturers, installation guidelines.
3. Review firestopping requirements and weather resistive membrane requirements and placement locations.
4. Review field quality control procedures.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Indicate type of preservative used and net amount of preservative retained.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Include physical properties of treated materials.
3. For fire-retardant treatments, include physical properties of treated plywood both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D5516.
4. For products receiving waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

B. Evaluation Reports: For the following, from ICC-ES:

1. Wood-preservative-treated plywood.
2. Fire-retardant-treated plywood.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Stack panels flat with spacers beneath and between each bundle to provide air circulation.

B. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PANEL PRODUCTS

A. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.

B. Factory mark panels to indicate compliance with applicable standard.

2.2 WALL SHEATHING

A. Wood Structural Panel Sheathing
1. Type: Provide plywood sheathing at all locations
a. Bid Alternate:
1) Provide plywood sheathing at the following locations:
a) On exterior face of all exterior walls
b) On the interior face of walls in the drive through wash bay
c) At other locations as indicated on the drawings
2) Provide plywood or OSB sheathing at all other locations.
2. Exposure Rating: Exterior 1
3. Grade: Sheathing
4. Span Rating: Not less than 32/16.
5. Nominal Thickness: As indicated, not less than 15/32 inch.

2.3 ROOF SHEATHING

A. Wood Structural Panel Sheathing
1. Type: Plywood
2. Exposure Rating: Exterior 1
3. Grade: Sheathing
4. Span Rating: Not less than 32/16.
5. Nominal Thickness: As indicated, not less than 19/32 inch.

2.4 SUBFLOORING AND UNDERLAYMENT

A. Wood Structural Panel Subfloor
1. Type: Plywood Single Floor Panels
2. Exposure Rating: Exposure 1
3. Grade: Doc PS1
4. Span Rating: Not less than 24.
5. Nominal Thickness: Not less than 23/32 inch.
6. Edge Detail: Tongue and groove.

7. Surface Finish: Fully sanded face.

2.5 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. For roof and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M.

B. Nails, Brads, and Staples: ASTM F1667.

C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

D. Screws for Fastening Sheathing to Wood Framing: ASTM C1002.

2.6 MISCELLANEOUS MATERIALS

A. Adhesives for Field Gluing Panels to Wood Framing: Formulation complying with APA AFG-01 that is approved for use with type of construction panel indicated by manufacturers of both adhesives and panels.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.

C. Securely attach to substrate by fastening as indicated, complying with the following:

1. Table 2304.9.1, "Fastening Schedule," in the ICC's International Building Code.
2. ICC-ES evaluation report for fastener.

D. Use common wire nails unless otherwise indicated. 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. Install fasteners without splitting wood.

E. Coordinate sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

F. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

G. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 WOOD STRUCTURAL PANEL INSTALLATION

A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.

B. Fastening Methods: Fasten panels as indicated below:

1. Subflooring:

a. Glue and nail to wood framing.
b. Space panels 1/8 inch apart at edges and ends.

2. Wall and Roof Sheathing:

a. Nail to wood framing.
b. Space panels 1/8 inch apart at edges and ends.

3.3 PROTECTION

A. Protect installed products until finish materials can be applied.

B. Cover the top and edges of unfinished roof panel work to protect it from the weather and to prevent accumulation of water in the cores of the panels.

1. Do not leave panels exposed to moisture. Wet panels shall be removed prior to application of roof covering.

END OF SECTION

SECTION 061753

SHOP FABRICATED WOOD TRUSSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
1. Wood roof trusses.
2. Wood girder trusses.
3. Wood truss bracing.
4. Wood truss accessories.

B. Related Sections:
1. Section 061000 – Rough Carpentry
2. Section 066000 - Sheathing.

1.3 DEFINITIONS

A. Metal-Plate-Connected Wood Trusses: Planar structural units consisting of metal-plate-connected members fabricated from dimension lumber and cut and assembled before delivery to Project site.

B. TPI: Truss Plate Institute, Inc.

C. Lumber grading agencies, and the abbreviation used to reference them, include the following:
1. NELMA – Northeastern Lumber Manufacturers Association
2. NLGA – National Lumber Grades Authority
3. SPIB – Southern Pine Inspection Bureau
4. WCLIB – West Coast Lumber Inspection Bureau
5. WWPA – Western Wood Products Association

1.4 PERFORMANCE REQUIREMENTS

A. Retain “Delegated Design” paragraph below if Contractor is required to assume responsibility for design.

B. Delegated Design: Engage a qualified professional engineer registered in the state that the project is located in to design metal-plate-connected wood trusses.

C. Editing Note: Revise the following paragraphs for design load requirements.

D. Structural Performance: Provide metal-plate-connected wood trusses capable of withstanding design loads within limits and under conditions indicated. Comply with requirements in TPI 1 unless more stringent requirements are specified below.
1. Design Standards:
a. 2014 Indiana Building Code
b. 2012 International Building Code

c. 2010 ASCE-7 American Society of Civil Engineers, “Minimum Design Loads for Buildings and Other Structures”.
d. TPI 1, "National Design Standard for Metal Plate Connected Wood Truss Construction."
e. TPI DSB, "Recommended Design Specification for Temporary Bracing of Metal Plate Connected Wood Trusses."
f. TPI HIB, "Commentary and Recommendations for Handling, Installing & Bracing Metal Plate Connected Wood Trusses."
g. Wood Structural Design Standard: Comply with applicable requirements in AF&PA's "National Design Specifications for Wood Construction" and its "Supplement."
h.

2. Design Loads: As indicated on project drawings and as indicated below:
   a. Risk Category II
   b. Wind Loads:
      1) Basic Wind Speed: 115 mph
      2) Exposure: C
      3) Enclosure: Partially Enclosed Building
   c. Snow Loads:
      1) Ground Snow Load: 20 psf
      2) Importance Factor: 1.0
      3) Thermal Factor: 1.2
      4) Exposure Factor: 1.0
3. Maximum Deflection Under Design Loads:
   a. Roof Trusses:
      1) Live load vertical deflection of 1/360 of span unless otherwise noted.
      2) Total load vertical deflection of 1/240 of span unless otherwise noted.
   b. Floor Trusses: Vertical deflection of 1/480 of span unless otherwise noted.

1.5 SUBMITTALS

A. Shop Drawings: Prepared by or under the supervision of a qualified professional engineer. Show fabrication and installation details for trusses.
   1. Show location, pitch, span, camber, configuration, and spacing for each type of truss required.
   2. Indicate sizes, stress grades, and species of lumber.
   3. Indicate locations of permanent bracing required to prevent buckling of individual truss members due to design loads.
   4. Indicate type, size, material, finish, design values, orientation, and location of metal connector plates.
   5. Show splice details and bearing details.
   6. Retain “Delegated-Design Submittal” paragraph below if design services have been delegated to Contractor.
   7. Delegated-Design Submittal: For metal-plate-connected wood trusses indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

B. Informational/Quality Assurance/Control Submittals:
   1. Product Certificates: For metal-plate-connected wood trusses, signed by officer of truss fabricating firm.
   2. Qualification Data: For metal-plate manufacturer, professional engineer, and fabricator.
   3. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.

1.6 QUALITY ASSURANCE

A. Retain the following or special testing is required.

B. Metal Connector-Plate Manufacturer Qualifications: A manufacturer that is a member of TPI and that complies with quality-control procedures in TPI 1 for manufacture of connector plates.
1. Manufacturer's responsibilities include providing professional engineering services needed to assume engineering responsibility.
2. Engineering Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.

C. Source Limitations for Connector Plates: Obtain metal connector plates from a single manufacturer.

D. Design by Manufacturer: Trusses shall be designed by connector-plate manufacturer to support all superimposed dead and live loads indicated, with design approved and certified by a Structural Engineer licensed to practice in jurisdiction.

E. Fabricator's Qualifications: Provide trusses by a firm which has a record of successfully fabricating trusses similar to type indicated and which complies with the following requirements for quality control:
1. Fabricator practices a quality control program, which complies with, or is comparable to, one published in TPI "Quality Standards for Metal Plate Connected Wood Trusses" and which involves inspection by an independent inspection and testing agency acceptable to A/E and authorities having jurisdiction.

F. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Handle and store trusses to comply with recommendations of TPI HIB, "Commentary and Recommendations for Handling, Installing & Bracing Metal Plate Connected Wood Trusses."
1. Store trusses flat, off of ground, and adequately supported to prevent lateral bending.
2. Protect trusses from weather by covering with waterproof sheeting, securely anchored.
3. Provide for air circulation around stacks and under coverings.

B. Inspect trusses showing discoloration, corrosion, or other evidence of deterioration. Discard and replace trusses that are damaged or defective.

C. Retain the following if Project requires LEED Construction Waste Management.

1.8 COORDINATION

A. Time delivery and erection of trusses to avoid extended on-site storage and to avoid delaying progress of other trades whose work must follow erection of trusses.

PART 2 - PRODUCTS

2.1 DIMENSION LUMBER

A. Retain “Certified Wood” paragraph below if wood products are required to be certified for LEED. An alternate method of dealing with this credit requirement is to retain requirement in Section “Sustainable Design Requirements” that gives Contractor the option and responsibility to determine how the credit requirement will be met.

B. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
   1. Factory mark each piece of lumber with grade stamp of grading agency.
   2. For exposed lumber indicated to receive a stained or natural finish, omit grade stamp and provide certificates of grade compliance issued by grading agency.
   3. Provide dressed lumber, S4S.
   4. Provide dry lumber with 19 percent maximum moisture content at time of dressing.

C. Grade and Species: For truss chord and web members, provide dimension lumber of any species, graded visually or mechanically, and capable of supporting required loads without exceeding allowable design values according to AF&PA's "National Design Specifications for Wood Construction" and its "Supplement."

D. Retain “Minimum Specific Gravity for Top Chords” paragraph below if required for diaphragm construction.

E. Minimum Specific Gravity for Top Chords: 0.50.

F. Permanent Bracing: Provide wood bracing that complies with requirements for miscellaneous lumber in Division 06 Section "Rough Carpentry."

G. Editing Note: Edit the following paragraph if minimum top or bottom chord sizes are desired.

H. Minimum Chord Size for Roof Trusses: 2x6 nominal for both top and bottom chords

2.2 METAL CONNECTOR PLATES

A. General: Fabricate connector plates to comply with TPI 1.

B. Hot-Dip Galvanized Steel Sheet: ASTM A 653; Structural Steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G60 coating designation; and not less than 0.036 inch thick.
   1. Use for interior locations, unless otherwise indicated.

C. Hot-Dip Heavy-Galvanized-Steel Sheet: ASTM A 653; Structural Steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 coating designation; and not less than 0.36 inch thick.
   1. Use for wood-preservative-treated lumber and where indicated.

D. Stainless-Steel Sheet: ASTM A 666, Type 304, and not less than 0.035 inch thick.
   1. Use for exterior locations and where indicated.

2.3 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
   1. Provide fasteners for use with metal framing anchors that comply with written recommendations of metal framing manufacturer.
   2. Where trusses are exposed to weather, in ground contact, made from pressure-preservative treated wood, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153 or Type 304 stainless steel.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Power-Driven Fasteners: ICC-ES ESR-1539.

D. Wood Screws: ASME B18.6.1.

E. Lag Bolts: ASME B18.2.1.

F. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.

2.4 WOOD TRUSS ACCESSORIES

A. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer, that meet or exceed those of products of manufacturers listed. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

B. Galvanized Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653, G60 coating designation.
   1. Use for interior locations, unless otherwise noted.

C. Hot-Dip Heavy-Galvanized-Steel Sheet: ASTM A653; Structural Steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 coating designation; and not less than 0.036 inch thick.
   1. Use for wood-preservative-treated lumber and where indicated.

D. Stainless-Steel Sheet: ASTM A 666, Type 304.
   1. Use for exterior locations and where indicated.

E. Truss Tie-Downs: Bent strap tie for fastening roof trusses to wall studs below, 1-1/2 inches wide by 0.050 inch thick. Tie fastens to one side of truss, top plates, and side of stud below.
   1. Simpson Strong-Tie H2.5A Hurricane Tie
   2. Approved equal.

F. Roof Truss Clips: Angle clips for bracing bottom chord of roof trusses at non-load-bearing walls, 1-1/4 inches wide by 0.050 inch thick. Clip is fastened to truss through slotted holes to allow for truss deflection.

G. Floor Truss Hangers: U-shaped hangers, full depth of floor truss, with 1-3/4-inch- long seat; formed from metal strap 0.062 inch thick with tabs bent to extend over and be fastened to supporting member.

H. Roof Truss Bracing/Spacers: U-shaped channels, 1-1/2 inches wide by 1 inch deep by 0.040 inch thick, made to fit between 2 adjacent trusses and accurately space them apart, and with tabs having metal teeth for fastening to trusses.

I. Drag Strut Connectors: Angle clip with one leg extended for fastening to the side of girder truss.
   1. Angle clip is 3 by 3 by 0.179 by 8 inches with extended leg 8 inches long. Connector has galvanized finish.

2.5 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: SSPC-Paint 20, with dry film containing a minimum of 94 percent zinc dust by weight.

2.6 FABRICATION

A. Cut truss members to accurate lengths, angles, and sizes to produce close-fitting joints with wood to wood bearing in assembled units.

B. Fabricate metal connector plates to sizes, configurations, thicknesses, and anchorage details required to withstand design loads for types of joint designs indicated.

C. Assemble truss members in design configuration indicated; use jigs or other means to ensure uniformity and accuracy of assembly with joints closely fitted to comply with tolerances in TPI 1.
   1. Position members to produce design camber indicated.
   2. Fabricate wood trusses within manufacturing tolerances in TPI 1.

D. Connect truss members by metal connector plates located and securely embedded simultaneously in both sides of wood members by air or hydraulic press.

2.7 SOURCE QUALITY CONTROL

A. Retain this article if special inspection is recalled. Consider deleting if requiring that fabricator participants in a recognized quality-assurance program that complies with quality-control procedures in TPI and that involves third-party inspection by an independent testing and inspecting agency and if authorities having jurisdiction approve fabrication work without special inspections. Coordinate with “Fabricator Qualifications” paragraph in “Quality Assurance” article.

B. Special Inspections: Owner will engage a qualified special inspector to perform special inspections.
   1. Provide special inspector with access to fabricator’s documentation of detailed fabrication and quality-control procedures that provide a basis for inspection control of the workmanship and the fabricator’s ability to conform to approved construction documents and referenced standards.
   2. Provide special inspector with access to places where wood trusses are being fabricated to perform inspections.

C. Correct deficiencies in work that special inspections indicate does not comply with the Contract Documents.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine substrates, areas, conditions, and abutting trusses and 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 INSTALLATION

A. Install wood trusses only after supporting construction is in place and is braced and secured.

B. If trusses are delivered to Project site in more than one piece, assemble trusses before installing.

C. Hoist trusses in place by lifting equipment suited to sizes and types of trusses required, exercising care not to damage truss members or joints by out-of-plane bending or other causes.

D. Install and brace trusses according to TPI recommendations and as indicated.

E. Provide adequate bracing to assure that trusses are maintained in alignment before, during, and after installation.

F. Install trusses plumb, parallel, square, and true to line and securely fasten to supporting construction.

G. Space trusses as indicated; adjust and align trusses in location before permanently fastening.

H. Anchor trusses securely at bearing points; use metal truss tie-downs or floor truss hangers as applicable. Install fasteners through each fastener hole in truss accessories according to manufacturer's fastening schedules and written instructions.

I. Securely connect each truss ply required for forming built-up girder trusses.
   1. Anchor trusses to girder trusses as indicated.

J. Install and fasten permanent bracing during truss erection and before construction loads are applied. Anchor ends of permanent bracing where terminating at walls or beams.
   1. Install bracing to comply with Division 06 Section "Rough Carpentry."

K. Install wood trusses within installation tolerances in TPI 1.

L. Do not alter trusses after fabrication. Do not cut, drill, notch, or remove truss members.

M. Where trusses do not fit, return them to the fabricator and replace with trusses of correct size.

N. Replace wood trusses that are damaged or do not meet requirements.
   1. Damaged trusses may be repaired according to truss repair details signed and sealed by the qualified professional engineer responsible for truss design, when approved by Engineer.

3.3 REPAIRS AND PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

B. Repair rusted or damaged galvanized coatings on exposed surfaces of metal connector plates with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

END OF SECTION

# SECTION 066400 - PLASTIC PANELING

## 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. Plastic sheet paneling.

### 1.3 SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For plastic paneling and trim accessories, in manufacturer's standard sizes.

C. Warranty Documentation: Submit manufacturer’s standard warranty.

### 1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, panel Installer, panel manufacturer's representative, and installers whose work interfaces with or affects panels.
2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review methods and procedures related to panel installation, including manufacturer's written instructions.
4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
5. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
6. Review temporary protection requirements for metal panel assembly during and after installation.
7. Review of procedures for repairing panels damaged after installation.
8. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

## 1.5 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install plastic paneling until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

# PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

A. Source Limitations: Obtain plastic paneling and trim accessories from single manufacturer.

B. Product shall be sourced from a single production run.

## 2.2 PLASTIC SHEET PANELING

A. Glass-Fiber-Reinforced Plastic Paneling: Gelcoat-finished, glass-fiber-reinforced plastic panels complying with ASTM D5319.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Crane Composites, Inc. - Glasbord
    b. Glasteel. – Glasliner FRP
    c. Marlite. -

2. Surface-Burning Characteristics: As follows when tested by a qualified testing agency according to ASTM E84. Identify products with appropriate markings of applicable testing agency.

    a. Flame-Spread Index: 200 or less.
    b. Smoke-Developed Index: 450 or less.

3. Nominal Thickness: Not less than .09 inch.
4. Surface Finish: Molded pebble texture.
5. Color: White.
6. Wall panel dimensions: 4’x12’
7. All panels to be from single production run to insure uniformity throughout project.

## 2.3 ACCESSORIES

A. Trim Accessories: Manufacturer's standard one-piece vinyl extrusions designed to retain and cover edges of panels. Provide division bars, inside corners, outside corners, and caps as needed to conceal edges.

1. Color: White.

B. Exposed Fasteners: Nylon drive rivets recommended by panel manufacturer.

C. Concealed Mounting Splines: Continuous, H-shaped aluminum extrusions designed to fit into grooves routed in edges of factory-laminated panels and to be fastened to substrate.

D. Adhesive: As recommended by plastic paneling manufacturer.

E. Sealant: Sealant recommended by plastic paneling manufacturer and complying with requirements in Section 079200 "Joint Sealants."

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, 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. Prepare substrate by sanding high spots and filling low spots as needed to provide flat, even surface for panel installation.

B. Clean substrates of substances that could impair adhesive bond, including oil, grease, dirt, and dust.

C. Condition panels by unpacking and placing in installation space before installation according to manufacturer's written recommendations.

D. Lay out paneling before installing. Locate panel joints to provide equal panels at ends of walls not less than half the width of full panels, so that trimmed panels at corners are not less than 12 inches wide.

1. Mark plumb lines on substrate at panel joint locations for accurate installation.
2. Locate panel joints to allow clearance at panel edges according to manufacturer's written instructions.
3. Install with 12’-0” dimension in vertical orientation to eliminate horizontal joints.

### 3.3 INSTALLATION

A. Install plastic paneling according to manufacturer's written instructions.

B. Install panels in a full spread of adhesive.

C. Install trim accessories with adhesive and nails or staples. Do not fasten through panels.

D. Fill grooves in trim accessories with 100% silicone sealant before installing panels, and bed inside corner trim in a bead of sealant.

E. Maintain uniform space between panels and wall fixtures. Fill space with sealant.

F. Remove excess sealant and smears as paneling is installed. Clean with solvent recommended by sealant manufacturer and then wipe with clean dry cloths until no residue remains.

END OF SECTION 066400

# SECTION 072100 - THERMAL INSULATION

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

### 1.2 SUMMARY

A. Section Includes:

1. Extruded polystyrene foam-plastic board insulation.
2. Glass-fiber blanket insulation.

### 1.3 ACTION SUBMITTALS

A. Product Data: For the following:

1. Extruded polystyrene foam-plastic board insulation.
2. Glass-fiber blanket insulation.

B. Product Test Reports: For each product, for tests performed by a qualified testing agency.

C. Research Reports: For foam-plastic insulation.

### 1.4 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. Protect foam-plastic board insulation as follows:

1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.
3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD INSULATION

A. Extruded Polystyrene Board Insulation, Type X: ASTM C578, Type X, 15-psi minimum compressive strength; unfaced. **for 1" on exterior walls R-3.8**

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Dow Chemical Company (The).
   b. Kingspan Insulation.
   c. Owens Corning.

2. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
3. Smoke-Developed Index: Not more than 450 when tested in accordance with ASTM E84.
4. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
5. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

B. Extruded Polystyrene Board Insulation, Type IV: ASTM C578, Type IV, 25-psi minimum compressive strength; unfaced. **for foundation (2") and under slab (3")**

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Dow Chemical Company (The).
   b. Kingspan Insulation.
   c. Owens Corning.

2. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
3. Smoke-Developed Index: Not more than 450 when tested in accordance with ASTM E84.
4. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
5. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

2.2 GLASS-FIBER BLANKET INSULATION

A. Glass-Fiber Blanket Insulation, Polypropylene-Scrim-Kraft Faced ASTM C665, Type II (nonreflective faced), Class A (faced surface with a flame-spread index of 25 or less); Category 1 (membrane is a vapor barrier). **(for attic R-38)**

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. CertainTeed Corporation.
   b. Johns Manville; a Berkshire Hathaway company.

c. Knauf Insulation.
d. Owens Corning.

2. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

**B.** Glass-Fiber Blanket Insulation, Unfaced: ASTM C665, Type I; passing ASTM E136 for combustion characteristics. **(for exterior walls R-19)**

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. CertainTeed Corporation.
b. Johns Manville; a Berkshire Hathaway company.
c. Knauf Insulation.
d. Owens Corning.

2. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
3. Smoke-Developed Index: Not more than 50 when tested in accordance with ASTM E84.
4. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

## 2.3 INSULATION FASTENERS

A. Cap-head (min. 1") nails or screws of sufficient length to penetrate framing members a minimum ¾" or through structural sheathing.

B. Adhesive Installation: Manufacturer's recommended adhesive.

## 2.4 ACCESSORIES

A. Insulation for Miscellaneous Voids:

1. Glass-Fiber Insulation: ASTM C764, Type II, loose fill; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E84.
2. Spray Polyurethane Foam Insulation: ASTM C1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E84.

B. Eave Ventilation Troughs: Preformed, rigid fiberboard or plastic sheets designed and sized to fit between roof framing members and to provide ventilation between insulated attic spaces and vented eaves.

# PART 3 - EXECUTION

## 3.1 PREPARATION

A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

## 3.2 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Install insulation with manufacturer's R-value label exposed after insulation is installed.

D. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

E. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

## 3.3 INSTALLATION OF SLAB INSULATION

A. On vertical slab edge and foundation surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions.

1. If not otherwise indicated, extend insulation a minimum of 24 inches below exterior grade line.

B. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

1. If not otherwise indicated, extend insulation a minimum of 24 inches in from exterior walls.

## 3.4 INSTALLATION OF FOUNDATION WALL INSULATION

A. Butt panels together for tight fit.

B. Adhesive Installation: Install with adhesive or press into tacky waterproofing or dampproofing according to manufacturer's written instructions.

## 3.5 INSTALLATION OF INSULATION ON EXTERIOR FRAMED AND SHEATHED WALLS

A. Board Insulation
1. Install pads of adhesive spaced approximately 24 inches.
2. Apply Insulation to outside of braced framing or structural sheathing. Tongue and groove (T&G) edge panels install horizontally, square edge panels install vertically.
3. Use cap-head (min. 1”) nails or screws spaced 12” o.c. for the perimeter and 16” o.c. in the field to attach the panels. Choose fasteners of sufficient length to penetrate framing members a minimum ¾” or through structural sheathing.
4. Cover all framing with Insulation and fit joints tightly. Joints and openings may be sealed with joint tape per manufacturer’s standards.

## 3.6 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

A. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:

1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members. Insulation to be completely dry before enclosing in wall.
3. Install carbon steel wires as needed to hold insulation in place and keep material from causing sagging in the wall or ceiling.
4. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
5. Attics: Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.
6. Install layers in attic batts perpendicular to the layer below.
7. For wood-framed construction, install blankets according to ASTM C1320 and as follows:

    a. With faced blankets having stapling flanges, lap blanket flange over flange of adjacent blanket to maintain continuity of vapor retarder once finish material is installed over it.

8. Vapor-Retarder-Faced Blankets: Tape joints and ruptures in vapor-retarder facings, and seal each continuous area of insulation to ensure airtight installation.

B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:

1. Glass-Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft.
2. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

## 3.7 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.

B. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 072100

# SECTION 072500 – WEATHER BARRIERS

## 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. Building wrap.
   2. Flexible flashing.

### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

   1. For building wrap, include data on air and water-vapor permeance based on testing according to referenced standards.

### 1.4 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For water-resistive barrier and flexible flashing, from ICC-ES.

## PART 2 - PRODUCTS

### 2.1 WATER-RESISTIVE BARRIER

A. Building Wrap: ASTM E1677, Type I air barrier; with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, when tested according to ASTM E84; UV stabilized; and acceptable to authorities having jurisdiction.

   1. Products: Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but not limited to, the following:
      a. DuPont; Tyvek Commercial Wrap.
      b. James Hardie Building Products; Hardie Wrap.
      c. Or approved equal.

   2. Water-Vapor Permeance: Not less than 20 per ASTM E96/E96M, Desiccant Method (Procedure A).
   3. Air Permeance: Not more than 0.006 cfm/sq. ft. when tested according to ASTM E2178.
   4. Allowable UV Exposure Time: Not less than three months.

B. Building-Wrap Tape: Pressure-sensitive plastic tape recommended by building-wrap manufacturer for sealing joints and penetrations in building wrap.

## 2.2 FLEXIBLE FLASHING

A. Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch.

1. Products: Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but not limited to, the following:
   a. DuPont; DuPont Flashing Tape.
   b. James Hardie Building Products; Hardie Wrap Flex Flashing.
   c. Grace Construction Products, a unit of W.R. Grace & Co.; Vycor Butyl Self Adhered Flashing

B. Primer for Flexible Flashing: Product recommended in writing by flexible flashing manufacturer for substrate.

C. Nails and Staples: Product recommended in writing by flexible flashing manufacturer and complying with ASTM F1667.

# PART 3 - EXECUTION

## 3.1 WATER-RESISTIVE BARRIER INSTALLATION

A. Cover exposed exterior surface of sheathing with water-resistive barrier securely fastened to framing immediately after sheathing is installed.

B. Cover sheathing with water-resistive barrier as follows:
1. Apply barrier to cover vertical flashing with a minimum 4-inch overlap unless otherwise indicated.

C. Building Wrap: Comply with manufacturer's written instructions and warranty requirements.

1. Seal seams, edges, fasteners, and penetrations with tape.
2. Extend into jambs of openings and seal corners with tape.

## 3.2 FLEXIBLE FLASHING INSTALLATION

A. Apply flexible flashing where indicated to comply with manufacturer's written instructions.

1. Prime substrates as recommended by flashing manufacturer.
2. Lap seams and junctures with other materials at least 4 inches except that at flashing flanges of other construction, laps need not exceed flange width.

3. Lap flashing over water-resistive barrier at bottom and sides of openings.
4. Lap water-resistive barrier over flashing at heads of openings.
5. After flashing has been applied, roll surfaces with a hard rubber or metal roller to ensure that flashing is completely adhered to substrates.

END OF SECTION 072500

SECTION 073113 - ASPHALT SHINGLES

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. Asphalt shingles.
2. Underlayment.
3. Ridge Vents

B. Related Sections:
1. Section 061600 "Sheathing" for roof and wall sheathing.
2. Section 076200 "Sheet Metal Flashing and Trim" for roof drainage fabrications.

1.3 DEFINITION

A. Roofing Terminology: See ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definitions of terms related to roofing work in this Section.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples for Initial Selection: For each type of asphalt shingle indicated.

C. Samples for Verification: For the following products, of sizes indicated, to verify color selected:
1. Asphalt Shingle: Full size.
2. Ridge Vent: 12-inch- (300-mm-) long Sample.
3. Exposed Valley Lining: 12 inches (300 mm) square.
4. Self-Adhering Underlayment: 12 inches (300 mm) square.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for asphalt shingles.

C. Warranties: Sample of special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of asphalt shingle to include in maintenance manuals.

B. Manufacturer’s NDL Warranty

C. Roofing Installer’s Warranty.

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. Asphalt Shingles: 100 sq. ft (9.3 sq. m) of each type, in unbroken bundles.

1.8 QUALITY ASSURANCE

A. Source Limitations: Obtain ridge and hip cap shingles ridge vents felt underlayment and self-adhering sheet underlayment from single source from single manufacturer.

B. Installer Qualifications: Letter signed by the manufacturer stating that the contractor is approved to install the specified shingles and related components to provide the specified warranty.

C. Fire-Resistance Characteristics: Where indicated, provide asphalt shingles and related roofing materials identical to those of assemblies tested for fire resistance per test method below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing agency.
   1. Exterior Fire-Test Exposure: Class A; ASTM E 108 or UL 790, for application and roof slopes indicated.

1.9 PRE-INSTALLATION MEETINGS

A. Preinstallation conference: Conduct conference at project site with representatives from: Architectural Firm, Owner’s Project Manager, General Contractor, Roofing Sub-Contractor and Manufacturer’s Representative.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Store roofing materials in a dry, well-ventilated, weathertight location according to asphalt shingle manufacturer's written instructions. Store underlayment rolls on end on pallets or other raised surfaces. Do not double stack rolls.
   1. Handle, store, and place roofing materials in a manner to avoid significant or permanent damage to roof deck or structural supporting members.

B. Protect unused underlayment from weather, sunlight, and moisture when left overnight or when roofing work is not in progress.

1.11 PROJECT CONDITIONS

A. Environmental Limitations: Install asphalt shingles and self-adhering sheet underlayment within the weather conditions recommended by manufacturer.

1.12 WARRANTY :

A. Polymer Modified Asphalt shingles subjected to terms and conditions of the standard Manufacturer’s 50 Year Limited warranty. The 50 Year Laminated Shingle Warranty includes limited term resistance to wind up to 130 MPH for 15 years. Manufacturer’s wind warranty coverage is subject to the shingles being sealed. Limited lifetime algae resistance warranty with first 20 years non prorated

B. Special Warranty: Manufacturer's warranty without monetary limitation (NDL), in which manufacturer agrees to repair or replace components of asphalt shingle roofing system that fail

in materials or workmanship that result in leaks within specified warranty period. Contractor must follow specific manufacturer installation instructions for the NDL warranty.

C. Special warranty includes asphalt shingles, flashings, roof insulation, vented nail base, and other components of roofing system.

D. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GLASS-FIBER-REINFORCED POLYMER MODIFIED ASPHALT SHINGLES

A. Physical Properties
1. Impact Resistance UL 2218 Class 4
2. Wind Resistance 130 MPH
3. Fire Rating ASTM E 108 Class A
4. Granule Adhesion UL Max. 0.35-gram loss
5. Approximate Weight 275 lb. Per Square
6. Warranty: 20-Year NDL Warranty
7. Wind Warranty 130 MPH (15 years)
8. Algae Warranty Limited Lifetime
9. ASTM D3018, Type 1 Pass
10. ASTM D3462 Passed
11. ASTM D3161 Class F (110 mph) Passed
12. ASTM D7158 Class H (150 mph) Passed

B. Color to be selected from the manufacturer's standard colors.

C. Acceptable Manufacturers and product name:
1. Malarkey, Legacy Scotchgard
2. Or approved equal.

2.2 UNDERLAYMENT MATERIALS

A. Synthetic Felt:
1. Provide synthetic underlayment as indicated on the project drawings or specified herein.
2. On slopes 3:12 to 5:12 a double layer of underlayment is required.
3. Acceptable Manufacturer and product name:
a. Malarkey Secure Start Plus
b. Or approved equal

B. Self-Adhering Underlayment.
1. Provide self-adhering underlayment as indicated on the project drawings or specified herein.
2. Self-adhering sheet shall be a minimum of 55 mils thick.
3. Self-adhering sheet shall be 1 meter or 36" in width.
4. Acceptable Manufacturers and product name:
a) Malarkey Arctic Seal
b) Or approved equal.

C. RELATED ROOFING PRODUCTS
1. Hip and Ridge Shingles: Malarkey 12" RidgeFlex Hip and Ridge over standard rigid vents or EZ Ridge XT (10") for over hips for high profile appearance.
.

2. Starter Shingles: Malarkey Smart Start.

2.3 RIDGE VENTS

A. Rigid Ridge Vent: Quarrix Storm Stop Ridge Vent rolled with nails high-density polypropylene for use under ridge shingles to provide a balanced attic ventilation system along with eave intake.

2.4 ACCESSORIES

A. Asphalt Roofing Cement: ASTM D 4586, Type II, asbestos free.

B. Elastomeric Flashing Sealant: ASTM C920, Type S, Grade NS, one-part, non-sag, elastomeric polymer sealant; of class and use classifications required to seal joints and remain watertight; recommended in writing by manufacturer for installation of flashing systems.

C. Roofing Nails: ASTM F 1667; aluminum, stainless-steel, copper, or hot-dip galvanized-steel wire shingle nails, minimum 0.120-inch- (3-mm-) diameter, barbed shank, sharp-pointed, with a minimum 3/8-inch- (9.5-mm-) diameter flat head and of sufficient length to penetrate 3/4 inch (19 mm) into solid wood decking or extend at least 1/8 inch (3 mm) through OSB or plywood sheathing.
   1. Where nails are in contact with metal flashing, use nails made from same metal as flashing.

D. Felt Underlayment Nails: Aluminum, stainless-steel, or hot-dip galvanized-steel wire with low-profile capped heads or disc caps, 1-inch (25-mm) minimum diameter.

2.5 METAL FLASHING AND TRIM

A. General: Comply with requirements in Section 076200 "Sheet Metal Flashing and Trim."
   1. Sheet Metal: .032 pre-finished aluminum, mill finished.

B. Fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of the item.
   1. Drip Edges: Fabricate in lengths not exceeding 10 feet (3 m) with 2-inch (50-mm) roof-deck flange and 1-1/2-inch (38-mm) fascia flange with 3/8-inch (9.6-mm) drip at lower edge.

Vent Pipe Flashings: The Ultimate Pipe Flashing from Lifetime Tools (size specific)

C. EXECUTION

2.6 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
   1. Examine roof sheathing to verify that sheathing joints are supported by framing and blocking or metal clips and that installation is within flatness tolerances.
   2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and completely anchored; and that provision has been made for flashings and penetrations through asphalt shingles.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

2.7 UNDERLAYMENT INSTALLATION

A. General: Comply with shingle manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.

B. Single-Layer Felt Underlayment: Install on roof deck parallel with and starting at the eaves. Lap sides a minimum of 2 inches (50 mm) over underlying course. Lap ends a minimum of 4 inches (100 mm). Stagger end laps between succeeding courses at least 72 inches (1830 mm). Fasten with felt underlayment nails.
1. Install felt underlayment on roof deck not covered by self-adhering sheet underlayment. Lap sides of felt over self-adhering sheet underlayment not less than 3 inches (75 mm) in direction to shed water. Lap ends of felt not less than 6 inches (150 mm) over self-adhering sheet underlayment.
2. Install fasteners at no more than 36 inch (900 mm) o.c.

C. Self-Adhering Sheet Underlayment: Install, wrinkle free, on roof deck. Comply with low-temperature installation restrictions of underlayment manufacturer if applicable. Install at locations indicated below, lapped in direction to shed water. Lap sides not less than 3-1/2 inches (89 mm). Lap ends not less than 6 inches (150 mm) staggered 24 inches (600 mm) between courses. Roll laps with roller. Cover underlayment within seven days.
1. Eaves: Extend from edges of eaves 36 inches (914 mm) beyond interior face of exterior wall.
2. Rakes: Extend from edges of rake 24 inches (600 mm) beyond interior face of exterior wall.
3. Valleys: Extend from lowest to highest point 18 inches (450 mm) on each side.
4. Hips: Extend 18 inches (450 mm) on each side.
5. Ridges: Extend 36 inches (914 mm) on each side without obstructing continuous ridge vent slot.
6. Roof Slope Transitions: Extend 18 inches (450 mm) on each roof slope.

2.8 METAL FLASHING INSTALLATION

A. General: Install metal flashings and other sheet metal to comply with requirements in Section 076200 "Sheet Metal Flashing and Trim."
1. Install metal flashings according to recommendations in ARMA's "Residential Asphalt Roofing Manual" and asphalt shingle recommendations in NRCA's "The NRCA Roofing and Waterproofing Manual."

B. Rake Drip Edges: Install rake drip edge flashings over underlayment and fasten to roof deck.

C. Eave Drip Edges: Install eave drip edge flashings below underlayment and fasten to roof sheathing.

D. Pipe Flashings: Form flashing around pipe penetrations and asphalt shingles. Fasten and seal to asphalt shingles as recommended by manufacturer.

2.9 ASPHALT SHINGLE INSTALLATION

A. General: Install asphalt shingles according to manufacturer's written instructions, recommendations in ARMA's "Residential Asphalt Roofing Manual," and asphalt shingle recommendations in NRCA's "The NRCA Roofing and Waterproofing Manual."

B. Install starter strip along lowest roof edge, consisting of an asphalt shingle strip with tabs removed at least 7 inches (175 mm) wide with self-sealing strip face up at roof edge.
   1. Extend asphalt shingles 1/2 inch (13 mm) over fasciae at eaves and rakes.
   2. Install starter strip along rake edge.

C. Install first and remaining courses of asphalt shingles stair-stepping diagonally across roof deck with manufacturer's recommended offset pattern at succeeding courses, maintaining uniform exposure.

D. Fasten asphalt shingle strips with a minimum of four roofing nails located according to manufacturer's written instructions.
   1. When ambient temperature during installation is below 50 deg F (10 deg C), seal asphalt shingles with asphalt roofing cement spots.

E. Closed-Cut Valleys: Extend asphalt shingle strips from one side of valley 12 inches (300 mm) beyond center of valley. Use one-piece shingle strips without joints in valley. Fasten with extra nail in upper end of shingle. Install asphalt shingle courses from other side of valley and cut back to a straight line 2 inches (50 mm) short of valley centerline. Trim upper concealed corners of cut-back shingle strips.
   1. Do not nail asphalt shingles within 6 inches (150 mm) of valley center.
   2. Set trimmed, concealed-corner asphalt shingles in a 3-inch- (75-mm-) wide bed of asphalt roofing cement.

F. Ridge Vents: Install continuous ridge vents over asphalt shingles according to manufacturer's written instructions. Fasten with roofing nails of sufficient length to penetrate sheathing.

G. Ridge and Hip Cap Shingles: Maintain same exposure of cap shingles as roofing shingle exposure. Lap cap shingles at ridges to shed water away from direction of prevailing winds. Fasten with roofing nails of sufficient length to penetrate sheathing.
   1. Fasten ridge cap asphalt shingles to cover ridge vent without obstructing airflow.

END OF SECTION 073113

# SECTION 074213.13 - FORMED METAL WALL PANELS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Exposed-fastener, lap-seam metal wall panels.
2. Metal liner panels.

B. Related Requirements:

1. Section 074293 "Soffit Panels" for metal panels used in horizontal soffit applications.

### 1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, Owner's insurer if applicable, metal panel Installer, metal panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal panels, including installers of doors, windows, and louvers.
2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review methods and procedures related to metal panel installation, including manufacturer's written instructions.
4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
5. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that affect metal panels.
6. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
7. Review temporary protection requirements for metal panel assembly during and after installation.
8. Review of procedures for repair of metal panels damaged after installation.
9. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

### 1.3 ACTION SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.

1. Exposed-fastener, lap-seam metal wall panels.
2. Metal liner panels.

B. Shop Drawings:

1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
2. Accessories: Include details of the flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches (1:10).

C. Samples for Initial Selection:

1. Color chart of manufacturer’s standard colors.

## 1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For exposed-fastener, lap-seam metal wall panels for tests performed by a qualified testing agency.

C. Field quality-control reports.

D. Sample Warranties: For special warranties.

## 1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For metal panels to include in maintenance manuals.

## 1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.

B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Retain strippable protective covering on metal panels during installation.

## 1.7 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

## 1.8 COORDINATION

A. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

## 1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including rupturing, cracking, or puncturing.
b. Deterioration of metals and other materials beyond normal weathering.

2. Warranty Period: Two years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Delta E units when tested according to ASTM D2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

# PART 2 - PRODUCTS

## 2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E1592:

1. Wind Loads: As indicated on Drawings.
2. Other Design Loads: As indicated on Drawings.
3. Deflection Limits: For wind loads, no greater than 1/180 of the span.

B. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. (0.3 L/s per sq. m) when tested according to ASTM E283 at the following test-pressure difference:

1. Test-Pressure Difference: 6.24 lbf/sq. ft. (300 Pa).

C. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E331 at the following test-pressure difference:

1. Test-Pressure Difference: 6.24 lbf/sq. ft. (300 Pa).

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

## 2.2 EXPOSED-FASTENER, LAP-SEAM METAL WALL PANELS (Exterior Siding)

A. Provide factory-formed metal panels designed to be field assembled by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps. Include accessories required for weathertight installation.

B. Tapered-Rib-Profile, Exposed-Fastener Metal Wall Panels: Formed with raised, trapezoidal major ribs and intermediate stiffening ribs symmetrically spaced between major ribs.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Berridge Manufacturing Company.
b. Fabral; a brand of OmniMax International.
c. MBCI; Cornerstone Building Brands.
d. McElroy Metal, Inc.
e. Or approved equal.

2. Material: Galvalume steel sheet conforming to ASTM A792, AZ55 coating for bare; AZ50 coating for painted; 24 gauge (min) sheet thickness.
a. Exterior Finish: Two-coat fluoropolymer
b. Color: As selected by Architect from manufacturer's full range.

3. Major-Rib Spacing: 6 -12 inches o.c.
4. Panel Coverage: 24 -36 inches
5. Panel Height: 0.75 inch - 1.5 inches.

## 2.3 METAL LINER PANELS (Interior Ceilings)

A. Provide factory-formed metal liner panels designed for interior ceilings and field assembled by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners inside laps. Include accessories required for a complete installation.

B. Metal Liner Panels: Solid panels formed with intermediate stiffening ribs symmetrically spaced between panel edges; with a flush joint between panels.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Berridge Manufacturing Company.
b. Fabral; a brand of OmniMax International.
c. MBCI; Cornerstone Building Brands.
d. McElroy Metal, Inc.
e. Or approved equal.

2. Material: Galvalume steel sheet conforming to ASTM A792, AZ55 coating for bare; AZ50 coating for painted; 26 gauge (min) sheet thickness.
   a. Exterior Finish: Two-coat fluoropolymer
   b. Color: White

3. Major-Rib Spacing: 6 -12 inches o.c.
4. Panel Coverage: 24 -36 inches
5. Panel Height: 0.75 inch - 1.5 inches.

## 2.4 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Subframing and Furring: ASTM C645, cold-formed, metallic-coated steel sheet, ASTM A653/A653M, G90 (Z275) hot-dip galvanized coating designation or ASTM A792/A792M, Class AZ50 (Class AZM150) aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.

B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.

1. Closures: Provide closures at eaves and rakes, fabricated of same metal as metal panels.
2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- (25-mm-) thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.

D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.

E. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.

1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
2. Joint Sealant: ASTM C920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.
3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C1311.

## 2.5 FABRICATION

A. Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

C. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.

D. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
4. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.

    a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

## 2.6 FINISHES

A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Steel Panels and Accessories:

1. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions (Kynar 500 or equivalent).

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.
1. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal wall panel manufacturer.

a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C754 and metal panel manufacturer's written recommendations.

### 3.3 INSTALLATION OF METAL PANELS

A. Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Shim or otherwise plumb substrates receiving metal panels.

2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
3. Install screw fasteners in predrilled holes.
4. Locate and space fastenings in uniform vertical and horizontal alignment.
5. Install flashing and trim as metal panel work proceeds.
6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
7. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

B. Fasteners:

1. Steel Panels: Use stainless steel fasteners for surfaces exposed to the exterior; use galvanized-steel fasteners for surfaces exposed to the interior.

C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.

D. Lap-Seam Metal Panels: Fasten metal panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.

1. Lap ribbed or fluted sheets one full rib. Apply panels and associated items true to line for neat and weathertight enclosure.
2. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal panels.
3. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
4. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
5. Flash and seal panels with weather closures at perimeter of all openings.

E. Watertight Installation:

1. Apply a continuous ribbon of sealant or tape to seal lapped joints of metal panels, using sealant or tape as recommend by manufacturer on side laps of nesting-type panels; and elsewhere as needed to make panels watertight.
2. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
3. At panel splices, nest panels with minimum 6-inch (152-mm) end lap, sealed with sealant and fastened together by interlocking clamping plates.

F. Metal Liner Panels: Install panels on underside of roof trusses.

G. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal wall panel manufacturer; or, if not indicated, provide types recommended by metal panel manufacturer.

H. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.

1. Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and achieve waterproof performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (610 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).

## 3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect completed metal wall panel installation, including accessories.

B. Remove and replace metal wall panels where tests and inspections indicate that they do not comply with specified requirements.

C. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.

D. Prepare test and inspection reports.

## 3.5 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

B. After metal panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

C. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 074213.13

# SECTION 074293 - SOFFIT PANELS

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

### 1.2 SUMMARY

A. Section Includes:

1. Metal soffit panels.

B. Related Sections:
1. Section 074213.13 "Formed Metal Wall Panels" for lap-seam metal wall panels.

### 1.3 SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.

B. Samples for Initial Selection:

1. Color chart of manufacturer’s standard colors.

C. Qualification Data: For Installer.

D. Product Test Reports: For each product, tests performed by a qualified testing agency.

E. Sample Warranties: For special warranties.

### 1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For metal panels to include in maintenance manuals.

### 1.5 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

## 1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.

B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Retain strippable protective covering on metal panels during installation.

## 1.7 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

## 1.8 COORDINATION

A. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of walls, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

## 1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including rupturing, cracking, or puncturing.
b. Deterioration of metals and other materials beyond normal weathering.

2. Warranty Period: Two years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Delta E units when tested according to ASTM D2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

A. Panel Performance Requirements: Provide panels, which have been manufactured, fabricated and installed to withstand structural and thermal movement, wind loading and weather exposure to maintain manufacturer's performance criteria without defects, damage, failure or infiltration of water.

1. Uplift Tests:
   a. ASTM E 1592

### 2.2 METAL SOFFIT PANELS

A. Provide metal soffit panels designed to be installed by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners in side laps. Include accessories required for weathertight installation.

B. V-Groove-Profile Metal Soffit Panels: Perforated panels formed with vertical panel edges and intermediate stiffening ribs symmetrically spaced between panel edges; with a V-groove joint between panels.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Berridge Manufacturing Company.
   b. Fabral; a brand of OmniMax International.
   c. McElroy Metal, Inc.
   d. Or approved equal.

2. Material: Galvalume steel sheet conforming to ASTM A792, AZ50 coating for painted; 26 gauge (min.) sheet thickness.

3. Panel Coverage: 12-16 inches.
4. Panel Height: 0.375 inch.
5. Fully Vented: 9% Minimum
6. Exterior Finish: Two-coat fluoropolymer.
7. Color: As selected from manufacturers standard colors.

### 2.3 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Subframing and Furring: ASTM C645, cold-formed, metallic-coated steel sheet, ASTM A653/A653M, G90 (Z275 hot-dip galvanized) coating designation or ASTM A792/A792M, Class AZ50 (Class AZM150) aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.

B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.

1. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- (25-mm-) thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Finish flashing and trim with same finish system as adjacent metal panels.

D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.

E. Panel Sealants: Provide sealant types recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.

1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
2. Joint Sealant: ASTM C920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.
3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C1311.

## 2.4 FABRICATION

A. Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

C. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.

D. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.

2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
3. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
5. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.

    a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal soffit panel manufacturer for application but not less than thickness of metal being secured.

## 2.5 FINISHES

A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions (Kynar 500 or equivalent).

    1. Metal Panel Color:
        a. Selected from full range of manufacturer’s standard colors.
    2. Metal Related Trim/Accessories Color:
        a. Selected from full range of manufacturer’s standard colors.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.

1. Examine framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal panel manufacturer.
2. Examine sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal panel manufacturer.

a. Verify that air- or water-resistive barriers been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C754 and metal panel manufacturer's written recommendations.

## 3.3 INSTALLATION

A. Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Shim or otherwise plumb substrates receiving metal panels.
2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
3. Install screw fasteners in predrilled holes.
4. Locate and space fastenings in uniform vertical and horizontal alignment.
5. Install flashing and trim as metal panel work proceeds.
6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
7. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

B. Fasteners:
1. Stainless steel fasteners for surfaces exposed to the exterior; use galvanized-steel fasteners for surfaces exposed to the interior.

C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.

D. Lap-Seam Metal Panels: Fasten metal panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.

1. Apply panels and associated items true to line for neat and weathertight enclosure.
2. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal panels.
3. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.

4. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.

E. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal panel system including trim, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal panel manufacturer; or, if not indicated, provide types recommended by metal panel manufacturer.

F. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.

1. Install exposed flashing and trim that is without buckling, and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to achieve waterproof performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (610 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).

## 3.4 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

B. After metal panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

C. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 074293

# SECTION 076200 - SHEET METAL FLASHING AND TRIM

## 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. Formed roof-drainage sheet metal fabrications.

B. Related Requirements:
   1. Section 073113 Asphalt Shingles for sheet metal flashing and trim integral with roofing.
   2. Section 074213.13 Formed Metal Wall Panels for sheet metal flashing and trim integral with metal wall panels.

## 1.3 COORDINATION

A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.

B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

## 1.4 SUBMITTALS

A. Shop Drawings: For sheet metal flashing and trim.
   1. Submit brochures of gutters and accessories, including installation details.

B. Samples for Verification: Sample of manufacturers standard colors for owner’s choice.

## 1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

## 1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.

   1. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
   2. Protect stored sheet metal flashing and trim from contact with water.

B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

## 1.7 WARRANTY

A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

# PART 2 - PRODUCTS

## 2.1 PERFORMANCE REQUIREMENTS

A. Sheet metal flashing and trim assemblies, including cleats, anchors, and fasteners, shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

B. Sheet Metal Standard for Flashing and Trim: Comply with SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.

C. SPRI Wind Design Standard: Manufacture and install roof edge flashings tested in accordance with ANSI/SPRI/FM 4435/ES-1 and capable of resisting the following design pressure:

1. Design Pressure: As indicated on Drawings

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change: 120 deg F , ambient; 180 deg F, material surfaces.

## 2.2 SHEET METALS

A. Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.

B. Aluminum Sheet: ASTM B209 (ASTM B209M), alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required; with smooth, flat surface.

1. Exposed Coil-Coated Finish:

a. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

2. Color: As selected by Architect from manufacturer's full range
3. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil (0.013 mm).

## 2.3 ROOF-DRAINAGE SHEET METAL FABRICATIONS

A. Hanging Gutters:

1. Fabricate to cross section required, complete with end pieces, outlet tubes, and other accessories as required.
2. Roll form gutters to the longest practical lengths.
3. Furnish flat-stock gutter brackets and flat-stock gutter spacers and straps fabricated from same metal as gutters, of size recommended by SMACNA, but with thickness not less than twice the gutter thickness.
4. Fabricate expansion joints, expansion-joint covers, and gutter accessories from same metal as gutters.
5. Gutter Profile: 6 inch Style “F”. in accordance with SMACNA standards.
6. Aluminum thickness: .040
7. Sealing materials as recommended by manufacturer.
8. Expansion joint materials as recommended by manufacturer.
9. Kynar 500 or equal finish to match metal siding.

B. Downspouts:
1. Downspouts to match guttering in color, finish, and material gauge.
2. Fabricate brackets to match color, finish, and thickness of downspouts unless otherwise noted.
3. Anchors as recommended by manufacturer.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.

1. Verify compliance with requirements for installation tolerances of substrates.
2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION OF ROOF-DRAINAGE SYSTEM

A. Install sheet metal roof-drainage items to produce complete roof-drainage system in accordance with SMACNA recommendations and as indicated. Coordinate installation of roof perimeter flashing with installation of roof-drainage system.

B. Hanging Gutters:

1. Install gutter, downspouts, and accessories in accordance with manufacturer's instructions. Allow for expansion at corners and joints.
2. Expansion Joints: Provide manufacturer's standard expansion joints at 50'-0" o.c. max. Sections less than 50'-0" should be rolled continuous without joints. Design for minimum ¾" thermal movement.
3. Attach gutters at eave or fascia to firmly anchor them in position.
4. Provide end closures and seal watertight with sealant.
5. Fasten gutter spacers to front and back of gutter.
6. Anchor gutter with **straps** spaced not more than 36 inches apart to roof deck unless otherwise indicated, and loosely lock to front gutter bead.
7. Seal all joints weathertight.

C. Downspouts:

1. Join sections with 1-1/2-inch (38-mm) telescoping joints.
2. Provide hangers with fasteners designed to hold downspouts securely to walls.
3. Locate hangers at top and bottom and at approximately 60 inches (1500 mm) o.c.
4. Provide elbows at base of downspout to direct water away from building.
5. Precast splash blocks.

### 3.3 CLEANING

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean off excess sealants.

3.4 PROTECTION

A. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.

B. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended in writing by sheet metal flashing and trim manufacturer.

C. Maintain sheet metal flashing and trim in clean condition during construction.

D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures, as determined by Architect.

END OF SECTION 076200

# SECTION 079200 - JOINT SEALANTS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section includes joint sealants for the following applications including those specified by reference to this section:

1. Exterior joints in the following vertical surfaces and horizontal nontraffic surfaces:
   a. Siding joints (refer to metal siding manufacturer's recommendations)
   b. Perimeter joints around doors and windows

2. Interior Joints in the following vertical and horizontal nontraffic surfaces:
   a. Perimeter joints around doors and windows
   b. Joints in plastic paneling (refer to paneling manufacturer's recommendations)
   c. Joints between plumbing fixtures and adjoining walls, floors, and counters.
   d. Other joints as indicated.

B. Related Requirements:
   1. Section 066400 – "Plastic Paneling"
   2. Section 074213.13 – "Formed Metal Wall Panels"

### 1.2 PERFORMANCE REQUIREMENTS

A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

B. Provide joint sealants for interior applications that maintain airtight and water resistant continuous joint seals without staining or deteriorating joint substrates.

### 1.3 SUBMITTALS

C. Product Data: For each joint-sealant product indicated.

D. Samples for Initial Selection: Manufacturer's standard color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

E. Samples for Verification: For each type and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- (13-mm-) wide joints formed between two 6-inch- (150-mm-) long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

## 1.2 INFORMATIONAL SUBMITTALS

A. Preconstruction Field-Adhesion-Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified in "Preconstruction Testing" Article.

B. Field Quality-Control Reports: For field-adhesion-test reports, for each sealant application tested.

C. Sample warranties.

## 1.3 CLOSEOUT SUBMITTALS

A. Manufacturers' special warranties.

B. Installer's special warranties.

## 1.4 QUALITY ASSURANCE

A. Installer Qualifications: Authorized representative who is trained and approved by manufacturer.

B. Testing Agency Qualifications: Qualified in accordance with ASTM C1021 to conduct the testing indicated.

## 1.5 MOCKUPS

A. Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.

## 1.6 FIELD CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F (5 deg C).
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.7 WARRANTY

A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:

1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
2. Disintegration of joint substrates from causes exceeding design specifications.
3. Mechanical damage caused by individuals, tools, or other outside agents.
4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain joint sealants from single manufacturer for each sealant type.

2.2 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. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.3 EXTERIOR JOINT SEALANTS

1. Refer to metal siding manufacturer’s standards for siding sealants.

2. Other exterior locations:
   a. MasterSeal® NP 150 Low-modulus, non-sag, elastomeric, hybrid sealant by BASF The Chemical Company.
   b. Approved equal.

## 2.4 MILDEW-RESISTANT JOINT SEALANTS

A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.

B. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.

1. Dow Corning Corporation; 786 Mildew Resistant.
2. GE Silicones, Sanitary SCS1700
3. Tremco; Tremsil 200.
4. Or approved equal.

## 2.5 BUTYL JOINT SEALANTS

A. Butyl-Rubber-Based Joint Sealants: ASTM C1311.

1. Refer to Metal Wall Panels Manufacturer’s Recommendations

## 2.6 LATEX JOINT SEALANTS

A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C834, Type P, Grade NF.

1. Tremco; Tremflex 834
2. Bostik Findley; Chem-Calk 600
3. Or approved equal.

## 2.7 JOINT-SEALANT BACKING

A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C1330, Type C (closed-cell material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

## 2.8 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. 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.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

# PART 3 - EXECUTION

## 3.1 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.

## 3.2 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 porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:

    a. Concrete.

3. Remove laitance and form-release agents from concrete.
4. 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. Nonporous joint substrates include the following:

    a. Metal.
    b. Glass.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. 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.

## 3.3 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. Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. 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.

F. 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.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint profile in accordance with Figure 8A in ASTM C1193 unless otherwise indicated.

    a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

3.4 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.

PROTECTION

B. 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.

3.7 JOINT SEALANT SCHEDULE

A. Metal Siding

1. Refer to Metal Siding Manufacturer's recommendations

B. Plastic Paneling
1. Refer to FRP Manufacturer's recommendations

C. Concrete Slab – Refer to 033000 Cast in Place Concrete

D. Joint Sealant Application: Interior joints between cabinetry and countertops.
1. Single component mildew resistant silicone

E. Joint Sealant application: Interior joints between plumbing fixtures and adjoining walls, floors, and counters.
1. Single component mildew resistant silicone

F. Joint Sealant Application: Perimeter joints between interior surfaces and frames of interior doors, windows, and entrances.
1. Latex sealant

G. Joint Sealant Application: Perimeter joints between exterior surfaces and frames of doors, windows, and entrances.
1. Master Seal NP150

H. Joint Sealant Application: Perimeter of concrete slabs
1. Refer to 033000 Cast-In-Place Concrete

END OF SECTION 079200

# SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section includes:

1. Interior standard steel doors and frames.
2. Exterior standard steel doors and frames.

B. Related Requirements:
1. Section 087100 "Door Hardware" for door hardware for hollow-metal doors.

### 1.2 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings in accordance with NAAMM-HMMA 803 or ANSI/SDI A250.8.

### 1.3 COORDINATION

A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

B. Coordinate requirements for installation of door hardware, electrified door hardware, and access control and security systems.

### 1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, core descriptions, and finishes.

B. Shop Drawings: Include the following:

1. Elevations of each door type.
2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
4. Locations of reinforcement and preparations for hardware.
5. Details of each different wall opening condition.
6. Details of anchorages, joints, field splices, and connections.
7. Details of accessories.
8. Details of moldings, removable stops, and glazing.

C. Product Schedule: For hollow-metal doors and frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final door hardware schedule.

## 1.5 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each type of thermally rated door assemblies for tests performed by a qualified testing agency indicating compliance with performance requirements.

## 1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow-metal doors and frames palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.

1. Provide additional protection to prevent damage to factory-finished units.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow-metal doors and frames vertically under cover at Project site with head up. Place on minimum 4-inch- (102-mm-) high wood blocking. Provide minimum 1/4-inch (6-mm) space between each stacked door to permit air circulation.

# PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ceco Door; ASSA ABLOY.
2. Curries Company; ASSA ABLOY.
3. Steelcraft; an Allegion brand.

## 2.2 PERFORMANCE REQUIREMENTS

A. Thermally Rated Door Assemblies: Provide door assemblies with U-factor of not more than 0.6 deg Btu/F x h x sq. ft. when tested in accordance with ASTM C1363 or ASTM E1423.

## 2.3 INTERIOR STANDARD STEEL DOORS AND FRAMES

A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 2; ANSI/SDI A250.4, Level B.

1. Doors:

    a. Type: As indicated in the Door and Frame Schedule.
    b. Thickness: 1-3/4 inches.
    c. Face: steel sheet, minimum thickness of 0.042 inch.
    d. Edge Construction: Model 1, Full Flush.
    e. Edge Bevel: Provide manufacturer's standard beveled or square edges.
    f. Core: Manufacturer's standard.

2. Frames:

    a. Materials: steel sheet, minimum thickness of 0.053 inch.
    b. Construction: Full profile welded.

3. Exposed Finish: Prime.

## 2.4 EXTERIOR STANDARD STEEL DOORS AND FRAMES

A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Extra-Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 3; ANSI/SDI A250.4, Level A. At locations indicated on the Floor Plan.

1. Doors:

    a. Type: As indicated in the Door and Frame Schedule.
    b. Thickness: 1-3/4 inches.
    c. Face: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A60 coating.
    d. Edge Construction: Model 2, Seamless.
    e. Edge Bevel: Provide manufacturer's standard beveled or square edges.
    f. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets. Seal joints against water penetration.
    g. Bottom Edges: Close bottom edges of doors where required for attachment of weather stripping with end closures or channels of same material as face sheets. Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape.
    h. Core: Manufacturer's standard**.**

2. Frames:

    a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A60 coating.
    b. Construction: Full profile welded.

3. Exposed Finish: Prime.

## 2.5 FRAME ANCHORS

A. Jamb Anchors:

1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
2. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 24 inches of frame height above 7 feet.
3. Postinstalled Expansion Anchor: Minimum 3/8-inch diameter bolts with expansion shields or inserts, with manufacturer's standard pipe spacer.

B. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor.

C. Material: ASTM A879/A879M, Commercial Steel (CS), 04Z (12G) coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A1008/A1008M or ASTM A1011/A1011M; hot-dip galvanized in accordance with ASTM A153/A153M, Class B.

## 2.6 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B.

D. Inserts, Bolts, and Fasteners: Hot-dip galvanized in accordance with ASTM A153/A153M.

E. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.

F. Mineral-Fiber Insulation: ASTM C665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E136 for combustion characteristics.

G. Glazing: Comply with requirements in Section 088000 "Glazing."

## 2.7 FABRICATION

A. Hollow-Metal Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.

1. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
2. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.

    a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
    b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

B. Hardware Preparation: Factory prepare hollow-metal doors and frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping in accordance with ANSI/SDI A250.6, the Door Hardware Schedule, and templates.

1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
2. Comply with BHMA A156.115 for preparing hollow-metal doors and frames for hardware.

C. Glazed Lites: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with mitered hairline joints.

1. Provide stops and moldings flush with face of door, and with stops unless otherwise indicated.
2. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames. Provide loose stops and moldings on inside of hollow-metal doors and frames.
3. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.
4. Provide stops for installation with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

## 2.8 STEEL FINISHES

A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

## 2.9 LOUVERS

A. Provide louvers for interior doors, where indicated, which comply with SDI 111, with blades or baffles formed of 0.020-inch thick, cold-rolled steel sheet set into 0.032-inch thick steel frame.

## PART 3 - EXECUTION

### 3.1 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces. Touch up factory-applied finishes where spreaders are removed.

B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

### 3.2 INSTALLATION

A. Install hollow-metal doors and frames plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and with manufacturer's written instructions.

B. Hollow-Metal Frames: Comply with ANSI/SDI A250.11.

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed Work.

    a. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces. Touch-up finishes.
    b. Install frames with removable stops located on secure side of opening.
2. Floor Anchors: Secure with post installed expansion anchors.
3. In-Place Concrete or Masonry Construction: Secure frames in place with post installed expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
4. Installation Tolerances: Adjust hollow-metal frames to the following tolerances:

    a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
    b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
    c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
    d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.

C. Hollow-Metal Doors: Fit and adjust hollow-metal doors accurately in frames, within clearances specified below.

1. Non-Fire-Rated Steel Doors: Comply with ANSI/SDI A250.8.

D. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with hollow-metal manufacturer's written instructions.

## 3.3 FIELD QUALITY CONTROL

A. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

B. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

## 3.4 REPAIR

A. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

END OF SECTION 081113

# SECTION 083613 - SECTIONAL OVERHEAD DOORS

## PART 1 - GENERAL

### 1.1 SECTION INCLUDES

A. Insulated Sectional Overhead Doors.

B. Electric Operators and Controls.

C. Operating Hardware, tracks, and support.

### 1.2 RELATED SECTIONS

A. Section 079200 - Joint Sealers: Perimeter sealant and backup materials.

B. Section 08710 - Door Hardware: Cylinder locks.

C. Section 260533A - Raceway and Boxes: Empty conduit from control station to door operator.

D. Section 262726A - Wiring Connections: Electrical service to door operator.

### 1.3 REFERENCES

A. ANSI/DASMA 102 - American National Standard Specifications for Sectional Overhead Type Doors.

### 1.4 DESIGN / PERFORMANCE REQUIREMENTS

A. Wind Loads: Design and size components to withstand loads caused by pressure and suction of wind acting normal to plane of wall as calculated in accordance with applicable code.
   1. Design pressure of 42 lb/sq ft.

B. Wiring Connections: Requirements for electrical characteristics.
   1. 115 volts, single phase, 60 Hz.

C. Single-Source Responsibility: Provide doors, tracks, motors, and accessories from one manufacturer for each type of door. Provide secondary components from source acceptable to manufacturer of primary components.

### 1.5 SUBMITTALS

A. Submit under provisions of Section 013400.

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: Indicate plans and elevations including opening dimensions and required tolerances, connection details, anchorage spacing, hardware locations, and installation details.

D. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

E. Operation and Maintenance Data.

F. Color chart of manufacturer’s standard colors for color selection.,

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sectional doors to include in operation and maintenance manuals.

B. Manufacturer's warranties.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened labeled packaging until ready for installation.

B. Protect materials from exposure to moisture until ready for installation.

C. Store materials in a dry, ventilated weathertight location.

1.9 WARRANTY

A. Warranty: Manufacturer’s limited door and operators System warranty for 10 year against delamination of polyurethane foam from steel face and all other components for 3 years or 20,000 cycles, whichever comes first.

PART 2 PRODUCTS

2.1 INSULATED SECTIONAL OVERHEAD DOORS

A. Basis of Design: 596 Series Thermacore Insulated Steel Doors by Overhead Door Corporation.

B. Manufacturers: Subject to compliances with requirements, provide products by one of the following:

a. Overhead Door Corportation
b. Haas Door
c. Wayne-Dalton Corp.
d. Other approved equal.

2. Door Assembly: Metal/foam/metal sandwich panel construction, with PVC thermal break and weather-tight ship-lap design meeting joints.
   a. Panel Thickness: 2 inches (51 mm).
   b. Exterior Surface: Flush, textured.
   c. Exterior Steel: 20 gauge, galvanized.
   d. End Stiles: 16 gauge with thermal break.
   e. Spring Counterbalance: Sized to weight of the door, with a helically wound, oil tempered torsion spring mounted on a steel shaft; cable drum of diecast aluminum with high strength galvanized aircraft cable. Sized with a minimum 7 to 1 safety factor.
      1) Standard cycle spring: 10,000 cycles.
      2) High cycle spring: 25,000 cycles.
   f. Insulation: CFC-free and HCFC-free polyurethane, fully encapsulated.
   g. Thermal Values: R-value of 17.40; U-value of 0.057.
   h. Air Infiltration: 0.08 cfm at 15 mph; 0.08 cfm at 25 mph.
   i. Sound Transmission: Class 26.
   j. Partial Glazing of Steel Panels:
      1) 1/2 inch (12.5 mm) Clear Lexan Insulated glazing.
3. Finish and Color:
   a. Two coat baked-on polyester:
      1) Interior color, white.
      2) Exterior color, as chosen from Manufacturer's standard colors.
4. Windload Design: Provide to meet the Design/Performance requirements specified.
5. Hardware: Galvanized steel hinges and fixtures. Ball bearing rollers with hardened steel races.
6. Lock:
   a. Keyed lock with interlock switch for automatic operator.

7. Weatherstripping:
   a. EPDM bulb-type strip at bottom section.
   b. Flexible Jamb seals.
   c. Flexible Header seal.
8. Track: Provide track as recommended by manufacturer to suit loading required and clearances available. Door headroom is 20" max. Verify door will fit within given headroom.
   a. Size:
      1) 2 inch @ 12'-0" wide doors.
      2) 3 inch @ 20'-0" wide doors.
   b. Type:
      1) Standard lift.
9. Electric Motor Operation: Provide UL listed electric operator, size and type as recommended by manufacturer to move door in either direction at not less than 2/3 foot nor more than 1 foot per second. Operator shall meet UL325/2010 requirements for continuous monitoring of safety devices.
   a. Entrapment Protection: Required for momentary contact, includes radio control operation.
      1) Pneumatic sensing edge up to 18 feet (5.5 m) wide. Constant contact only complying with UL 325/2010.
      2) Electric sensing edge monitored to meet UL 325/2010.
      3) Photoelectric sensors monitored to meet UL 325/2010.

b. Operator Controls:
   1) Push-button operated control stations with open, close, and stop buttons.
c. Special Operation:
   1) Radio control operation.

10. Emergency Manual Operation: Push-up type designed so required force for door operation does not exceed 25 lbf.

11. Emergency Operation Disconnect Device: Hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.

## PART 3 EXECUTION

### 3.1 EXAMINATION

A. Do not begin installation until openings have been properly prepared.

B. Verify wall openings are ready to receive work and opening dimensions and tolerances are within specified limits.

C. Verify electric power is available and of correct characteristics.

D. If preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

### 3.2 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.

### 3.3 INSTALLATION

A. Install overhead doors and track in accordance with approved shop drawings and the manufacturer’s printed instructions.

B. Coordinate installation with adjacent work to ensure proper clearances and allow for maintenance.

C. Anchor assembly to wall construction and building framing without distortion or stress.

D. Securely brace door tracks suspended from structure. Secure tracks to structural members only.

E. Fit and align door assembly including hardware.

F. Coordinate installation of electrical service. Complete power and control wiring from disconnect to unit components.

3.4 CLEANING AND ADJUSTING

A. Adjust door assembly to smooth operation and in full contact with weatherstripping.

B. Clean doors, frames and glass.

C. Remove temporary labels and visible markings.

3.5 PROTECTION

A. Do not permit construction traffic through overhead door openings after adjustment and cleaning.

B. Protect installed products until completion of project.

C. Touch-up, damaged coatings and finishes and repair minor damage before Substantial Completion.

**END OF SECTION**

# SECTION 085200 - WOOD WINDOWS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Aluminum-clad wood windows.

### 1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, glazing and fabrication methods, dimensions of individual components and profiles, hardware, and finishes for wood windows.

B. Shop Drawings: For wood windows.

1. Include plans, elevations, sections, hardware, accessories, insect screens, operational clearances, and details of installation, including anchor, flashing, and sealant installation.

### 1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each type of wood window, for tests performed by a qualified testing agency.

C. Field quality-control reports.

D. Sample Warranties: For manufacturer's warranties.

### 1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.

B. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.

C. Installer Qualifications: An installer acceptable to wood window manufacturer or supplier for installation of units required for this Project.

1.5 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace wood windows that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure to meet performance requirements.
b. Structural failures including excessive deflection, water leakage, and air infiltration.
c. Faulty operation of movable sash and hardware.
d. Deterioration of materials and finishes beyond normal weathering.
e. Failure of insulating glass.

2. Warranty Period:

a. Window: 10 years from date of Substantial Completion.
b. Glazing Units, Nonlaminated: 20 years from date of Substantial Completion.
c. Glazing Units, Laminated: 10 years from date of Substantial Completion.
d. Aluminum-Cladding Finish: **10** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain wood windows from single source from single manufacturer.

2.2 WINDOW PERFORMANCE REQUIREMENTS

A. Product Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.

1. Window Certification: WDMA certified with label attached to each window.

B. Performance Class and Grade: AAMA/WDMA/CSA 101/I.S.2/A440 as follows:

1. Minimum Performance Class: **R**.
2. Minimum Performance Grade: **35**.

C. Thermal Transmittance: NFRC 100 maximum whole-window U-factor of **0.30 Btu/sq. ft. x h x deg F (1.71 W/sq. m x K)**

D. Solar Heat-Gain Coefficient (SHGC): NFRC 200 maximum whole-window SHGC of **0.40.**

E. Sound Transmission Class (STC): Rated for not less than **26** STC when tested for laboratory sound transmission loss according to ASTM E90 and determined by ASTM E413.

F. Outside-Inside Transmission Class (OITC): Rated for not less than **22** OITC when tested for laboratory sound transmission loss according to ASTM E90 and determined by ASTM E1332.

## 2.3 WOOD WINDOWS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Pella Corporation **Lifestyle Series** or comparable product by one of the following:

1. Aluminum-Clad Wood Windows:

a. EAGLE Window & Door, Inc.; an Andersen Window & Door company.
b. Marvin Windows and Doors.
c. <**Insert manufacturer's name**>.

B. Operating Types: Provide the following operating types in locations indicated on Drawings:
1. Double hung.

C. Certified Wood: Wood products shall be certified as "FSC Pure"[ **or "FSC Mixed Credit"**] in accordance with FSC STD-01-001 and FSC STD-40-004.

D. Frames and Sashes: Fine-grained wood lumber complying with AAMA/WDMA/CSA 101/I.S.2/A440; kiln dried to a moisture content of not more than 12 percent at time of fabrication; free of visible finger joints on linear members, blue stain, knots, pitch pockets, and surface checks larger than 1/32 inch (0.8 mm) deep by 2 inches (51 mm) wide; water-repellent preservative treated.

1. Exterior Finish: **Aluminum-clad** wood.

a. Aluminum Finish: **Manufacturer's standard baked-on enamel finish**.
b. Color: **As selected by Architect**.

2. Interior Finish: **Manufacturer's standard color-coated finish**
a. Painted Color: **White**.

E. Insulating-Glass Units: ASTM E2190.

1. Glass: ASTM C1036, Type 1, Class 1, q3.

a. Tint or Pattern: **Clear**, **Obscure (at restroom)**.

2. Lites: Two.
3. Filling: Fill space between glass lites with argon.
4. Low-E Coating: Sputtered on second or third surface.

F. Glazing System: Manufacturer's standard factory-glazing system that produces weathertight seal.

G. Hardware, General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, carbon steel complying with AAMA 907, or other corrosion-resistant material

compatible with adjacent materials; designed to smoothly operate, tightly close, and securely lock windows, and sized to accommodate sash weight and dimensions.

1. Exposed Hardware Color and Finish: **White**.

H. Hung Window Hardware:

1. Counterbalancing Mechanism: Complying with AAMA 902, concealed, of size and capacity to hold sash stationary at any open position.
2. Locks and Latches: Allow unobstructed movement of the sash across adjacent sash in direction indicated and operated from the inside only.
3. Tilt Hardware: Releasing tilt latch allows sash to pivot about horizontal axis to facilitate cleaning exterior surfaces from the interior.

I. Weather Stripping: Provide full-perimeter weather stripping for each operable sash unless otherwise indicated.

J. Fasteners: Noncorrosive and compatible with window members, trim, hardware, anchors, and other components.

1. Exposed Fasteners: Do not use exposed fasteners to greatest extent possible. For application of hardware, use fasteners that match finish hardware being fastened.

## 2.4 INSECT SCREENS

A. General: Fabricate insect screens to integrate with window frame. Provide screen for each operable exterior sash. Screen wickets are not permitted.

1. Type and Location: **Full, outside for double-hung** sashes.

B. Aluminum Frames: Manufacturer's standard aluminum alloy complying with SMA 1004 or SMA 1201. Fabricate frames with mitered or coped joints or corner extrusions, concealed fasteners, and removable PVC spline/anchor concealing edge of frame.

1. Tubular Framing Sections and Cross Braces: Roll formed from aluminum sheet.
2. Finish for Interior Screens: Baked-on organic coating in **color selected by Architect from manufacturer's full range**.
3. Finish for Exterior Screens: **Baked-on organic coating in color selected by Architect from manufacturer's full range**.

C. Glass-Fiber Mesh Fabric: 18-by-16 (1.1-by-1.3-mm) mesh of PVC-coated, glass-fiber threads; woven and fused to form a fabric mesh resistant to corrosion, shrinkage, stretch, impact damage, and weather deterioration. Comply with ASTM D3656/D3656M and SMA 1201.

1. Mesh Color: **Manufacturer's standard**.

## 2.5 FABRICATION

A. Fabricate wood windows in sizes indicated. Include a complete system for installing and anchoring windows.

B. Glaze wood windows in the factory.

C. Weather strip each operable sash to provide weathertight installation.

D. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation. Allow for scribing, trimming, and fitting at Project site.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Verify rough opening dimensions, levelness of sill plate, and operational clearances.

C. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure weathertight window installation.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components. For installation procedures and requirements not addressed in manufacturer's written instructions, comply with installation requirements in ASTM E2112.

B. Install windows level, plumb, square, true to line, without distortion, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction to produce weathertight construction.

C. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action (dissimilar materials, treated lumber, etc.) at the points of contact with other materials.

D. For fin method of attachment, integrate window system installation with exterior water-resistant barrier using flashing/sealant tape. Apply and integrate flashing/sealant tape with water-resistant barrier using watershed principles in accordance with window manufacturer's written instructions.

E. Place interior seal around window perimeter to maintain continuity of building thermal and air barrier using insulating-foam sealant.

F. Seal window to exterior wall cladding with sealant and related backing materials at perimeter of assembly.

G. Leave windows closed and locked.

## 3.3 ADJUSTING, CLEANING, AND PROTECTION

A. Adjust operating sashes and hardware for a tight fit at contact points and weather stripping for smooth operation and weathertight closure.

B. Clean exposed surfaces immediately after installing windows. Remove excess sealants, glazing materials, dirt, and other substances.

1. Keep protective films and coverings in place until final cleaning.

C. Remove and replace sashes if glass has been broken, chipped, cracked, abraded, or damaged during construction period.

D. Protect window surfaces from contact with contaminating substances resulting from construction operations. If contaminating substances do contact window surfaces, remove contaminants immediately in accordance with manufacturer's written instructions.

END OF SECTION 085200

SECTION 08 71 00 - FINISHING HARDWARE

PART 1 - GENERAL

1.01 DESCRIPTION:

A. Hardware Requirements:

1. Provide locks and other devices called for in the schedule.
2. The schedule is not intended to be entirely inclusive but is furnished to assist Contractor in determining the extent and quality of hardware required. Provide all related items and accessories as required for a fully functional system.
3. Hardware items not specifically mentioned shall be supplied in equal quality and type indicated in the schedule.

1.02 SUBMITTALS:

A. Submit complete schedule showing factory numbers and sizes for approval.

B. Furnish catalog cuts, drawings and other descriptive hardware data as required.

C. Submit evidence of purchase of permanent **Stanley Security Solutions Best Lock Corporation or Marshall Best Security Corporation** cores for all locksets, cylinders, and padlocks.

1.03 QUALITY ASSURANCE:

A. Applicable Federal Specifications:

1. Hardware types listed shall meet the requirements of the applicable provisions of the following Federal Specifications:

| | | |
|---|---|---|
| a. | Hinges | FF-H-00116d |
| b. | Locks and Door Trim | FF-H-00106c/gen. |
| c. | Door closer | FF-H-121d |
| d. | Door stops and bumpers | FF-H-111a |

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING:

A. Deliver hardware individually packed and labeled with item number corresponding to approved schedule.

1.05 JOB CONDITIONS:

A. Furnish correct hardware to fit the door and frame conditions, with special attention to threshold heights.

1.06 SUBSTITUTIONS:

A. Trade names and catalog numbers of a particular manufacturer are given as a means of describing type, materials, strength, design, quality, weight, mechanical construction and operation of hardware items and requirements to which such hardware shall conform.

B. Hardware of other manufacturers may be substituted upon written approval of the Designer with the following exceptions:

1. All keyed locks shall have cores manufactured by **Stanley Security Solutions Best Lock Corporation, Indianapolis, Indiana, or Marshall Best Security Corporation.**

1.07 SPECIAL KEYING REQUIREMENTS:

A. Construction and permanent cores and temporary and permanent keys for all locks.

1. Construction cores will remain the property of the Stanley Security Solution Best Lock Corporation, (or Marshall Best Security Corporation) and will be exchanged by the Owner for permanent cores master-keyed to the Owners system.
2. Control key and operating keys for construction shall not be part of Owner's permanent master-key system. Control key and one (1) operating key shall be furnished to Owner prior to occupancy.
3. Contractor shall, at no additional charge, furnish credit to the Owner direct from Best Lock Corporation factory or sales representative the following items:

a. One (1) permanent core keyed lock.
b. Two (2) keys per permanent core.

4. **All keyed locks** shall be furnished with construction cores. **All exterior locks** shall be furnished with **brass** construction cores.

1.08 GUARANTEE:

A. Guarantee in writing that hardware furnished is free from defects in material and workmanship. Guarantee shall be for a period of one year from date of final acceptance.

B. Agree to repair or replace defective hardware during the guarantee period at no additional cost to Owner.

PART 2 - PRODUCTS

2.01 FABRICATION:

A. General:

1. All hardware shall be of best manufacture in quality, finish and design free from defects.
2. Finish for hardware: U.S. 26D unless otherwise indicated.

B. Locksets: as specified.

1. Back set: 2 3/4 inches.

C. Door closer: comply with manufacturer's recommendations for individual door size and location.

1. Closer Bodies: cast iron, with malleable iron arms.
2. Provide parallel arms, corner brackets and drop plates as required.
3. Where wall conditions permit, all door closer shall swing 180 degrees.
4. Accessible Entrance Closer shall meet American's with Disabilities Act of 1990 amended to date.

D. Butts-Hinges:

1. Full mortise type, 4 ½ inches by 4 ½ inches, unless otherwise indicated.
2. Supply butts of sufficient width to swing 180 degrees or to nearest wall.
3. All exterior doors, which swing out, shall have non-removable hinge pins.

E. Stops and Holders: dome type, cast bronze, with rubber cushions.

F. Anchors for thresholds and door stops: lead machine screw anchors. Rawl plugs are not acceptable.

## PART 3 - EXECUTION

### 3.01 INSPECTION:

A. Examine the drawings, projections of trim and rebates to permit door to free swing 180 degrees or to the closest adjacent wall.

B. Check thickness of doors and verify sizes of all hardware, for proper fit and performance.

### 3.02 INSTALLATION:

A. All hardware shall be installed by mechanics skilled in the application of institutional grade hardware.

B. All instruction sheets and installation details, which are packed with the hardware, shall be read and understood before an attempt is made to install the hardware.

C. Install finishing hardware without marring adjacent work. After fitting, remove until painting is completed, then reinstall.

D. Thresholds:

1. Bedded in synthetic rubber sealant.
2. Fasten with lead machine screw anchors.
3. Shall not be pre-drilled.
4. Accessible Entrance Thresholds shall meet American's with Disabilities Act of 1990 amended to date.

E. After installation, all templates, instruction sheets, and installation details, shall be placed in a file folder to be turned over to Owner when building is accepted.

3.03 ADJUSTMENT:

A. Examine hardware at work completion.

B. Test, oil, grease, ease, and adjust hardware for perfect operation.

3.04 HARDWARE SCHEDULE:

A. All work shall be Grade 1 and ADA compliant

B. Unless otherwise indicated, provide Hager or approved equal hardware for each door opening.

C. Provide Cormax Cores

D. Hardware listed in schedule is taken from the catalogs of the following manufacturers:

| | | |
|---|---|---|
| 1. | Butts | Hager |
| 2. | Locks and Door Trim | Stanley Best |
| 3. | Door closer | LCN |
| 4. | Stop Bumpers | Hager |
| 5. | Silencers | Hager |
| 6. | Thresholds | National Guard |
| 7. | Flush Bolts | Glynn Johnson |
| 8. | Door Seals and Bottoms | |
| 9. | Drip Guard | |

E. DOOR SCHEDULE:

Unisex Restroom #105 Door (Labeled as A):

| | | |
|---|---|---|
| 1. | 3 ea. BB1279 4 ½ x 4 ½ | HAG |
| 2. | 1 ea. Lockset – 9K3-0L-15K - STD - 626 | S. Best (Privacy) |
| 3. | 1 ea. Door stop wall mount – 232W | HAG |
| 4. | 3 ea. Silencers – 307D GR | HAG |

Mech #103, Storage #104, (Labeled as A1):

| | | |
|---|---|---|
| 1. | 3 ea. BB1279 4 ½ x 4 ½ | HAG |
| 2. | 1 ea. Lockset – 9K3-7D-15K - STD - 626 | S. Best (Make passage) |
| 3. | 1 ea. Door stop wall mount – 232W | HAG |
| 4. | 3 ea. Silencers – 307D GR | HAG |

Exterior Entry Doors (Labeled as B):

| | | |
|---|---|---|
| 1. | 3 ea. BB1279 4 ½ x 4 ½ | HAG |
| 2. | 1 ea. Lockset - 93K7AB15K - STK - 626 | S. Best (Entry) |
| 3. | 1 ea. Closer – 4111 DEL HEDA | LCN |
| 4. | 1 ea. Threshold - 427 Alum. | N.G. |
| 5. | 1 ea. Door Drip 16A | N.G. |
| 6. | 1 set Weather-strip - 160 VA | N.G. |
| 7. | 1 set door bottom seal – 15NA | N.G. |
| 8. | 3 ea. Silencers – 307D GR | HAG |

Pair of Interior Doors (Labeled as C).

| | | |
|---|---|---|
| 1. | 3 ea. BB1279 4 ½ x 4 ½ | HAG |
| 2. | 1 ea. Lockset - 93K7N15K - STK - 626 | S. Best (Passage) |
| 3. | 1 pr. Flush Bolts – FB6 with 1 ea. Dust Proof Strike | G.J. |
| 4. | 2 ea. Door stop wall mount – 232W | HAG |
| 5. | 1 set Weather-strip - 160VA | N.G. |
| 6. | 1 set Door bottom seal – 15NA | N.G |
| 7. | 3 ea. Silencers – 307D GR | HAG |

Sectional Upward Acting Garage Doors (Labeled as D1 and D2):

| | | |
|---|---|---|
| 1. | See Section 08361 for Hardware Requirements. | |
| 2. | 1 ea. Rim cylinder 1E-62-S2-RP-626 | S. Best |

Miscellaneous Hardware:

1. Provide all items of miscellaneous hardware required for finished carpentry.

END OF SECTION

# SECTION 092900 - GYPSUM BOARD

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Interior gypsum board.

### 1.2 ACTION SUBMITTALS

A. Product Data: For the following:
1. Mold-resistant gypsum board.
2. Joint treatment materials.

### 1.3 DELIVERY, STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

### 1.4 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

## PART 2 - PRODUCTS

### 2.1 GYPSUM BOARD, GENERAL

A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

B. Regional Materials: Gypsum panel products shall be manufactured in United States. Materials used for production of Gypsum panel and all related materials shall be extracted, harvested, or recovered in United States.

## 2.2 INTERIOR GYPSUM BOARD

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. American Gypsum.
2. National Gypsum Company.
3. USG Corporation.

B. Mold-Resistant Gypsum Board: ASTM C1396/C1396M. With moisture- and mold-resistant core and paper surfaces.

1. Core: 1/2 inch
2. Long Edges: Tapered.
3. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

## 2.3 TRIM ACCESSORIES

A. Interior Trim: ASTM C1047.

1. Material: Plastic
2. Shapes:

a. Cornerbead.
b. U-Bead: J-shaped; exposed short flange does not receive joint compound.

## 2.4 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C475/C475M.

B. Joint Tape:

1. Interior Gypsum Board: Paper.

C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.

## 2.5 AUXILIARY MATERIALS

A. Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.

B. Steel Drill Screws: ASTM C1002 unless otherwise indicated.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION AND FINISHING OF PANELS, GENERAL

A. Comply with ASTM C840.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

F. Wood Framing: Install gypsum panels over wood framing, with floating internal corner construction. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members or provide control joints to counteract wood shrinkage.

### 3.3 INSTALLATION OF INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:
   1. Mold-Resistant Type: Unisex Restroom 105

B. Single-Layer Application:

   1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.

2. On partitions/walls, apply gypsum panels horizontally (perpendicular to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.

    a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
3. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

## 3.4 INSTALLATION OF TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints according to ASTM C840.

C. Interior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners.
2. U-Bead: Use at exposed panel edges.

## 3.5 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints, beveled edges, and damaged surface areas.

C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C840:

1. Level 1: Concealed areas, and where indicated.
2. Level 4: At surfaces that will be exposed to view unless otherwise indicated.

    a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."

## 3.6 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

C. Remove and replace panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900

# SECTION 099000 - PAINTING

## 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. Primers
   2. Water-based finish coatings

### 1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples: For each type of topcoat product indicated.

C. Samples for Verification: For each type of paint system and in each color and gloss of topcoat indicated.

   1. Submit Samples on rigid backing, 8 inches square.
   2. Step coats on Samples to show each coat required for system.
   3. Label each coat of each Sample, for location and application area.

### 1.4 QUALITY ASSURANCE

A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

### 1.5 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 .

### 1.6 PROJECT CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

## 1.7 EXTRA MATERIALS

A. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.

1. Quantity: Furnish an additional 5 percent, but not less than 1 gal. of each material and color applied.

# PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

A. **Basis-of-Design Products**: Sherwin-Williams Company (The).

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Benjamin Moore & Co.
2. PPG Architectural Finishes, Inc.

## 2.2 PAINT, GENERAL

A. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.

B. Colors: As selected by Architect from manufacturer's full range.

## 2.3 PRIMERS/SEALERS

A. Interior Latex Primer/Sealer:
1. Sherwin-Williams, ProMar 200 Zero VOC Latex Primer

## 2.4 METAL PRIMERS

A. Interior:
1. Pro Industrial Pro-Cryl Universal Acrylic Primer

2.5 WOOD PRIMERS

A. Interior Latex-Based Wood Primer:
   1. Sherwin-Williams, : PrepRite ProBlock® Latex Primer/Sealer, B51 Series.

2.6 PAINTS

A. Interior Latex Paint:

   1. Sherwin-Williams, ProMar 200 Zero VOC Interior **Flat: Restroom Ceiling**

   2. Sherwin-Williams, ProMar 200 Zero VOC Interior **Eg-Shel: Plywood Walls (Break Room)**

   3. Sherwin -Williams, Pro Industrial™ Acrylic Semi-Gloss, B66-650 Series**: Non-traffic Wood Trim.**

B. Interior (Semi-gloss): **Walls in Restrooms**

   1. Sherwin-Williams, Pro Industrial Pre-Catalyzed Waterbased Epoxy Semi-gloss

C. Metal

   1. Sherwin-Williams, Pro Industrial Acrylic Semi-Gloss

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.

B. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers. Begin coating application only after unsatisfactory conditions have been corrected and surface is dry.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.

B. Remove plates, machined surfaces, and similar items already in place that are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting. After completing painting operations, reinstall items that were removed.
   1. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

C. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.

D. Gypsum Board Substrates: Do not begin paint application until finishing compound is dry and sanded smooth.

## 3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions.

## 3.4 CLEANING AND PROTECTION

A. After completing paint application, clean spattered surfaces. Do not scratch or damage adjacent finished surfaces. Correct damage to work of other trades by cleaning, replacing, and refinishing. At completion of construction, touch up and restore defaced painted surfaces.

## 3.5 INTERIOR PAINTING SCHEDULE

A. Gypsum Board Substrates Ceilings (Restroom 105):
1. Prime Coat: Sherwin-Williams, ProMar 200 Zero VOC Latex Primer.
2. Intermediate Coat: Sherwin-Williams, ProMar 200 Zero VOC Interior Flat.
3. Topcoat: Sherwin-Williams, ProMar 200 Zero VOC Interior Flat

B. Gypsum Board Substrate Walls – (Restroom 105):
1. Prime Coat: Sherwin -Williams, ProMar 200 Zero VOC Latex Primer.
2. Intermediate Coat: S-W, Pro Industrial Pre-Catalyzed Waterbased Epoxy Semi-gloss.
3. Topcoat: Pro Industrial Pre-Catalyzed Waterbased Epoxy Semi-gloss

C. Wood Substrate, Non-traffic Surfaces (Interior Trim):
1. Prime Coat: Sherwin -Williams: PrepRite ProBlock® Latex Primer/Sealer, B51 Series
2. Intermediate Coat: Sherwin -Williams, Pro Industrial™ Acrylic Semi-Gloss, B66-650 Series
3. Topcoat: Sherwin -Williams, Pro Industrial™ Acrylic Semi-Gloss, B66-650 Series

D. Wood Substrate, Plywood Walls (Break Room 102):
1. Prime Coat: Sherwin -Williams, ProMar 200 Zero VOC Latex Primer.
2. Intermediate Coat: Sherwin -Williams, ProMar 200 Zero VOC Interior Eg-Shel:.
3. Topcoat: Sherwin -Williams, ProMar 200 Zero VOC Interior Eg-Shel:.

E. Metal Substrates (Interior Doors and Frames):
1. Prime Coat: Sherwin – Williams, Pro Industrial Pro-Cryl Universal Acrylic Primer.
2. Intermediate Coat: Sherwin-Williams, Pro Industrial Acrylic Semi Gloss.
3. Topcoat: Sherwin-Williams, Pro Industrial Acrylic Semi-Gloss.

## 3.6 EXTERIOR PAINTING SCHEDULE

A. Metal Substrates (Exterior Doors and Frames)

1. Prime Coat: Sherwin – Williams, Pro Industrial Pro-Cryl Universal Acrylic Primer.
2. Intermediate Coat: Sherwin-Williams, Pro Industrial Acrylic Semi Gloss.
3. Topcoat: Sherwin-Williams, Pro Industrial Acrylic Semi-Gloss.

END OF SECTION 099123

# SECTION 101423.16 - ROOM-IDENTIFICATION PANEL SIGNAGE

## 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 room-identification signs that are directly attached to the building.

### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For room-identification signs.

1. Include fabrication and installation details and attachments to other work.
2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
3. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign at least half size.

C. Product Schedule: For room-identification signs. Use same designations indicated on Drawings or specified.

### 1.4 WARRANTY

A. Special Warranty: 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 embedded graphic image.
c. Separation or delamination of sheet materials and components.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design.

2.2 ROOM-IDENTIFICATION SIGNS

A. Room-Identification Sign: Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. ASI Sign Systems, Inc.

b. Approved equal

2. Laminated-Sheet Sign: Photopolymer face sheet with raised graphics laminated to acrylic backing sheet to produce composite sheet.

a. Composite-Sheet Thickness: Manufacturer's standard for size of sign.
b. Surface-Applied Graphics: Size and projection as required by ADA standards.
c. Color: As selected by Architect from manufacturer's full range. Signage colors to contrast as required by ADA standards.

3. Mounting: Manufacturer's standard method for substrates indicated.

4. Text and Typeface: Accessible raised characters and Braille (Grade 2, contracted). Finish raised characters to contrast with background color, and finish Braille to match background color.

2.3 SIGN MATERIALS

A. Acrylic Sheet: ASTM D4802, category as standard with manufacturer for each sign, Type UVF (UV filtering).

B. Vinyl Film: UV-resistant vinyl film with pressure-sensitive, permanent adhesive; die cut to form characters or images as indicated on Drawings.

C. Paints and Coatings for Sheet Materials: Inks, dyes, and paints that are recommended by manufacturer for optimum adherence to surface and are UV and water resistant for colors and exposure indicated.

## 2.4 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following:

1. Use concealed fasteners and anchors unless indicated to be exposed.
2. For exterior exposure, furnish stainless-steel devices unless otherwise indicated.
3. Exposed Metal-Fastener Components, General:

    a. Fabricated from same basic metal and finish of fastened sign unless otherwise indicated.
    b. Fastener Heads: Tamper Proof

4. Sign Mounting Fasteners:

    a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of sign material or screwed into back of sign assembly unless otherwise indicated.
    b. Through Fasteners: Exposed metal fasteners matching sign finish, with type of head indicated, and installed in predrilled holes.

## 2.5 FABRICATION

A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.

1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
3. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
4. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.

## 2.6 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.

1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Install signs so they do not protrude or obstruct according to the accessibility standard.
3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.

B. Accessibility: Install signs in locations on walls according to the accessibility standards.

C. Mounting Methods:

1. Tamper Proof Screws.

3.2 ADJUSTING AND CLEANING

A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

B. Remove temporary protective coverings and strippable films as signs are installed.

C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

**SCHEDULE:**

**Signage Location Schedule:**

**Breakroom 102**

**Storage 103**

**Mechanical 104**

**Uni-sex Restroom 105**

**Tactile exit sign in Breakroom 102**

**Weight limit signage for Breakroom 102**

**Hazardous Materials Area**

END OF SECTION 101423.16

# SECTION 123623.13 - PLASTIC-LAMINATE-CLAD COUNTERTOPS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Plastic-laminate-clad countertops.

B. Related Requirements:
1. Section 64116 “Plastic Laminate Clad Architectural Cabinets”

### 1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For plastic-laminate-clad countertops.

1. Include plans, sections, details, and attachments to other work. Detail fabrication and installation, including field joints.
2. Show locations and sizes of cutouts and holes for items installed in plastic-laminate-clad countertops.
3. Apply AWI Quality Certification Program label to Shop Drawings.

C. Samples: Plastic laminates in each type, color, pattern, and surface finish required in manufacturer's standard size.

### 1.3 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

1. Shop Certification: AWI's Quality Certification Program accredited participant.

### 1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver countertops only after casework and supports on which they will be installed have been completed in installation areas.

B. Store countertops in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

C. Keep surfaces of countertops covered with protective covering during handling and installation.

1.5 FIELD CONDITIONS

A. Environmental Limitations with Humidity Control: Do not deliver or install countertops until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F (16 and 32 deg C) and relative humidity between 25 and 55 percent during the remainder of the construction period.

B. Field Measurements: Where countertops are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Established Dimensions: Where countertops are indicated to fit to other construction, establish dimensions for areas where countertops are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 PLASTIC-LAMINATE-CLAD COUNTERTOPS

A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of plastic-laminate-clad countertops indicated for construction, finishes, installation, and other requirements.

B. Grade: Custom or better.

C. High-Pressure Decorative Laminate: NEMA LD 3, Grade HGS.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Formica Corporation.
b. Wilsonart.
c. Approved equal.

D. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
1. As selected by Owner from manufacturer's full range.

E. Edge Treatment: Same as laminate cladding on horizontal surfaces.

F. Edge Profile: As selected by Owner from manufacturer's full range.

G. Core Material: Particleboard or MDF.

H. Core Thickness: 3/4 inch.

1. Build up countertop thickness to 1-1/2 inches at front, back, and ends with additional layers of core material laminated to top.

I. Backsplash: As selected by Owner from manufacturer's full range.

## 2.2 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard unless otherwise indicated.

B. Composite Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of countertop and quality grade specified unless otherwise indicated.
1. MDF: Medium-density fiberboard, ANSI A208.2, Grade 130.
2. Particleboard: ANSI A208.1, Grade M-2.
3. Softwood Plywood: DOC PS 1.

## 2.3 ACCESSORIES

A. Wire-Management Grommets: Circular, molded-plastic grommets and matching plastic caps with slot for wire passage.
1. Outside Diameter: As selected from Manufacturer’s standards.
2. Color: As selected from Manufacturer’s standards.

## 2.4 MISCELLANEOUS MATERIALS

A. Adhesive for Bonding Plastic Laminate: As selected by fabricator to comply with requirements.

1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

## 2.5 FABRICATION

A. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.

B. Fabricate countertops to dimensions, profiles, and details indicated. Provide front and end overhang of 1 inch over base cabinets. Ease edges to radius indicated for the following:

1. Solid-Wood (Lumber) Members: 1/16 inch unless otherwise indicated.

C. Complete fabrication, including assembly, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

## PART 3 - EXECUTION

### 3.1 PREPARATION

A. Before installation, condition countertops to average prevailing humidity conditions in installation areas.

B. Before installing countertops, examine shop-fabricated work for completion and complete work as required, including removal of packing.

### 3.2 INSTALLATION

A. Assemble countertops and complete fabrication at Project site to the extent that it was not completed in the shop.

1. Provide cutouts for appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately, and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
2. Seal edges of cutouts by saturating with varnish.

B. Field Jointing: Where possible, make in the same manner as shop jointing, using dowels, splines, adhesives, and fasteners recommended by manufacturer. Prepare edges to be joined in shop so Project-site processing of top and edge surfaces is not required. Locate field joints where shown on Shop Drawings.

1. Secure field joints in countertops with concealed clamping devices located within 6 inches of front and back edges and at intervals not exceeding 24 inches. Tighten in accordance with manufacturer's written instructions to exert a constant, heavy-clamping pressure at joints.

C. Scribe and cut countertops to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

D. Countertop Installation: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.

1. Install countertops level and true in line. Use concealed shims as required to maintain not more than a 1/8-inch-in-96-inches variation from a straight, level plane.
2. Seal joints between countertop and backsplash, if any, and joints where countertop and backsplash abut walls with mildew-resistant silicone sealant or another permanently elastic sealing compound recommended by countertop material manufacturer.

### 3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective countertops, where possible, to eliminate functional and visual defects. Where not possible to repair, replace countertops. Adjust joinery for uniform appearance.

B. Clean countertops on exposed and semiexposed surfaces.

C. Protection: Provide Kraft paper or other suitable covering over countertop surfaces, taped to underside of countertop at a minimum of 48 inches o.c. Remove protection at Substantial Completion.

END OF SECTION 123623.13

# SECTION 220517 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Sleeves.
2. Sleeve-seal systems.
3. Grout.
4. Silicone sealants.

### 1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

### 1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

## PART 2 - PRODUCTS

### 2.1 SLEEVES

A. Cast-Iron Pipe Sleeves: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral water stop collar.

B. Steel Pipe Sleeves: ASTM A53/A53M, Type E, Grade B, Schedule 40, anticorrosion coated, with plain ends and integral welded water stop collar.

C. Galvanized-Steel Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

D. PVC Pipe Sleeves: ASTM D1785, Schedule 40.

### 2.2 SLEEVE-SEAL SYSTEMS

A. 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 minimum.

3. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
4. Pressure Plates: Carbon steel.
5. Connecting Bolts and Nuts: Carbon steel of length required to secure pressure plates to sealing elements.

## 2.3 GROUT

A. Description: Non-shrink for interior and exterior sealing openings in non-fire-rated walls or floors.

B. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

## 2.4 SILICONE SEALANTS

A. Silicone, S, NS, 25, NT: Single-component, non-sag, plus 25 percent and minus 25 percent movement capability, non-traffic-use, neutral-curing silicone joint sealant, ASTM C920, Type S, Grade NS, Class 25, Use NT.

B. Silicone, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and non-traffic-use, neutral-curing silicone joint sealant; ASTM C920, 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.

# PART 3 - EXECUTION

## 3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Cut sleeves to length for mounting flush with both surfaces.

    a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.

2. Using grout or, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.
2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint.

E. 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.

## 3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

## 3.3 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Leak Test: After allowing for a full cure, test sleeves and sleeve seals for leaks. Repair leaks and retest until no leaks exist.

B. Sleeves and sleeve seals will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

## 3.4 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Exterior Concrete Walls above Grade:

a. Piping Smaller Than NPS 6: Cast-iron pipe sleeves.
b. Piping NPS 6 and Larger: Cast-iron pipe sleeves.

2. Exterior Concrete Walls below Grade:

a. Piping Smaller than NPS 6 Cast-iron pipe sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

b. Piping NPS 6 and Larger; Cast-iron pipe sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

3. Concrete Slabs-on-Grade:

a. Piping Smaller than NPS 6 Cast-iron pipe sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

b. Piping NPS 6 and Larger: Cast-iron pipe sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

4. Concrete Slabs above Grade:

a. Piping Smaller Than NPS 6: Steel pipe sleeves.
b. Piping NPS 6 and Larger: Steel pipe sleeves.

5. Interior Partitions:

a. Piping Smaller Than NPS 6: Steel pipe sleeves.
b. Piping NPS 6 and Larger: Galvanized-steel sheet sleeves.

END OF SECTION 220517

# SECTION 220518 - ESCUTCHEONS FOR PLUMBING PIPING

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Escutcheons.
2. Floor plates.

### 1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

## PART 2 - PRODUCTS

### 2.1 ESCUTCHEONS

A. One-Piece, Steel Type: With polished, chrome-plated finish and setscrew fastener.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped steel with polished, chrome-plated finish and spring-clip fasteners.

C. One-Piece, Stamped-Steel Type: With polished, chrome-plated finish and spring-clip fasteners.

D. Split-Plate, Stamped-Steel Type: With polished, chrome-plated finish; concealed hinge; and spring-clip fasteners.

### 2.2 FLOOR PLATES

A. Split Floor Plates: Cast brass with concealed hinge.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of insulated piping and with OD that completely covers opening.

1. Escutcheons for New Piping and Relocated Existing Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep pattern.
b. Chrome-Plated Piping: One-piece steel with polished, chrome-plated finish.
c. Insulated Piping: One-piece steel with polished finish.
d. Insulated Piping: One-piece stamped steel or split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece steel with polished, chrome-plated finish.
f. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece stamped steel or split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
g. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece steel with polished, chrome-plated finish.
h. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece stamped steel or split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.

C. Install floor plates for piping penetrations of equipment-room floors.

D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. New Piping: Split floor plate.
2. Existing Piping: Split floor plate.

## 3.2 FIELD QUALITY CONTROL

A. Using new materials, replace broken and damaged escutcheons and floor plates.

END OF SECTION 220518

# SECTION 220523.12 - BALL VALVES FOR PLUMBING PIPING

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Brass ball valves.
2. Bronze ball valves.

### 1.2 ACTION SUBMITTALS

A. Shop drawings.

## PART 2 - PRODUCTS

### 2.1 GENERAL REQUIREMENTS FOR VALVES

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B1.20.1 for threads for threaded end valves.
2. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
3. ASME B16.18 for solder-joint connections.
4. ASME B31.9 for building services piping valves.

C. NSF Compliance: NSF 61 and NSF 372 for valve materials for potable-water service.

D. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.

E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

F. Valve Sizes: Same as upstream piping unless otherwise indicated.

G. Valve Actuator Types:

1. Gear Actuator: For quarter-turn valves NPS 4 and larger.
2. Handlever: For quarter-turn valves smaller than NPS 4.

H. Valves in Insulated Piping:

1. Include 2-inch stem extensions.
2. Extended operating handles of nonthermal-conductive material and protective sleeves that allow operation of valves without breaking vapor seals or disturbing insulation.
3. Memory stops that are fully adjustable after insulation is applied.

## 2.2 BRASS BALL VALVES

A. Brass Ball Valves, Two-Piece with Full Port and Brass Trim, Press Ends:

1. Description:

a. Standard: MSS SP-110 or MSS SP-145.
b. CWP Rating: Minimum 200 psig.
c. Body Design: Two piece.
d. Body Material: Forged brass.
e. Ends: Press.
f. Press Ends Connection Rating: Minimum 200 psig.
g. Seats: PTFE or RPTFE.
h. Stem: Brass.
i. Ball: Chrome-plated brass.
j. Port: Full.
k. O-Ring: Buna-N or EPDM.

## 2.3 BRONZE BALL VALVES

A. Bronze Ball Valves, Two-Piece with Full Port, and Bronze or Brass Trim, Press Ends:

1. Description:

a. Standard: MSS SP-110 or MSS-145.
b. CWP Rating: Minimum 200 psig.
c. Body Design: Two piece.
d. Body Material: Bronze.
e. Ends: Press.
f. Press Ends Connections Rating: Minimum 200 psig.
g. Seats: PTFE or RTPFE.
h. Stem: Bronze or brass.
i. Ball: Chrome-plated brass.
j. Port: Full.
k. O-Ring Seal: EPDM or Buna-N.

## PART 3 - EXECUTION

### 3.1 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

### 3.2 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.

### 3.3 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:

1. Brass ball valves, two-piece with full port and brass trim. Provide with threaded-joint ends.
2. Bronze ball valves, two-piece with full port and bronze or brass trim. Provide with threaded-joint ends.

END OF SECTION 220523.12

# SECTION 220523.14 - CHECK VALVES FOR PLUMBING PIPING

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Bronze swing check valves.
2. Bronze swing check valves, press ends.
3. Iron swing check valves.
4. Iron swing check valves with closure control.

### 1.2 ACTION SUBMITTALS

A. Product Data: For each type of valve.

1. Certification that products comply with NSF 61.

## PART 2 - PRODUCTS

### 2.1 GENERAL REQUIREMENTS FOR VALVES

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B1.20.1 for threads for threaded end valves.
2. ASME B16.1 for flanges on iron valves.
3. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
4. ASME B16.18 for solder joint.
5. ASME B31.9 for building services piping valves.

C. Drinking Water System Components - Health Effects and Drinking Water System Components - Lead Content Compliance: NSF 61 and NSF 372.

D. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.

E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

F. Valve Sizes: Same as upstream piping unless otherwise indicated.

G. Valve Bypass and Drain Connections: MSS SP-45.

## 2.2 BRONZE SWING CHECK VALVES

A. Bronze Swing Check Valves with Bronze Disc, Class 125:

1. Description:

a. Standard: MSS SP-80, Type 3.
b. CWP Rating: 200 psig.
c. Body Design: Horizontal flow.
d. Body Material: ASTM B62, bronze.
e. Ends: Threaded or soldered. See valve schedule articles.
f. Disc: Bronze.

## 2.3 IRON SWING CHECK VALVES

A. Iron Swing Check Valves with Metal Seats, Class 125:

1. Description:

a. Standard: MSS SP-71, Type I.
b. CWP Rating: 200 psig.
c. Body Design: Clear or full waterway.
d. Body Material: ASTM A126, gray iron with bolted bonnet.
e. Ends: Flanged or threaded. See valve schedule articles.
f. Trim: Bronze.
g. Gasket: Asbestos free.

# PART 3 - EXECUTION

## 3.1 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install swing check valves for proper direction of flow in horizontal position with hinge pin level.

## 3.2 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

## 3.3 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:

1. Pump-Discharge Check Valves:

a. NPS 2 and Smaller: Bronze swing check valves with bronze disc.
b. NPS 2-1/2 and Larger for Domestic Water: Iron swing check valves with lever and weight or spring; metal-seat check valves.
c. NPS 2-1/2 and Larger for Sanitary Waste and Storm Drainage: Iron swing check valves with lever and weight or spring.

B. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.

## 3.4 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 (DN 50) and Smaller:

1. Bronze swing check valves bronze disc, Class 125.

B. Pipe NPS 2-1/2 and Larger:

1. Iron swing check valves with metal seats, Class 125.
2. Iron swing check valves with closure control, lever and spring, Class 125.

END OF SECTION 220523.14

# SECTION 220523.15 - GATE VALVES FOR PLUMBING PIPING

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Bronze gate valves.

### 1.2 ACTION SUBMITTALS

A. Product Data: For each type of valve.

1. Certification that products comply with NSF 61 and NSF 372.

## PART 2 - PRODUCTS

### 2.1 GENERAL REQUIREMENTS FOR VALVES

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B1.20.1 for threads for threaded end valves.
2. ASME B16.1 for flanges on iron valves.
3. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
4. ASME B16.18 for solder joint.
5. ASME B31.9 for building services piping valves.

C. NSF Compliance: NSF 61 and NSF 372 for valve materials for potable-water service.

D. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.

E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

F. Valve Sizes: Same as upstream piping unless otherwise indicated.

G. RS Valves in Insulated Piping: With 2-inch stem extensions.

H. Valve Bypass and Drain Connections: MSS SP-45.

## 2.2 BRONZE GATE VALVES

A. Bronze Gate Valves, NRS, Class 125:

1. Description:

a. Standard: MSS SP-80, Type 1.
b. CWP Rating: 200 psig.
c. Body Material: Bronze with integral seat and screw-in bonnet.
d. Ends: Threaded or solder joint.
e. Stem: Bronze.
f. Disc: Solid wedge; bronze.
g. Packing: Asbestos free.
h. Handwheel: Malleable iron, bronze, or aluminum.

B. Bronze Gate Valves, RS, Class 125:

1. Description:

a. Standard: MSS SP-80, Type 2.
b. CWP Rating: 200 psig.
c. Body Material: Bronze with integral seat and screw-in bonnet.
d. Ends: Threaded or solder joint.
e. Stem: Bronze.
f. Disc: Solid wedge; bronze.
g. Packing: Asbestos free.
h. Handwheel: Malleable iron, bronze, or aluminum.

C. Bronze Gate Valves, Press Ends:

1. Description:

a. Standard: MSS SP-80 and MSS SP-139.
b. CWP Rating: Minimum 200 psig.
c. Body Material: Bronze with integral seat and union-ring bonnet.
d. Ends: Press.
e. Press Ends Connection Rating: Minimum 200 psig.
f. Stem: Brass or bronze rising.
g. Disc: Solid wedge; bronze.
h. Packing: Graphite.
i. Port: Full.
j. Handwheel: Malleable iron, bronze, or aluminum.

## PART 3 - EXECUTION

### 3.1 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install chainwheels on operators for gate valves NPS 4 and larger and more than 96 inches above floor. Extend chains to 60 inches above finished floor.

### 3.2 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

### 3.3 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. Use gate valves for shutoff service only.

B. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.

### 3.4 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:

1. Bronze gate valves, NRS, Class 125 with threaded ends.

END OF SECTION 220523.15

# SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING 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 ACTION SUBMITTALS

A. Product Data: For each type of product.

### 1.3 INFORMATIONAL SUBMITTALS

A. Welding certificates.

### 1.4 QUALITY ASSURANCE

A. Structural-Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M.

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code, Section IX---Latest version adopted by the State of Indiana.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

## 2.2 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, hot-dip galvanized, or electro-galvanized.
3. Nonmetallic Coatings: Plastic coated or epoxy powder coated.
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 and Tube Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

## 2.3 TRAPEZE PIPE HANGERS

A. Description: MSS SP-58, 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.

## 2.4 THERMAL HANGER-SHIELD INSERTS

A. Insulation-Insert Material for Cold Piping: ASTM C552, Type II cellular glass with 100-psig minimum compressive strength and vapor barrier.

B. Insulation-Insert Material for Hot Piping: ASTM C552, Type II cellular glass with 100-psig minimum compressive strength.

C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

E. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

## 2.5 FASTENER SYSTEMS

A. 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 anchors, for use in hardened Portland cement concrete, with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Indoor Applications: Zinc-coated steel.
2. Outdoor Applications: Stainless steel.

## 2.6 PIPE-POSITIONING SYSTEMS

A. Description: IAPMO PS 42 positioning system composed of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

## 2.7 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural-carbon-steel shapes.

## 2.8 MATERIALS

A. Carbon Steel: ASTM A1011/A1011M.

B. Structural Steel: ASTM A36/A36M carbon-steel plates, shapes, and bars; black and galvanized.

C. Stainless Steel: ASTM A240/A240M.

D. Grout: ASTM C1107/C1107M, 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 APPLICATION

A. 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.

## 3.2 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-58. 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 A36/A36M 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.

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 of same thickness as piping insulation.

## 3.3 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment, and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

## 3.4 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers.

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.

## 3.5 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

## 3.6 PAINTING

A. Touchup: Clean field welds and abraded, shop-painted areas. Paint exposed areas immediately after erecting hangers and supports. Use same materials as those used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas, and apply galvanizing-repair paint to comply with ASTM A780/A780M.

## 3.7 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-58 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 finishes.

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 attachments for general service applications.

F. Use stainless-steel pipe hangers and stainless-steel attachments for hostile environment applications.

G. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.

H. Use padded hangers for piping that is subject to scratching.

I. Use thermal hanger-shield inserts for insulated piping and tubing.

J. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2.
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg. F pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.

5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction occurs.
18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction occurs.
19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction occurs but vertical adjustment is unnecessary.
20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction occurs and vertical adjustment is unnecessary.
21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation, in addition to expansion and contraction, is required.

K. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

L. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment of up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg. F piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11 split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg. F piping installations.

M. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable-Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

N. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal Hanger-Shield Inserts: For supporting insulated pipe.

O. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load, and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load, and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load, and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:

    a. Horizontal (MSS Type 54): Mounted horizontally.
    b. Vertical (MSS Type 55): Mounted vertically.
    c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

P. Comply with MSS SP-58 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

Q. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

R. 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 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. Metal Labels for Equipment:

1. Material and Thickness: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Letter Color: Black.
3. Background Color: Yellow.
4. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
5. 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.
6. Fasteners: Stainless-steel rivets.
7. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
2. Letter Color: Black.
3. Background Color: Yellow.
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.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number, and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

## 2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.

B. Letter Color: Red.

C. Background Color: White.

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 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.

G. Fasteners: Stainless-steel rivets.

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. Pre-tensioned Pipe Labels: Pre-coiled, semi-rigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; 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. Domestic Water Piping

   a. Background: Safety green.
   b. Letter Colors: White.

2. Sanitary Waste and Storm Drainage Piping:

   a. Background Color: Safety black.
   b. Letter Color: White.

END OF SECTION 220553

# SECTION 220719 - PLUMBING PIPING INSULATION

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section includes insulating the following plumbing piping services:

1. Domestic hot-water piping.
2. Supplies and drains for handicap-accessible lavatories and sinks.

### 1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
3. Detail removable insulation at piping specialties, equipment connections, and access panels.
4. Detail application of field-applied jackets.

### 1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

### 1.4 QUALITY ASSURANCE

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

B. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Supply and Drain Protective Shielding Guards: ICC A117.1.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Products shall not contain asbestos, lead, mercury, or mercury compounds.

B. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

C. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Special-Shaped Insulation: ASTM C552, Type III.
2. Preformed Pipe Insulation without Jacket: Comply with ASTM C552, Type II, Class 1.
3. Preformed Pipe Insulation with Factory-Applied ASJ: Comply with ASTM C552, Type II, Class 2.
4. Factory fabricate shapes according to ASTM C450 and ASTM C585.

D. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C534, Type I for tubular materials.

E. Mineral-Fiber, Preformed Pipe Insulation:

1. Type I, 850 Deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C547, Type I, Grade A, with factory-applied ASJ.

2.2 INSULATING CEMENTS

A. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C449.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Cellular-Glass Adhesive: Two-component, thermosetting urethane adhesive containing no flammable solvents, with a service temperature range of minus 100 to plus 200 deg F.

1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.4 MASTICS AND COATINGS

A. Materials shall be compatible with insulation materials, jackets, and substrates.

B. Vapor-Retarder Mastic: Water based; suitable for indoor use on below-ambient services.

1. Water-Vapor Permeance: Comply with ASTM C755, Section 7.2.2, Table 2, for insulation type and service conditions.
2. Service Temperature Range: Minus 20 to plus 180 deg F.

C. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.

1. Water-Vapor Permeance: ASTM E96, greater than 1.0 perm at manufacturer's recommended dry film thickness.
2. Service Temperature Range: Minus 20 to plus 180 deg F.
3. Color: White.

## 2.5 SEALANTS

A. Joint Sealants for Cellular-Glass Products:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Permanently flexible, elastomeric sealant.
3. Service Temperature Range: Minus 100 to plus 300 deg. F.
4. Color: White or gray.

B. FSK and Metal Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg. F.
4. Color: Aluminum.

C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg. F.
4. Color: White.

## 2.6 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in. in a Leno weave, for pipe.

## 2.7 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C921, Type I, unless otherwise indicated.

B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. Adhesive: As recommended by jacket material manufacturer.
2. Color: White.
3. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
    a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

## 2.8 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C1136.

1. Width: 3 inches.
2. Thickness: 11.5 mils.
3. Adhesion: 90 ounces force/inch in width.
4. Elongation: 2 percent.
5. Tensile Strength: 40 lbf/inch in width.
6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C1136.

1. Width: 3 inches.
2. Thickness: 6.5 mils.
3. Adhesion: 90 ounces force/inch in width.
4. Elongation: 2 percent.
5. Tensile Strength: 40 lbf/inch in width.
6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.

1. Width: 2 inches.
2. Thickness: 6 mils.
3. Adhesion: 64 ounces force/inch in width.
4. Elongation: 500 percent.
5. Tensile Strength: 18 lbf/inch in width.

D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive

.

1. Width: 2 inches.
2. Thickness: 3.7 mils.
3. Adhesion: 100 ounces force/inch in width.
4. Elongation: 5 percent.
5. Tensile Strength: 34 lbf/inch in width.

## 2.9 SECUREMENTS

A. Aluminum Bands: ASTM B209 Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

## 2.10 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers :

1. Description: Manufactured plastic wraps for covering plumbing fixture and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

B. Protective Shielding Piping Enclosures:

1. Description: Manufactured plastic enclosure for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with ADA requirements.

# PART 3 - EXECUTION

## 3.1 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

## 3.2 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.

    a. For below-ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.

5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above-ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Cleanouts.

## 3.3 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

D. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.

## 3.4 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

C. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

## 3.5 INSTALLATION OF CELLULAR-GLASS INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient services, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as pipe insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of cellular-glass insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

## 3.6 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturers recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

## 3.7 INSTALLATION OF MINERAL-FIBER PREFORMED PIPE INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.

3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

## 3.8 INSTALLATION OF POLYOLEFIN INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Seal split-tube longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of polyolefin sheet insulation of same thickness as pipe insulation.

4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of polyolefin pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install cut sections of polyolefin pipe and sheet insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties, and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

## 3.9 FIELD-APPLIED JACKET INSTALLATION

A. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

B. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

C. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

## 3.10 FINISHES

A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below.

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by the Engineer of Record. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless-steel jackets.

## 3.11 FIELD QUALITY CONTROL

A. Perform tests and inspections.

## 3.12 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Hot and Recirculated Hot Water: Insulation shall be one of the following; thickness in accordance with the latest edition of the Indiana Energy Code:

1. Flexible Elastomeric.
2. Mineral-Fiber, Preformed Pipe Insulation.

B. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities: Insulation shall be one of the following:

1. Flexible Elastomeric.
2. Mineral-Fiber, Preformed Pipe Insulation, Type I.

END OF SECTION 220719

# SECTION 221116 - DOMESTIC WATER PIPING

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Copper tube and fittings.
2. Piping joining materials.
3. Transition fittings.
4. Dielectric fittings.

### 1.2 ACTION SUBMITTALS

A. Product Data: For transition fittings and dielectric fittings.

### 1.3 INFORMATIONAL SUBMITTALS

A. System purging and disinfecting activities report.

B. Field quality-control reports.

## PART 2 - PRODUCTS

### 2.1 PIPING MATERIALS

A. Potable-water piping and components shall comply with NSF 14, NSF 61, and NSF 372.

### 2.2 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.

B. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.

C. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.

D. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.

E. Copper Unions:

1. MSS SP-123.
2. Cast-copper-alloy, hexagonal-stock body.
3. Ball-and-socket, metal-to-metal seating surfaces.

4. Solder-joint or threaded ends.

## 2.3 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials:

1. AWWA C110/A21.10, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
2. Full-face or ring type unless otherwise indicated.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, lead-free alloys.

D. Flux: ASTM B 813, water flushable.

E. Brazing Filler Metals: AWS A5.8M/A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

## 2.4 TRANSITION FITTINGS

A. General Requirements:

1. Same size as pipes to be joined.
2. Pressure rating at least equal to pipes to be joined.
3. End connections compatible with pipes to be joined.

B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

## 2.5 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:

1. Standard: ASSE 1079.
2. Pressure Rating: 125 psig minimum at 180 deg. F.
3. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:

1. Standard: ASSE 1079.
2. Factory-fabricated, bolted, companion-flange assembly.
3. Pressure Rating: 125 psig minimum at 180 deg. F.

4. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Insulating Kits:

1. Non-conducting materials for field assembly of companion flanges.
2. Pressure Rating: 150 psig.
3. Gasket: Neoprene or phenolic.
4. Bolt Sleeves: Phenolic or polyethylene.
5. Washers: Phenolic with steel backing washers.

## PART 3 - EXECUTION

### 3.1 PIPING INSTALLATION

A. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."

B. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve inside the building at each domestic water-service entrance.

C. Install shutoff valve immediately upstream of each dielectric fitting.

D. Install water-pressure-reducing valves downstream from shutoff valves.

E. Install domestic water piping with 0.25 percent slope downward toward drain.

F. Rough-in domestic water piping for water-meter installation according to utility company's requirements.

G. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

H. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

I. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

J. Install piping to permit valve servicing.

K. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.

L. Install piping free of sags and bends.

M. Install fittings for changes in direction and branch connections.

N. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

O. Install thermometers on outlet piping from each water heater.

P. Install sleeves for piping penetrations of walls, ceilings, and floors.

Q. Install sleeve seals for piping penetrations of concrete walls and slabs.

R. Install escutcheons for piping penetrations of walls, ceilings, and floors.

## 3.2 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Brazed Joints" chapter.

E. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."

F. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

## 3.3 TRANSITION FITTING INSTALLATION

A. Install transition couplings at joints of dissimilar piping.

B. Transition Fittings in Underground Domestic Water Piping:

1. Fittings for NPS 1-1/2 and Smaller: Fitting-type coupling.
2. Fittings for NPS 2 and Larger: Sleeve-type coupling.

C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-to-metal transition fittings.

## 3.4 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric couplings.

C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges.

D. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

## 3.5 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with the following requirements:

1. Vertical Piping: MSS Type 8 or 42, clamps.
2. Individual, Straight, Horizontal Piping Runs--100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers
3. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Install hangers for copper piping with maximum horizontal spacing and minimum rod diameters, to comply with MSS-58.

C. Support horizontal piping within 12 inches of each fitting.

D. Support vertical runs of copper and ductile iron to comply with MSS-58.

## 3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.

C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
1. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
2. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
3. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

## 3.7 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Piping Inspections:

    a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by Owner.
    b. During installation, Owner at least one day before inspection must be made. Perform tests specified below in presence of Owner:

        1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
        2) Final Inspection: Arrange for Owner to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.

2. Piping Tests:

    a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
    b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
    c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
    d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
    e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
    f. Prepare reports for tests and for corrective action required.

B. Domestic water piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

## 3.8 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.

    a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
    b. Adjust calibrated balancing valves to flows indicated.

5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.

7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

## 3.9 CLEANING

A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:

a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
b. Fill and isolate system according to either of the following:

1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.

c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
d. Repeat procedures if biological examination shows contamination.
e. Submit water samples in sterile bottles to authorities having jurisdiction.

B. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.

C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

## 3.10 PIPING SCHEDULE

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.

D. Under-building-slab, domestic water, NPS 2 and smaller, shall be one of the following:

1. Hard copper tube, ASTM B 88, Type L; solder-joint fittings; and brazed joints.

E. Aboveground domestic water piping, NPS 2 and smaller, shall be one of] the following:

1. Hard copper tube, ASTM B 88, Type L.

END OF SECTION 221116

# SECTION 221119 - DOMESTIC WATER PIPING SPECIALTIES

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

### 1.2 SUMMARY

A. Section Includes:

1. Vacuum breakers.
2. Backflow preventers.
3. Balancing valves.
4. Temperature-actuated, water mixing valves.
5. Strainers.
6. Hose bibbs.
7. Wall hydrants.
8. Water-hammer arresters.

### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For domestic water piping specialties.

1. Include diagrams for power, signal, and control wiring.

C. Sustainable Design Submittals:

### 1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

### 1.5 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

A. Potable-water piping and components shall comply with NSF 61.

B. Comply with NSF 372 for low lead.

2.2 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

2.3 VACUUM BREAKERS

A. Pipe-Applied, Atmospheric-Type Vacuum Breakers

1. Standard: ASSE 1001.
2. Size: NPS 1/4 to NPS 3 as required to match connected piping.
3. Body: Bronze.
4. Inlet and Outlet Connections: Threaded.

B. Hose-Connection Vacuum Breakers :

1. Standard: ASSE 1011.
2. Body: Bronze, non-removable, with manual drain.
3. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.

2.4 BACKFLOW PREVENTERS

A. Intermediate Atmospheric-Vent Backflow Preventers :

1. Standard: ASSE 1012.
2. Operation: Continuous-pressure applications.
3. Size: Match line size/flow.
4. Body: Bronze.

B. Reduced-Pressure-Principle Backflow Preventers:

1. Standard: ASSE 1013.
2. Operation: Continuous-pressure applications.
3. Pressure Loss: 12 psig maximum, through middle third of flow range.

4. Body: Bronze for NPS 2 and smaller; cast iron with interior lining that complies with AWWA C550 for NPS 2-1/2 and larger.
5. End Connections: Threaded for NPS 2; flanged for NPS 2-1/2 and larger.
6. Configuration: Designed for horizontal, straight-through flow.
7. Accessories:

    a. Valves NPS 2 and Smaller: Ball type with threaded ends on inlet and outlet.
    b. Valves NPS 2-1/2 and Larger: Outside-screw and yoke-gate type with flanged ends on inlet and outlet.
    c. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

C. Double-Check, Backflow-Prevention Assemblies :

1. Standard: ASSE 1015.
2. Operation: Continuous-pressure applications unless otherwise indicated.
3. Pressure Loss: 5 psig maximum, through middle third of flow range.
4. Body: Bronze for NPS 2 and smaller; cast iron with interior lining that complies with AWWA C550 for NPS 2-1/2 and larger.
5. End Connections: Threaded for NPS 2 smaller; flanged for NPS 2-1/2 and larger.
6. Configuration: Designed for horizontal flow.
7. Accessories:

    a. Valves NPS 2 and Smaller: Ball type with threaded ends on inlet and outlet.
    b. Valves NPS 2-1/2 and Larger: Outside-screw and yoke-gate type with flanged ends on inlet and outlet.

## 2.5 BALANCING VALVES

A. Memory-Stop Balancing Valves :

1. Standard: MSS SP-110 for two-piece, copper-alloy ball valves.
2. Pressure Rating: 400-psig minimum CWP.
3. Size: NPS 2 or smaller.
4. Body: Copper alloy.
5. Port: Standard or full port.
6. Ball: Chrome-plated brass.
7. Seats and Seals: Replaceable.
8. End Connections: Solder joint or threaded.
9. Handle: Vinyl-covered steel with memory-setting device.

## 2.6 TEMPERATURE-ACTUATED, WATER MIXING VALVES

A. Water-Temperature Limiting Devices :

1. Standard: ASSE 1017.
2. Pressure Rating: 125 psig.

3. Type: Thermostatically controlled, water mixing valve.
4. Material: Bronze body with corrosion-resistant interior components.
5. Connections: Threaded inlets and outlet.
6. Accessories: Check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
7. Tempered-Water Setting: 110 deg. F.(Adjustable)

B. Primary, Thermostatic, Water Mixing Valves :

1. Standard: ASSE 1017.
2. Pressure Rating: 125 psig minimum unless otherwise indicated.
3. Type: Exposed-mounted, thermostatically controlled, water mixing valve.
4. Material: Bronze body with corrosion-resistant interior components.
5. Connections: Threaded union inlets and outlet.
6. Accessories: Manual temperature control, check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
7. Tempered-Water Setting: 110 deg. F (Adjustable).

## 2.7 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers :

1. Pressure Rating: 125 psig minimum unless otherwise indicated.
2. Body: Bronze for NPS 2 and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved, epoxy coated and] for NPS 2-1/2 and larger.
3. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
4. Screen: Stainless steel with round perforations unless otherwise indicated.
5. Perforation Size:

    a. Strainers NPS 2 and Smaller: 0.020 inch.
    b. Strainers NPS 2-1/2 to NPS 4: 0.045 inch.
    c. Strainers NPS 5 and Larger: 0.10 inch.

6. Drain: Pipe plug.

## 2.8 HOSE BIBBS

A. Hose Bibbs :

1. Standard: ASME A112.18.1 for sediment faucets.
2. Body Material: Bronze.
3. Seat: Bronze, replaceable.
4. Supply Connections: NPS 1/2 or NPS 3/4 threaded or solder-joint inlet.
5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
6. Pressure Rating: 125 psig.
7. Vacuum Breaker: Integral, non-removable, drainable, hose-connection vacuum breaker complying with ASSE 1011.

8. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
9. Finish for Service Areas: Rough bronze.
10. Finish for Finished Rooms: Chrome or nickel plated.
11. Operation for Equipment Rooms: Wheel handle.
12. Operation for Service Areas: Wheel handle.
13. Operation for Finished Rooms: Wheel handle.
14. Include integral wall flange with each chrome- or nickel-plated hose bibb.

## 2.9 WALL HYDRANTS

A. Non-freeze, Hot- and Cold-Water Wall Hydrants:

1. Standard: ASME A112.21.3M for self-draining wall hydrants.
2. Pressure Rating: 125 psig.
3. Casing and Operating Rods: Of length required to match wall thickness. Include wall clamps.
4. Inlet: NPS 3/4.
5. Outlet: Concealed.
6. Box: Deep, flush mounted with cover.
7. Box and Cover Finish: Polished nickel bronze.
8. Vacuum Breaker:

    a. Non-removable, manual-drain-type, hose-connection vacuum breaker complying with ASSE 1011 or backflow preventer complying with ASSE 1052.
    b. Garden-hose thread complying with ASME B1.20.7 on outlet.

# PART 3 - EXECUTION

## 3.1 INSTALLATION

A. Backflow Preventers: Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.

1. Locate backflow preventers in same room as connected equipment or system.
2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe-to-floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are unacceptable for this application.
3. Do not install bypass piping around backflow preventers.

B. Water Regulators: Install with inlet and outlet shutoff valves. Install pressure gauges on inlet and outlet.

C. Balancing Valves: Install in locations where they can easily be adjusted.

D. Temperature-Actuated, Water Mixing Valves: Install with check stops or shutoff valves on inlets and with shutoff valve on outlet.

1. Install cabinet-type units recessed in or surface mounted on wall as specified.

## 3.2 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. When installing piping specialties adjacent to equipment and machines, allow space for service and maintenance.

C. Comply with requirements for grounding equipment in the latest edition of the Indiana Electrical Code.

## 3.3 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Test each installed device according to authorities having jurisdiction (State of Indiana Department of Health and local water utility) and the device's reference standard.

B. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

## 3.4 ADJUSTING

A. Set field-adjustable pressure set points of water pressure-reducing valves.

B. Set field-adjustable flow set points of balancing valves.

C. Set field-adjustable temperature set points of temperature-actuated, water mixing valves.

END OF SECTION 221119

# SECTION 221316 - SANITARY WASTE AND VENT PIPING

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Hub-and-spigot, cast-iron soil pipe and fittings.
2. Copper tube and fittings.
3. PVC pipe and fittings.
4. Specialty pipe fittings.

### 1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 10-foot head of water.

### 2.2 PIPING MATERIALS

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

### 2.3 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 74, Service class.

B. Gaskets: ASTM C 564, rubber.

C. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

## 2.4 COPPER TUBE AND FITTINGS

A. Copper Type DWV Tube: ASTM B 306, drainage tube, drawn temper.

B. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.

C. Copper Pressure Fittings:

1. Copper Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
2. Copper Unions: MSS SP-123, copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

D. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.

1. Flange Gasket Materials: ASME B16.21, full-face, flat, nonmetallic, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

E. Solder: ASTM B 32, lead free with ASTM B 813, water-flushable flux.

## 2.5 PVC PIPE AND FITTINGS

A. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-DWV" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.

B. Solid-Wall PVC Pipe: Schedule 40,ASTM D 2665, drain, waste, and vent.

C. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.

D. Adhesive Primer: ASTM F 656.

E. Solvent Cement: ASTM D 2564.

## 2.6 SPECIALTY PIPE FITTINGS

A. Transition Couplings:

1. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
2. Unshielded, Non-pressure Transition Couplings:

a. Standard: ASTM C 1173.
b. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.

c. End Connections: Same size as and compatible with pipes to be joined.
d. Sleeve Materials:

1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
3) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

3. Shielded, Non-pressure Transition Couplings:

a. Standard: ASTM C 1460.
b. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
c. End Connections: Same size as and compatible with pipes to be joined.

## PART 3 - EXECUTION

### 3.1 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.

1. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations.
2. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends.

1. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical.
2. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe.

    a. Straight tees, elbows, and crosses may be used on vent lines.

3. Do not change direction of flow more than 90 degrees.
4. Use proper size of standard increasers and reducers if pipes of different sizes are connected.

    a. Reducing size of waste piping in direction of flow is prohibited.

K. Lay buried building waste piping beginning at low point of each system.

1. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream.
2. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
3. Maintain swab in piping and pull past each joint as completed.

L. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

M. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."

N. Install aboveground PVC piping according to ASTM D 2665.

O. Plumbing Specialties:

1. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary waste gravity-flow piping.

2. Install drains in sanitary waste gravity-flow piping.

P. Do not enclose, cover, or put piping into operation until it is inspected and approved by the engineer of record.

Q. Install sleeves for piping penetrations of walls, ceilings, and floors.

R. Install sleeve seals for piping penetrations of concrete walls and slabs.

S. Install escutcheons for piping penetrations of walls, ceilings, and floors.

## 3.2 JOINT CONSTRUCTION

A. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

B. Join copper tube and fittings with soldered joints according to ASTM B 828. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.

C. Grooved Joints: Cut groove ends of pipe according to AWWA C606. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections, over gasket, with keys seated in piping grooves. Install and tighten housing bolts.

D. Plastic, Non-pressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 appendixes.
3. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 appendixes.

## 3.3 SPECIALTY PIPE FITTING INSTALLATION

A. Transition Couplings:

1. Install transition couplings at joints of piping with small differences in ODs.
2. In Waste Drainage Piping: Unshielded, non-pressure transition couplings.

## 3.4 INSTALLATION OF HANGERS AND SUPPORTS

1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
2. Install stainless-steel pipe hangers for horizontal piping in corrosive environments.
3. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
4. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
5. Vertical Piping: MSS Type 8 or Type 42, clamps.
6. Install individual, straight, horizontal piping runs:

    a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer than 100 Feet: MSS Type 43, adjustable roller hangers.
    c. Longer than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.

7. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
8. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Install hangers for soil piping, with maximum horizontal spacing and minimum rod diameters, to comply with MSS-58(metallic) and the latest edition of the Indiana Plumbing Code.

C. Support horizontal piping and tubing within 12 inches of each fitting, valve, and coupling.

D. Support vertical runs of soil piping to comply with MSS-58(metallic), locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

## 3.5 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect waste and vent piping to the following:

1. Plumbing Fixtures: Connect waste piping in sizes indicated, but not smaller than required by plumbing code.
2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
3. Plumbing Specialties: Connect waste and vent piping in sizes indicated, but not smaller than required by plumbing code.
4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
5. Install horizontal backwater valves with cleanout cover flush with floor.
6. Equipment: Connect waste piping as indicated.

    a. Provide shutoff valve if indicated and union for each connection.
    b. Use flanges instead of unions for connections NPS 2-1/2 and larger.

D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

E. Make connections according to the following unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

## 3.6 IDENTIFICATION

A. Identify exposed sanitary waste and vent piping.

## 3.7 FIELD QUALITY CONTROL

A. During installation, notify The Engineer of Record at least 24 hours before inspection must be made. Perform tests specified below in their presence.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.

2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired.

a. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.

3. Leave uncovered and unconcealed new, altered, extended, or replaced waste and vent piping until it has been tested and approved.

a. Expose work that was covered or concealed before it was tested.

4. Roughing-in Plumbing Test Procedure: Test waste and vent piping except outside leaders on completion of roughing-in.

a. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water.
b. From 15 minutes before inspection starts to completion of inspection, water level must not drop.
c. Inspect joints for leaks.

5. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight.

a. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg.
b. Use U-tube or manometer inserted in trap of water closet to measure this pressure.
c. Air pressure must remain constant without introducing additional air throughout period of inspection.
d. Inspect plumbing fixture connections for gas and water leaks.

6. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
7. Prepare reports for tests and required corrective action.

## 3.8 CLEANING AND PROTECTION

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect sanitary waste and vent piping during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

D. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

E. Repair damage to adjacent materials caused by waste and vent piping installation.

## 3.9 PIPING SCHEDULE

A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.

B. Aboveground, soil and waste piping NPS 4 and smaller shall be one of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Copper Type DWV tube, copper drainage fittings, and soldered joints.
3. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
4. Dissimilar Pipe-Material Couplings: Non-pressure transition couplings.

C. Aboveground, soil and waste piping NPS 5 and larger shall be one the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
3. Dissimilar Pipe-Material Couplings: Non-pressure transition couplings.

D. Aboveground, vent piping NPS 4 and smaller shall be one of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Copper Type DWV tube, copper drainage fittings, and soldered joints.

    a. Option for Vent Piping, NPS 2-1/2 and NPS 3-1/2: Hard copper tube, Type M; copper pressure fittings; and soldered joints.
3. Solid-wall] PVC pipe, PVC socket fittings, and solvent-cemented joints.
4. Dissimilar Pipe-Material Couplings: Non-pressure transition couplings.

E. Underground, soil, waste, and vent piping NPS 4 and smaller shall be one of the following:

1. Service class, cast-iron soil piping; gaskets; and gasketed joints.
2. Solid wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
3. Dissimilar Pipe-Material Couplings: Non-pressure transition couplings.

F. Underground, soil and waste piping NPS 5 and larger shall be one of the following:

1. Service class, cast-iron soil piping; gaskets; and gasketed joints.
2. Solid-wall PVC pipe; PVC socket fittings; and solvent-cemented joints.
3. Dissimilar Pipe-Material Couplings: Non-pressure transition couplings.

END OF SECTION 221316

# SECTION 221319 - SANITARY WASTE PIPING SPECIALTIES

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Backwater valves.
2. Cleanouts.
3. Roof flashing assemblies.
4. Miscellaneous sanitary drainage piping specialties.

## PART 2 - PRODUCTS

### 2.1 ASSEMBLY DESCRIPTIONS

A. Sanitary waste piping specialties shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14 for plastic sanitary waste piping specialty components.

### 2.2 CLEANOUTS

A. Cast-Iron Exposed Cleanouts:

1. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
2. Size: Same as connected drainage piping
3. Closure: Countersunk plug.
4. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

B. Cast-Iron Wall Cleanouts:

1. Standard: ASME A112.36.2M. Include wall access.
2. Size: Same as connected drainage piping.
3. Body: As required to match connected piping.
4. Closure Plug:

    a. Brass.
    b. Countersunk head.
    c. Drilled and threaded for cover attachment screw.
    d. Size: Same as or not more than one size smaller than cleanout size.

5. Wall Access: Round cover plate with screw.

C. Plastic Floor Cleanouts :

1. Size: Same as connected branch.
2. Body: PVC.
3. Closure Plug: PVC.
4. Riser: Drainage pipe fitting and riser to cleanout of same material as drainage piping.

.

## 2.3 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Open Drains :

1. Description: Shop or field fabricate from ASTM A74, Service class, hub-and-spigot, cast-iron soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting joined with ASTM C564 rubber gaskets.
2. Size: Same as connected waste piping.

B. Deep-Seal Traps :

1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.
2. Size: Same as connected waste piping.

a. NPS 2: 4-inch-minimum water seal.
b. NPS 2-1/2 and Larger: 5-inch-minimum water seal.

C. Floor-Drain, Trap-Seal Primer Fittings:

1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
2. Size: Same as floor drain outlet with NPS ½ side inlet.

D. Air-Gap Fittings :

1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
2. Body: Bronze or cast iron.
3. Inlet: Opening in top of body.
4. Outlet: Larger than inlet.
5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

E. Sleeve Flashing Device :

1. Description: Manufactured, cast-iron fitting, with clamping device that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend 1 inch above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.
2. Size: As required for close fit to riser or stack piping.

F. Stack Flashing Fittings :

1. Description: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
2. Size: Same as connected stack vent or vent stack.

G. Vent Caps :

1. Description: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.
2. Size: Same as connected stack vent or vent stack.

H. Expansion Joints :

1. Standard: ASME A112.6.4.
2. Body: Cast iron with bronze sleeve, packing, and gland.
3. End Connections: Matching connected piping.
4. Size: Same as connected soil, waste, or vent piping.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

A. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated.

1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
2. Locate at each change in direction of piping greater than 45 degrees.
3. Locate at minimum intervals of 50 feet (15 m) for piping NPS 4 and smaller and 100 feet for larger piping.
4. Locate at base of each vertical soil and waste stack.

B. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

C. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

D. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.

E. Assemble open drain fittings and install with top of hub 1 inch above floor.

F. Install deep-seal traps on floor drains and other waste outlets, if indicated.

G. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.

1. Exception: Fitting may be omitted if trap has trap-seal primer connection.

2. Size: Same as floor drain inlet.

H. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

I. Install sleeve and sleeve seals with each riser and stack passing through floors with waterproof membrane.

J. Install vent caps on each vent pipe passing through roof.

K. Install expansion joints on vertical stacks and conductors. Position expansion joints for easy access and maintenance.

L. Install wood-blocking reinforcement for wall-mounting-type specialties.

M. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

## 3.2 CONNECTIONS

A. Install piping adjacent to equipment to allow service and maintenance.

B. Ground equipment according to the latest edition of the Indiana Electrical Code.

## 3.3 FLASHING INSTALLATION

A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required.

B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.

1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches specialty.

C. Set flashing on floors and roofs in solid coating of bituminous cement.

D. Secure flashing into sleeve and specialty clamping ring or device.

E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings.

F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

## 3.4 LABELING AND IDENTIFYING

A. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit.

## 3.5 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221319

# SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Balancing Air Systems:

a. Gas-Fired Furnace/Direct Expansion Air Conditioning.

### 1.2 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. NEBB: National Environmental Balancing Bureau.

C. TAB: Testing, adjusting, and balancing.

D. TABB: Testing, Adjusting, and Balancing Bureau.

E. TAB Specialist: An independent entity meeting qualifications to perform TAB work.

F. TDH: Total dynamic head.

### 1.3 INFORMATIONAL SUBMITTALS

A. Certified TAB reports.

### 1.4 QUALITY ASSURANCE

A. TAB Specialists Qualifications: Certified by AABC.

1. TAB Field Supervisor: Employee of the TAB specialist and certified by AABC.
2. TAB Technician: Employee of the TAB specialist and certified by AABC as a TAB technician.

B. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."

C. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.7.2.3 - "System Balancing."

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems designs that may preclude proper TAB of systems and equipment.

B. Examine installed systems for balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are applicable for intended purpose and are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine equipment performance data including fan curves.

1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

F. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

G. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, filters are clean, and equipment with functioning controls is ready for operation.

H. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

I. Examine operating safety interlocks and controls on HVAC equipment.

J. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

A. Prepare a TAB plan that includes strategies and step-by-step procedures for balancing the systems.

B. Perform system-readiness checks of HVAC systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:

1. Airside:

a. Duct systems are complete with terminals installed.
b. Volume, smoke, and fire dampers are open and functional.
c. Clean filters are installed.
d. Fans are operating, free of vibration, and rotating in correct direction.
e. Automatic temperature-control systems are operational.
f. Ceilings are installed.
g. Windows and doors are installed.
h. Suitable access to balancing devices and equipment is provided.

## 3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance" and in this Section.

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.

1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

## 3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Cross-check the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. For variable-air-volume systems, develop a plan to simulate diversity.

D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

G. Verify that motor starters are equipped with properly sized thermal protection.

H. Check dampers for proper position to achieve desired airflow path.

I. Check for airflow blockages.

J. Check condensate drains for proper connections and functioning.

K. Check for proper sealing of air-handling-unit components.

L. Verify that air duct system is sealed as specified in Section 233113 "Metal Ducts."

## 3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure total airflow.

a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.
b. Where duct conditions allow, measure airflow by Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses to obtain total airflow.
c. Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
d. If a reliable Pitot-tube traverse or coil traverse is not possible, measure airflow at terminals and calculate the total airflow.

2. Measure fan static pressures as follows:

a. Measure static pressure directly at the fan outlet or through the flexible connection.
b. Measure static pressure directly at the fan inlet or through the flexible connection.
c. Measure static pressure across each component that makes up the air-handling system.
d. Report artificial loading of filters at the time static pressures are measured.

3. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
4. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload occurs. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows.

1. Measure airflow of submain and branch ducts.
2. Adjust submain and branch duct volume dampers for specified airflow.
3. Re-measure each submain and branch duct after all have been adjusted.

C. Adjust air inlets and outlets for each space to indicated airflows.

1. Set airflow patterns of adjustable outlets for proper distribution without drafts.
2. Measure inlets and outlets airflow.
3. Adjust each inlet and outlet for specified airflow.
4. Re-measure each inlet and outlet after they have been adjusted.

## 3.6 TOLERANCES

A. Set HVAC system's airflow rates and water flow rates within the following tolerances:

1. Supply, Return, and Energy Recovery Fans and Equipment with Fans: Plus or minus 10 percent.
2. Air Outlets and Inlets: Plus or minus 10 percent.

B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

## 3.7 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
2. Include a list of instruments used for procedures, along with proof of calibration.
3. Certify validity and accuracy of field data.

B. Final Report Contents: In addition to certified field-report data, include the following:

1. Fan curves.
2. Manufacturers' test data.
3. Field test reports prepared by system and equipment installers.
4. Other information relative to equipment performance; do not include Shop Drawings and Product Data.

C. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.
2. Name and address of the TAB specialist.
3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of TAB supervisor who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
11. Summary of contents including the following:

a. Indicated versus final performance.
b. Notable characteristics of systems.
c. Description of system operation sequence if it varies from the Contract Documents.

12. Nomenclature sheets for each item of equipment.
13. Data for terminal units, including manufacturer's name, type, size, and fittings.
14. Notes to explain why certain final data in the body of reports vary from indicated values.
15. Test conditions for fans performance forms including the following:

a. Settings for outdoor-, return-, and exhaust-air dampers.
b. Conditions of filters.
c. Cooling coil, wet- and dry-bulb conditions.
d. Face and bypass damper settings at coils.
e. Fan drive settings including settings and percentage of maximum pitch diameter.
f. Inlet vane settings for variable-air-volume systems.
g. Settings for supply-air, static-pressure controller.
h. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air systems. Present each system with single-line diagram and include the following:

1. Quantities of outdoor, supply, return, and exhaust airflows.
2. Duct, outlet, and inlet sizes.
3. Balancing stations.
4. Position of balancing devices.

E. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:

1. Unit Data:

a. Unit identification.
b. Location.
c. Make and type.
d. Model number and unit size. inches and bore.
e. Center-to-center dimensions of sheave and amount of adjustments in inches.
f.
g. Manufacturer's serial number.
h. Unit arrangement and class.
i. Discharge arrangement.
j. Sheave make, size in
k. Number, make, and size of belts.
l. Number, type, and size of filters.

2. Motor Data:

a. Motor make, and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches and bore.

f. Center-to-center dimensions of sheave and amount of adjustments in inches.

3. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm.
b. Total system static pressure in inches wg.
c. Fan rpm.
d. Discharge static pressure in inches wg.
e. Filter static-pressure differential in inches wg.
f. Preheat-coil static-pressure differential in inches wg.
g. Cooling-coil static-pressure differential in inches wg.
h. Heating-coil static-pressure differential in inches wg.
i. Outdoor airflow in cfm.
j. Return airflow in cfm.
k. Outdoor-air damper position.
l. Return-air damper position.
m. Vortex damper position.

F. Apparatus-Coil Test Reports:

1. Coil Data:

a. System identification.
b. Location.
c. Coil type.
d. Number of rows.
e. Fin spacing in fins per inch o.c.
f. Make and model number.
g. Face area in sq. ft.
h. Tube size in NPS.
i. Tube and fin materials.
j. Circuiting arrangement.

2. Test Data (Indicated and Actual Values):

a. Airflow rate in cfm.
b. Average face velocity in fpm.
c. Air pressure drop in inches wg.
d. Outdoor-air, wet- and dry-bulb temperatures in deg F.
e. Return-air, wet- and dry-bulb temperatures in deg F.
f. Entering-air, wet- and dry-bulb temperatures in deg F.
g. Leaving-air, wet- and dry-bulb temperatures in deg F.
h. Refrigerant expansion valve and refrigerant types.
i. Refrigerant suction pressure in psig.
j. Refrigerant suction temperature in deg F.
k. Inlet steam pressure in psig.

G. Gas- and Oil-Fired Heat Apparatus Test Reports: In addition to manufacturer's factory startup equipment reports, include the following:

1. Unit Data:

a. System identification.
b. Location.
c. Make and type.
d. Model number and unit size.
e. Manufacturer's serial number.
f. Fuel type in input data.
g. Output capacity in Btu/h.
h. Ignition type.
i. Burner-control types.
j. Motor horsepower and rpm.
k. Motor volts, phase, and hertz.
l. Motor full-load amperage and service factor.
m. Sheave make, size in inches, and bore.
n. Center-to-center dimensions of sheave and amount of adjustments in inches.

2. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm.
b. Entering-air temperature in deg F.
c. Leaving-air temperature in deg F.
d. Air temperature differential in deg F.
e. Entering-air static pressure in inches wg.
f. Leaving-air static pressure in inches wg.
g. Air static-pressure differential in inches wg.
h. Low-fire fuel input in Btu/h.
i. High-fire fuel input in Btu/h.
j. Motor voltage at each connection.
k. Motor amperage for each phase.
l. .

H. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:

a. System identification.
b. Location.
c. Make and type.
d. Model number and size.
e. Manufacturer's serial number.
f. Arrangement and class.
g. Sheave make, size in inches, and bore.
h. Center-to-center dimensions of sheave and amount of adjustments in inches.

2. Motor Data:

a. Motor make, and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches, and bore.
f. Center-to-center dimensions of sheave, and amount of adjustments in inches.

g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm.
b. Total system static pressure in inches wg.
c. Fan rpm.
d. Discharge static pressure in inches wg.
e. Suction static pressure in inches wg.

I. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data:

a. System and air-handling-unit number.
b. Location and zone.
c. Traverse air temperature in deg F.
d. Duct static pressure in inches wg.
e. Duct size in inches.
f. Duct area in sq. ft.
g. Indicated airflow rate in cfm.
h. Indicated velocity in fpm.
i. Actual airflow rate in cfm.
j. Actual average velocity in fpm.
k. Barometric pressure in psig.

J. Instrument Calibration Reports:

1. Report Data:

a. Instrument type and make.
b. Serial number.
c. Application.
d. Dates of use.
e. Dates of calibration.

## 3.8 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION 230593

# SECTION 230713 - DUCT INSULATION

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section includes insulating the following duct services:

1. Indoor, concealed supply and outdoor air—all shall be insulated.
2. Indoor, exposed supply and outdoor air---all shall be insulated.

B. Insulation thickness shall comply with all requirements of the Indiana Energy Code, latest edition.

### 1.2 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

### 1.3 QUALITY ASSURANCE

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

## PART 2 - PRODUCTS

### 2.1 INSULATION MATERIALS

A. Products shall not contain asbestos, lead, mercury, or mercury compounds.

B. Blanket Insulation: Jacketed mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C553, Type II and ASTM C1290, Type I

### 2.2 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

C. ASJ Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

## 2.3 MASTICS AND COATINGS

A. Materials shall be compatible with insulation materials, jackets, and substrates.

## 2.4 SEALANTS

A. ASJ Flashing Sealants :

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: White.

## 2.5 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C1136, Type I.

## 2.6 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C1136.

1. Width: 3 inches.
2. Thickness: 11.5 mils
3. Adhesion: 90 ounces force/inch in width.
4. Elongation: 2 percent.
5. Tensile Strength: 40 lbf/inch in width.
6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

# PART 3 - EXECUTION

## 3.1 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

## 3.2 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces, free of voids throughout the length of ducts and fittings.

B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Keep insulation materials dry during application and finishing.

G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

H. Install insulation with least number of joints practical.

I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

End of Section

# SECTION 230993.11 - SEQUENCE OF OPERATIONS FOR FURNACE AND AIR CONDITIONING

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section includes control sequences for furnace and air conditioning.

### 1.2 HEATING/COOLING CONTROL SEQUENCES

A. Furnace Heating Mode:

1. In heating mode, outdoor air conditioning condensing unit shall be disabled.
2. Furnace shall supply air/heat to the space on a call for heat from the unit thermostat.

B. Air Conditioning Cooling Mode:

1. In cooling mode, outdoor air conditioning condensing unit shall be enabled.
2. Air conditioning system shall supply air/cooling to the space on a call for cooling from the unit thermostat.

END OF SECTION 230993.11

# SECTION 231123 - FACILITY NATURAL-GAS PIPING

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Pipes, tubes, and fittings.
2. Piping and tubing joining materials.
3. Manual gas shutoff valves.
4. Dielectric unions.

### 1.2 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.

D. Comply with all applicable requirements of the latest edition of the Indiana Fuel Gas Code.

## PART 2 - PRODUCTS

### 2.1 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 Exterior/Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and PE.

### 2.2 PIPING SPECIALTIES

A. 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.

## 2.3 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.

## 2.4 MANUAL GAS SHUTOFF VALVES

A. See "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles for where each valve type is applied in various services.

B. 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.

C. One-Piece, Bronze Ball Valve with Bronze Trim: MSS SP-110.
1. Body: Bronze, complying with ASTM B 584.
2. Ball: Chrome-plated brass.
3. Stem: Bronze; blowout proof.
4. Seats: Reinforced TFE; blowout proof.
5. Packing: Separate pack nut with adjustable-stem packing threaded ends.
6. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
7. CWP Rating: 600 psig.
8. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
9. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

## 2.5 DIELECTRIC UNIONS

A. Dielectric Unions:

1. 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.

## 2.6 INDOOR PIPING INSTALLATION

A. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Locate valves for easy access.

F. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Verify final equipment locations for roughing-in.

J. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.

K. 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.

L. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.

M. 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.

N. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.

O. Connect branch piping from top or side of horizontal piping.

P. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment.

Q. Do not use natural-gas piping as grounding electrode.

R. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.

## 2.7 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.

## 2.8 HANGER AND SUPPORT INSTALLATION

A. Install hangers for steel piping with maximum horizontal spacing and minimum rod diameter, to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

B. Support horizontal piping within 12 inches of each fitting.

C. Support vertical runs of steel piping to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

## 2.9 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.

F. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

## 2.10 INDOOR PIPING SCHEDULE

A. Aboveground, branch piping NPS 1 and smaller shall be the following:
1. Steel pipe with malleable-iron fittings and threaded joints.

B. Aboveground, distribution piping shall be one of the following:

1. Steel pipe with malleable-iron fittings and threaded joints.
2. Steel pipe with wrought-steel fittings and welded joints.

C. Underground, below building, piping shall be one of the following:

1. Steel pipe with malleable-iron fittings and threaded joints.
2. Steel pipe with wrought-steel fittings and welded joints.

D. .

## 2.11 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

A. Valves shall be the following:

1. One-piece, bronze ball valve with bronze trim.

.

END OF SECTION 231123

# SECTION 232300 - REFRIGERANT PIPING

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Refrigerant pipes and fittings.

### 1.2 QUALITY ASSURANCE

A. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."

B. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

A. Line Test Pressure for Refrigerant R-134a:

1. Suction Lines for Air-Conditioning Applications: 115 psig.
2. Suction Lines for Heat-Pump Applications: 225 psig.
3. Hot-Gas and Liquid Lines: 225 psig.

B. Line Test Pressure for Refrigerant R-407C:

1. Suction Lines for Air-Conditioning Applications: 230 psig.
2. Suction Lines for Heat-Pump Applications: 380 psig.
3. Hot-Gas and Liquid Lines: 380 psig.

C. Line Test Pressure for Refrigerant R-410A:

1. Suction Lines for Air-Conditioning Applications: 300 psig.
2. Suction Lines for Heat-Pump Applications: 535 psig.
3. Hot-Gas and Liquid Lines: 535 psig.

### 2.2 COPPER TUBE AND FITTINGS

A. Copper Tube: ASTM B 88, Type K or L

B. Solder Filler Metals: ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.

C. Flexible Connectors:

1. Body: Tin-bronze bellows with woven, flexible, tinned-bronze-wire-reinforced protective jacket.
2. End Connections: Socket ends.
3. Offset Performance: Capable of minimum 3/4-inch misalignment in minimum 7-inch-long assembly.
4. Working Pressure Rating: Factory test at minimum 500 psig.
5. Maximum Operating Temperature: 250 deg F.

## PART 3 - EXECUTION

### 3.1 PIPING INSTALLATION

A. Install refrigerant piping according to ASHRAE 15. Insulate per manufacturer's instructions.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping adjacent to machines to allow service and maintenance.

F. Install piping free of sags and bends.

G. Install fittings for changes in direction and branch connections.

H. Select system components with pressure rating equal to or greater than system operating pressure.

I. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

J. Install refrigerant piping in protective conduit where installed belowground.

K. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.

L. Slope refrigerant piping as follows:

1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
2. Install horizontal suction lines with a uniform slope downward to compressor.
3. Install traps and double risers to entrain oil in vertical runs.

4. Liquid lines may be installed level.

M. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.

N. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.

## 3.2 PIPE 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. Soldered Joints: Construct joints according to ASTM B 828.

## 3.3 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Comply with ASME B31.5, Chapter VI.
2. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in "Performance Requirements" Article.

    a. Fill system with nitrogen to the required test pressure.
    b. System shall maintain test pressure at the manifold gage throughout duration of test.
    c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
    d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

END OF SECTION 232300

# SECTION 233113 - METAL DUCTS

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section. All ductwork shall comply with this section of the specifications and shall be of galvanized sheet metal construction.

### 1.2 SUMMARY

A. Section Includes:

1. Single-wall rectangular ducts and fittings.
2. Sheet metal materials.
3. Sealants and gaskets.
4. Hangers and supports.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

A. Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible".

B. Airstream Surfaces: Surfaces in contact with airstream shall comply with requirements in ASHRAE 62.1.

C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment," and Section 7 - "Construction and System Startup."

D. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

E. Duct Dimensions: Unless otherwise indicated, all duct dimensions indicated on Drawings are inside clear dimensions and do not include insulation or duct wall thickness.

### 2.2 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

1. Construct ducts of galvanized sheet steel unless otherwise indicated.

B. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

## 2.3 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A653/A653M.

## 2.4 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested in accordance with UL 723; certified by an NRTL.

## 2.5 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Galvanized-steel rods and nuts.

B. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

C. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A603.

D. Steel Cable End Connections: Galvanized-steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

E. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

# PART 3 - EXECUTION

## 3.1 DUCT INSTALLATION

A. Install ducts in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

B. Install ducts in maximum practical lengths with fewest possible joints.

C. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

D. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

E. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

F. Install ducts with a clearance of 1 inch plus allowance for insulation thickness.

G. Protect duct interiors from moisture, construction debris and dust, and other foreign materials both before and after installation.

H. Elbows: Use long-radius elbows wherever they fit.

1. Fabricate 90-degree rectangular mitered elbows to include turning vanes.

I. Branch Connections: Use lateral or conical branch connections.

## 3.2 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts from being dented, scratched, or damaged. Install in a manner that maintains access over and under by personnel.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

D. Maintain consistency, symmetry, and uniformity in arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

## 3.3 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

## 3.4 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

## 3.5 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Leakage Tests:

1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.

C. Duct System Cleanliness Tests:

1. Visually inspect duct system to ensure that no visible contaminants are present.

## 3.6 DUCT CLEANING

A. Clean new duct system(s) before testing, adjusting, and balancing.

B. Clean the following components by removing surface contaminants and deposits:

1. Air outlets and inlets (registers, grilles, and diffusers).
2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
4. Coils and related components.
5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
6. Supply-air ducts, dampers, actuators, and turning vanes.
7. Dedicated exhaust and ventilation components and makeup air systems.

END OF SECTION 233113

# SECTION 233300 - AIR DUCT ACCESSORIES

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Backdraft and pressure relief dampers.
2. Flange connectors.
3. Turning vanes.
4. Duct-mounted access doors.
5. Flexible connectors.
6. Duct accessory hardware.

### 1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

### 1.3 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

## PART 2 - PRODUCT

### 2.1 ASSEMBLY DESCRIPTION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

### 2.2 MATERIALS

A. Galvanized Sheet Steel: Comply with ASTM A653/A653M.

1. Galvanized Coating Designation: G60
2. Exposed-Surface Finish: Mill phosphatized.

B. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts.

## 2.3 BACKDRAFT AND PRESSURE RELIEF DAMPERS

A. Description: Gravity balanced.

B. Maximum Air Velocity: 1000 fpm.

C. Maximum System Pressure: 1-inch wg.

D. Blades: Multiple single-piece blades, center pivoted, maximum 6-inch width, 0.025-inch-thick, with sealed edges.

E. Blade Action: Parallel.

F. Return Spring: Adjustable tension.

G. Bearings: Steel ball.

H. Accessories:

1. Adjustment device to permit setting for varying differential static pressure.
2. Counterweights and spring-assist kits for vertical airflow installations.
3. Screen Type: Bird.
4. 90-degree stops.

## 2.4 FLANGE CONNECTORS

A. Description: Factory-fabricated, slide-on transverse flange connectors, gaskets, and components.

B. Material: Galvanized steel.

C. Gage and Shape: Match connecting ductwork.

## 2.5 TURNING VANES

A. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

B. Manufactured Turning Vanes for Nonmetal Ducts: Fabricate curved blades of resin-bonded fiberglass with acrylic polymer coating; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

C. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 4-3, "Vanes and Vane Runners," and 4-4, "Vane Support in Elbows."

D. Vane Construction: Single wall.

## 2.6 DUCT-MOUNTED ACCESS DOORS

A. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 7-2 (7-2M), "Duct Access Doors and Panels," and 7-3, "Access Doors - Round Duct."

1. Door:

   a. Double wall, rectangular.
   b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
   c. Vision panel.
   d. Hinges and Latches: 1-by-1-inch or piano hinge and cam latches.
   e. Fabricate doors airtight and suitable for duct pressure class.

2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
3. Number of Hinges and Locks:

   a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
   b. Access Doors up to 18 Inches Square: Two hinges and two sash locks.

## 2.7 FLEXIBLE CONNECTORS

A. Materials: Flame-retardant or noncombustible fabrics.

B. Coatings and Adhesives: Comply with UL 181, Class 1.

C. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to two strips of 2-3/4-inch-wide, 0.028-inch- thick, galvanized sheet steel. Provide metal compatible with connected ducts.

## 2.8 DUCT ACCESSORY HARDWARE

A. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

# PART 3 - EXECUTION

## 3.1 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts.

B. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment.

C. Install access doors with swing against duct static pressure. Label access doors.

D. Install flexible connectors to connect ducts to equipment.

## 3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate dampers to verify full range of movement.
2. Inspect locations of access doors and verify that purpose of access door can be performed.
3. Inspect turning vanes for proper and secure installation.

END OF SECTION 233300

# SECTION 238126 - SPLIT-SYSTEM GAS-FIRED FURNACE/AIR-CONDITIONER

## PART 1 - GENERAL

### 1.1 SUMMARY

A. This section includes a split-system air-conditioning unit consisting of separate evaporator-fan and compressor/condenser components. Contractor is to provide a new fully functional HVAC system installed in compliance with manufacturer's installation instructions and all applicable codes. All required labor/components are to be included regardless of whether or not they are explicitly described.

### 1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

### 1.3 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

B. Warranty information fully completed by contractor, submitted and acknowledged by manufacturer.

### 1.4 QUALITY ASSURANCE

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.

### 1.5 WARRANTY

A. Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period. Nothing in this section negates the contractor's warranty obligation(s) described elsewhere in their contract with the State of Indiana.

1. Contractor Responsibility:

a. Contractor is responsible for registering the warranty in the owner's name with the manufacturer within the timeframe required by the manufacturer

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

A. Bryant (Carrier) or Lennox models fully equal in construction and performance to the Basis of Design.

B. Other manufacturers will be considered only if the contractor makes a complete submission of the proposed substitution to the Engineer of Record a minimum of seven (7) calendar days prior to bid date. If another manufacturer is approved, then the Engineer of Record will issue an addendum giving all bidders the opportunity to include that equipment in their bid.

C. Submitted equipment is to meet the warranty requirements described above.

D. Contractor shall verify that any equipment proposed fits in the available space.

### 2.2 High-Efficiency Gas-Fired Furnace, Air Conditioning Coil and Condensing/Compressor Unit:

A. Basis of Design(furnace): Basis of Design (furnace/cooling coil): Bryant Model 912SC30040S14; 37,000 BTUH output heating; 92% Efficiency; natural gas compatible; 910 CFM airflow; 1/3 HP 115 V/Single Phase/60 Hz; Centrifugal blower wheel and PSC-type motor. Blower motor shall be direct drive with multiple speeds. Cooling coil shall be provided by the same manufacturer and shall be 2 tons nominal cooling capacity.

B. Humidification is not included.

C. Basis of Design (outdoor condensing/compressor unit): Bryant Legacy 116BNA024 2 tons nominal capacity. R-410A refrigerant type. Voltage shall be 230V/single phase/60 Hz.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

A. Install units level and plumb.

B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.

C. Equipment Mounting:

1. Install ground-mounted, compressor-condenser components on contractor-provided cast-in-place concrete equipment base minimum 6 inches below grade and 8 inches above grade.

### 3.2 CONNECTIONS

A. Where piping is installed adjacent to unit, allow space for service and maintenance of unit.

B. Duct Connections: Drawings indicate the general arrangement of ducts. Contractor shall adjust as required by field conditions and unit configuration. Connect supply and return ducts to split-system air-conditioning units with flexible duct connectors.

## 3.3 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

END OF SECTION 238126

# SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Copper building wire rated 600 V or less.
2. Connectors, splices, and terminations rated 600 V and less.

B. Product Schedule: Indicate type, use, location, and termination locations.

### 1.2 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

## 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. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

C. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for stranded conductors.

D. Conductor Insulation:

1. Type USE-2: Comply with UL 854.
2. Type THHN and Type THWN-2: Comply with UL 83.

E. 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.

3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

F. Circuits:

1. Single circuit
2. Power-Limited Fire-Alarm Circuits: Comply with UL 1424.

G. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for stranded conductors.

H. Ground Conductor: Bare.

I. Conductor Insulation:

1. Type THHN/THWN-2: Comply with UL 83.

## 2.2 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.

# PART 3 - EXECUTION

## 3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper; solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

## 3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type USE, single conductor in raceway.

B. Exposed Feeders: Type THHN/THWN-2, single conductors in raceway.

C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN/THWN-2, single conductors in raceway.

D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway OR Underground feeder cable, Type UF where allowed by code.

E. Exposed Branch Circuits, Including in Crawlspaces: Type THHN/THWN-2, single conductors in raceway.

F. Branch Circuits Concealed in Ceilings, Walls, and Partitions:Type THHN/THWN-2, single conductors in raceway.

A. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway OR Underground feeder cable, Type UF where allowed by code.

## 3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.

B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage cables or raceway.

D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

## 3.4 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies.

## 3.5 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 SUMMARY

A. Section includes grounding and bonding electrical/piping systems, building structure and equipment.

### 1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

### 1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans showing dimensioned as-built locations of grounding features specified in "Field Quality Control" Article.

B. Qualification Data: For testing agency and testing agency's field supervisor.

C. Field quality-control reports.

### 1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1. Plans showing as-built, dimensioned locations of system described in "Field Quality Control" Article, including the following:

a. Ground rods.
b. Ground rings.
c. Grounding arrangements and connections for separately derived systems.

## 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. Bare Copper Conductors:

1. Solid Conductors: ASTM B3.
2. Stranded Conductors: ASTM B8.
3. Tinned Conductors: ASTM B33.
4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch 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 wide and 1/16 inch thick.
7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

C. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches in cross section, with 9/32-inch holes spaced 1-1/8 inches 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. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

C. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

D. Bus-Bar Connectors: Compression type, copper or copper alloy, with two wire terminals.

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. Cable Tray Ground Clamp: Mechanical type, zinc-plated malleable iron.

H. Conduit Hubs: Mechanical type, terminal with threaded hub.

I. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with hex head bolt.

J. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with hex head bolt.

K. Lay-in Lug Connector: Mechanical type terminal with set screw.

L. Service Post Connectors: Mechanical type, bronze alloy terminal, in short- and long-stud lengths, capable of single and double conductor connections.

M. Signal Reference Grid Clamp: Mechanical type, stamped-steel terminal with hex head screw.

N. Straps: Solid copper.

O. Tower Ground Clamps: Mechanical type, copper or copper alloy.

P. U-Bolt Clamps: Mechanical type, copper or copper alloy, listed for direct burial.

Q. Water Pipe Clamps:

1. Mechanical type.
   a. Listed for direct burial.

2. U-bolt type with malleable-iron clamp and copper ground connector rated for direct burial.

## 2.4 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel, 3/4 inch by 10 feet.

B. Ground Plates: 1/4 inch thick, hot-dip galvanized.

# PART 3 - EXECUTION

## 3.1 APPLICATIONS

A. Conductors: Install stranded conductors for No. 6 AWG copper and larger unless otherwise indicated.

B. Underground Grounding Conductors: Install bare copper conductor, No. 2/0 AWG minimum.

1. Bury at least 30 inches 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 minimum from wall, 6 inches above finished floor unless otherwise indicated.
2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.

D. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.

3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

## 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 will extend above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches above to 6 inches below concrete. Seal floor opening with waterproof, 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 two ground rods and ground ring around the pad. 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 from the foundation.

## 3.4 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. 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.

8. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.

C. 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.

D. Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

## 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 Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.

C. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.

D. 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.

E. 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.

## 3.6 FIELD QUALITY CONTROL

A. 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 ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

B. Grounding system will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION 260526

# SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:
   1. Conduit and cable support devices.
   2. Support for conductors in vertical conduit.
   3. Mounting, anchoring, and attachment components, including powder-actuated fasteners, mechanical expansion anchors, concrete inserts, clamps, through bolts, toggle bolts, and hanger rods.

ACTION SUBMITTALS

B. Product Data: For each type of product.

C. Shop Drawings: For fabrication and installation details for electrical hangers and support systems.

   1. Hangers. Include product data for components.
   2. Equipment supports.

### 1.2 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, and coordinated with each other, using input from installers of the items involved.

B. Seismic Qualification Data: Certificates, for hangers and supports for electrical equipment and systems, accessories, and components, from manufacturer.

C. Welding certificates.

## PART 2 - PRODUCTS

### 2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

B. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be made of malleable iron.

C. 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 F3125/F3125M, Grade A325.
6. Toggle Bolts: Steel springhead type.
7. Hanger Rods: Threaded steel.

## 2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

# 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. 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 in diameter.

C. 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. Retain paragraph below for projects where seismic design requirements do not apply. Consider retaining for light-commercial projects only.

D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits 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. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

C. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To 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. 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 thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
5. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts.
6. To Light Steel: Sheet metal screws.
7. 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.

D. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

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. Boxes, enclosures, and cabinets.

### 1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

## PART 2 - PRODUCTS

### 2.1 METAL CONDUITS AND FITTINGS

A. Metal Conduit:

1. 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.
2. GRC: Comply with ANSI C80.1 and UL 6.
3. IMC: Comply with ANSI C80.6 and UL 1242.
4. EMT: Comply with ANSI C80.3 and UL 797.
5. FMC: Comply with UL 1; zinc-coated steel.
6. 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. 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.

## 2.2 BOXES, ENCLOSURES, AND CABINETS

A. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

B. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

C. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb. Outlet boxes designed for attachment of luminaires weighing more than 50 lb. shall be listed and marked for the maximum allowable weight.

D. Paddle Fan Outlet Boxes: Nonadjustable, designed for attachment of paddle fan weighing 70 lb.

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.

E. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

F. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.

G. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

# 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: IMC.

B. Indoors: Apply raceway products as specified below unless otherwise indicated.

1. Exposed, Not Subject to Physical Damage: EMT. Concealed in Ceilings and Interior Walls and Partitions: EMT.
2. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
3. Damp or Wet Locations: GRC.
4. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.

C. Minimum Raceway Size: 1/2-inch trade size.

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. EMT: Use setscrew fittings. Comply with NEMA FB 2.10.
3. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

## 3.2 INSTALLATION

A. 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.

B. Do not fasten conduits onto the bottom side of a metal deck roof.

C. Keep raceways at least 6 inches from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

D. Arrange stub-ups so curved portions of bends are not visible above finished slab.

E. 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 of change in direction.

F. 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.

G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

H. Support conduit within 12 inches of enclosures to which attached.

I. Raceways Embedded in Slabs:

1. Run conduit larger than 1-inch 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 intervals.
2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
3. Arrange raceways to keep a minimum of 1 inch of concrete cover in all directions.
4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.

J. 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.

K. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

L. 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 trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

M. Surface Raceways:

1. Install surface raceway with a minimum 2-inch radius control at bend points.
2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches 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.

N. 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.

O. 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.

P. Expansion-Joint Fittings:

1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg. F and that has straight-run length that exceeds 25 feet.
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 temperature change.
    b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
    c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.
    d. Attics: 135 deg F 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 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.

Q. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 36 inches 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.

R. 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.

S. 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.

T. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

U. Locate boxes so that cover or plate will not span different building finishes.

V. 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.

W. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

X. Set metal floor boxes level and flush with finished floor surface.

## 3.3 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies.

END OF SECTION 260533

# 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 A53/A53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

### 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. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Carbon steel.
3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, 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: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.

B. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

C. Design Mix: 5000-psi, 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, nonshrinking foam.

# PART 3 - EXECUTION

## 3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

A. Comply with NECA 1.

B. 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 annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed.
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 above finished floor level.

C. 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.

D. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

E. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

F. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch 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 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. Labels.
3. Bands and tubes.
4. Tapes and stencils.
5. Tags.
6. Signs.
7. Cable ties.
8. Paint for identification.
9. Fasteners for labels and signs.

### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each type of label and sign to illustrate composition, size, colors, lettering style, mounting provisions, and graphic features of identification products.

## 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 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.

G. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg. F.

## 2.2 COLOR AND LEGEND REQUIREMENTS

A. Raceways and Cables Carrying Circuits at 600 V or Less:

1. Black letters on an orange field.
2. Legend: Indicate voltage and system or service type.

B. 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. Color shall be factory applied or field applied for sizes larger than No. 8 AWG.

2. Colors for 208/120-V Circuits:

a. Phase A: Black.
b. Phase B: Red.
c. Phase C: Blue.

3. Colors for 240-V Circuits:

a. Phase A: Black.
b. Phase B: Red.

4. Color for Neutral: White.
5. Color for Equipment Grounds: Bare copper or green.
6. Colors for Isolated Grounds: Green with two or more yellow stripes.

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."

E. Equipment Identification Labels:

1. Black letters on a white field.

## 2.3 LABELS

A. Vinyl Wraparound Labels: Preprinted, flexible labels laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.

B. Snap-around Labels: Slit, pre-tensioned, flexible, preprinted, color-coded acrylic sleeves, with diameters sized to suit diameter and that stay in place by gripping action.

C. Self-Adhesive Wraparound Labels: Preprinted, 3-mil-thick, polyester flexible label with acrylic pressure-sensitive adhesive.

1. Self-Lamination: Clear; UV- weather- and chemical-resistant; self-laminating, protective shield over the legend. Labels sized such that the clear shield overlaps the entire printed legend.
2. Marker for Labels: Permanent, waterproof, black ink marker recommended by tag manufacturer.
3. Marker for Labels: Machine-printed, permanent, waterproof, black ink recommended by printer manufacturer.

D. Self-Adhesive Labels: Polyester transfer-printed, 3-mil-thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.

1. Minimum Nominal Size:

a. 1-1/2 by 6 inches for raceway and conductors.
b. 3-1/2 by 5 inches or equipment.

## 2.4 BANDS AND TUBES

A. Snap-around, Color-Coding Bands: Slit, pre-tensioned, flexible, solid-colored acrylic sleeves, 2 inches long, with diameters sized to suit diameter and that stay in place by gripping action.

B. Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tubes with machine-printed identification labels, sized to suit diameters of and shrunk to fit firmly around item being identified. Full shrink recovery occurs at a maximum of 200 deg. F. Comply with UL 224.

## 2.5 TAPES AND STENCILS

A. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

B. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; not less than 3 mils thick by 1 to 2 inches wide; compounded for outdoor use.

C. Tape and Stencil: 4-inch-wide black stripes on 10-inch centers placed diagonally over orange background and is 12 inches wide. Stop stripes at legends.

D. Floor Marking Tape: 2-inch-wide, 5-mil pressure-sensitive vinyl tape, with black and white stripes and clear vinyl overlay.

E. Underground-Line Warning Tape:

Tape:

a. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical 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.

F. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch.

## 2.6 TAGS

A. Write-on Tags:

1. Polyester Tags: 0.010 inch minimum thickness, with corrosion-resistant grommet and cable tie for attachment.
2. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
3. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

## 2.7 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 grommets in corners for mounting.
3. Nominal Size: 7 by 10 inches.

B. Metal-Backed Butyrate Signs:

1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs, with 0.0396-inch galvanized-steel backing, punched and drilled for fasteners, and with colors, legend, and size required for application.
2. 1/4-inch grommets in corners for mounting.

3. Nominal Size: 10 by 14 inches.

C. Laminated Acrylic or Melamine Plastic Signs:

1. Engraved legend.
2. Thickness:

   a. For signs up to 20 sq. in., minimum 1/16 inch thick.
   b. For signs larger than 20 sq. in., 1/8 inch thick.
   c. Engraved legend with black letters on white face.
   d. Punched or drilled for mechanical fasteners with 1/4-inch grommets in corners for mounting.
   e. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

## 2.8 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.
2. Tensile Strength at 73 Deg F according to ASTM D638: 12,000 psi.
3. Temperature Range: Minus 40 to plus 185 deg F.
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.
2. Tensile Strength at 73 Deg F according to ASTM D638: 12,000 psi.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black.

C. Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one piece, and self-locking.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 Deg F according to ASTM D638: 7000 psi.
3. UL 94 Flame Rating: 94V-0.
4. Temperature Range: Minus 50 to plus 284 deg F.
5. Color: Black.

## 2.9 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 INSTALLATION

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. Install identifying devices before installing acoustical ceilings and similar concealment.

C. Verify identity of each item before installing identification products.

D. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.

E. Apply identification devices to surfaces that require finish after completing finish work.

F. Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.

G. 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.

H. System Identification for Raceways and Cables under 600 V: Identification shall completely encircle cable or conduit. Place identification of two-color markings in contact, side by side.

1. Secure tight to surface of conductor, cable, or raceway.

I. System Identification for Raceways and Cables over 600 V: Identification shall completely encircle cable or conduit. Place adjacent identification of two-color markings in contact, side by side.

1. Secure tight to surface of conductor, cable, or raceway.

J. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

K. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch-high letters for emergency instructions at equipment used for power transfer.

L. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from the floor.

M. Accessible Fittings for Raceways: Identify the covers of each junction and pull box of the following systems with the wiring system legend and system voltage. System legends shall be as follows:

1. "EMERGENCY POWER."
2. "POWER."
3. "UPS."

N. Vinyl Wraparound Labels:

1. Secure tight to surface at a location with high visibility and accessibility.
2. Attach labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to the location and substrate.

O. Snap-around Labels: Secure tight to surface at a location with high visibility and accessibility.

P. Self-Adhesive Wraparound Labels: Secure tight to surface of raceway or cable at a location with high visibility and accessibility.

Q. Self-Adhesive Labels:

1. On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.
2. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high label; where two lines of text are required, use labels 2 inches high.

R. Snap-around Color-Coding Bands: Secure tight to surface at a location with high visibility and accessibility.

S. Heat-Shrink, Preprinted Tubes: Secure tight to surface at a location with high visibility and accessibility.

T. Marker Tapes: Secure tight to surface at a location with high visibility and accessibility.

U. Self-Adhesive Vinyl Tape: Secure tight to surface at a location with high visibility and accessibility.

1. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding.

V. Tape and Stencil: Comply with requirements in painting Sections for surface preparation and paint application.

W. Floor Marking Tape: Apply stripes to finished surfaces following manufacturer's written instructions.

X. 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 below finished grade. Use multiple tapes where width of multiple lines installed in a common trench exceeds 16 inches overall.

2. Limit use of underground-line warning tape to direct-buried cables.
3. Install underground-line warning tape for direct-buried cables and cables in raceways.

Y. Write-on Tags:

1. Place in a location with high visibility and accessibility.
2. Secure using general-purpose cable ties.

Z. Baked-Enamel Signs:

1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
2. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on minimum 1-1/2-inch-high sign; where two lines of text are required, use signs minimum 2 inches high.

AA. Metal-Backed Butyrate Signs:

1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
2. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on minimum 1-1/2-inch- high sign; where two lines of text are required, use signs minimum 2 inches high.

BB. 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.
2. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on minimum 1-1/2-inch- high sign; where two lines of text are required, use signs minimum 2 inches high.

CC. Cable Ties: General purpose, for attaching tags, except as listed below:

1. Outdoors: UV-stabilized nylon.
2. In Spaces Handling Environmental Air: Plenum rated.

## 3.2 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 Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits, More Than 30 A and 120 V to Ground: Identify with self-adhesive raceway labels.

1. Locate identification at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

D. 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. "POWER."
3. "UPS."

E. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use vinyl wraparound labels to identify the phase.

1. Locate identification at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

F. Locations of Underground Lines: Underground-line warning tape for power, lighting, communication, and control wiring and optical-fiber cable.

G. 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.

H. Instructional Signs: Self-adhesive labels, including the color code for grounded and ungrounded conductors.

I. 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.

J. Arc Flash Warning Labeling: Self-adhesive labels.

K. Operating Instruction Signs: Self-adhesive labels.

L. Emergency Operating Instruction Signs: Self-adhesive labels with white legend on a red background with minimum 3/8-inch- high letters for emergency instructions at equipment used for power transfer.

M. Equipment Identification Labels:

1. Indoor Equipment: Self-adhesive label.

2. Outdoor Equipment: Laminated acrylic or melamine sign.

END OF SECTION 260553

# SECTION 262413 – SWITCHBOARDS AND RELATED APPURTENANCES

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section includes, as applicable to the scope of the particular project:

1. Service and distribution switchboards rated 600 V and less.
2. Disconnecting and overcurrent protective devices.
3. Accessory components and features.
4. Identification.

### 1.2 ACTION SUBMITTALS

A. Product Data: For each switchboard, overcurrent protective device, surge protection device, ground fault protector, accessory, and component.

B. Shop Drawings: For each switchboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings.
2. Detail enclosure types. Enclosures shall be code-compliant for the application.
3. Detail bus configuration, current, and voltage ratings.
4. Detail short-circuit current rating of switchboards and overcurrent protective devices.
5. Include evidence of nationally recognized testing laboratory listing for series rating of installed devices.
6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
7. Include schematic and wiring diagrams for power, signal, and control wiring.

### 1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: Prior to construction, submit to the Engineer of Record the name(s) and specific experience of the licensed electrician(s) in responsible charge of on-site work.

B. Seismic Qualification Data: Certificates, for switchboards, 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.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Licensed electricians and their directly-supervised subordinates: all workers trained in electrical safety as required by NFPA 70E.

1.6 WARRANTY

A. Contractor's Warranty: Contractor agrees to repair or replace switchboard enclosures, buswork, overcurrent protective devices, accessories, and factory installed interconnection wiring that fail in materials or workmanship within the contractually specified warranty period. All repairs shall comply with manufacturers' requirements for warranty repairs.

PART 2 - PRODUCTS

2.1 SWITCHBOARDS

A. Source Limitations: Obtain switchboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

B. Where a specific manufacturer and model number is listed as the basis of design, the contractor has the option during the bidding period of submitting for approval by the Engineer of Record the name and model number of a proposed substitution. Such requests for approval must be submitted in writing to the Engineer of Record no less than 7 calendar days prior to the stated bid date. Substitutions submitted subsequent to that date are subject to rejection without review.

1. Any proposed substituted product must objectively be the equal of the basis of design. This pertains to construction/materials/durability and to the manufacturer's standard warranty, regardless of whether/not the construction/materials and/or length-of-warranty were explicitly contractually specified.

C. Switchboards described in this article include service and distribution types most commonly applied.

D. Front-Connected, Front-Accessible Switchboards:

1. Main Devices: Panel mounted.
2. Branch Devices: Panel mounted.
3. Sections front and rear aligned.

E. Nominal System Voltage and Main Breaker Rating: As shown on the contract drawings.

F. Indoor Enclosures: Steel, NEMA 250, Type 1.

G. Outdoor Enclosures: Type 3R.

1. Finish: Factory-applied finish in manufacturer's standard color; undersurfaces treated with corrosion-resistant undercoating.
2. Enclosure: Rearward-sloping roof; bolt-on rear cover for each section, with provisions for padlocking.

H. Service Entrance Rating: Switchboards intended for use as service entrance equipment shall contain from one to six service disconnecting means (as specified and as allowed by the Indiana Electrical Code) with overcurrent protection, a neutral bus with disconnecting link, a grounding electrode conductor terminal, and a main bonding jumper.

I. Bus Transition and Incoming Pull Sections: Matched and aligned with basic switchboard.

J. Removable, Hinged Rear Doors and Compartment Covers: Secured by standard bolts for access to rear interior of switchboard.

K. Hinged Front Panels: Allow access to circuit breaker, accessory, and blank compartments.

L. Buses and Connections:

1. Provide phase bus arrangement A, B, C from front to back, top to bottom, and left to right when viewed from the front of the switchboard.
2. Phase- and Neutral-Bus Material: Tin-plated, high-strength, electrical-grade aluminum alloy with tin-plated aluminum circuit-breaker line connections.
3. Tin-plated aluminum feeder circuit-breaker line connections.
4. Load Terminals: Insulated, rigidly braced, runback bus extensions, of same material as through buses, equipped with approved connectors for outgoing circuit conductors. Provide load terminals for future circuit-breaker positions at full-ampere rating of circuit-breaker position.
5. Ground Bus: Hard-drawn copper of 98 percent conductivity, equipped with approved connectors for feeder and branch-circuit ground conductors.
6. Main-Phase Buses and Equipment-Ground Buses: Uniform capacity for entire length of switchboard's main and distribution sections. Provide for future extensions from both ends.
7. Disconnect Links:

    a. Isolate neutral bus from incoming neutral conductors.
    b. Bond neutral bus to equipment-ground bus for switchboards utilized as service equipment or separately derived systems.

8. Neutral Buses: 100 percent of the ampacity of phase buses unless otherwise indicated, equipped with approved connectors for outgoing circuit neutral cables. Brace bus extensions for busway feeder neutral bus.

## 2.2 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. Electronic trip circuit breakers with RMS sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:

    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.

4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
5. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker; trip activation on fuse opening or on opening of fuse compartment door.
6. GFCI Circuit Breakers: Single- and double-pole configurations with Class A ground-fault protection (6-mA trip).
7. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
8. MCCB Features and Accessories:

    a. Standard frame sizes, trip ratings, and number of poles.
    b. Lugs: Suitable for number, size, trip ratings, and conductor material.
    c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
    d. Ground-Fault Protection: Integrally-mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.

B. Insulated-Case Circuit Breaker (ICCB): 100 percent rated, sealed, insulated-case power circuit breaker with interrupting capacity rating to meet available fault current.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

A. Receive, inspect, handle, and store switchboards according to NECA 400.

B. Install switchboards and accessories according to NECA 400.

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, straps and brackets, and temporary blocking of moving parts from switchboard units and components.

D. Operating Instructions: Mount basic operating instructions for switchboards, including emergency procedures.

E. Install filler plates in unused spaces of panel-mounted sections.

F. Install overcurrent protective devices and surge protection devices.

G. Comply with NECA 1.

## 3.2 FIELD QUALITY CONTROL

A. Perform the following tests and inspections :

1. Acceptance Testing:

    a. Test insulation resistance for each switchboard bus, component, connecting supply, feeder, and control circuit.
    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.

B. Switchboard will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports, including a certified report that identifies switchboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

## 3.3 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain switchboards, overcurrent protective devices, instrumentation, and accessories.

END OF SECTION 262413

# SECTION 262416 - PANELBOARDS

## 1.1 SUMMARY

A. Section Includes:

1. Distribution panelboards.
2. Lighting and appliance branch-circuit panelboards.

## 1.2 DEFINITIONS

A. MCCB: Molded-case circuit breaker.

B. SPD: Surge protective device.

## 1.3 ACTION SUBMITTALS

A. Product Data: For each type of panelboard.

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 overcurrent protective devices.
5. Include evidence of NRTL listing for series rating of installed devices.
6. Include evidence of NRTL listing for SPD as installed in panelboard.
7. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
8. Include wiring diagrams for power, signal, and control wiring.
9. Key interlock scheme drawing and sequence of operations.
10. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards.

## 1.4 INFORMATIONAL SUBMITTALS

A. Panelboard schedules for installation in panelboards.

## 1.5 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.6 FIELD CONDITIONS

A. Service Conditions: NEMA PB 1, usual service conditions, as follows:

1. Ambient temperatures within limits specified: -20 to +120 degrees F ambient temperature.

1.7 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace panelboards that fail in materials or workmanship within specified warranty period.

PART 2 - PRODUCTS

2.1 PANELBOARDS COMMON 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. Comply with NEMA PB 1.

C. Comply with NFPA 70.

D. Enclosures: 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. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 5.

2. Height: 84 inches 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.

E. Phase, Neutral, and Ground Buses: Hard-drawn copper, 98 percent conductivity.

F. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Main and Neutral Lugs: Compression type, with a lug on the neutral bar for each pole in the panelboard.
3. Ground Lugs and Bus-Configured Terminators: Compression type, with a lug on the bar for each pole in the panelboard.

4. Feed-Through Lugs: Compression type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
5. Sub-feed (Double) Lugs: Compression type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.

G. 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.

H. Future Devices: Panelboards shall have mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

I. Panelboard Short-Circuit Current Rating: Rated for series-connected system with integral or remote upstream overcurrent protective devices and labeled by an NRTL. Include label or manual with size and type of allowable upstream and branch devices listed and labeled by an NRTL for series-connected short-circuit rating.

J. 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.

## 2.2 PERFORMANCE REQUIREMENTS

A. Surge Suppression: Factory installed as an integral part of panelboards, complying with UL 1449 SPD Type 1.

## 2.3 POWER PANELBOARDS

A. Panelboards: NEMA PB 1, distribution type.

B. Doors: Secured with vault-type latch with tumbler lock; keyed alike.

1. For doors more than 36 inches high, provide two latches, keyed alike.

C. Mains: Circuit breaker.

D. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Plug-in circuit breakers.

E. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers.

F. Branch Overcurrent Protective Devices: Fused switches.

G. Contactors in Main Bus: NEMA ICS 2, Class A, general-purpose controller, with same short-circuit interrupting rating as panelboard.

## 2.4 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

B. Mains: Circuit breaker.

C. Branch Overcurrent Protective Devices: Plug-in circuit breakers, replaceable without disturbing adjacent units.

D. Contactors in Main Bus: NEMA ICS 2, Class A general-purpose controller, with same short-circuit interrupting rating as panelboard.

E. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

F. Column-Type Panelboards: Single row of overcurrent devices with narrow gutter extension and overhead junction box equipped with ground and neutral terminal buses.

## 2.5 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. MCCB: Comply with UL 489, with interrupting capacity to meet available fault currents.

1. 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.

2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. Electronic Trip Circuit Breakers:

    a. RMS sensing.
    b. Field-replaceable rating plug or electronic trip.
    c. Digital display of settings, trip targets, and indicated metering displays.
    d. Multi-button keypad to access programmable functions and monitored data.
    e. Ten-event, trip-history log. Each trip event shall be recorded with type, phase, and magnitude of fault that caused the trip.
    f. Integral test jack for connection to portable test set or laptop computer.
    g. Field-Adjustable Settings:

        1) Instantaneous trip.
        2) Long- and short-time pickup levels.
        3) Long and short time adjustments.
        4) Ground-fault pickup level, time delay, and I squared T response.

4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
5. GFCI Circuit Breakers: Single- and double-pole configurations with Class A ground-fault protection (6-mA trip).
6. GFEP Circuit Breakers: Class B ground-fault protection (30-mA trip).

7. Arc-Fault Circuit Interrupter Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
8. Sub-feed Circuit Breakers: Vertically mounted.
9. 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: Compression 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 off position.
    h. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

## 2.6 IDENTIFICATION

A. Panelboard Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles shall be located on the interior of the panelboard door.

B. Breaker Labels: Faceplate shall list current rating, UL and IEC certification standards, and AIC rating.

C. Circuit Directory: Directory card inside panelboard door, mounted in transparent card holder.

## 2.7 ACCESSORY COMPONENTS AND FEATURES

A. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

# PART 3 - EXECUTION

## 3.1 INSTALLATION

A. Comply with NECA 1.

B. Install panelboards and accessories according to NECA 407.

C. Mount top of trim 90 inches above finished floor unless otherwise indicated.

D. Mount panelboard cabinet plumb and rigid without distortion of box.

E. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

F. Install overcurrent protective devices and controllers not already factory installed.

1. Set field-adjustable, circuit-breaker trip ranges.

G. 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.

H. Install filler plates in unused spaces.

I. Stub four 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch empty conduits into raised floor space or below slab not on grade.

J. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

## 3.2 IDENTIFICATION

A. Create a directory to indicate installed circuit loads; incorporate Owner's final room designations. Obtain approval before installing. Handwritten directories are not acceptable. Install directory inside panelboard door.

B. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

C. 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."

D. Install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems" identifying source of remote circuit.

## 3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

C. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test for low-voltage air circuit breakers stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

D. Panelboards will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results, with comparisons of the two scans. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

END OF SECTION 262416

# SECTION 262726 - WIRING DEVICES

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Standard-grade receptacles, 125 V, 20 A.
2. GFCI receptacles, 125 V, 20 A.
3. Toggle switches, 120/277 V, 20 A.
4. Decorator-style devices, 20 A.
5. Occupancy sensors.
6. Wall plates.

### 1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: List of legends and description of materials and process used for pre-marking wall plates.

C. Samples: One for each type of device and wall plate specified, in each color specified.

### 1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

## 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 use.

B. Comply with NFPA 70.

C. Comply with NEMA WD 1.

D. Device Color:

1. Most devices: As selected by the Architect.

E. Wall Plate Color: For plastic covers, match device color.

F. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

## 2.2 STANDARD-GRADE RECEPTACLES, 125 V, 20 A

A. Duplex Receptacles, 125 V, 20 A :

1. Description: Two pole, three wire, and self-grounding.
2. Configuration: NEMA WD 6, Configuration 5-20R.
3. Standards: Comply with UL 498 and FS W-C-596.

B. Tamper-Resistant Duplex Receptacles, 125 V, 20 A :

1. Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle.
2. Configuration: NEMA WD 6, Configuration 5-20R.
3. Standards: Comply with UL 498 and FS W-C-596.
4. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" Article.

C. Weather-Resistant Duplex Receptacle, 125 V, 20 A :

1. Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle. Square face.
2. Configuration: NEMA WD 6, Configuration 5-20R.
3. Standards: Comply with UL 498.
4. Marking: Listed and labeled as complying with NFPA 70, "Receptacles in Damp or Wet Locations" Article.

D. Tamper- and Weather-Resistant Duplex Receptacles, 125 V, 20 A :

1. Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle. Square face.
2. Configuration: NEMA WD 6, Configuration 5-20R.
3. Standards: Comply with UL 498.
4. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" and "Receptacles in Damp or Wet Locations" articles.

E. Tamper-Resistant Duplex Receptacles :

1. Description: Single-piece, rivetless, nickel-plated, all-brass grounding system. Nickel-plated, brass mounting strap. Integral shutters that operate only when a plug is inserted in the line voltage receptacle.
2. Line Voltage Receptacles: Two pole, three wire, and self-grounding; NEMA WD 6, Configuration 5-20R.

3. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" Article.

## 2.3 GFCI RECEPTACLES, 125 V, 20 A

A. Duplex GFCI Receptacles, 125 V, 20 A :

1. Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding.
2. Configuration: NEMA WD 6, Configuration 5-20R.
3. Standards: Comply with UL 498, UL 943 Class A, and FS W-C-596.

B. Tamper-Resistant Duplex GFCI Receptacles, 125 V, 20 A :

1. Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle.
2. Configuration: NEMA WD 6, Configuration 5-20R.
3. Standards: Comply with UL 498, UL 943 Class A, and FS W-C-596.
4. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" Article.

C. Tamper- and Weather-Resistant, GFCI Duplex Receptacles, 125 V, 20 A

1. Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle. Square face.
2. Configuration: NEMA WD 6, Configuration 5-20R.
3. Standards: Comply with UL 498 and UL 943 Class A.
4. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" and "Receptacles in Damp or Wet Locations" articles.

## 2.4 TOGGLE SWITCHES, 120/277 V, 20 A

A. Single-Pole Switches, 120/277 V, 20 A :

1. Standards: Comply with UL 20 and FS W-S-896.

B. Two-Pole Switches, 120/277 V, 20 A :

1. Comply with UL 20 and FS W-S-896.

C. Three-Way Switches, 120/277 V, 20 A :

1. Comply with UL 20 and FS W-S-896.

D. Four-Way Switches, 120/277 V, 20 A :

1. Standards: Comply with UL 20 and FS W-S-896.

E. Lighted Single-Pole Switches, 120/277 V, 20 A :

1. Description: Handle illuminated when switch is off.
2. Standards: Comply with NEMA WD 1, UL 20, and FS W-S-896.
3. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" Article.

## 2.5 OCCUPANCY SENSORS

A. Wall Switch Sensor Light Switch, Dual Technology :

1. Description: Switchbox-mounted, combination lighting-control sensor and conventional switch lighting-control unit using dual (ultrasonic and passive infrared) technology.
2. Standards: Comply with UL 20.
3. Rated 960 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.
4. Adjustable time delay of 20 minutes.
5. Able to be locked to Automatic-On mode.
6. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc.
7. Connections: Provisions for connection to BAS.
8. Connections: RJ-45 communications outlet.
9. Connections: Integral wireless networking.

B. Wall Sensor Light Switch, Passive Infrared :

1. Description: Switchbox-mounted, combination, lighting-control sensor and conventional switch lighting-control unit using passive infrared technology.
2. Standards: Comply with UL 20.
3. Connections: Provisions for connection to BAS.
4. Connections: Hard wired.
5. Connections: Wireless.
6. Rated 960 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.
7. Integral relay for connection to BAS.
8. Adjustable time delay of 20 minutes.
9. Able to be locked to Automatic-On mode.
10. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc.

C. Fan-Speed Controls :

1. Description: Modular, 120-V ac, full-wave, solid-state units with integral, quiet on-off switches and audible frequency and EMI/RFI filters.
2. Standards: Comply with UL 1917.

D. Telephone Outlet :
1. Description: Single RJ-11 jack for terminating Category 3, balanced twisted pair cable.
2. Standards: Comply with UL 1863.

## 2.6 DIMMERS

A. Wall-Box Dimmers:

1. Description: Modular, full-wave, solid-state dimmer switch with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.
2. Control: Continuously adjustable slider; with single-pole or three-way switching.
3. Standards: Comply with UL 1472.
4. Incandescent Lamp Dimmers: 120 V; control shall follow square-law dimming curve. On-off switch positions shall bypass dimmer module.

    a. 600 W; dimmers shall require no derating when ganged with other devices.

5. Fluorescent Lamp Dimmer Switches: Modular; compatible with dimmer ballasts; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming with low end not greater than 20 percent of full brightness.
6. LED Lamp Dimmer Switches: Modular; compatible with LED lamps; trim potentiometer to adjust low-end dimming; capable of consistent dimming with low end not greater than 20 percent of full brightness.

## 2.7 WALL PLATES

A. Single Source: Obtain wall plates from same manufacturer of wiring devices.

B. 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 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.

C. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable cover.

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. 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.
2. 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.
3. Install wiring devices after all wall preparation, including painting, is complete.

C. Device Installation:

1. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
2. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

D. 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.

E. Dimmers:

1. Install dimmers within terms of their listing.
2. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device, listing conditions in the written instructions.

F. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multi-gang wall plates.

G. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Test Instruments: Use instruments that comply with UL 1436.
2. Test Instrument for Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

B. Tests for Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.

2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.

C. Wiring device will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

END OF SECTION 262726

# SECTION 265119 - LED INTERIOR LIGHTING

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section includes the following types of LED luminaires. Refer to contract drawings to verify types used on the specific project.

1. Cylinder.
2. Downlight.
3. High bay, linear.
4. High bay, nonlinear.
5. Linear industrial.
6. Low bay.
7. Parking garage.
8. Recessed, linear.
9. Strip light.
10. Surface mount, linear.
11. Surface mount, nonlinear.
12. Suspended, linear.
13. Suspended, nonlinear.

### 1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Certified photometric data.

B. Shop Drawings:

1. Include plans and mounting/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.

### 1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale and coordinated with each other, using input from installers of the items involved.

B. Seismic Qualification Data: For luminaires, accessories, and components, from manufacturer.

C. Product Certificates: For each type of luminaire.

D. Product test reports.

E. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturer's laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.

B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, accredited under the NVLAP for Energy Efficient Lighting Products, and complying with the applicable IES testing standards.

C. Provide luminaires from a single manufacturer for each luminaire type.

1.6 CONTRACTOR’S WARRANTY

A. The contractor agrees to repair or replace components of luminaires that fail in materials or workmanship during the one-year warranty period.

PART 2 - PRODUCTS

2.1 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. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp characteristics:

a. "USE ONLY" and include specific lamp type.
b. Lamp diameter, shape, size, wattage, and coating.
c. CCT and CRI.

C. Recessed luminaires shall comply with NEMA LE 4.

D. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit re-lamping without use of tools. Components are designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during re-lamping and when secured in operating position.

E. Diffusers and Globes:
1. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
2. Glass: Annealed crystal glass unless otherwise indicated.
3. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.

F. With integral mounting provisions.

## 2.2 DOWNLIGHT

A. Lamp:
1. Rated lamp life of 35,000 hours minimum to L70.
2. Dimmable from 100 percent to 0 percent of maximum light output.
3. Internal driver.
4. User-Replaceable Lamps:

a. Bulb shape complying with ANSI C78.79.
b. Lamp base complying with ANSI C81.61 or IEC 60061-1.

5. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.

B. Housings:
1. Universal mounting bracket.
2. Integral junction box with conduit fittings.

C. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit re-lamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during re-lamping and when secured in operating position.

D. Diffusers and Globes:
1. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
2. Glass: Annealed crystal glass unless otherwise indicated.
3. Lens Thickness: At least 0.125-inch minimum unless otherwise indicated.

E. Standards:
1. Recessed luminaires shall comply with NEMA LE 4.

## 2.3 LINEAR INDUSTRIAL

A. Lamp:
1. Rated lamp life of 35,000 hours to L70.
2. Dimmable from 100 percent to 0 percent of maximum light output.
3. Internal driver.
4. User-Replaceable Lamps:

a. Bulb shape complying with ANSI C78.79.
b. Lamp base complying with ANSI C81.61 or IEC 60061-1.

5. Lens Thickness: At least 0.125-inch minimum unless otherwise indicated.

B. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Components are designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

C. Diffusers and Globes:
1. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
2. Glass: Annealed crystal glass unless otherwise indicated.
3. Lens Thickness: At least 0.125-inch minimum unless otherwise indicated.

D. With integral mounting provisions.

## 2.4 LOWBAY

A. Lamp:
1. Minimum allowable efficacy of 80 lm/W.
2. Rated lamp life of 35,000 hours to L70.
3. Dimmable from 100 percent to 0 percent of maximum light output.
4. Internal driver.
5. User-Replaceable Lamps:

a. Bulb shape complying with ANSI C78.79.
b. Lamp base complying with ANSI C81.61 or IEC 60061-1.

6. Lens Thickness: At least 0.125-inch minimum unless otherwise indicated.

B. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Components are designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

C. Diffusers and Globes:
1. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
2. Glass: Annealed crystal glass unless otherwise indicated.
3. Lens Thickness: At least 0.125-inch minimum unless otherwise indicated.

## 2.5 RECESSED, LINEAR

1. Rated lamp life of 35,000 hours to L70.
2. Dimmable from 100 percent to 0 percent of maximum light output.
3. Internal driver.
4. User-Replaceable Lamps:

a. Bulb shape complying with ANSI C78.79.
b. Lamp base complying with ANSI C81.61 or IEC 60061-1.

5. Lens Thickness: At least 0.125-inch minimum unless otherwise indicated.

B. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Components are designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

C. Diffusers and Globes:
1. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
2. Glass: Annealed crystal glass unless otherwise indicated.
3. Lens Thickness: At least 0.125-inch minimum unless otherwise indicated.

## 2.6 STRIP LIGHT

A. Lamp:
1. Rated lamp life of 35,000 hours to L70.
2. Dimmable from 100 percent to 0 percent of maximum light output.
3. Internal driver.
4. User-Replaceable Lamps:
a. Bulb shape complying with ANSI C78.79.
b. Lamp base complying with ANSI C81.61 or IEC 60061-1

5. Lens Thickness: At least 0.125-inch minimum unless otherwise indicated.

B. Housings:
1. With integral mounting provisions.

C. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping of luminaire without use of tools. Components are designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

D. Diffusers and Globes:
1. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
2. Glass: Annealed crystal glass unless otherwise indicated.
3. Lens Thickness: At least 0.125-inch minimum unless otherwise indicated.

## 2.7 SURFACE MOUNT, LINEAR

A. Lamp:
1. Rated lamp life of 35,000 hours to L70.
2. Dimmable from 100 percent to 0 percent of maximum light output.
3. Internal driver.
4. User-Replaceable Lamps:

a. Bulb shape complying with ANSI C78.79.
b. Lamp base complying with ANSI C81.61 or IEC 60061-1.

5. Lens Thickness: At least 0.125-inch minimum unless otherwise indicated.

B. Housings:
1. With integral mounting provisions.

C. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Components are designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

D. Diffusers and Globes:
1. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
2. Glass: Annealed crystal glass unless otherwise indicated.
3. Lens Thickness: At least 0.125-inch minimum unless otherwise indicated.

## 2.8 SURFACE MOUNT, NONLINEAR

A. Lamp:
1. Rated lamp life of 35,000 hours to L70.
2. Dimmable from 100 percent to 0 percent of maximum light output.
3. Internal driver.
4. User-Replaceable Lamps:

a. Bulb shape complying with ANSI C78.79.
b. Lamp base complying with ANSI C81.61 or IEC 60061-1.

5. Lens Thickness: At least 0.125-inch minimum unless otherwise indicated.

B. Housings:
1. With integral mounting provisions.

C. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Components are designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

D. Diffusers and Globes:
1. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
2. Glass: Annealed crystal glass unless otherwise indicated.
3. Lens Thickness: At least 0.125-inch minimum unless otherwise indicated.

## 2.9 SUSPENDED, LINEAR

A. Lamp:
1. Rated lamp life of 35,000 hours to L70.
2. Dimmable from 100 percent to 0 percent of maximum light output.
3. Internal driver.

4. User-Replaceable Lamps:

    a. Bulb shape complying with ANSI C78.79.
    b. Lamp base complying with ANSI C81.61 or IEC 60061-1.

5. Lens Thickness: At least 0.125-inch minimum unless otherwise indicated.

B. Housings:
1. With integral mounting provisions.

C. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Components are designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

D. Diffusers and Globes:
1. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
2. Glass: Annealed crystal glass unless otherwise indicated.
3. Lens Thickness: At least 0.125-inch minimum unless otherwise indicated.

E. Standards:

1. ENERGY STAR certified.
2. RoHS compliant.
3. UL Listing: Listed for damp location.

## 2.10 SUSPENDED, NONLINEAR

A. Lamp:
1. Rated lamp life of 35,000 hours to L70.
2. Dimmable from 100 percent to 0 percent of maximum light output.
3. Internal driver.
4. User-Replaceable Lamps:

    a. Bulb shape complying with ANSI C78.79.
    b. Lamp base complying with ANSI C81.61 or IEC 60061-1.

5. Lens Thickness: At least 0.125-inch minimum unless otherwise indicated.

B. Housings:
1. Universal mounting bracket.
2. Integral junction box with conduit fittings.

C. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Components are designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

D. Diffusers and Globes:

1. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
2. Glass: Annealed crystal glass unless otherwise indicated.
3. Lens Thickness: At least 0.125-inch minimum unless otherwise indicated.

## 2.11 MATERIALS

A. Metal Parts:

1. Free of burrs and sharp corners and edges.
2. Sheet metal components shall be steel unless otherwise indicated.
3. Form and support to prevent warping and sagging.

B. Steel:

1. ASTM A36/A36M for carbon structural steel.
2. ASTM A568/A568M for sheet steel.

C. Stainless Steel:

1. 1. Manufacturer's standard grade.
2. 2. Manufacturer's standard type, ASTM A240/240M.

D. Galvanized Steel: ASTM A653/A653M.

E. Aluminum: ASTM B209.

## 2.12 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.

## 2.13 LUMINAIRE SUPPORT

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 steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.

Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

C. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1.

B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.

C. Install lamps in each luminaire.

D. Supports:

1. Sized and rated for luminaire weight.
2. Able to maintain luminaire position after cleaning and relamping.
3. Provide support for luminaire without causing deflection of ceiling or wall.
4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.

3.2 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. Luminaire will be considered defective if it does not pass operation tests and inspections.

C. Prepare test and inspection reports

END OF SECTION 265119.

# SECTION 265213 - EMERGENCY AND EXIT LIGHTING

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Emergency lighting units.
2. Exit signs.

### 1.2 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color Rendering Index.

C. Emergency Lighting Unit: A lighting unit with integral or remote emergency battery powered supply and the means for controlling and charging the battery and unit operation.

D. Fixture: See "Luminaire" Paragraph.

E. Lumen: Measured output of lamp and luminaire, or both.

F. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of emergency lighting unit, exit sign, and emergency lighting support, arranged by designation.

B. Shop Drawings: For nonstandard or custom luminaires.

1. Include plans as well as mounting and attachment details.
2. Include details of equipment 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.

### 1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, coordinated with each other, using input from installers of the items involved:

B. Product Certificates: For each type of luminaire.

C. Seismic Qualification Data: Certificates, for luminaires, accessories, and components, from manufacturer.

D. Manufacturer's Warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.6 CONTRACTOR'S WARRANTY

A. The contractor agrees to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period of 1 year.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR EMERGENCY LIGHTING

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. NRTL Compliance: Fabricate and label emergency lighting units, exit signs, and batteries to comply with UL 924.

C. Comply with NFPA 70 and NFPA 101.

D. Comply with NEMA LE 4 for recessed luminaires.

E. Comply with UL 1598 for recessed luminaires.

F. Internal Type Emergency Power Unit: Self-contained, modular, battery-inverter unit, factory mounted within luminaire body.

1. Emergency Connection: Connect un-switched 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. 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.

4. Battery: Sealed, maintenance-free, nickel-cadmium type.
5. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
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.

G. External Type: Self-contained, modular, battery-inverter unit, suitable for powering one or more lamps, remote mounted from luminaire.

1. Connect un-switched circuit to battery-inverter unit and switched circuit to luminaire.
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. Nightlight Connection: Operate lamp in a remote fixture continuously.
4. Battery: Sealed, maintenance-free, nickel-cadmium type.
5. Charger: Fully automatic, solid-state, constant-current type.
6. Housing: NEMA 250, Type 1 enclosure listed for installation inside, on top of, or remote from luminaire.
7. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
8. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
9. 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.

## 2.2 EMERGENCY LIGHTING

A. Emergency Luminaires and Emergency Lighting Units:

1. Provide where indicated, or required by Indiana Code, with the following additional features:

a. Operating at nominal voltage as indicated on the plans or required for the specific installation.

## 2.3 EXIT SIGNS

A. Internally Lighted Signs:

1. Operating at nominal voltage as indicated on the plans or required for the specific installation.
2. Lamps for AC Operation: LEDs; 50,000 hours minimum rated lamp life.
3. Self-Powered Exit Signs (Battery Type): Internal emergency power unit.

B. Self-Luminous Signs:

1. Powered by tritium gas, with universal bracket for flush-ceiling, wall, or end mounting. Signs shall be guaranteed by manufacturer to maintain the minimum brightness requirements in UL 924 for 10 years.
2. Use strontium oxide aluminate compound to store ambient light and release the stored energy when the light is removed. Include universal bracket for flush-ceiling, wall, or end mounting.

## 2.4 MATERIALS

A. Metal Parts:

1. Free of burrs and sharp corners and edges.
2. Sheet metal components shall be steel unless otherwise indicated.
3. Form and support to prevent warping and sagging.

B. Doors, Frames, and Other Internal Access:

1. Smooth operating, free of light leakage under operating conditions.
2. Designed to permit re-lamping without use of tools.
3. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during re-lamping and when secured in operating position.

C. Diffusers and Globes:

1. Retain "Glass" Subparagraph below if glass option is chosen in "Diffusers and Globes" Paragraph.
2. Glass: Annealed crystal glass unless otherwise indicated.
3. Acrylic: 100 percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
4. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.

## 2.5 METAL FINISHES

A. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

# PART 3 - EXECUTION

## 3.1 INSTALLATION

A. Comply with NECA 1.

B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.

C. Install lamps in each luminaire.

D. Supports:

1. Sized and rated for luminaire and emergency power unit weight.
2. Able to maintain luminaire position 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.

E. Wall-Mounted Luminaire Support:

1. Install per manufacturer’s installation instructions. Do not attach directly to drywall.

F. Suspended Luminaire Support:

1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of fixture 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 rod or wire support for suspension for each unit length of fixture 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.

G. Ceiling Grid Mounted Luminaires:

1. Secure to any required outlet box.
2. Secure emergency power unit using approved fasteners in a minimum of four locations, spaced near corners of emergency power unit.

H. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

## 3.2 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.

B. Luminaire will be considered defective if it does not pass operation tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION 265213

SECTION 312000

EARTH MOVING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Section Includes:

1. Preparing subgrades for slabs on grade, walks, pavements, and turf and grasses.
2. Excavation and backfilling for buildings and structures
3. Geotextile and drainage course for concrete slabs-on-grade
4. Excavating and backfilling for buildings and structures demolition.
5. Subbase course for concrete walks and concrete pavement.
6. Subbase course and base course for asphalt paving.
7. Excavating and backfilling trenches for utilities and pits for buried utility structures.

1.2 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. Additional information concerning Earth Moving may be found in the Geotechnical Engineering Evaluation Report. All requirements of the Geotechnical Engineering Evaluation shall be followed. The information shown in the evaluation is for information only and it shall be the contractors responsibility to field verifies conditions indicated. In case of conflict between the drawings, Geotechnical Engineering Evaluation, and this Earth Moving specification, the more stringent requirements shall govern.

C. Indiana Department of Transportation, "Standard Specifications".

1.3 DEFINITIONS

A. Backfill: Soil material or controlled low-strength material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Aggregate layer placed between the subbase course and concrete paving or hot-mix asphalt paving.

C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.

D. Drainage Fill: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

E. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Soils Consultant. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Soils Consultant. Unauthorized excavation, as well as remedial work directed by Soils Consultant, shall be without additional compensation.

G. Fill: Soil materials used to raise existing grades.

H. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

I. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

J. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

K. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

L. Protection Zones: Groups of trees, shrubs and plants or other sensitive areas delineated on the Demolition Plans which must be protected throughout the project.

1.4 QUALITY ASSURANCE

A. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E 329 and ASTM D 3740 for testing indicated.

B. Materials specified must comply with the Indiana Department of Transportation (INDOT) gradations.

C. Pre-excavation Conference: Conduct conference at Project site.

1.5 SUBMITTALS

A. Submittal procedures and requirements shall comply with Division 01 Specification Sections.

B. Product Data: For each type of the following manufactured products required:
1. Certificate of Gradation of materials
2. Geotextiles.
3. Controlled low-strength material, including design mixture.
4. Warning tapes.

C. Material Test Reports: For each borrow soil material proposed for fill and backfill as follows:

1. Classification according to ASTM D 2487.
2. Laboratory compaction curve according to ASTM D 1557.

1.6 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth moving operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

B. Utility Locator Service: Notify "Indiana811" by calling 811 and scheduling public utility locates for the area where Project is located before beginning earth moving operations. The contractor is responsible for locating onsite private utility mains and service lines.

C. Do not commence earth moving operations until temporary erosion and sedimentation control measures are in place.

D. Do not commence earth moving operations until plant-protection measures are in place.

E. The following practices are prohibited within the protection zones as delineated on the project site demolition plans:

1. Storage of construction materials, debris, or excavated material.
2. Parking vehicles or equipment.
3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or other digs unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

F. Do not direct vehicle or equipment exhaust towards protection zones.

G. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: Soil Classification Groups GW, GP, GM, SW, SP, and SM according to ASTM D 2487, or a combination of these groups; free of rock or gravel larger than 2 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487, or a combination of these groups.

1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

D. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.

E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch sieve and not more than 8 percent passing a No. 200 sieve.

F. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 10 percent passing a No. 200 sieve.

G. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.

H. Drainage Fill: Narrowly graded mixture of washed crushed stone, or crushed or uncrushed gravel with 100 percent passing a 1 inch sieve and 0 to 5 percent passing a No. 8 sieve.

I. Sand: ASTM C 33; fine aggregate.

J. Rip Rap : Aggregates shall be broken stone or rock, Class I in accordance with Section 904.04 of the Indiana Department of Transportation Standard Specifications. Gradation of the material shall comply with the following requirements:

1. 100% shall pass a 24-inch sieve.
2. 85-100% shall pass an 18-inch sieve.
3. 35-50% shall pass a 12-inch sieve.
4. 10-30% shall pass a 6-inch sieve.
5. 0-10% shall pass a 3 inch sieve.

Reasonable care shall be taken in loading to obtain a similar gradation for consecutive loads.

J. Topsoil: Loose, friable soil of loamy character, graded free from subsoil, clay lumps, vegetation, weeds, debris, rocks larger than one inch in any dimension and excessive amounts of smaller rocks, or other material detrimental to proper vegetative growth. Topsoil shall have a pH range of 5.5 to 7.5, 4% organic material minimum. Remove any unsuitable topsoil from the site. Dispose of excess topsoil offsite (on-site where directed by Owner.) Any additional topsoil required shall meet this specification and shall be from a source approved by the Architect/Engineer.

K. Indiana Department of Transportation (INDOT) Aggregates: Fine and Coarse aggregates shall come from an Indiana Department of Transportation approved source and shall comply with the following gradation requirements:

Sizes of Fine Aggregates - INDOT Spec. 904.02 (h)

| SIZES (PERCENT PASSING) | | | | | | |
|---|---|---|---|---|---|---|
| Sieve Sizes | 23 | 24 | 15 | 16 | PP | S&I |
| 3/8 in. (9.5 mm) | 100 | 100 | | | | 100 |
| No. 4 (4.75 mm) | 95-100 | 95-100 | | | 100 | |
| No. 6 (3.35 mm) | | | 100 | | | |
| No. 8 (2.36 mm) | 80-100 | 70-100 | 90-100 | | 85-95 | |
| No. 16 (1.18 mm) | 50-85 | 40-80 | 050-75 | | | |
| No. 30 (600 um) | 25-60 | 20-60 | 15-40 | 100 | 50-65 | |
| No. 50 (300 um) | 5-30 | 7-40 | | | 15-25 | 0-30 |
| No. 80 (180 um) | | | 0-10 | 95-100 | | |
| No. 100 (150 um) | 0-10 | 1-20 | 0-3 | | 0-10 | |
| No. 200 (75 um)[2] | 0-3 | 0-6 | | 65-100 | | 0-7 |

Sizes of Coarse Aggregates - INDOT Spec. 904.03 (e)

| Sieve Sizes | COARSE AGGREGATE SIZES (PERCENT PASSING) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | COARSE GRADED | | | | | | | | DENSE GRADED | |
| | 2 | 5 | 8 | 9 | 11 | 12 | 43[1] | 91 | 53[1] | 73[1] |
| 4 in. (100 mm) | | | | | | | | | | |
| 3 1/2 in. (90 mm) | | | | | | | | | | |
| 2 1/2 in. (63 mm) | 100 | | | | | | | | | |
| 2 in (50 mm) | 80-100 | | | | | | | | | |
| 1 1/2 in. (37.5 mm) | | 100 | | | | | 100 | | 100 | |
| 1 in. (25 mm) | 0-25 | 85-98 | 100 | | | | 70-90 | 100 | 80-100 | 100 |
| 3/4 in. (19 mm) | 0-10 | 60-85 | 75-95 | 100 | | | 50-70 | | 70-90 | 90-100 |
| 1/2 in. (12.5 mm) | 0-7 | 30-60 | 40-70 | 60-85 | 100 | 100 | 35-50 | | 55-80 | 60-90 |
| 3/8 in. (9.5 mm) | | 15-45 | 20-50 | 30-60 | 75-95 | 95-100 | | | | |
| No. 4 (4.75 mm) | | 0-15 | 0-15 | 0-15 | 10-30 | 50-80 | 20-40 | | 35-60 | 35-60 |
| No. 8 (2.36 mm) | | 0-10 | 0-10 | 0-10 | 0-10 | 0-35 | 15-35 | | 25-50 | |
| No. 30 (600 um) | | | | | | 0-4 | 5-20 | | 12-30 | 12-30 |
| No. 200 (75 um)[2] | | | | | | | 0-6.0 | | 5.0-10.0[4] | 5.0-12.0 |
| Decant (PCC)[3] | | 0-1.5 | 0-1.5 | 0-1.5 | 0-1.5 | 0-1.5 | | 0-1.5 | | |
| Decant (Non-PCC) | 0-2.5 | 0-2.5 | 0-3.0 | 0-2.5 | 0-2.5 | 0-2.0 | | 0-2.5 | | |

Notes:
1. The liquid limit shall not exceed 25 (35 if slag) and the plasticity index shall not exceed 5. The liquid limit shall be determined in accordance with AASHTO T 89 and the plsticity index in accordance with AASHTO T 90.
2. Includes the total amount passing the No. 200 (75 um) sieve as determined by AASHTO T 11 and T27.
3. Decant may be 0-2.5 for stone and slag.
4. When slag is used for separation layers as defined in 302.01, the total amount passing the No. 200 (75 um) sieve

2.2 CONTROLLED LOW-STRENGTH MATERIAL (FLOWABLE FILL)

A. Controlled Low-Strength Material: Self-compacting, flowable concrete material produced from the following:

1. Portland cement: ASTM C 150, Type II.
2. Fly Ash: ASTM C 618, Class C or F.
3. Normal-Weight Aggregate: ASTM C 33, 3/4-inch nominal maximum aggregate size.
4. Foaming Agent: ASTM C 869.
5. Water: ASTM C 94/C 94M.
6. Air-Entraining Admixture: ASTM C 260.

B. Produce conventional-weight, controlled low-strength material with 80-psi compressive strength when tested according to ASTM C 495. Reference Flowable Fill specification 312323 for more information on this material.

2.3 ACCESSORIES

A. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene 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 the 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 as follows:

1. Red: Electric.
2. Yellow: Gas, oil, steam, and dangerous materials.
3. Orange: Telephone and other communications.
4. Blue: Water systems.
5. Green: Sewer systems.

B. Geotextiles:
1. Geotextile shall conform to requirements of Indiana Department of Transportation (INDOT) Standard Specifications.
2. Geotextile shall be furnished in protective wrapping which shall protect the material from ultraviolet radiation and abrasion due to shipping and handling. If the geotextile is to be exposed directly to sunlight in excess of two weeks, the fabric shall be ultraviolet stabilized.
3. Geotextile for subgrade stabilization and/or base separation:
   a. Mirafi 180N
   b. Propex Geotex 801
   c. ADS 8801
   d. Contech C-80NW

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth moving operations.

B. Protect and maintain erosion and sedimentation controls during earth moving operations.

C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.2 DEWATERING

A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

3.3 EXPLOSIVES

A. Explosives: Do not use explosives.

3.4 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

3.5 EXCAVATION FOR STRUCTURES

A. Excavations for Footings and Foundations:
1. Excavate to indicated elevations and dimensions with a tolerance of plus or minus 1 inch.
2. Footings shall bear on firm undisturbed material. If unsuitable material is discovered, re-establish the bearing elevation of the footing by localized undercutting and filling with suitable engineered fill or concrete as recommended by the Testing Agency.
3. Place all footings the same day excavations are opened. If this is not possible, adequately protect the exposed material in the bases of the footing excavations from any detrimental changes in condition such as from disturbance, rain, or freezing. Surface runoff shall not be allowed to enter excavations.

B. Excavation of Existing Construction:

1. Excavations for Footings and Foundations: Do not over excavate in areas of foundation removals and leave solid base to receive other work. Any portions of the below grade structures approved by the Owner to remain shall be noted on the as-built drawings.

C. Excavations at Edges of Tree- and Plant-Protection Zones:

1. Excavate by hand 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.

3.6 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.7 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to depth and width necessary to remove indicated utility.

B. Excavate trenches to indicated gradients, lines, depths, and elevations.

1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

C. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit unless otherwise indicated.

1. Clearance: 12 inches each side of pipe or conduit or as indicated.

D. Trench Bottoms: Excavate trenches 4 inches deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells of pipe.

1. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

E. 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.

3.8 SUBGRADE INSPECTION

A. Notify Geotechnical Engineer / Testing Agency when excavations have reached required subgrade.

B. If Geotechnical Engineer / Testing Agenccy determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

C. Proof-roll subgrade below the pavements with a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction. Limit vehicle speed to 3 mph.
2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Soils Consultant, and replace with compacted backfill or fill as directed.

D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Soils Consultant, without additional compensation.

F. Place geotextile soil reinforcing where indicated on drawings, or a directed by the Geotechnical Engineer, on prepared subgrade. Lap joints a minimum of 24 inches, and protect from damage during granular base installation.

3.9 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Class A concrete may be used when approved by Soils Consultant.

1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Soils Consultant.

3.10 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.11 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:

1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
2. Surveying locations of underground utilities for Record Documents.
3. Testing and inspecting underground utilities.
4. Removing concrete formwork.
5. Removing trash and debris.
6. Removing temporary shoring and bracing, and sheeting.
7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

C. The top and bottom supporting slabs for all concrete walls retaining earth must be placed and have reached at least 75 percent of their specified compressive strength prior to placing backfill.

1. All concrete walls retaining earth must have reached at least 75 percent of their specified compressive strength prior to placing backfill.

D. All backfill placed against concrete walls shall be Drainage Fill.

3.12 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. 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. Concrete is specified in Section 033000 "Cast-in-Place Concrete"

D. Trenches under Roadways: Provide 4-inch- thick, concrete-base slab support for piping or conduit 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. Concrete is specified in Section 03 3000 "Cast-in-Place Concrete"

E. Backfill voids with satisfactory soil while removing shoring and bracing.

F. Place and compact initial backfill of satisfactory soil, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the pipe or conduit.

1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

G. Place and compact final backfill of satisfactory soil to final subgrade elevation.

H. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.13 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations as follows:

1. Under grass and planted areas, use satisfactory soil material.
2. Under walks and pavements, use satisfactory soil material.
3. Under steps and ramps, use engineered fill.
4. Under building slabs, use engineered fill.
5. Under footings and foundations, use engineered fill.

C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.14 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.15 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 6 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 1557:

1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent.
2. Under foundations, test subgrade and compact each layer of engineered fill at 97 percent.
3. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 95 percent.
4. Under natural turf or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 90 percent.
5. For utility trenches, compact each layer of initial and final backfill soil material at 95 percent.
6. Compaction by flooding is not acceptable.

D. At end of each of filling and compaction operations, proof roll with smooth tired vehicle to leave smooth surface sealed to shed water.

E. Prior to preparing formwork for the foundations, the excavation shall be inspected as specified in the soils report and any action required will be done as described therein.

3.16 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Rough Grading: Slope grades to direct water away from paved areas and to prevent ponding. Finish subgrades to required elevations within the following tolerances:

1. Turf or Unpaved Areas: Plus or minus 1 inch above or below required subgrade elevations.
2. Walks: Shape surface of areas under walks to line, grade and cross-section with finish surface not more than 0.10 ft. above or below required subgrade elevation.
3. Pavements: Shape surface of areas under pavement to line, grade and cross-section with finish surface not more than 1/2 inch above or below required subgrade elevation.

3.17 SUBSURFACE DRAINAGE

A. Subsurface Drain: Place subsurface drainage geotextile around perimeter of subdrainage trench. Place a 6-inch course of filter material on subsurface drainage geotextile to support subdrainage pipe. Encase subdrainage pipe in a minimum of 12 inches of filter material, placed in compacted layers 6 inches thick, and wrap in subsurface drainage geotextile, overlapping sides and ends at least 6 inches.

3.18 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

A. Place subbase course and base course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place subbase course and base course under pavements and walks as follows:
1. Place base course material over subbase course under hot-mix asphalt pavement.

2. Shape subbase course and base course to required crown elevations and cross-slope grades.
3. Place subbase course and base course 6 inches or less in compacted thickness in a single layer.
4. Place subbase course and base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
5. Compact subbase course and base course with a minimum 10-ton roller, to an optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.
6. Perform hand tamping in areas inaccessible to mechanized compaction equipment.
7. Place earth or other approved materials along the edges of the base course so that at least one foot of the shoulder is rolled and compacted simultaneously with the rolling and compacting of each base course layer.

3.19 DRAINAGE COURSE UNDER CONCRETE SLABS-ON-GRADE

A. Place drainage fill on subgrades free of mud, frost, snow, or ice.

B. On prepared and compacted subgrade, place and compact drainage fill under cast-in-place concrete slabs-on-grade as follows:

1. Install geotextile as required on the drawings.
2. Place drainage fill that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
3. Maintain optimum moisture content for compacting material during placement operations. Compact to the specified density.

3.20 GEOTEXTILE INSTALLATION

A. Geotextile shall be installed in accordance with the manufacturer's recommended procedures.

B. Fabric shall be placed in a manner and at locations shown on the drawings. The surface to receive the geotextile shall be prepared to a smooth condition, free of obstructions, depressions and debris. Fabric shall be placed loosely, not in a stretched condition. Equipment shall not be operated directly on geotextile.

C. For subgrade separation, or stabilization, install geotextile smoothly over prepared subgrade. Lap fabric per manufacturer’s recommendations, or 12 inches, whichever is greater. Do not operate trucks or equipment directly on geotextile.

3.21 FIELD QUALITY CONTROL

A. Special Inspections: Owner or Owner’s Agent will engage a qualified Testing Agency to perform the following special inspections:

1. Determine prior to placement of fill that site has been prepared in compliance with requirements.
2. Determine that fill material and maximum lift thickness comply with requirements.
3. Determine, at the required frequency, that in-place density of compacted fill complies with requirements.

B. Testing Agency: Owner or Owner’s Agent will engage a qualified geotechnical engineering testing agency to perform tests and inspections.

C. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.

D. Footing Subgrade: Verify by testing that the soil bearing capacity is acceptable at each column footing and at 8'-0" intervals along wall footings at the indicated bearing elevations.

E. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable.

1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. or less of paved area or building slab, but in no case fewer than three tests.
2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for every 100 feet or less of wall length, but no fewer than two tests.
3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 150 feet or less of trench length, but no fewer than two tests.

F. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained. Additional compaction and testing will be done at no additional expense to the Owner.

G. Test finished granular base course surface with a 16 foot straight edge applied parallel and at right angles of centerline of area to be paved.
1. Correct any surface deficiencies greater than ½" by loosening, adding or removing material, and reshaping and re-compacting.

3.22 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by Soils Consultant; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

D. Positive drainage of surface water, including existing and new building downspout discharge, shall be maintained away from structure foundations to avoid wetting and weakening of foundation soils both during construction and after construction is complete.

3.23 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

B. Transport surplus satisfactory soil to designated storage areas on Owner's property. Stockpile or spread soil as directed by Soils Consultant.

END OF SECTION