



100% DESIGN SPECIFICATIONS – BID SET

**PROJECT MANUAL
VOLUME 1 (DIVISIONS 00 – 10)
FOR
THE CONSTRUCTION OF**

**Lake Lewisville Water Treatment Plant Dewatering Improvements
Denton Purchase Order No. 186564
Ordinance 18-1234
Garver Project No. 18088080**

Chris Watts
Mayor

Todd Hileman
City Manager

Todd Estes, P.E.
Director of Capital Projects

Timothy Fisher, PE
Director of Water Utilities

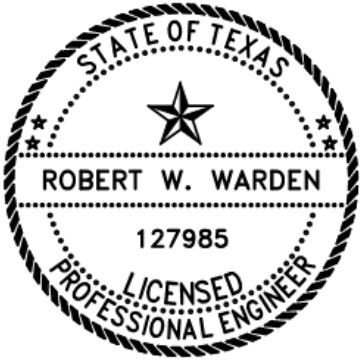

Mamun Yusuf, PE
Water Utilities Senior Engineer

**Prepared for
The City of Denton**

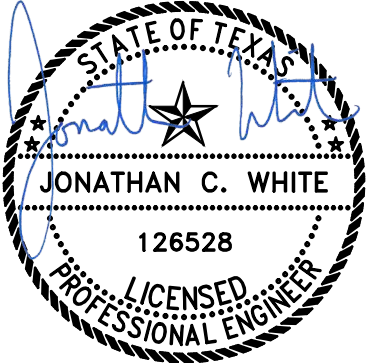
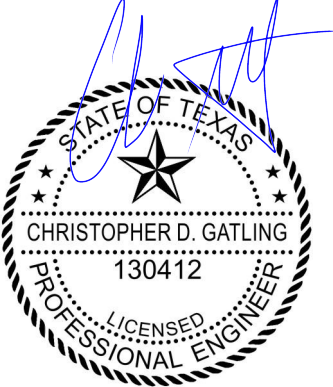
2019

by Garver

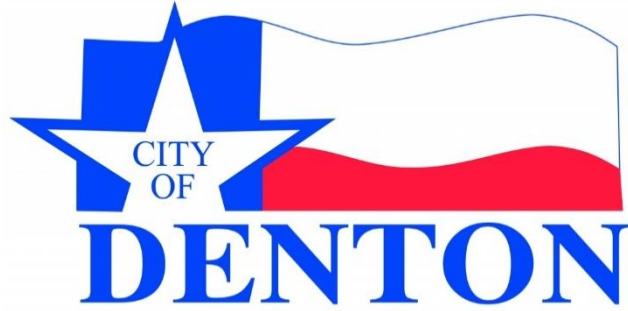
CERTIFICATIONS

<p>LAKE LEWISVILLE WATER TREATMENT PLANT DEWATERING IMPROVEMENTS GARVER PROJECT NO. 18088080 CITY OF DENTON PO NO. 186564 ORDINANCE NO. 18-1234</p>	
<p>I hereby certify that the applicable portions of this project plans and specifications were prepared by me or under my direct supervision and that I am a duly Licensed Engineer under the laws of the State of TX.</p>	
<p>SEAL AND SIGNATURE</p>	<p>APPLICABLE DIVISION OR PROJECT RESPONSIBILITY</p>
<p align="center">Robert W. Warden, P.E.</p>  <p align="center"><i>Robert W Warden</i></p> <p align="center">Digitally Signed: 05/20/2019</p>	<p>Division 01 Division 22 Division 23 Division 40 Division 41 Division 43 Division 44 Division 46</p>
<p align="center">Kipp Martin, P.E.</p>  <p align="center"><i>Kipp A Martin</i></p> <p align="center">Digitally Signed: 05/20/2019</p>	<p>Division 02 Division 03 Division 04 Division 05 Division 07 Division 08 Division 09 Division 10</p>

CERTIFICATIONS

SEAL AND SIGNATURE	APPLICABLE DIVISION OR PROJECT RESPONSIBILITY
<p align="center">Jonathan White, P.E.</p>  <p align="center">Digitally Signed: 05/20/2019</p>	<p>Division 26</p>
<p align="center">Chris Gatling, P.E.</p>  <p align="center">Digitally Signed: 05/20/2019</p>	<p>Division 31 Division 32 Division 33</p>

<p>GARVER, LLC CERTIFICATE OF AUTHORIZATION:</p>
<p>TX ENGINEERING FIRM REGISTRATION NO. F-5713</p> <p>Expiration Date: 1/31/2020</p>



City of Denton

Standard Construction Specification Documents

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SECTION 00 05 10
CONSTRUCTION CONTRACT ORDINANCE

[Assembler: For Contract Document execution, remove this page and replace with the approved Construction Contract Ordinance for the award of the project. Ordinance insert shall be on blue paper.]

END OF SECTION

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SECTION 00 05 15
ADDENDA

[Assembler: For Contract Document execution, remove this page and replace with any addenda issued during bidding.]

END OF SECTION

1 The Bidding and Contract Documents may be examined or obtained on-line by visiting the City
2 of Denton’s Purchasing Division website at [http://www.cityofdenton.com/en-](http://www.cityofdenton.com/en-us/business/solicitations-contracting)
3 [us/business/solicitations-contracting](http://www.cityofdenton.com/en-us/business/solicitations-contracting) and clicking on the “See Open Solicitations” link to the
4 advertised projects on Ion Wave (Denton electronic solicitation site) . The Contract Documents
5 may be downloaded, viewed, and printed by interested contractors and/or suppliers. **The**
6 **contractor is required to fill out the Certificate of Interested Parties Form 1295 and the**
7 **form must be submitted to the Project Manager before the contract will be presented to the**
8 **City Council. The form can be obtained at <https://www.ethics.state.tx.us/tec/1295-Info.htm> .**
9

10
11 **PREBID CONFERENCE**

12 A prebid conference may be held as described in Section 00 21 13 - INSTRUCTIONS TO
13 BIDDERS at the following location, date, and time:

14 **DATE: June 25, 2019**

15 **TIME: 2:00pm**

16 **PLACE: Purchasing Division**
17 **901-B Texas Street**
18 **Denton, Texas 76209**

19 **LOCATION: Purchasing Conference Room, 2nd Floor**
20

21
22 **PREBID WALKTHROUGH – Not Applicable**
23

24
25 **CITY'S RIGHT TO ACCEPT OR REJECT BIDS**

26 City reserves the right to waive irregularities and to accept or reject bids.
27

28
29 **FUNDING**

30 Any Contract awarded under this INVITATION TO BIDDERS is expected to be funded from
31 revenues generated from *user fees and bonds of* Denton’s Public Utility Board to the work
32 under this INVITATION TO BIDDERS.
33

34
35 **INQUIRIES**

36 All inquiries relative to this procurement should be addressed to the following:

37 **Deadline for Questions: July 5, 2019**

38 Attn: IFB 7096, Jane Rogers, Sr. Buyer, City of Denton,

39 Email: Purchasing@cityofdenton.com

40 Phone: 940-349-7318
41

42 **ADVERTISEMENT DATES**

43 *June 18, 2019*

44 *June 25, 2019*
45

46 **END OF SECTION**

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SECTION 00 21 13
INSTRUCTIONS TO BIDDERS

Defined Terms

- 1.1. Terms used in these INSTRUCTIONS TO BIDDERS, which are defined in Section 00 72 00 - GENERAL CONDITIONS.

- 1.2. Certain additional terms used in these INSTRUCTIONS TO BIDDERS have the meanings indicated below which are applicable to both the singular and plural thereof.
 - 1.2.1. Bidder: Any person, firm, partnership, company, association, or corporation acting directly through a duly authorized representative, submitting a bid for performing the work contemplated under the Contract Documents.

 - 1.2.2. Nonresident Bidder: Any person, firm, partnership, company, association, or corporation acting directly through a duly authorized representative, submitting a bid for performing the work contemplated under the Contract Documents whose principal place of business is not in the State of Texas.

 - 1.2.3. Successful Bidder: The lowest responsible and responsive Bidder to whom City (on the basis of City's evaluation as hereinafter provided) makes an award.

 - 1.2.4. Purchasing Agent: City designated representative to assist in solicitation of bids from vendors for City contracts.

2. Copies of Bidding Documents

- 2.1. Neither City nor Engineer shall assume any responsibility for errors or misinterpretations resulting from the Bidders use of incomplete sets of Bidding Documents.

- 2.2. City and Engineer in making Bidding Documents available do so only for the purpose of obtaining Bids for the Work and do not authorize or confer a license or grant for any other use.

3. Minimum Qualifications

- 3.1. The following minimum requirements must be demonstrated in order for the submission to be considered responsive. The form can be found in Section 00 45 13 – Bidder’s Minimum Qualification Statement.
 - 3.1.1. Bidder shall provide documentation demonstrating three (3) years minimum experience providing services similar to those indicated in Section 00 11 13 – Invitation to Bidders. Experience shall include the following:
 - 3.1.1.1. Repairs or renovations requiring system isolation and coordination of activities at an active municipal water treatment facility
 - 3.1.1.2. Installation and startup of piping, valves and equipment handling potable water for public consumption
 - 3.1.1.3. Installation and startup or process mechanical systems of equipment handling solids from water or wastewater

1 3.1.1.4. Large, multidiscipline projects which include extensive electrical,
2 process mechanical, instrumentation, structural and civil work
3

4 3.1.2. Bidder shall provide documentation of five (5) references from governmental
5 entities for which Bidder has performed similar services to those indicated in
6 Section 00 11 13 – Invitation to Bidders.
7

8 3.1.3. Bidder shall fill out provided safety record questionnaire.
9

10
11 **4. Examination of Bidding and Contract Documents, Other Related Data, and Site**
12

13 4.1. Before submitting a Bid, each Bidder shall:
14

15 4.1.1. Examine and carefully study the Contract Documents and other related data
16 identified in the Bidding Documents (including "technical data" referred to in
17 Paragraph 4.2. below). No information given by City or any representative of the
18 City other than that contained in the Contract Documents and officially
19 promulgated addenda thereto, shall be binding upon the City.
20

21 4.1.2. Visit the site to become familiar with and satisfy Bidder as to the general, local and
22 site conditions that may affect cost, progress, performance or furnishing of the
23 Work.
24

25 4.1.3. Consider federal, state and local Laws and Regulations that may affect cost,
26 progress, performance or furnishing of the Work.
27

28 4.1.4. Be advised, City, in accordance with Title VI of the Civil Rights Act of 1964, 78
29 Stat. 252, 42 U.S.C. 2000d to 2000d-4 and Title 49, Code of Federal Regulations,
30 Department of Transportation, Subtitle A, Office of the Secretary, Part 21,
31 Nondiscrimination in Federally-assisted programs of the Department of
32 Transportation issued pursuant to such Act, hereby notifies all bidders that it will
33 affirmatively insure that in any contract entered into pursuant to this advertisement,
34 disadvantaged business enterprises will be afforded full opportunity to submit bids
35 in response to this invitation and will not be discriminated against on the grounds of
36 race, color, or national origin in consideration of award.
37

38 4.1.5. Study all: (i) reports of explorations and tests of subsurface conditions at or
39 contiguous to the Site and all drawings of physical conditions relating to existing
40 surface or subsurface structures at the Site (except Underground Facilities) that
41 have been identified in the Contract Documents as containing reliable "technical
42 data" and (ii) reports and drawings of Hazardous Environmental Conditions, if any,
43 at the Site that have been identified in the Contract Documents as containing
44 reliable "technical data."
45

1 4.1.6. Be advised that the Contract Documents on file with the City shall constitute all of
2 the information which the City will furnish. All additional information and data
3 which the City will supply after promulgation of the formal Contract Documents
4 shall be issued in the form of written addenda and shall become part of the Contract
5 Documents just as though such addenda were actually written into the original
6 Contract Documents. No information given by the City other than that contained in
7 the Contract Documents and officially promulgated addenda thereto, shall be
8 binding upon the City.
9

10 4.1.7. Perform independent research, investigations, tests, borings, and such other means
11 as may be necessary to gain a complete knowledge of the conditions which will be
12 encountered during the construction of the project. On request, City may provide
13 each Bidder access to the site to conduct such examinations, investigations,
14 explorations, tests and studies as each Bidder deems necessary for submission of a
15 Bid. Bidder must fill all holes and clean up and restore the site to its former
16 conditions upon completion of such explorations, investigations, tests and studies.
17

18 4.1.8. Determine the difficulties of the Work and all attending circumstances affecting the
19 cost of doing the Work, time required for its completion, and obtain all information
20 required to make a proposal. Bidders shall rely exclusively and solely upon their
21 own estimates, investigation, research, tests, explorations, and other data which are
22 necessary for full and complete information upon which the proposal is to be based.
23 It is understood that the submission of a proposal is prima-facie evidence that the
24 Bidder has made the investigation, examinations and tests herein required. Claims
25 for additional compensation due to variations between conditions actually
26 encountered in construction and as indicated in the Contract Documents will not be
27 allowed.
28

29 4.1.9. Promptly notify City of all conflicts, errors, ambiguities or discrepancies in or
30 between the Contract Documents and such other related documents. The Contractor
31 shall not take advantage of any gross error or omission in the Contract Documents,
32 and the City shall be permitted to make such corrections or interpretations as may
33 be deemed necessary for fulfillment of the intent of the Contract Documents.
34

35 4.2. Reference is made to Section 00 73 00 – Supplementary Conditions for identification of:
36

37 4.2.1. those reports of explorations and tests of subsurface conditions at or contiguous to
38 the site which have been utilized by City in preparation of the Contract Documents.
39 The logs of Soil Borings, if any, on the plans are for general information only.
40 Neither the City nor the Engineer guarantee that the data shown is representative of
41 conditions which actually exist.
42

43 4.2.2. those drawings of physical conditions in or relating to existing surface and
44 subsurface structures (except Underground Facilities) which are at or contiguous to
45 the site that have been utilized by City in preparation of the Contract Documents.
46

1 4.2.3. copies of such reports and drawings will be made available by City to any Bidder
2 on request. Those reports and drawings may not be part of the Contract
3 Documents, but the "technical data" contained therein upon which Bidder is entitled
4 to rely as provided in Paragraph 4.02. of the General Conditions has been identified
5 and established in Paragraph SC 4.02 of the Supplementary Conditions. Bidder is
6 responsible for any interpretation or conclusion drawn from any "technical data" or
7 any other data, interpretations, opinions or information.
8

9 4.3. The submission of a Bid will constitute an incontrovertible representation by Bidder (i)
10 that Bidder has complied with every requirement of this Paragraph 4, (ii) that without
11 exception the Bid is premised upon performing and furnishing the Work required by the
12 Contract Documents and applying the specific means, methods, techniques, sequences or
13 procedures of construction (if any) that may be shown or indicated or expressly required
14 by the Contract Documents, (iii) that Bidder has given City written notice of all
15 conflicts, errors, ambiguities and discrepancies in the Contract Documents and the
16 written resolutions thereof by City are acceptable to Bidder, and when said conflicts,
17 etc., have not been resolved through the interpretations by City as described in
18 Paragraph 6., and (iv) that the Contract Documents are generally sufficient to indicate
19 and convey understanding of all terms and conditions for performing and furnishing the
20 Work.
21

22 4.4. The provisions of this Paragraph 4, inclusive, do not apply to Asbestos, Polychlorinated
23 biphenyls (PCBs), Petroleum, Hazardous Waste or Radioactive Material covered by
24 Paragraph 4.06. of the General Conditions, unless specifically identified in the Contract
25 Documents.
26

27 4.5. The Bidder acknowledges and agrees to comply with the requirements of City Ethics
28 Ordinance No. 18-157.
29

30 **5. Availability of Lands for Work, Etc.**
31

32 5.1. The lands upon which the Work is to be performed, rights-of-way and easements for
33 access thereto and other lands designated for use by Contractor in performing the Work
34 are identified in the Contract Documents. All additional lands and access thereto
35 required for temporary construction facilities, construction equipment or storage of
36 materials and equipment to be incorporated in the Work are to be obtained and paid for
37 by Contractor. Easements for permanent structures or permanent changes in existing
38 facilities are to be obtained and paid for by City unless otherwise provided in the
39 Contract Documents.
40

41 5.2. Outstanding right-of-way, easements, and/or permits to be acquired by the City are listed
42 in Paragraph SC 4.01 of the Supplementary Conditions. In the event the necessary right-
43 of-way, easements, and/or permits are not obtained, the City reserves the right to cancel
44 the award of contract at any time before the Bidder begins any construction work on the
45 project.
46

47 5.3. The Bidder shall be prepared to commence construction without all executed right-of-
48 way, easements, and/or permits, and shall submit a schedule to the City of how
49 construction will proceed in the other areas of the project that do not require permits
50 and/or easements.
51

1 **6. Interpretations and Addenda**

2
3 6.1. All questions about the meaning or intent of the Bidding Documents are to be directed to
4 the City in Ion Wave on or before 2 p.m., the Thursday prior to the Bid opening.
5 Questions received after this day **WILL NOT** be responded to. Interpretations or
6 clarifications considered necessary by City in response to such questions will be issued
7 by Addenda delivered to all parties recorded by City as having received the Bidding
8 Documents. Only questions answered by formal written Addenda will be binding. Oral
9 and other interpretations or clarifications will be without legal effect.

10
11
12
13 6.2. Addenda may also be issued to modify the Bidding Documents as deemed advisable by
14 City.

15
16 6.3. Addenda or clarifications may be posted via the City's online hosting site, which can be
17 located by visiting the City of Denton's Purchasing Division website at
18 <http://www.cityofdenton.com/en-us/business/solicitations-contracting> and
19 clicking on the "See Open Solicitations" link.

20
21 6.4. A prebid conference may be held at the time and place indicated in the Advertisement or
22 INVITATION TO BIDDERS. Representatives of City will be present to discuss the
23 Project. Bidders are encouraged to attend and participate in the conference. City will
24 transmit to all prospective Bidders of record such Addenda as City considers necessary
25 in response to questions arising at the conference. Oral statements may not be relied
26 upon and will not be binding or legally effective.

27
28 **7. Bid Security**

29
30 7.1. Each Bid for projects over \$100,000, must be accompanied by Bid Bond made payable to
31 City in an amount of five (5) percent of Bidder's maximum Bid price on form attached,
32 issued by a surety meeting the requirements of Paragraphs 5.01 of the General
33 Conditions, and in accordance with Texas Local Government Code 262.032.

34
35 7.2. The Bid Bond of all Bidders will be retained until the conditions of the Notice of Award
36 have been satisfied. If the Successful Bidder fails to execute and deliver the complete
37 Agreement within 10 days after the Notice of Award, City may consider Bidder to be in
38 default, rescind the Notice of Award, and the Bid Bond of that Bidder will be forfeited.
39 Such forfeiture shall be City's exclusive remedy if Bidder defaults. The Bid Bond of all
40 other Bidders whom City believes to have a reasonable chance of receiving the award
41 will be retained by City until final contract execution.

42
43 **8. Contract Times**

44 The number of days within which, or the dates by which, Milestones are to be achieved in
45 accordance with the General Requirements and the Work is to be completed and ready for
46 Final Acceptance is set forth in the Agreement or incorporated therein by reference to the
47 attached Bid Form.

48
49 **9. Liquidated Damages**

50 Provisions for liquidated damages are set forth in the Agreement.

51

1 **10. Substitute and "Or-Equal" Items**

2 The Contract, if awarded, will be on the basis of materials and equipment described in the
3 Bidding Documents without consideration of possible substitute or "or-equal" items.
4 Whenever it is indicated or specified in the Bidding Documents that a "substitute" or "or-
5 equal" item of material or equipment may be furnished or used by Contractor if acceptable to
6 City, application for such acceptance will not be considered by City until after the Effective
7 Date of the Agreement. The procedure for submission of any such application by Contractor
8 and consideration by City is set forth in Paragraphs 6.05A., 6.05B. and 6.05C. of the General
9 Conditions and is supplemented in Section 01 25 00 of the General Requirements.

10
11 **11. Subcontractors, Suppliers and Others**

12
13 11.1. No Contractor shall be required to employ any Subcontractor, Supplier, other person
14 or organization against whom Contractor has reasonable objection.

15
16 **12. Bid Form**

17
18 12.1. The Bid Form is included with the Bidding Documents; additional copies may be
19 obtained from the City.

20
21 12.2. All blanks on the Bid Form must be completed and the Bid Form signed. Erasures or
22 alterations shall be initialed by the person signing the Bid Form. A Bid price shall be
23 indicated for each Bid item, alternative, and unit price item listed therein. In the case
24 of optional alternatives, the words "No Bid," "No Change," or "Not Applicable" may
25 be entered. Bidder shall state the prices, in both words and numerals, for which the
26 Bidder proposes to do the work contemplated or furnish materials required. If
27 handwritten, all prices shall be written legibly. In case of discrepancy between price
28 in written/typed words and the price in written/typed numerals, the price in
29 written/typed words shall govern.

30
31 12.3. Bids by corporations shall be executed in the corporate name by the president or a
32 vice-president or other corporate officer accompanied by evidence of authority to
33 sign, as provided herein, Section 00 45 43 – Corporate Resolution of Authorizing
34 Signatories. The corporate address and state of incorporation shall be shown below
35 the signature.

36
37 12.4. Bids by partnerships shall be executed in the partnership name and signed by a
38 partner, whose title must appear under the signature accompanied by evidence of
39 authority to sign. The official address of the partnership shall be shown below the
40 signature.

41
42 12.5. Bids by limited liability companies shall be executed in the name of the firm by a
43 member and accompanied by evidence of authority to sign. The state of formation of
44 the firm and the official address of the firm shall be shown.

45
46 12.6. Bids by individuals shall show the Bidder's name and official address.

47
48 12.7. Bids by joint ventures shall be executed by each joint venturer in the manner
49 indicated on the Bid Form. The official address of the joint venture shall be shown.
50

- 1 12.8. All names shall be typed below the signature.
2
3 12.9. The Bid shall contain an acknowledgement of receipt of all Addenda, the numbers of
4 which shall be filled in on the Bid Form.
5
6 12.10. Postal and e-mail addresses and telephone number for communications regarding the
7 Bid shall be shown.
8
9 12.11. Evidence of authority to conduct business as a Nonresident Bidder in the state of
10 Texas shall be provided in accordance with Section 00 43 37 – Vendor Compliance
11 to State Law Non Resident Bidder.
12

13. Submission of Bids

- 13
14
15 13.1. Bids may be submitted electronically in Ion Wave or by hard copy.
16 13.2. Hard copies of bid bonds shall be submitted for both electronic and hard copy
17 submissions. Bonds must be submitted in a sealed envelope before the due date and
18 time as indicated in Section 00 11 13 – Invitation to Bidders.
19
20 13.3. Bids shall be submitted on the prescribed Bid Form, provided with the Bidding
21 Documents, at the time and place indicated in the Advertisement or INVITATION
22 TO BIDDERS, and shall be enclosed in an opaque sealed envelope, marked with the
23 Bid Number, Project title, the name and address of Bidder, and accompanied by the
24 Bid security and other required documents, as indicated in Section 00 41 00 – Bid
25 Form. If the Bid is sent through the mail or other delivery system, the sealed
26 envelope shall be enclosed in a separate envelope with the notation "BID
27 ENCLOSED" on the face of it. Hard copy submissions shall also include a flash
28 drive, containing a complete copy of the response, and be addressed as follows:
29

30 City of Denton
31 901-B Texas Street
32 Denton, TX 76209
33 Attn: Materials Management/Purchasing Division, IFB 7096 LLWTP
34 Dewatering Improvements
35

1 **14. Modification and Withdrawal of Bids**
2

- 3 14.1. Bids addressed to the Purchasing Agent and filed with the Purchasing Division may
4 be withdrawn prior to the time set for bid opening. A request for withdrawal must be
5 made in writing by an appropriate document duly executed in the manner that a Bid
6 must be executed and delivered to the place where Bids are to be submitted at any
7 time prior to the opening of Bids. After all Bids not requested for withdrawal are
8 opened and publicly read aloud, the Bids for which a withdrawal request has been
9 properly filed may, at the option of the City, be returned unopened.
10
11 14.2. Bidders may modify their Bid by electronic communication at any time prior to the
12 time set for the closing of Bid receipt.
13

14 **15. Opening of Bids**

15 Bids will be opened and read aloud publicly at the place where Bids are to be submitted. An
16 abstract of the amounts of the base Bids and major alternates (if any) will be made available
17 to Bidders after the opening of Bids.
18

19 **16. Bids to Remain Subject to Acceptance**

20 All Bids will remain subject to acceptance for the time period specified for Notice of Award
21 and execution and delivery of a complete Agreement by Successful Bidder. City may, at
22 City's sole discretion, release any Bid and nullify the Bid security prior to that date.
23

24 **17. Evaluation of Bids and Award of Contract**
25

26 17.1. City reserves the right to reject any or all Bids, including without limitation the rights
27 to reject any or all nonconforming, nonresponsive, unbalanced or conditional Bids
28 and to reject the Bid of any Bidder if City believes that it would not be in the best
29 interest of the Project to make an award to that Bidder, whether because the Bid is
30 not responsive or the Bidder is unqualified or of doubtful financial ability or fails to
31 meet any other pertinent standard or criteria established by City. City also reserves
32 the right to waive informalities not involving price, contract time or changes in the
33 Work with the Successful Bidder. Discrepancies between the multiplication of units
34 of Work and unit prices will be resolved in favor of the unit prices. Discrepancies
35 between the indicated sum of any column of figures and the correct sum thereof will
36 be resolved in favor of the correct sum. Discrepancies between words and figures
37 will be resolved in favor of the words.
38

- 39 17.1.1. Any or all bids will be rejected if City has reason to believe that collusion exists
40 among the Bidders, Bidder is an interested party to any litigation against City,
41 City or Bidder may have a claim against the other or be engaged in litigation,
42 Bidder is in arrears on any existing contract or has defaulted on a previous
43 contract, Bidder has performed a prior contract in an unsatisfactory manner, or
44 Bidder has uncompleted work which in the judgment of the City will prevent or
45 hinder the prompt completion of additional work if awarded.
46

- 1 17.2. City may consider the qualifications and experience of Subcontractors, Suppliers, and
2 other persons and organizations proposed for those portions of the Work as to which
3 the identity of Subcontractors, Suppliers, and other persons and organizations must
4 be submitted as provided in the Contract Documents or upon the request of the City.
5 City also may consider the operating costs, maintenance requirements, performance
6 data and guarantees of major items of materials and equipment proposed for
7 incorporation in the Work when such data is required to be submitted prior to the
8 Notice of Award.
9
- 10 17.3. City may conduct such investigations as City deems necessary to assist in the
11 evaluation of any Bid and to establish the responsibility, qualifications, and financial
12 ability of Bidders, proposed Subcontractors, Suppliers and other persons and
13 organizations to perform and furnish the Work in accordance with the Contract
14 Documents to City's satisfaction within the prescribed time.
15
- 16 17.4. Contractor shall perform with his own organization, work of a value not less than
17 35% of the value embraced on the Contract, unless otherwise approved by the City.
18 Contractor shall complete and submit Section 00 43 36 – Proposed Subcontractors
19 Form.
20
- 21 17.5. If the Contract is to be awarded, it will be awarded to lowest responsible and
22 responsive Bidder whose evaluation by City indicates that the award will be in the
23 best interests of the City.
24
- 25 17.6. Pursuant to Texas Government Code Chapter 2252.001, the City will not award
26 contract to a Nonresident Bidder unless the Nonresident Bidder's bid is lower than
27 the lowest bid submitted by a responsible Texas Bidder by the same amount that a
28 Texas resident bidder would be required to underbid a Nonresident Bidder to obtain a
29 comparable contract in the state in which the nonresident's principal place of
30 business is located.
31
- 32 17.7. A contract is not awarded until formal City Council authorization. If the Contract is
33 to be awarded, City will award the Contract within 120 days after the day of the Bid
34 opening unless extended in writing. No other act of City or others will constitute
35 acceptance of a Bid. Upon the contractor award a Notice of Award will be issued by
36 the City.
37
- 38 17.8. Failure or refusal to comply with the requirements may result in rejection of Bid.
39
- 40 17.9. Contractor is required to fill out the Certificate of Interested Parties Form 1295 and
41 the form must be submitted to the City Project Manager before the contract will be
42 presented to the City Council. The form can be obtained at
43 <https://www.ethics.state.tx.us/tec/1295-Info.htm>.
44
45

1 **18. Signing of Agreement**
2 When City issues a Notice of Award to the Successful Bidder, it will be accompanied by the
3 required number of unsigned counterparts of the Agreement. Within 14 days thereafter
4 Contractor shall sign and deliver the required number of counterparts of the Agreement to
5 City with the required Bonds, Certificates of Insurance, and all other required documentation.
6 City shall thereafter deliver one fully signed counterpart to Contractor.
7
8

END OF SECTION

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SECTION 00 35 13
CONFLICT OF INTEREST AFFIDAVIT

CONFLICT OF INTEREST QUESTIONNAIRE -

FORM CIQ

For vendor or other person doing business with local governmental entity

This questionnaire reflects changes made to the law by H.B. 23, 84th Leg., Regular Session.

This questionnaire is being filed in accordance with Chapter 176, Local Government Code, by a vendor who has a business relationship as defined by Section 176.001(1-a) with a local governmental entity and the vendor meets requirements under Section 176.006(a).

By law this questionnaire must be filed with the records administrator of the local government entity not later than the 7th business day after the date the vendor becomes aware of facts that require the statement to be filed. See Section 176.006(a-1), Local Government Code.

A vendor commits an offense if the vendor knowingly violates Section 176.006, Local Government Code. An offense under this section is a misdemeanor.

1 Name of vendor who has a business relationship with local governmental entity.

2 Check this box if you are filing an update to a previously filed questionnaire.

(The law requires that you file an updated completed questionnaire with the appropriate filing authority not later than the 7th business day after the date on which you became aware that the originally filed questionnaire was incomplete or inaccurate.)

3 Name of local government officer about whom the information in this section is being disclosed.

Name of Officer

This section, (item 3 including subparts A, B, C & D), must be completed for each officer with whom the vendor has an employment or other business relationship as defined by Section 176.001(1-a), Local Government Code. Attach additional pages to this Form CIQ as necessary.

A. Is the local government officer named in this section receiving or likely to receive taxable income, other than investment income, from the vendor?

Yes

No

B. Is the vendor receiving or likely to receive taxable income, other than investment income, from or at the direction of the local government officer named in this section AND the taxable income is not received from the local governmental entity?

Yes

No

C. Is the filer of this questionnaire employed by a corporation or other business entity with respect to which the local government officer serves as an officer or director, or holds an ownership of one percent or more?

Yes

No

D. Describe each employment or business and family relationship with the local government officer named in this section.

4 I have no Conflict of Interest to disclose.

5

Signature of vendor doing business with the governmental entity

Date

SECTION 00 41 00

BID FORM

TO: IFB 7096, Jane Rogers, Sr. Buyer
c/o: Purchasing Division
901-B Texas Street
Denton, Texas 76209

FOR: Lake Lewisville Water Treatment Plant Dewatering Improvements

1 Enter Into Agreement

The undersigned Bidder proposes and agrees, if this Bid is accepted, to enter into an Agreement with City in the form included in the Bidding Documents to perform and furnish all Work as specified or indicated in the Contract Documents for the Bid Price and within the Contract Time indicated in this Bid and in accordance with the other terms and conditions of the Contract Documents.

2 BIDDER Acknowledgements and Certification

- 2.1 In submitting this Bid, Bidder accepts all of the terms and conditions of the INVITATION TO BIDDERS and INSTRUCTIONS TO BIDDERS, including without limitation those dealing with the disposition of Bid Bond.
- 2.2 Bidder is aware of all costs to provide the required insurance, will do so pending contract award, and will provide a valid insurance certificate meeting all requirements within 14 days of notification of award.
- 2.3 Bidder certifies that this Bid is genuine and not made in the interest of or on behalf of any undisclosed individual or entity and is not submitted in conformity with any collusive agreement or rules of any group, association, organization, or corporation.
- 2.4 Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid.
- 2.5 Bidder has not solicited or induced any individual or entity to refrain from bidding.
- 2.6 Bidder has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for the Contract. For the purposes of this Paragraph:
- a. "corrupt practice" means the offering, giving, receiving, or soliciting of any thing of value likely to influence the action of a public official in the bidding process.
 - b. "fraudulent practice" means an intentional misrepresentation of facts made (a) to influence the bidding process to the detriment of City (b) to establish Bid prices at artificial non-competitive levels, or (c) to deprive City of the benefits of free and open competition.
 - c. "collusive practice" means a scheme or arrangement between two or more Bidders, with or without the knowledge of City, a purpose of which is to establish Bid prices at artificial, non-competitive levels.
 - d. "coercive practice" means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process or affect the execution of the Contract.

1 2.7 The Bidder acknowledges and agrees to comply with the requirements of City Ethics
2 Ordinance No. 18-757.
3

4 **3 Time of Completion**
5

- 6 3.1 The Work will be complete for Final Acceptance within 365 days after the date when the
7 Contract Time commences to run as provided in Paragraph 2.03 of the General Conditions.
8 3.2 Bidder accepts the provisions of the Agreement as to liquidated damages in the event of
9 failure to complete the Work {and/or achievement of Milestones} within the times
10 specified in the Agreement.
11

12 **4 Attached to this Bid**
13

14 The following documents are attached to and made a part of this Bid:

- 15 a. This Bid Form
16 b. Required Bid Bond, Section 00 43 13 issued by a surety meeting the requirements of
17 Paragraph 5.01 of the General Conditions.
18 c. Proposal Form Section
19 d. Vendor Compliance to State Law Non-Resident Bidder, Section 00 43 37
20 e. Conflict of Interest Affidavit, Section 00 35 13
21 f. Proposed Subcontractors Form, Section 00 43 36
22 g. Bidders Minimum Qualification Statement, Section 00 45 13
23 h. Corporate Resolution of Authorized Signatories, Section 00 45 43
24 i. Any additional documents that may be required by Section 12 of the Instructions to
25 Bidders
26

27 **5 Total Bid Amount**
28

- 29 5.1 Bidder will complete the Work in accordance with the Contract Documents for the
30 following bid amount. In the space provided below, please enter the total bid amount for
31 this project. Only this figure will be read publicly by the City at the bid opening.
32 5.2 It is understood and agreed by the Bidder in signing this proposal that the total bid amount
33 entered below is subject to verification and/or modification by multiplying the unit bid
34 prices for each pay item by the respective estimated quantities shown in this proposal and
35 then totaling all of the extended amounts.
36

37 Bid Item No. 1:

38
39 Construction of belt filter presses and dumpsterveyor equipment at or near the Lake Lewisville
40 Water Treatment Plant as shown on the Plans or as otherwise required by these Contract
41 Documents, for the amount of _____
42 _____ Dollars.
43

44 Total Bid Amount: \$ _____
45
46
47
48
49
50

1 Bid Item No. 2:
2
3 Construction of improvements at or near the Lake Lewisville Water Treatment Plant and all
4 Work, with the exception of Bid Item No. 1, as shown on the Plans or as otherwise required by
5 these Contract Documents, for the amount of
6 _____
7 _____ Dollars.
8
9 Total Bid Amount: \$ _____
10

1 **6 Bid Submittal**

2
3
4
5

This Bid is submitted on _____, 20__ by the entity named below.

6 Respectfully submitted,

7
8
9
10
11

By: _____
(Signature)

(Printed Name)

12
13

Title: _____

14
15
16
17

Company: _____

18
19

Address: _____

20

State of Incorporation: _____

21

Email: _____

22

Phone: _____

Receipt is acknowledged of the following Addenda:	Initial
Addendum No. 1:	
Addendum No. 2:	
Addendum No. 3:	
Addendum No. 4:	

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SECTION 00 43 36
PROPOSED SUBCONTRACTORS FORM

Each Bidder for a City procurement is required to complete the information below by identifying the proposed subcontractors whom they intend to utilize and the approximate percentage of the overall contract that will be allocated to each entity. Bidder is reminded that a minimum of 35% of the Contract must be performed by Bidder's company.

Company Name	Type of Work to be Performed	Overall Contract Percentage (%)
General Contractor:		
Subcontractors:		

The undersigned hereby certifies that the subcontractors described in the table above will be utilized for this project at the approximate percentage levels indicated above.

BIDDER:

_____ By: _____
 Company (Please Print)

_____ Signature: _____
 Address

_____ Title: _____
 City/State/Zip (Please Print)

Date: _____

END OF SECTION

SECTION 00 43 37

VENDOR COMPLIANCE TO STATE LAW NON- RESIDENT BIDDER

Texas Government Code Chapter 2252 was adopted for the award of contracts to nonresident bidders. This law provides that, in order to be awarded a contract as low bidder, nonresident bidders (out-of-state contractors whose corporate offices or principal place of business are outside the State of Texas) bid projects for construction, improvements, supplies or services in Texas at an amount lower than the lowest Texas resident bidder by the same amount that a Texas resident bidder would be required to underbid a nonresident bidder in order to obtain a comparable contract in the State which the nonresident’s principal place of business is located.

The appropriate blanks in Section A must be filled out by all nonresident bidders in order for your bid to meet specifications. The failure of nonresident bidders to do so will automatically disqualify that bidder. Resident bidders must check the box in Section B.

A. Nonresident bidders in the State of _____, our principal place of business, are required to be _____ percent lower than resident bidders by State Law. A copy of the statute is attached.

Nonresident bidders in the State of _____, our principal place of business, are not required to underbid resident bidders.

B. The principal place of business of our company or our parent company or majority owner is in the State of Texas.

BIDDER:

Company By: _____
(Please Print)

Address Signature: _____

City/State/Zip Title: _____
(Please Print)

Date: _____

END OF SECTION

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SECTION 00 45 13
BIDDER'S MINIMUM QUALIFICATION STATEMENT

List three (3) Government references, **other than the City of Denton**, who can verify the quality of service your company provides. The City prefers customers of similar size and scope of work to this solicitation.

REFERENCE ONE

GOVERNMENT/COMPANY NAME: _____
LOCATION: _____
CONTACT PERSON AND TITLE: _____
TELEPHONE NUMBER: _____
SCOPE OF WORK: _____
CONTRACT PERIOD: _____

REFERENCE TWO

GOVERNMENT/COMPANY NAME: _____
LOCATION: _____
CONTACT PERSON AND TITLE: _____
TELEPHONE NUMBER: _____
SCOPE OF WORK: _____
CONTRACT PERIOD: _____

REFERENCE THREE

GOVERNMENT/COMPANY NAME: _____
LOCATION: _____
CONTACT PERSON AND TITLE: _____
TELEPHONE NUMBER: _____
SCOPE OF WORK: _____
CONTRACT PERIOD: _____

SAFETY RECORD QUESTIONNAIRE

The City of Denton desires to avail itself of the benefits of Section 252.0435 of the Local Government Code, and consider the safety records of potential contractors prior to award of City contracts. Pursuant to Section 252.0435 of the Local Government Code, the City of Denton has adopted the following written definition and criteria for accurately determining the safety record of a respondent prior to awarding City contracts.

The definition and criteria for determining the safety record of a respondent for this consideration shall be:

The City of Denton shall consider the safety record of the respondent in determining the responsibility thereof. The City may consider any incidence involving worker safety or safety of the citizens of the City of Denton, be it related or caused by environmental, mechanical, operational, supervision or any other cause or factor. Specifically, the City may consider, among other things:

- A. Complaints to, or final orders entered by, the Occupational Safety and Health Review Commission (OSHRC), against the respondent for violations of OSHA regulations within the past three (3) years.
- B. Citations (as defined below) from an Environmental Protection Agency (as defined below) for violations within the past five (5) years. Environmental Protection Agencies include, but are not necessarily limited to, the U.S. Army Corps of Engineers (USACOE), the U.S. Fish and Wildlife Service (USFWS), the Environmental Protection Agency (EPA), the Texas Commission on Environmental Quality (TCEQ), the Texas Natural Resource Conservation Commission (TNRCC) (predecessor to the TCEQ), the Texas Department of Health (TDH), the Texas Parks and Wildlife Department (TPWD), the Structural Pest Control Board (SPCB), agencies of local governments responsible for enforcing environmental protection or worker safety related laws or regulations, and similar regulatory agencies of other states of the United States. Citations include notices of violation, notices of enforcement, suspension/revocations of state or federal licenses or registrations, fines assessed, pending criminal complaints, indictments, or convictions, administrative orders, draft orders, final orders, and judicial final judgments.
- C. Convictions of a criminal offense within the past ten (10) years, which resulted in bodily harm or death.
- D. Any other safety related matter deemed by the City Council to be material in determining the responsibility of the respondent and his or her ability to perform the services or goods required by the solicitation documents in a safe environment, both for the workers and other employees of respondent and the citizens of the City of Denton.

In order to obtain proper information from respondents so that City of Denton may consider the safety records of potential contractors prior to awarding bids on City contracts, City of Denton requires that respondents answer the following three (3) questions and submit them with their submissions:

1 **QUESTION ONE**

2
3 Has the respondent, or the firm, corporation, partnership, or institution represented by the
4 respondent, or anyone acting for such firm, corporation, partnership or institution, received
5 citations for violations of OSHA within the past three (3) years?

6
7 YES _____ NO _____

8
9 If the respondent has indicated YES for question number one above, the respondent must provide
10 to City of Denton, with its submission, the following information with respect to each such
11 citation:

12
13 Date of offense, location of establishment inspected, category of offense, final disposition of
14 offense, if any, and penalty assessed.

15
16 **QUESTION TWO**

17
18 Has the respondent, or the firm, corporation, partnership, or institution represented by the
19 respondent, or anyone acting for such firm, corporation, partnership or institution, received
20 citations for violations of environmental protection laws or regulations, of any kind or type,
21 within the past five years? Citations include notice of violation, notice of enforcement,
22 suspension/revocations of state or federal licenses, or registrations, fines assessed, pending
23 criminal complaints, indictments, or convictions, administrative orders, draft orders, final orders,
24 and judicial final judgments.

25
26 YES _____ NO _____

27
28 If the respondent has indicated YES for question number two above, the respondent must provide
29 to City of Denton, with its submission, the following information with respect to each such
30 conviction:

31
32 Date of offense or occurrence, location where offense occurred, type of offense, final disposition
33 of offense, if any, and penalty assessed.

34
35 **QUESTION THREE**

36
37 Has the respondent, or the firm, corporation, partnership, or institution represented by respondent,
38 or anyone acting for such firm, corporation, partnership, or institution, ever been convicted,
39 within the past ten (10) years, of a criminal offense which resulted in serious bodily injury or
40 death?

41
42 YES _____ NO _____

43
44 If the respondent has indicated YES for question number three above, the respondent must
45 provide to City of Denton, with its submission, the following information with respect to each
46 such conviction:

47 Date of offense, location where offense occurred, type of offense, final disposition of offense, if
48 any, and penalty assessed.

49 **END OF SECTION**

SECTION 00 45 26

CONTRACTOR COMPLIANCE WITH WORKER'S COMPENSATION LAW

Pursuant to Texas Labor Code Section 406.096(a), as amended, Contractor certifies that it provides worker's compensation insurance coverage for all of its employees employed on Lake Lewisville Water Treatment Plant Dewatering Improvements. Contractor further certifies that, pursuant to Texas Labor Code, Section 406.096(b), as amended, it will provide to City its subcontractor's certificates of compliance with worker's compensation coverage.

CONTRACTOR:

Company By: _____
(Please Print)

Address Signature: _____

City/State/Zip Title: _____
(Please Print)

THE STATE OF TEXAS §

COUNTY OF DENTON §

BEFORE ME, the undersigned authority, on this day personally appeared _____, known to me to be the person whose name is subscribed to the foregoing instrument, and acknowledged to me that he/she executed the same as the act and deed of _____ for the purposes and consideration therein expressed and in the capacity therein stated.

GIVEN UNDER MY HAND AND SEAL OF OFFICE this _____ day of _____, 20__.

Notary Public in and for the State of Texas

END OF SECTION

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SECTION 00 45 43
CORPORATE RESOLUTION AUTHORIZING SIGNATORIES

[Assembler: For Contract Document execution, remove this page and replace with Bidder's corporate resolution authorizing signatories.]

END OF SECTION

1 recognizes the delays, expense and difficulties involved in proving in a legal proceeding,
2 the actual loss suffered by the City if the Work is not completed on time. Accordingly,
3 instead of requiring any such proof, Contractor agrees that as liquidated damages for
4 delay (but not as a penalty). Should the Contractor exceed the time specified in Paragraph
5 4.1 above without reaching substantial completion for the project, the Contractor shall
6 pay City two thousand Dollars (\$2,000.00) for each day that expires until the substantial
7 completion milestone has been reached. Should the Contractor exceed the time specified
8 in Paragraph 4.1 above without reaching final completion for the project, the Contractor
9 shall pay City five hundred Dollars (\$500.00) for each day that expires after the time
10 specified for Final Acceptance until the City issues the Final Letter of Acceptance.

11 Article 5. CONTRACT DOCUMENTS

12 5.1 CONTENTS:

13 A. The Contract Documents which comprise the entire agreement between City and
14 Contractor concerning the Work consist of the following:

- 15 1. This Agreement.
- 16 2. Attachments to this Agreement:
 - 17 a. Bid Form
 - 18 1) Proposal Form
 - 19 2) Vendor Compliance to State Law Non-Resident Bidder
 - 20 3) State and Federal documents (*project specific*)
 - 21 b. Current Prevailing Wage Rate Table
 - 22 c. Insurance ACORD Form(s)
 - 23 d. Payment Bond
 - 24 e. Performance Bond
 - 25 f. Maintenance Bond
 - 26 g. Power of Attorney for the Bonds
 - 27 h. Worker's Compensation Affidavit
 - 28 i. Form 1295 – Certificate of Interested Parties
- 29 3. General Conditions.
- 30 4. Supplementary Conditions.

- 1 5. Specifications specifically made a part of the Contract Documents by attachment or,
2 if not attached, as incorporated by reference and described in the Table of Contents
3 of the Project’s Contract Documents.

- 4 6. North Central Texas Council of Governments Standard Specifications for Public
5 Works Construction – Fourth Edition, Divisions 200-800, and as amended by City, as
6 incorporated by reference and described in the Table of Contents of the Project’s
7 Contract Documents.

- 8 7. Drawings.

- 9 8. Addenda.

- 10 9. Documentation submitted by Contractor prior to Notice of Award.

- 11 10. The following which may be delivered or issued after the Effective Date of the
12 Agreement and, if issued, become an incorporated part of the Contract Documents:
 - 13 a. Notice to Proceed.
 - 14 b. Field Orders.
 - 15 c. Change Orders.
 - 16 d. Letter of Final Acceptance.
- 17
- 18

1 **Article 6. INDEMNIFICATION**

2 **6.1 Contractor covenants and agrees to indemnify, hold harmless and defend, at its own**
3 **expense, the city, its officers, servants and employees, from and against any and all claims**
4 **arising out of, or alleged to arise out of, the work and services to be performed by the**
5 **contractor, its officers, agents, employees, subcontractors, licensees or invitees under this**
6 **contract. This indemnification provision is specifically intended to operate and be**
7 **effective even if it is alleged or proven that all or some of the damages being sought were**
8 **caused, in whole or in part, by any act, omission or negligence of the city. This indemnity**
9 **provision is intended to include, without limitation, indemnity for any and all costs,**
10 **expenses and legal fees incurred by the city in defending against such claims and causes**
11 **of actions.**

12
13 **6.2 Contractor covenants and agrees to indemnify and hold harmless, at its own expense, the**
14 **city, its officers, servants and employees, from and against any and all loss of, damage to,**
15 **or destruction of, property of the city, arising out of, or alleged to arise out of, the work**
16 **and services to be performed by the contractor, its officers, agents, employees,**
17 **subcontractors, licensees or invitees under this contract. This indemnification provision**
18 **is specifically intended to operate and be effective even if it is alleged or proven that all**
19 **or some of the damages being sought were caused, in whole or in part, by any act,**
20 **omission or negligence of the city.**

21
22 **Article 7. MISCELLANEOUS**

23 **7.1 Terms.**

24 Terms used in this Agreement which are defined in Article 1 of the General Conditions will
25 have the meanings indicated in the General Conditions.

26 **7.2 Assignment of Contract.**

27 This Agreement, including all of the Contract Documents may not be assigned by the
28 Contractor without the advanced express written consent of the City.

29 **7.3 Successors and Assigns.**

30 City and Contractor each binds itself, its partners, successors, assigns and legal
31 representatives to the other party hereto, in respect to all covenants, agreements and
32 obligations contained in the Contract Documents.

1 7.4 Severability.

2 Any provision or part of the Contract Documents held to be unconstitutional, void or
3 unenforceable by a court of competent jurisdiction shall be deemed stricken, and all
4 remaining provisions shall continue to be valid and binding upon City and Contractor.

5 7.5 Governing Law and Venue.

6 This Agreement, including all of the Contract Documents is performable in the State of
7 Texas. Venue shall be Denton County, Texas, or the United States District Court for the
8 Eastern District of Texas, Sherman Division.

9 7.6 Authority to Sign.

10 Contractor shall attach evidence of authority to sign Agreement if signed by someone other
11 than the duly authorized signatory of the Contractor.

12

13 7.7 Prohibition On Contracts With Companies Boycotting Israel.

14 Contractor acknowledges that in accordance with Chapter 2270 of the Texas Government
15 Code, the City is prohibited from entering into a contract with a company for goods or
16 services unless the contract contains a written verification from the company that it: (1)

17 does not boycott Israel; and (2) will not boycott Israel during the term of the contract.

18 The terms "boycott Israel" and "company" shall have the meanings ascribed to those terms
19 in Section 808.001 of the Texas Government Code. ***By signing this contract, Contractor
20 certifies that Contractor's signature provides written verification to the City that
21 Contractor: (1) does not boycott Israel; and (2) will not boycott Israel during the term of
22 the contract.***

23

24 7.8 Immigration Nationality Act.

25 Contractor shall verify the identity and employment eligibility of its employees who perform
26 work under this Agreement, including completing the Employment Eligibility Verification
27 Form (I-9). Upon request by City, Contractor shall provide City with copies of all I-9 forms
28 and supporting eligibility documentation for each employee who performs work under this
29 Agreement. Contractor shall adhere to all Federal and State laws as well as establish
30 appropriate procedures and controls so that no services will be performed by any
31 Contractor employee who is not legally eligible to perform such services. **CONTRACTOR
32 SHALL INDEMNIFY CITY AND HOLD CITY HARMLESS FROM ANY PENALTIES, LIABILITIES,**

1 **OR LOSSES DUE TO VIOLATIONS OF THIS PARAGRAPH BY CONTRACTOR, CONTRACTOR'S**
2 **EMPLOYEES, SUBCONTRACTORS, AGENTS, OR LICENSEES.** City, upon written notice to
3 Contractor, shall have the right to immediately terminate this Agreement for violations of
4 this provision by Contractor.

5

6 7.9 No Third-Party Beneficiaries.

7 This Agreement gives no rights or benefits to anyone other than the City and the Contractor
8 and there are no third-party beneficiaries.

9

10

1 7.10 No Cause of Action Against Engineer.

2 Contractor, its subcontractors and equipment and materials suppliers on the Project or their
3 sureties, shall maintain no direct action against the Engineer, its officers, employees, and
4 subcontractors, for any claim arising out of, in connection with, or resulting from the
5 engineering services performed. Only the City will be the beneficiary of any undertaking by
6 the Engineer. The presence or duties of the Engineer's personnel at a construction site,
7 whether as on-site representatives or otherwise, do not make the Engineer or its personnel
8 in any way responsible for those duties that belong to the City and/or the City's Contractors
9 or other entities, and do not relieve the Contractors or any other entity of their obligations,
10 duties, and responsibilities, including, but not limited to, all construction methods, means,
11 techniques, sequences, and procedures necessary for coordinating and completing all
12 portions of the construction work in accordance with the Contract Documents and any
13 health or safety precautions required by such construction work. The Engineer and its
14 personnel have no authority to exercise any control over any construction contractor or
15 other entity or their employees in connection with their work or any health or safety
16 precautions.

17

18

SIGNATURE PAGE TO FOLLOW

19

1 IN WITNESS WHEREOF, City and Contractor have each executed this Agreement to be effective as
2 of the date subscribed by the City’s designated City Manager (“Effective Date”).

3

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13 37 ATTEST:

14 38 JENNIFER WALTERS, CITY SECRETARY

15 39

16 40

17 41 _____

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21 45 APPROVED AS TO LEGAL FORM:

22 46 AARON LEAL, CITY ATTORNEY

23 47

24 48 _____

25 49 _____

26 _____

27 _____

CITY OF DENTON

PHONE NUMBER

BY:

TITLE:

EMAIL ADDRESS

CONTRACTOR

[CONTRACTOR'S CORPORATE NAME HERE]

BY:

AUTHORIZED AGENT

NAME

TITLE

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SECTION 00 61 13
PERFORMANCE BOND

THE STATE OF TEXAS §
§ KNOW ALL BY THESE PRESENTS:
COUNTY OF DENTON §

That we, _____, known as
"Principal" herein and _____, a corporate
surety(sureties, if more than one) duly authorized to do business in the State of Texas, known as
"Surety" herein (whether one or more), are held and firmly bound unto the City of Denton, a
municipal corporation created pursuant to the laws of Texas, known as "City" herein, in the
penal sum of, _____ Dollars
(\$ _____), lawful money of the United States, to be paid in Denton, Denton
County, Texas for the payment of which sum well and truly to be made, we bind ourselves, our
heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these
presents.

WHEREAS, the Principal has entered into a certain written contract with the City
awarded the ____ day of _____, 20____, which Contract is hereby referred to and
made a part hereof for all purposes as if fully set forth herein, to furnish all materials,
equipment labor and other accessories defined by law, in the prosecution of the Work, including
any Change Orders, as provided for in said Contract designated as Lake Lewisville Water
Treatment Plant Dewatering Improvements.

NOW, THEREFORE, the condition of this obligation is such that if the said Principal shall
faithfully perform it obligations under the Contract and shall in all respects duly and faithfully
perform the Work, including Change Orders, under the Contract, according to the plans,
specifications, and contract documents therein referred to, and as well during any period of

1 extension of the Contract that may be granted on the part of the City, then this obligation shall
2 be and become null and void, otherwise to remain in full force and effect.

3 **PROVIDED FURTHER**, that if any legal action be filed on this Bond, venue shall lie in
4 Denton County, Texas or the United States District Court for the Eastern District of Texas,
5 Sherman Division.

6 This bond is made and executed in compliance with the provisions of Chapter 2253 of
7 the Texas Government Code, as amended, and all liabilities on this bond shall be determined in
8 accordance with the provisions of said statute.

9 **IN WITNESS WHEREOF**, the Principal and the Surety have SIGNED and SEALED this
10 instrument by duly authorized agents and officers on this the _____ day of _____
11 _____, 20____.

12 PRINCIPAL:

13 _____
14 _____
15 _____
16 _____

17
18 BY:

19 _____

20 Signature

21 ATTEST:

22 _____
23 _____

24 _____

25 (Principal) Secretary

26 Name and Title

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Address:

Witness as to Principal

SURETY:

BY:

Signature

Name and Title

Address:

1 **IN WITNESS WHEREOF**, the Principal and Surety have each SIGNED and SEALED
2 this instrument by duly authorized agents and officers on this the _____ day of
3 _____, 20____.

4

PRINCIPAL:

ATTEST:

BY: _____
Signature

(Principal) Secretary

Name and Title
Address: _____

Witness as to Principal

SURETY:

ATTEST:

BY: _____
Signature

(Surety) Secretary

Name and Title
Address: _____

Witness as to Surety

Telephone Number: _____

5

6 Note: If signed by an officer of the Surety, there must be on file a certified extract from the
7 bylaws showing that this person has authority to sign such obligation. If Surety's physical
8 address is different from its mailing address, both must be provided.

9

10 **THE DATE OF THE BOND SHALL NOT BE PRIOR**
11 **TO THE DATE THE CONTRACT IS AWARDED.**

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END OF SECTION

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SECTION 00 61 19
MAINTENANCE BOND

THE STATE OF TEXAS §
§ KNOW ALL BY THESE PRESENTS:
COUNTY OF TARRANT §

That we _____, known as
"Principal" herein and _____, a corporate surety
(sureties, if more than one) duly authorized to do business in the State of Texas, known as
"Surety" herein (whether one or more), are held and firmly bound unto the City of Denton, a
municipal corporation created pursuant to the laws of the State of Texas, known as "City"
herein, in the sum of _____ Dollars
(\$ _____), lawful money of the United States, to be paid in Denton, Denton
County, Texas, for payment of which sum well and truly be made unto the City and its
successors, we bind ourselves, our heirs, executors, administrators, successors and assigns,
jointly and severally, firmly by these presents.

WHEREAS, the Principal has entered into a certain written contract with the City awarded
the _____ day of _____, 20____, which Contract is hereby
referred to and a made part hereof for all purposes as if fully set forth herein, to furnish all
materials, equipment labor and other accessories as defined by law, in the prosecution of the
Work, including any Work resulting from a duly authorized Change Order (collectively herein,
the "Work") as provided for in said contract and designated as Lake Lewisville Water Treatment
Plant Dewatering Improvements; and

WHEREAS, Principal binds itself to use such materials and to so construct the Work in
accordance with the plans, specifications and Contract Documents that the Work is and will

1 remain free from defects in materials or workmanship for and during the period of **two (2) years**
2 after the date of Final Acceptance of the Work by the City (“Maintenance Period”); and

3

4 **WHEREAS**, Principal binds itself to repair or reconstruct the Work in whole or in part upon
5 receiving notice from the City of the need therefor at any time within the Maintenance Period.

6

7 **NOW THEREFORE**, the condition of this obligation is such that if Principal shall remedy
8 any defective Work, for which timely notice was provided by City, to a completion satisfactory
9 to the City, then this obligation shall become null and void; otherwise to remain in full force and
10 effect.

11

12 **PROVIDED, HOWEVER**, if Principal shall fail so to repair or reconstruct any timely
13 noticed defective Work, it is agreed that the City may cause any and all such defective Work to
14 be repaired and/or reconstructed with all associated costs thereof being borne by the Principal
15 and the Surety under this Maintenance bond; and

16

17 **PROVIDED FURTHER**, that if any legal action be filed on this Bond, venue shall lie in
18 Denton County, Texas or the United States District Court for the Eastern District of Texas,
19 Sherman Division; and

20

21 **PROVIDED FURTHER**, that this obligation shall be continuous in nature and successive
22 recoveries may be had hereon for successive breaches.

23

24

25

1 **IN WITNESS WHEREOF**, the Principal and the Surety have each SIGNED and SEALED this
 2 instrument by duly authorized agents and officers on this the _____ day of _____
 3 _____, 20____.

4

5

PRINCIPAL:

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BY:

12

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Signature

14

ATTEST:

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(Principal) Secretary

Name and Title

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Address:

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Witness as to Principal

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SURETY:

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BY:

Signature

ATTEST:

Name and Title

Address:

(Surety) Secretary

Witness as to Surety

Telephone

Number:

*Note: If signed by an officer of the Surety Company, there must be on file a certified extract from the by-laws showing that this person has authority to sign such obligation. If Surety's physical address is different from its mailing address, both must be provided. The date of the bond shall not be prior to the date the Contract is awarded.

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SECTION 00 61 25
CERTIFICATE OF INSURANCE

[Assembler: For Contract Document execution, remove this page and replace with standard ACORD Certificate of Insurance form.]

END OF SECTION

STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

**STANDARD GENERAL CONDITIONS OF THE
CONSTRUCTION CONTRACT**

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ARTICLE 1 – DEFINITIONS AND TERMINOLOGY

1.01 *Defined Terms*

- A. Wherever used in these General Conditions or in other Contract Documents, the terms listed below have the meanings indicated which are applicable to both the singular and plural thereof, and words denoting gender shall include the masculine, feminine and neuter. Said terms are generally capitalized or written in italics, but not always. When used in a context consistent with the definition of a listed-defined term, the term shall have a meaning as defined below whether capitalized or italicized or otherwise. In addition to terms specifically defined, terms with initial capital letters in the Contract Documents include references to identified articles and paragraphs, and the titles of other documents or forms.
1. *Addenda*—Written or graphic instruments issued prior to the opening of Bids which clarify, correct, or change the Bidding Requirements or the proposed Contract Documents.
 2. *Agreement*—The written instrument which is evidence of the agreement between City and Contractor covering the Work.
 3. *Application for Payment*—The form acceptable to City which is to be used by Contractor during the course of the Work in requesting progress or final payments and which is to be accompanied by such supporting documentation as is required by the Contract Documents.
 4. *Asbestos*—Any material that contains more than one percent asbestos and is friable or is releasing asbestos fibers into the air above current action levels established by the United States Occupational Safety and Health Administration.
 5. *Award* – Authorization by the City Council for the City to enter into an Agreement.
 6. *Bid*—The offer or proposal of a Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.
 7. *Bidder*—The individual or entity who submits a Bid directly to City.
 8. *Bidding Documents*—The Bidding Requirements and the proposed Contract Documents (including all Addenda).
 9. *Bidding Requirements*—The advertisement or Invitation to Bid, Instructions to Bidders, Bid security of acceptable form, if any, and the Bid Form with any supplements.
 10. *Business Day* – A business day is defined as a day that the City conducts normal business, generally Monday through Friday, except for federal or state holidays observed by the City.
 11. *Calendar Day* – A day consisting of 24 hours measured from midnight to the next midnight.

12. *Change Order*—A document, which is prepared and approved by the City, which is signed by Contractor and City and authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Time, issued on or after the Effective Date of the Agreement.
13. *City*— The City of Denton is a Texas home-rule municipal corporation acting by its City Council through its City Manager or his designee.
14. *City Attorney* – The officially appointed City Attorney of the City of Denton, Texas, or his duly authorized representative.
15. *City Council* - The duly elected and qualified governing body of the City of Denton, Texas.
16. *City Manager* – The officially appointed and authorized City Manager of the City of Denton, Texas, or his duly authorized representative.
17. *Contract Claim*—A demand or assertion by City or Contractor seeking an adjustment of Contract Price or Contract Time, or both, or other relief with respect to the terms of the Contract. A demand for money or services by a third party is not a Contract Claim.
18. *Contract*—The entire and integrated written document between the City and Contractor concerning the Work. The Contract contains the Agreement and all Contract Documents and supersedes prior negotiations, representations, or agreements, whether written or oral.
19. *Contract Documents*—Those items so designated in the Agreement. All items listed in the Agreement are Contract Documents. Approved Submittals, other Contractor submittals, and the reports and drawings of subsurface and physical conditions are not Contract Documents.
20. *Contract Price*—The moneys payable by City to Contractor for completion of the Work in accordance with the Contract Documents as stated in the Agreement (subject to the provisions of Paragraph 11.03 in the case of Unit Price Work).
21. *Contract Time*—The number of days or the dates stated in the Agreement to: (i) achieve Milestones, if any and (ii) complete the Work so that it is ready for Final Acceptance.
22. *Contractor*—The individual or entity with whom City has entered into the Agreement.
23. *Cost of the Work*—See Paragraph 11.01 of these General Conditions for definition.

24. *Damage Claims* – A demand for money or services arising from the Project or Site from a third party, City or Contractor exclusive of a Contract Claim.
25. *Day or day* – A day, unless otherwise defined, shall mean a Calendar Day.
26. *Drawings*—That part of the Contract Documents prepared or approved by Engineer which graphically shows the scope, extent, and character of the Work to be performed by Contractor. Submittals are not Drawings as so defined.
27. *Effective Date of the Agreement*—The date indicated in the Agreement on which it becomes effective, but if no such date is indicated, it means the date on which the Agreement is signed and delivered by the last of the two parties to sign and deliver.
28. *Engineer*—The licensed professional engineer or engineering firm registered in the State of Texas performing professional services for the City.
29. *Extra Work* – Additional work made necessary by changes or alterations of the Contract Documents or quantities; or for other reasons for which no prices are provided in the Contract Documents. Extra work shall be part of the Work.
30. *Field Order* — A written order issued by City which requires changes in the Work but which does not involve a change in the Contract Price, Contract Time, or the intent of the Engineer.
31. *Final Acceptance* – The written notice given by the City to the Contractor that the Work specified in the Contract Documents has been completed to the satisfaction of the City.
32. *Final Inspection* – Inspection carried out by the City to verify that the Contractor has completed the Work, and each and every part or appurtenance thereof, fully, entirely, and in conformance with the Contract Documents.
33. *General Requirements*—Sections of Division 1 of the Contract Documents.
34. *Hazardous Environmental Condition* — The presence at the Site of Asbestos, PCBs, Petroleum, Hazardous Waste, Radioactive Material, or other materials in such quantities or circumstances that may present a substantial danger to persons or property exposed thereto.
35. *Hazardous Waste*—Hazardous waste is defined as any solid waste listed as hazardous or possesses one or more hazardous characteristics as defined in the federal waste regulations, as amended from time to time.
36. *Incidental* – Work items that the Contractor is not paid for directly, but costs for which are included under the various bid items of the Project.

37. *Laws and Regulations*—Any and all applicable laws, rules, regulations, ordinances, codes, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.
38. *Liens*—Charges, security interests, or encumbrances upon Project funds, real property, or personal property.
39. *Major Item* – An Item of work included in the Contract Documents that has a total cost equal to or greater than 5% of the original Contract Price or \$25,000 whichever is less.
40. *Milestone*—A principal event specified in the Contract Documents relating to an intermediate Contract Time prior to Final Acceptance of the Work.
41. *Notice of Award*—The written notice by City to the Successful Bidder stating that upon timely compliance by the Successful Bidder with the conditions precedent listed therein, City will sign and deliver the Agreement.
42. *Notice to Proceed*—A written notice given by City to Contractor fixing the date on which the Contract Time will commence to run and on which Contractor shall start to perform the Work specified in Contract Documents.
43. *PCBs*—Polychlorinated biphenyls.
44. *Petroleum*—Petroleum, including crude oil or any fraction thereof which is liquid at standard conditions of temperature and pressure (60 degrees Fahrenheit and 14.7 pounds per square inch absolute), such as oil, petroleum, fuel oil, oil sludge, oil refuse, gasoline, kerosene, and oil mixed with other non-Hazardous Waste and crude oils.
45. *Plans* – See definition of Drawings.
46. *Project Schedule*—A schedule, prepared and maintained by Contractor, in accordance with the General Requirements, describing the sequence and duration of the activities comprising the Contractor’s plan to accomplish the Work within the Contract Time.
47. *Project*—The Work to be performed under the Contract Documents.
48. *Project Manager* —The authorized representative of the City who will be assigned to the Project.
49. *Project Manual* – The documentary information prepared for bidding and furnishing the Work. A listing of the contents of the Project Manual is contained in its Table of Contents.
50. *Public Meeting* – An announced meeting conducted by the City to facilitate public participation and to assist the public in gaining an informed view of the Project.

51. *Radioactive Material*—Source, special nuclear, or byproduct material as defined by the Atomic Energy Act of 1954 (42 USC Section 2011 et seq.) as amended from time to time.
52. *Regular Working Hours* – Excluding legal holidays, regular working hours shall be Monday thru Friday between 6:00 a.m. and 8:30 p.m. from June 1 to September 30 and between 7:00 a.m. and 8:30 p.m. from October 1 to May 31.
53. *Samples*—Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and which establish the standards by which such portion of the Work will be judged.
54. *Schedule of Submittals*—A schedule, prepared and maintained by Contractor, of required submittals and the time requirements to support scheduled performance of related construction activities.
55. *Schedule of Values*—A schedule, prepared and maintained by Contractor, allocating portions of the Contract Price to various portions of the Work and used as the basis for reviewing Contractor’s Applications for Payment.
56. *Site*—Lands or areas indicated in the Contract Documents as being furnished by City upon which the Work is to be performed, including rights-of-way, permits, and easements for access thereto, and such other lands furnished by City which are designated for the use of Contractor.
57. *Specifications*—That part of the Contract Documents consisting of written requirements for materials, equipment, systems, standards and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable thereto. Specifications may be specifically made a part of the Contract Documents by attachment or, if not attached, may be incorporated by reference as indicated in the Table of Contents (Division 00 00 00) of each Project.
58. *Subcontractor*—An individual or entity having a direct contract with Contractor or with any other Subcontractor for the performance of a part of the Work at the Site.
59. *Submittals*—All drawings, diagrams, illustrations, schedules, and other data or information which are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work.
60. *Subsidiary* – See definition of Incidental.
61. *Successful Bidder*—The Bidder submitting the lowest and most responsive Bid to whom City makes an Award.
62. *Superintendent* – The representative of the Contractor who is available at all times and able to receive instructions from the City and to act for the Contractor.

63. *Supplementary Conditions*—That part of the Contract Documents which amends or supplements these General Conditions.
64. *Supplier*—A manufacturer, fabricator, supplier, distributor, materialman, or vendor having a direct contract with Contractor or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by Contractor or Subcontractor.
65. *Underground Facilities*—All underground pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or attachments, and any encasements containing such facilities, including but not limited to, those that convey electricity, gases, steam, liquid petroleum products, telephone or other communications, cable television, water, wastewater, storm water, other liquids or chemicals, or traffic or other control systems.
66. *Unit Price Work*—See Paragraph 11.03 of these General Conditions for definition.
67. *Weekend Working Hours* – Hours between 8:00 a.m. and 8:30 p.m., Saturday, and between 1:00 p.m. and 8:30 p.m. Sunday or legal holiday, as approved in advance by the City.
68. *Work*—The entire construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction including any Change Order or Field Order, and furnishing, installing, and incorporating all materials and equipment into such construction, all as required by the Contract Documents.
69. *Working Day* – A working day is defined as a day, not including Saturdays, Sundays, or legal holidays authorized by the City for contract purposes, in which weather or other conditions not under the control of the Contractor will permit the performance of the principal unit of work underway for a continuous period of not less than 7 hours between 7 a.m. and 8 p.m.

1.02 *Terminology*

- A. The words and terms discussed in Paragraph 1.02.B through E are not defined but, when used in the Bidding Requirements or Contract Documents, have the indicated meaning.
- B. *Intent of Certain Terms or Adjectives:*
 1. The Contract Documents include the terms “as allowed,” “as approved,” “as ordered,” “as directed” or terms of like effect or import to authorize an exercise of judgment by City. In addition, the adjectives “reasonable,” “suitable,” “acceptable,” “proper,” “satisfactory,” or adjectives of like effect or import are used to describe an action or determination of City as to the Work. It is intended that such exercise of professional judgment, action, or determination will be solely to evaluate, in general, the Work for compliance with the information in the Contract Documents and with the design concept of the Project as a functioning whole as shown or indicated in the Contract Documents (unless there is a specific statement indicating otherwise).

C. *Defective:*

1. The word “defective,” when modifying the word “Work,” refers to Work that is unsatisfactory, faulty, or deficient in that it:
 - a. does not conform to the Contract Documents; or
 - b. does not meet the requirements of any applicable inspection, reference standard, test, or approval referred to in the Contract Documents; or
 - c. has been damaged prior to City’s written acceptance.

D. *Furnish, Install, Perform, Provide:*

1. The word “Furnish” or the word “Install” or the word “Perform” or the word “Provide” or the word “Supply,” or any combination or similar directive or usage thereof, shall mean furnishing and incorporating in the Work including all necessary labor, materials, equipment, and everything necessary to perform the Work indicated, unless specifically limited in the context used.

- E. Unless stated otherwise in the Contract Documents, words or phrases that have a well-known technical or construction industry or trade meaning are used in the Contract Documents in accordance with such recognized meaning.

ARTICLE 2 – PRELIMINARY MATTERS

2.01 *Copies of Documents*

City shall furnish to Contractor one (1) original executed copy and one (1) electronic copy of the Contract Documents, and three (3) additional copies of the Drawings. Additional copies will be furnished upon request at the cost of reproduction.

2.02 *Commencement of Contract Time; Notice to Proceed*

The Contract Time will commence to run on the day indicated in the Notice to Proceed. A Notice to Proceed may be given at any time within 30 days after the Effective Date of the Agreement.

2.03 *Starting the Work*

Contractor shall start to perform the Work on the date when the Contract Time commences to run. No Work shall be done at the Site prior to the date on which the Contract Time commences to run.

2.04 *Before Starting Construction*

Baseline Schedules: Submit in accordance with the Contract Documents, and prior to starting the Work.

2.05 *Preconstruction Conference*

Before any Work at the Site is started, the Contractor shall attend a Preconstruction Conference as specified in the Contract Documents.

2.06 *Public Meeting*

Contractor may not mobilize any equipment, materials or resources to the Site prior to Contractor attending the Public Meeting as scheduled by the City.

2.07 *Initial Acceptance of Schedules*

No progress payment shall be made to Contractor until acceptable schedules are submitted to City in accordance with the Schedule Specification as provided in the Contract Documents.

2.08 *Electronic Submittals*

- A. Except as otherwise stated elsewhere in the Contract, the City and Contractor may transmit, and shall accept, Project-related correspondence, text, data, documents, drawings, information, and graphics, including but not limited to Shop Drawings and other submittals, in electronic media or digital format.
- B. When transmitting items in electronic media or digital format, the transmitting party makes no representations as to long term compatibility, usability, or readability of the items resulting from the recipient's use of software application packages, operating systems, or computer hardware differing from those used in the drafting or transmittal of the items, or from those established in applicable transmittal protocols.

ARTICLE 3 – CONTRACT DOCUMENTS: INTENT, AMENDING, REUSE

3.01 *Intent*

- A. The Contract Documents are complementary; what is required by one is as binding as if required by all.
- B. It is the intent of the Contract Documents to describe a functionally complete project (or part thereof) to be constructed in accordance with the Contract Documents. Any labor, documentation, services, materials, or equipment that reasonably may be inferred from the Contract Documents or from prevailing custom or trade usage as being required to produce the indicated result will be provided whether or not specifically called for, at no additional cost to City.
- C. Clarifications and interpretations of the Contract Documents shall be issued by City.
- D. The Specifications may vary in form, format and style. Some Specification sections may be written in varying degrees of streamlined or declarative style and some sections may be

relatively narrative by comparison. Omission of such words and phrases as “the Contractor shall,” “in conformity with,” “as shown,” or “as specified” are intentional in streamlined sections. Omitted words and phrases shall be supplied by inference. Similar types of provisions may appear in various parts of a section or articles within a part depending on the format of the section. The Contractor shall not take advantage of any variation of form, format or style in making Contract Claims.

- E. The cross referencing of specification sections under the subparagraph heading “Related Sections include but are not necessarily limited to:” and elsewhere within each Specification section is provided as an aid and convenience to the Contractor. The Contractor shall not rely on the cross referencing provided and shall be responsible to coordinate the entire Work under the Contract Documents and provide a complete Project whether or not the cross referencing is provided in each section or whether or not the cross referencing is complete.

3.02 *Reference Standards*

A. Standards, Specifications, Codes, Laws, and Regulations

1. Reference to standards, specifications, manuals, or codes of any technical society, organization, or association, or to Laws or Regulations, whether such reference be specific or by implication, shall mean the standard, specification, manual, code, or Laws or Regulations in effect at the time of opening of Bids (or on the Effective Date of the Agreement if there were no Bids), except as may be otherwise specifically stated in the Contract Documents.
2. No provision of any such standard, specification, manual, or code, or any instruction of a Supplier, shall be effective to change the duties or responsibilities of City, Contractor, or any of their subcontractors, consultants, agents, or employees, from those set forth in the Contract Documents. No such provision or instruction shall be effective to assign to City, or any of its officers, directors, members, partners, employees, agents, consultants, or subcontractors, any duty or authority to supervise or direct the performance of the Work or any duty or authority to undertake responsibility inconsistent with the provisions of the Contract Documents.

3.03 *Reporting and Resolving Discrepancies*

A. *Reporting Discrepancies:*

1. *Contractor’s Review of Contract Documents Before Starting Work:* Before undertaking each part of the Work, Contractor shall carefully study and compare the Contract Documents and check and verify pertinent figures therein against all applicable field measurements and conditions. Contractor shall promptly report in writing to City any conflict, error, ambiguity, or discrepancy which Contractor discovers, or has actual knowledge of, and shall obtain a written interpretation or clarification from City before proceeding with any Work affected thereby.
2. *Contractor’s Review of Contract Documents During Performance of Work:* If, during the performance of the Work, Contractor discovers any conflict, error, ambiguity, or discrepancy

within the Contract Documents, or between the Contract Documents and (a) any applicable Law or Regulation, (b) any standard, specification, manual, or code, or (c) any instruction of any Supplier, then Contractor shall promptly report it to City in writing. Contractor shall not proceed with the Work affected thereby (except in an emergency as required by Paragraph 6.17.A) until an amendment or supplement to the Contract Documents has been issued by one of the methods indicated in Paragraph 3.04.

3. Contractor shall not be liable to City for failure to report any conflict, error, ambiguity, or discrepancy in the Contract Documents unless Contractor had actual knowledge thereof.

B. *Resolving Discrepancies:*

1. Except as may be otherwise specifically stated in the Contract Documents, the provisions of the Contract Documents shall take precedence in resolving any conflict, error, ambiguity, or discrepancy between the provisions of the Contract Documents and the provisions of any standard, specification, manual, or the instruction of any Supplier (whether or not specifically incorporated by reference in the Contract Documents).
2. In case of discrepancies, figured dimensions shall govern over scaled dimensions, Drawings shall govern over Specifications, and Supplementary Conditions shall govern over General Conditions and Specifications.

3.04 *Amending and Supplementing Contract Documents*

- A. The Contract Documents may be amended to provide for additions, deletions, and revisions in the Work or to modify the terms and conditions thereof by a Change Order.
- B. The requirements of the Contract Documents may be supplemented, and minor variations and deviations in the Work not involving a change in Contract Price or Contract Time, may be authorized, by one or more of the following ways:
 1. A Field Order;
 2. City's review of a Submittal (subject to the provisions of Paragraph 6.18.C); or
 3. City's written interpretation or clarification.

3.05 *Reuse of Documents*

- A. Contractor and any Subcontractor or Supplier shall not:
 1. have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of Engineer, including electronic media editions; or
 2. reuse any such Drawings, Specifications, other documents, or copies thereof on extensions of the Project or any other project without written consent of City and specific written

verification or adaptation by Engineer.

- B. The prohibitions of this Paragraph 3.05 will survive final payment, or termination of the Contract. Nothing herein shall preclude Contractor from retaining copies of the Contract Documents for record purposes.

3.06 *Electronic Data*

- A. Unless otherwise stated in the Supplementary Conditions, the data furnished by City or Engineer to Contractor, or by Contractor to City or Engineer, that may be relied upon are limited to the printed copies included in the Contract Documents (also known as hard copies). Files in electronic media format of text, data, graphics, or other types are furnished only for the convenience of the receiving party. Any conclusion or information obtained or derived from such electronic files will be at the user's sole risk. If there is a discrepancy between the electronic files and the hard copies, the hard copies govern.
- B. When transferring documents in electronic media format, the transferring party makes no representations as to long term compatibility, usability, or readability of documents resulting from the use of software application packages, operating systems, or computer hardware differing from those used by the data's creator.

ARTICLE 4 – AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS; REFERENCE POINTS

4.01 *Availability of Lands*

- A. City shall furnish the Site. City shall notify Contractor of any encumbrances or restrictions not of general application but specifically related to use of the Site with which Contractor must comply in performing the Work. City will obtain in a timely manner and pay for easements for permanent structures or permanent changes in existing facilities.
 - 1. The City has obtained or anticipates acquisition of and/or access to right-of-way, and/or easements. Any outstanding right-of-way and/or easements are anticipated to be acquired in accordance with the schedule set forth in the Supplementary Conditions. The Project Schedule submitted by the Contractor in accordance with the Contract Documents must consider any outstanding right-of-way, and/or easements.
 - 2. The City has or anticipates removing and/or relocating utilities, and obstructions to the Site. Any outstanding removal or relocation of utilities or obstructions is anticipated in accordance with the schedule set forth in the Supplementary Conditions. The Project Schedule submitted by the Contractor in accordance with the Contract Documents must consider any outstanding utilities or obstructions to be removed, adjusted, and/or relocated by others.
- B. Upon reasonable written request, City shall furnish Contractor with a current statement of record legal title and legal description of the lands upon which the Work is to be performed.

- C. Contractor shall provide for all additional lands and access thereto that may be required for construction facilities or storage of materials and equipment.

4.02 *Subsurface and Physical Conditions*

A. *Reports and Drawings:* The Supplementary Conditions identify:

1. those reports known to City of explorations and tests of subsurface conditions at or contiguous to the Site; and
2. those drawings known to City of physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities).

B. *Limited Reliance by Contractor on Technical Data Authorized:* Contractor may rely upon the accuracy of the “technical data” contained in such reports and drawings, but such reports and drawings are not Contract Documents. Such “technical data” is identified in the Supplementary Conditions. Contractor may not make any Contract Claim against City, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors with respect to:

1. the completeness of such reports and drawings for Contractor’s purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto; or
2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings; or
3. any Contractor interpretation of or conclusion drawn from any “technical data” or any such other data, interpretations, opinions, or information.

4.03 *Differing Subsurface or Physical Conditions*

A. *Notice:* If Contractor believes that any subsurface or physical condition that is uncovered or revealed either:

1. is of such a nature as to establish that any “technical data” on which Contractor is entitled to rely as provided in Paragraph 4.02 is materially inaccurate; or
2. is of such a nature as to require a change in the Contract Documents; or
3. differs materially from that shown or indicated in the Contract Documents; or
4. is of an unusual nature, and differs materially from conditions ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents;

then Contractor shall, promptly after becoming aware thereof and before further disturbing the

subsurface or physical conditions or performing any Work in connection therewith (except in an emergency as required by Paragraph 6.17.A), notify City in writing about such condition.

B. *Possible Price and Time Adjustments*

Contractor shall not be entitled to any adjustment in the Contract Price or Contract Time if:

1. Contractor knew of the existence of such conditions at the time Contractor made a final commitment to City with respect to Contract Price and Contract Time by the submission of a Bid or becoming bound under a negotiated contract; or
2. the existence of such condition could reasonably have been discovered or revealed as a result of the examination of the Contract Documents or the Site; or
3. Contractor failed to give the written notice as required by Paragraph 4.03.A.

4.04 *Underground Facilities*

A. *Shown or Indicated:* The information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or contiguous to the Site is based on information and data furnished to City or Engineer by the owners of such Underground Facilities, including City, or by others. Unless it is otherwise expressly provided in the Supplementary Conditions:

1. City and Engineer shall not be responsible for the accuracy or completeness of any such information or data provided by others; and
2. the cost of all of the following will be included in the Contract Price, and Contractor shall have full responsibility for:
 - a. reviewing and checking all such information and data;
 - b. locating all Underground Facilities shown or indicated in the Contract Documents;
 - c. coordination and adjustment of the Work with the owners of such Underground Facilities, including City, during construction; and
 - d. the safety and protection of all such Underground Facilities and repairing any damage thereto resulting from the Work.

B. *Not Shown or Indicated:*

1. If an Underground Facility which conflicts with the Work is uncovered or revealed at or contiguous to the Site which was not shown or indicated, or not shown or indicated with reasonable accuracy in the Contract Documents, Contractor shall, promptly after becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as required by Paragraph 6.17.A),

identify the owner of such Underground Facility and give notice to that owner and to City. City will review the discovered Underground Facility and determine the extent, if any, to which a change may be required in the Contract Documents to reflect and document the consequences of the existence or location of the Underground Facility. Contractor shall be responsible for the safety and protection of such discovered Underground Facility.

2. If City concludes that a change in the Contract Documents is required, a Change Order may be issued to reflect and document such consequences.
3. Verification of existing utilities, structures, and service lines shall include notification of all utility companies a minimum of 48 hours in advance of construction including exploratory excavation if necessary.

4.05 *Hazardous Environmental Condition at Site*

- A. *Reports and Drawings:* The Supplementary Conditions identify those reports and drawings known to City relating to Hazardous Environmental Conditions that have been identified at the Site.
- B. *Limited Reliance by Contractor on Technical Data Authorized:* Contractor may rely upon the accuracy of the “technical data” contained in such reports and drawings, but such reports and drawings are not Contract Documents. Such “technical data” is identified in the Supplementary Conditions. Contractor may not make any Contract Claim against City, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors with respect to:
 1. the completeness of such reports and drawings for Contractor’s purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences and procedures of construction to be employed by Contractor and safety precautions and programs incident thereto; or
 2. other data, interpretations, opinions and information contained in such reports or shown or indicated in such drawings; or
 3. any Contractor interpretation of or conclusion drawn from any “technical data” or any such other data, interpretations, opinions or information.
- C. Contractor shall not be responsible for any Hazardous Environmental Condition uncovered or revealed at the Site which was not shown or indicated in Drawings or Specifications or identified in the Contract Documents to be within the scope of the Work. Contractor shall be responsible for a Hazardous Environmental Condition created with any materials brought to the Site by Contractor, Subcontractors, Suppliers, or anyone else for whom Contractor is responsible.
- D. If Contractor encounters a Hazardous Environmental Condition or if Contractor or anyone for whom Contractor is responsible creates a Hazardous Environmental Condition, Contractor shall immediately: (i) secure or otherwise isolate such condition; (ii) stop all Work in connection with such condition and in any area affected thereby (except in an emergency as required by

Paragraph 6.17.A); and (iii) notify City (and promptly thereafter confirm such notice in writing). City may consider the necessity to retain a qualified expert to evaluate such condition or take corrective action, if any.

- E. Contractor shall not be required to resume Work in connection with such condition or in any affected area until after City has obtained any required permits related thereto and delivered written notice to Contractor: (i) specifying that such condition and any affected area is or has been rendered suitable for the resumption of Work; or (ii) specifying any special conditions under which such Work may be resumed.
- F. If after receipt of such written notice Contractor does not agree to resume such Work based on a reasonable belief it is unsafe, or does not agree to resume such Work under such special conditions, then City may order the portion of the Work that is in the area affected by such condition to be deleted from the Work. City may have such deleted portion of the Work performed by City's own forces or others.
- G. ***To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless City, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 4.06.G shall obligate Contractor to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.***
- H. The provisions of Paragraphs 4.02, 4.03, and 4.04 do not apply to a Hazardous Environmental Condition uncovered or revealed at the Site.

ARTICLE 5 – BONDS AND INSURANCE

5.01 *Licensed Sureties and Insurers*

All bonds and insurance required by the Contract Documents to be purchased and maintained by Contractor shall be obtained from surety or insurance companies that are duly licensed or authorized in the State of Texas to issue bonds or insurance policies for the limits and coverages so required. Such surety and insurance companies shall also meet such additional requirements and qualifications as may be provided in the Supplementary Conditions.

5.02 *Performance, Payment, and Maintenance Bonds*

- A. Contractor shall furnish performance and payment bonds, in accordance with Texas Government Code Chapter 2253 or successor statute, each in an amount equal to the Contract Price as security for the faithful performance and payment of all of Contractor's obligations under the Contract Documents.
- B. Contractor shall furnish maintenance bonds in an amount equal to the Contract Price as security

to protect the City against any defects in any portion of the Work described in the Contract Documents. Maintenance bonds shall remain in effect for two (2) years after the date of Final Acceptance by the City.

- C. All bonds shall be in the form prescribed by the Contract Documents except as provided otherwise by Laws or Regulations, and shall be executed by such sureties as are named in the list of “Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies” as published in Circular 570 (amended) by the Financial Management Service, Surety Bond Branch, U.S. Department of the Treasury. All bonds signed by an agent or attorney-in-fact must be accompanied by a sealed and dated power of attorney which shall show that it is effective on the date the agent or attorney-in-fact signed each bond. The bonds must be dated on, or after, the date of the Contract.
- D. If the surety on any bond furnished by Contractor is declared bankrupt or becomes insolvent or its right to do business is terminated in the State of Texas or it ceases to meet the requirements of Paragraph 5.02.C, Contractor shall promptly notify City and shall, within 30 days after the event giving rise to such notification, provide another bond and surety, both of which shall comply with the requirements of Paragraphs 5.01 and 5.02.C.

5.03 *Certificates of Insurance*

- A. Contractor shall deliver to City, with copies to each additional insured and loss payee identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance requested by City or any other additional insured) which Contractor is required to purchase and maintain.
 - 1. The certificate of insurance shall document the City, and all identified entities named in the Supplementary Conditions as “Additional Insured” on all liability policies.
 - 2. The Contractor’s general liability insurance shall include a, “per project” or “per location”, endorsement, which shall be identified in the certificate of insurance provided to the City.
 - 3. The certificate shall be signed by an agent authorized to bind coverage on behalf of the insured, be complete in its entirety, and show complete insurance carrier names as listed in the current A.M. Best Property & Casualty Guide
 - 4. The insurers for all policies must be licensed and/or approved to do business in the State of Texas. Except for workers’ compensation, all insurers must have a minimum rating of A-: VII in the current A. M. Best Key Rating Guide or have reasonably equivalent financial strength and solvency to the satisfaction of Risk Management. If the rating is below that required, written approval of City is required.
 - 5. All applicable policies shall include a Waiver of Subrogation (Rights of Recovery) in favor of the City. In addition, the Contractor agrees to waive all rights of subrogation against the Engineer (if applicable), and each additional insured identified in the Supplementary Conditions

6. Failure of the City to demand such certificates or other evidence of full compliance with the insurance requirements or failure of the City to identify a deficiency from evidence that is provided shall not be construed as a waiver of Contractor's obligation to maintain such lines of insurance coverage.
7. If insurance policies are not written for specified coverage limits, an Umbrella or Excess Liability insurance for any differences is required. Excess Liability shall follow form of the primary coverage.
8. Unless otherwise stated, all required insurance shall be written on the "occurrence basis". If coverage is underwritten on a claims-made basis, the retroactive date shall be coincident with or prior to the date of the effective date of the agreement and the certificate of insurance shall state that the coverage is claims-made and the retroactive date. The insurance coverage shall be maintained for the duration of the Contract and for three (3) years following Final Acceptance provided under the Contract Documents or for the warranty period, whichever is longer. An annual certificate of insurance submitted to the City shall evidence such insurance coverage.
9. Policies shall have no exclusions by endorsements, which, neither nullify or amend, the required lines of coverage, nor decrease the limits of said coverage unless such endorsements are approved in writing by the City. In the event a Contract has been bid or executed and the exclusions are determined to be unacceptable or the City desires additional insurance coverage, and the City desires the contractor/engineer to obtain such coverage, the contract price shall be adjusted by the cost of the premium for such additional coverage plus 10%.
10. Any self-insured retention (SIR), in excess of \$25,000.00, affecting required insurance coverage shall be approved by the City in regards to asset value and stockholders' equity. In lieu of traditional insurance, alternative coverage maintained through insurance pools or risk retention groups, or self-funding, must also be approved by City.
11. Any deductible in excess of \$5,000.00, for any policy that does not provide coverage on a first-dollar basis, must be acceptable to and approved by the City.
12. City, at its sole discretion, reserves the right to review the insurance requirements and to make reasonable adjustments to insurance coverage's and their limits when deemed necessary and prudent by the City based upon the scope of the Work, changes in statutory law, court decision or the claims history of the industry as well as of the contracting party to the City. The City shall be required to provide prior notice of 90 days, and the insurance adjustments shall be incorporated into the Work by Change Order.
13. City shall be entitled, upon written request and without expense, to receive copies of policies and endorsements thereto and may make any reasonable requests for deletion or revision or modifications of particular policy terms, conditions, limitations, or exclusions necessary to conform the policy and endorsements to the requirements of the Contract. Deletions, revisions, or modifications shall not be required where policy provisions are established by

law or regulations binding upon either party or the underwriter on any such policies.

14. City shall not be responsible for the direct payment of insurance premium costs for Contractor's insurance.

5.04 *Contractor's Insurance*

A. *Workers Compensation and Employers' Liability.* Contractor shall purchase and maintain such insurance coverage with limits consistent with statutory benefits outlined in the Texas Workers' Compensation Act (Texas Labor Code, Ch. 406, as amended), and minimum limits for Employers' Liability as is appropriate for the Work being performed and as will provide protection from claims set forth below which may arise out of or result from Contractor's performance of the Work and Contractor's other obligations under the Contract Documents, whether it is to be performed by Contractor, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to perform any of the Work, or by anyone for whose acts any of them may be liable:

1. claims under workers' compensation, disability benefits, and other similar employee benefit acts;
2. claims for damages because of bodily injury, occupational sickness or disease, or death of Contractor's employees.

B. *Commercial General Liability.* Coverage shall include but not be limited to covering liability (bodily injury or property damage) arising from: premises/operations, independent contractors, products/completed operations, personal injury, liability under an insured contract, and explosion/collapse/underground (where those exposures exist). Insurance shall be provided on an occurrence basis, and as comprehensive as the current Insurance Services Office (ISO) policy. This insurance shall apply as primary insurance with respect to any other insurance or self-insurance programs afforded to the City. The Commercial General Liability policy, shall have no exclusions by endorsements that would alter or nullify premises/operations, products/completed operations, contractual, personal injury, or advertising injury, which are normally contained with the policy, unless the City approves such exclusions in writing.

For construction projects that present a substantial completed operation exposure, the City may require the contractor to maintain completed operations coverage for a minimum of no less than three (3) years following the completion of the project (if identified in the Supplementary Conditions).

C. *Automobile Liability.* A commercial business auto policy shall provide coverage on "any auto", defined as autos owned, hired and non-owned and provide indemnity for claims for damages because bodily injury or death of any person and or property damage arising out of the work, maintenance or use of any motor vehicle by the Contractor, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to perform any of the Work, or by anyone for whose acts any of them may be liable.

- D. *Railroad Protective Liability.* If any of the work or any warranty work is within the limits of railroad right-of-way, the Contractor shall comply with the requirements identified in the Supplementary Conditions.
- E. *Notification of Policy Cancellation:* Contractor shall immediately notify City upon cancellation or other loss of insurance coverage. Contractor shall stop work until replacement insurance has been procured. There shall be no time credit for days not worked pursuant to this section.

5.05 *Acceptance of Bonds and Insurance; Option to Replace*

If City has any objection to the coverage afforded by or other provisions of the bonds or insurance required to be purchased and maintained by the Contractor in accordance with Article 5 on the basis of non-conformance with the Contract Documents, the City shall so notify the Contractor in writing within 10 Business Days after receipt of the certificates (or other evidence requested). Contractor shall provide to the City such additional information in respect of insurance provided as the City may reasonably request. If Contractor does not purchase or maintain all of the bonds and insurance required by the Contract Documents, the City shall notify the Contractor in writing of such failure prior to the start of the Work, or of such failure to maintain prior to any change in the required coverage.

ARTICLE 6 – CONTRACTOR’S RESPONSIBILITIES

6.01 *Supervision and Superintendence*

- A. Contractor shall supervise, inspect, and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents. Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction.
- B. At all times during the progress of the Work, Contractor shall assign a competent Superintendent, who is proficient in English, and who shall not be replaced without written notice to City. If at any time the Superintendent is not satisfactory to the City, Contractor shall, if requested by City, replace the Superintendent with another satisfactory to City.
- C. Contractor shall notify the City 24 hours prior to moving areas during the sequence of construction.

6.02 *Labor; Working Hours*

- A. Contractor shall provide competent, suitably qualified personnel to perform construction as required by the Contract Documents. Contractor shall at all times maintain good discipline and order at the Site.
- B. Except as otherwise required for the safety or protection of persons or the Work or property at the Site or adjacent thereto, and except as otherwise stated in the Contract Documents, all Work at the Site shall be performed during Regular Working Hours. Contractor will not permit the

performance of Work beyond Regular Working Hours or for Weekend Working Hours without City's written consent (which will not be unreasonably withheld). Written request (by letter or electronic communication) to perform Work:

1. for beyond Regular Working Hours, request must be made by noon at least two (2) Business Days prior
2. for Weekend Working Hours, request must be made by noon of the preceding Wednesday
3. for legal holidays, request must be made by noon seven Days prior to the legal holiday.

6.03 *Services, Materials, and Equipment*

- A. Unless otherwise specified in the Contract Documents, Contractor shall provide and assume full responsibility for all services, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities and incidentals necessary for the performance, Contractor required testing, start-up, and completion of the Work, whether or not such items are specifically called for in the Contract Documents.
- B. All materials and equipment incorporated into the Work shall be as specified or, if not specified, shall be of sufficient quality to complete the Work and new, except as otherwise provided in the Contract Documents. All special warranties and guarantees required by the Specifications shall expressly run to the benefit of City. If required by City, Contractor shall furnish satisfactory evidence (including reports of required tests) as to the source, kind, and quality of materials and equipment.
- C. All materials and equipment to be incorporated into the Work shall be stored, applied, installed, connected, erected, protected, used, cleaned, and conditioned in accordance with instructions of the applicable Supplier, except as otherwise may be provided in the Contract Documents.
- D. All items of standard equipment to be incorporated into the Work shall be the latest model at the time of bid, unless otherwise specified.

6.04 *Project Schedule*

- A. Contractor shall adhere to the Project Schedule established in accordance with Paragraph 2.07 and the General Requirements as it may be adjusted from time to time as provided below.
 1. Contractor shall submit to City for acceptance (to the extent indicated in Paragraph 2.07 and the General Requirements) proposed adjustments in the Project Schedule that will not result in changing the Contract Time. Such adjustments will comply with any provisions of the General Requirements applicable thereto.
 2. Contractor shall submit to City a monthly Project Schedule with a monthly progress payment

for the duration of the Contract in accordance with the schedule specification 01 32 16.

3. Proposed adjustments in the Project Schedule that will change the Contract Time shall be submitted in accordance with the requirements of Article 12. Adjustments in Contract Time may only be made by a Change Order.

6.05 *Substitutes and "Or-Equals"*

A. Whenever an item of material or equipment is specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular Supplier, the specification or description is intended to establish the type, function, appearance, and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent, or "or-equal" item or no substitution is permitted, other items of material or equipment of other Suppliers may be submitted to City for review under the circumstances described below.

1. *"Or-Equal" Items:* If in City's sole discretion an item of material or equipment proposed by Contractor is functionally equal to that named and sufficiently similar so that no change in related Work will be required, it may be considered by City as an "or-equal" item, in which case review and approval of the proposed item may, in City's sole discretion, be accomplished without compliance with some or all of the requirements for approval of proposed substitute items. For the purposes of this Paragraph 6.05.A.1, a proposed item of material or equipment will be considered functionally equal to an item so named if:

a. the City determines that:

- 1) it is at least equal in materials of construction, quality, durability, appearance, strength, and design characteristics;
- 2) it will reliably perform at least equally well the function and achieve the results imposed by the design concept of the completed Project as a functioning whole; and
- 3) it has a proven record of performance and availability of responsive service; and
- 4) it is not objectionable to the City.

b. Contractor certifies that, if approved and incorporated into the Work:

- 1) there will be no increase in cost to the City or increase in Contract Time; and
- 2) it will conform substantially to the detailed requirements of the item named in the Contract Documents.

2. *Substitute Items:*

a. If in City's sole discretion an item of material or equipment proposed by Contractor does not qualify as an "or-equal" item under Paragraph 6.05.A.1, it may be submitted as a

proposed substitute item.

- b. Contractor shall submit sufficient information as provided below to allow City to determine if the item of material or equipment proposed is essentially equivalent to that named and an acceptable substitute therefor. Requests for review of proposed substitute items of material or equipment will not be accepted by City from anyone other than Contractor.
- c. Contractor shall make written application to City for review of a proposed substitute item of material or equipment that Contractor seeks to furnish or use. The application shall comply with Section 01 25 00 and:
 - 1) shall certify that the proposed substitute item will:
 - a) perform adequately the functions and achieve the results called for by the general design;
 - b) be similar in substance to that specified;
 - c) be suited to the same use as that specified; and
 - 2) will state:
 - a) the extent, if any, to which the use of the proposed substitute item will prejudice Contractor's achievement of final completion on time;
 - b) whether use of the proposed substitute item in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with City for other work on the Project) to adapt the design to the proposed substitute item;
 - c) whether incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty; and
 - 3) will identify:
 - a) all variations of the proposed substitute item from that specified;
 - b) available engineering, sales, maintenance, repair, and replacement services; and
 - 4) shall contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including costs of redesign and Damage Claims of other contractors affected by any resulting change.

B. *Substitute Construction Methods or Procedures:* If a specific means, method, technique, sequence, or procedure of construction is expressly required by the Contract Documents, Contractor may furnish or utilize a substitute means, method, technique, sequence, or procedure

of construction approved by City. Contractor shall submit sufficient information to allow City, in City's sole discretion, to determine that the substitute proposed is equivalent to that expressly called for by the Contract Documents. Contractor shall make written application to City for review in the same manner as those provided in Paragraph 6.05.A.2.

- C. *City's Evaluation:* City will be allowed a reasonable time within which to evaluate each proposal or submittal made pursuant to Paragraphs 6.05.A and 6.05.B. City may require Contractor to furnish additional data about the proposed substitute. City will be the sole judge of acceptability. No "or-equal" or substitute will be ordered, installed or utilized until City's review is complete, which will be evidenced by a Change Order in the case of a substitute and an accepted Submittal for an "or-equal." City will advise Contractor in writing of its determination.
- D. *Special Guarantee:* City may require Contractor to furnish at Contractor's expense a special performance guarantee, warranty, or other surety with respect to any substitute. ***Contractor shall indemnify and hold harmless City and anyone directly or indirectly employed by them from and against any and all claims, damages, losses and expenses (including attorneys fees) arising out of the use of substituted materials or equipment.***
- E. *City's Cost Reimbursement:* City will record City's costs in evaluating a substitute proposed or submitted by Contractor pursuant to Paragraphs 6.05.A.2 and 6.05.B. Whether or not City approves a substitute so proposed or submitted by Contractor, Contractor may be required to reimburse City for evaluating each such proposed substitute. Contractor may also be required to reimburse City for the charges for making changes in the Contract Documents (or in the provisions of any other direct contract with City) resulting from the acceptance of each proposed substitute.
- F. *Contractor's Expense:* Contractor shall provide all data in support of any proposed substitute or "or-equal" at Contractor's expense.
- G. *City Substitute Reimbursement:* Costs (savings or charges) attributable to acceptance of a substitute shall be incorporated to the Contract by Change Order.
- H. *Time Extensions:* No additional time will be granted for substitutions.

6.06 *Concerning Subcontractors, Suppliers, and Others*

- A. Contractor shall perform with his own organization, work of a value not less than 35% of the value embraced on the Contract, unless otherwise approved by the City.
- B. Contractor shall not employ any Subcontractor, Supplier, or other individual or entity, whether initially or as a replacement, against whom City may have reasonable objection. Contractor shall not be required to employ any Subcontractor, Supplier, or other individual or entity to furnish or perform any of the Work against whom Contractor has reasonable objection (excluding those acceptable to City as indicated in Paragraph 6.06.C).
- C. The City may from time to time require the use of certain Subcontractors, Suppliers, or other

individuals or entities on the project, and will provide such requirements in the Supplementary Conditions.

- D. Contractor shall be fully responsible to City for all acts and omissions of the Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work just as Contractor is responsible for Contractor's own acts and omissions. Nothing in the Contract Documents:
1. shall create for the benefit of any such Subcontractor, Supplier, or other individual or entity any contractual relationship between City and any such Subcontractor, Supplier or other individual or entity; nor
 2. shall create any obligation on the part of City to pay or to see to the payment of any moneys due any such Subcontractor, Supplier, or other individual or entity except as may otherwise be required by Laws and Regulations.
- E. Contractor shall be solely responsible for scheduling and coordinating the Work of Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work under a direct or indirect contract with Contractor.
- F. All Subcontractors, Suppliers, and such other individuals or entities performing or furnishing any of the Work shall communicate with City through Contractor.
- G. All Work performed for Contractor by a Subcontractor or Supplier will be pursuant to an appropriate agreement between Contractor and the Subcontractor or Supplier which specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract Documents for the benefit of City.

6.07 *Wage Rates*

- A. *Duty to pay Prevailing Wage Rates.* The Contractor shall comply with all requirements of Chapter 2258, Texas Government Code (as amended), including the payment of not less than the rates determined by the City Council of the City of Denton to be the prevailing wage rates in accordance with Chapter 2258. Such prevailing wage rates are included in these Contract Documents.
- B. *Penalty for Violation.* A Contractor or any Subcontractor who does not pay the prevailing wage shall, upon demand made by the City, pay to the City \$60 for each worker employed for each calendar day or part of the day that the worker is paid less than the prevailing wage rates stipulated in these contract documents. This penalty shall be retained by the City to offset its administrative costs, pursuant to Texas Government Code 2258.023.
- C. *Complaints of Violations and City Determination of Good Cause.* On receipt of information, including a complaint by a worker, concerning an alleged violation of 2258.023, Texas Government Code, by a Contractor or Subcontractor, the City shall make an initial determination, before the 31st day after the date the City receives the information, as to whether

good cause exists to believe that the violation occurred. The City shall notify in writing the Contractor or Subcontractor and any affected worker of its initial determination. Upon the City's determination that there is good cause to believe the Contractor or Subcontractor has violated Chapter 2258, the City shall retain the full amounts claimed by the claimant or claimants as the difference between wages paid and wages due under the prevailing wage rates, such amounts being subtracted from successive progress payments pending a final determination of the violation.

- D. *Arbitration Required if Violation Not Resolved.* An issue relating to an alleged violation of Section 2258.023, Texas Government Code, including a penalty owed to the City or an affected worker, shall be submitted to binding arbitration in accordance with the Texas General Arbitration Act (Article 224 et seq., Revised Statutes) if the Contractor or Subcontractor and any affected worker does not resolve the issue by agreement before the 15th day after the date the City makes its initial determination pursuant to Paragraph C above. If the persons required to arbitrate under this section do not agree on an arbitrator before the 11th day after the date that arbitration is required, a district court shall appoint an arbitrator on the petition of any of the persons. The City is not a party in the arbitration. The decision and award of the arbitrator is final and binding on all parties and may be enforced in any court of competent jurisdiction.
- E. *Records to be Maintained.* The Contractor and each Subcontractor shall, for a period of three (3) years following the date of acceptance of the work, maintain records that show (i) the name and occupation of each worker employed by the Contractor in the construction of the Work provided for in this Contract; and (ii) the actual per diem wages paid to each worker. The records shall be open at all reasonable hours for inspection by the City. The provisions of Paragraph 6.23, Right to Audit, shall pertain to this inspection.
- F. *Progress Payments.* With each progress payment or payroll period, whichever is less, the Contractor shall submit an affidavit stating that the Contractor has complied with the requirements of Chapter 2258, Texas Government Code.
- G. *Posting of Wage Rates.* The Contractor shall post prevailing wage rates in a conspicuous place at all times.
- H. *Subcontractor Compliance.* The Contractor shall include in its subcontracts and/or shall otherwise require all of its Subcontractors to comply with Paragraphs A through G above.

6.08 *Patent Fees and Royalties*

- A. Contractor shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product, or device which is the subject of patent rights or copyrights held by others. If a particular invention, design, process, product, or device is specified in the Contract Documents for use in the performance of the Work and if, to the actual knowledge of City, its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights shall be disclosed by City in the Contract Documents. Failure of the City to disclose such information does not relieve the Contractor from its obligations to pay for the

use of said fees or royalties to others.

- B. *To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless City, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device not specified in the Contract Documents.***

6.09 *Permits and Utilities*

- A. *Contractor obtained permits and licenses.* Contractor shall obtain and pay for all construction permits and licenses except those provided for in the Supplementary Conditions or Contract Documents. City shall assist Contractor, when necessary, in obtaining such permits and licenses. Contractor shall pay all governmental charges and inspection fees necessary for the prosecution of the Work which are applicable at the time of opening of Bids, or, if there are no Bids, on the Effective Date of the Agreement, except for permits provided by the City as specified in 6.09.B. City shall pay all charges of utility owners for connections for providing permanent service to the Work.
- B. *City obtained permits and licenses.* City will obtain and pay for all permits and licenses as provided for in the Supplementary Conditions or Contract Documents. It will be the Contractor's responsibility to carry out the provisions of the permit. If the Contractor initiates changes to the Contract and the City approves the changes, the Contractor is responsible for obtaining clearances and coordinating with the appropriate regulatory agency. The City will not reimburse the Contractor for any cost associated with these requirements of any City acquired permit. The following are permits the City will obtain if required:
1. Texas Department of Transportation Permits
 2. U.S. Army Corps of Engineers Permits
 3. Texas Commission on Environmental Quality Permits
 4. Railroad Company Permits
 5. Texas Department of Licensing and Regulation (TDLR) Permits
- C. *Outstanding permits and licenses.* The City anticipates acquisition of and/or access to permits and licenses. Any outstanding permits and licenses are anticipated to be acquired in accordance with the schedule set forth in the Supplementary Conditions. The Project Schedule submitted by the Contractor in accordance with the Contract Documents must consider any outstanding permits and licenses.

6.10 *Laws and Regulations*

- A. Contractor shall give all notices required by and shall comply with all Laws and Regulations applicable to the performance of the Work. Except where otherwise expressly required by applicable Laws and Regulations, the City shall not be responsible for monitoring Contractor's compliance with any Laws or Regulations.
- B. If Contractor performs any Work knowing or having reason to know that it is contrary to Laws or Regulations, Contractor shall bear all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such Work. However, it shall not be Contractor's responsibility to make certain that the Specifications and Drawings are in accordance with Laws and Regulations, but this shall not relieve Contractor of Contractor's obligations under Paragraph 3.02.
- C. Changes in Laws or Regulations not known at the time of opening of Bids having an effect on the cost or time of performance of the Work may be the subject of an adjustment in Contract Price or Contract Time.

6.11 *Taxes*

- A. On a contract awarded by the City, an organization which qualifies for exemption pursuant to Texas Tax Code, Subchapter H (as amended), the Contractor may purchase, rent or lease all materials, supplies and equipment used or consumed in the performance of this contract by issuing to his supplier an exemption certificate in lieu of the tax, said exemption certificate to comply with State Comptroller's Rulings applicable to Texas Tax Code, Subchapter H. Any such exemption certificate issued to the Contractor in lieu of the tax shall be subject to and shall comply with all applicable rulings pertaining to the Texas Tax Code, Subchapter H.
- B. Texas Tax permits and information may be obtained from:
 - 1. Comptroller of Public Accounts
Sales Tax Division
Capitol Station
Austin, TX 78711; or
 - 2. <http://www.window.state.tx.us/taxinfo/taxforms/93-forms.html>

6.12 *Use of Site and Other Areas*

A. *Limitation on Use of Site and Other Areas:*

- 1. Contractor shall confine construction equipment, the storage of materials and equipment, and the operations of workers to the Site and other areas permitted by Laws and Regulations, and shall not unreasonably encumber the Site and other areas with construction equipment or other materials or equipment. Contractor shall assume full responsibility for any damage to any such land or area, or to the owner or occupant thereof, or of any adjacent land or areas

resulting from the performance of the Work.

2. At any time when, in the judgment of the City, the Contractor has obstructed, closed, or is carrying on operations in a portion of a street, right-of-way, or easement greater than is necessary for proper execution of the Work, the City may require the Contractor to finish the section on which operations are in progress before work is commenced on any additional area of the Site.
 3. Construction equipment, spoil materials, supplies, forms, buildings, labs, or equipment and supply storage buildings, or any other item that may be transported by flood flows, shall not be stored within existing federal floodways during the course of the Work.
 4. Should any Damage Claim be made by any such owner or occupant because of the performance of the Work, Contractor shall promptly attempt to resolve the Damage Claim.
 5. ***Pursuant to Paragraph 6.21, Contractor shall indemnify and hold harmless City, from and against all claims, costs, losses, and damages arising out of or relating to any claim or action, legal or equitable, brought by any such owner or occupant against City.***
- B. *Removal of Debris During Performance of the Work:* During the progress of the Work Contractor shall keep the Site and other areas free from accumulations of waste materials, rubbish, and other debris. Removal and disposal of such waste materials, rubbish, and other debris shall conform to applicable Laws and Regulations.
- C. *Site Maintenance Cleaning:* 24 hours after written notice is given to the Contractor that the clean-up on the job site is proceeding in a manner unsatisfactory to the City, if the Contractor fails to correct the unsatisfactory procedure, the City may take such direct action as the City deems appropriate to correct the clean-up deficiencies cited to the Contractor in the written notice (by letter or electronic communication), and the costs of such direct action, plus 25% of such costs, shall be deducted from the monies due or to become due to the Contractor.
- D. *Final Site Cleaning:* Prior to Final Acceptance of the Work, Contractor shall clean the Site and the Work and make it ready for utilization by City or adjacent property owner. At the completion of the Work Contractor shall remove from the Site all tools, appliances, construction equipment and machinery, and surplus materials and shall restore to original condition or better all property disturbed by the Work.
- E. *Loading Structures:* Contractor shall not load nor permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall Contractor subject any part of the Work or adjacent property to stresses or pressures that will endanger it.

6.13 *Record Documents*

- A. Contractor shall maintain in a safe place at the Site or in a place designated by the Contractor and approved by the City, one (1) record copy of all Drawings, Specifications, Addenda, Change Orders, Field Orders, and written interpretations and clarifications in good order and annotated to

show changes made during construction. These record documents together with all approved Samples and a counterpart of all accepted Submittals will be available to City for reference. Upon completion of the Work, these record documents, any operation and maintenance manuals, and Submittals will be delivered to City prior to Final Inspection. Contractor shall include accurate locations for buried and embedded items.

6.14 *Safety and Protection*

- A. Contractor shall be solely responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. Such responsibility does not relieve Subcontractors of their responsibility for the safety of persons or property in the performance of their work, nor for compliance with applicable safety Laws and Regulations. Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss to:
1. all persons on the Site or who may be affected by the Work;
 2. all the Work and materials and equipment to be incorporated therein, whether in storage on or off the Site; and
 3. other property at the Site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, utilities, and Underground Facilities not designated for removal, relocation, or replacement in the course of construction.
- B. Contractor shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss; and shall erect and maintain all necessary safeguards for such safety and protection. Contractor shall notify owners of adjacent property and of Underground Facilities and other utility owners when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property.
- C. Contractor shall comply with the applicable requirements of City's safety programs, if any.
- D. Contractor shall inform City of the specific requirements of Contractor's safety program, if any, with which City's employees and representatives must comply while at the Site.
- E. All damage, injury, or loss to any property referred to in Paragraph 6.14.A.2 or 6.14.A.3 caused, directly or indirectly, in whole or in part, by Contractor, any Subcontractor, Supplier, or any other individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, shall be remedied by Contractor.
- F. Contractor's duties and responsibilities for safety and for protection of the Work shall continue until such time as all the Work is completed and City has accepted the Work.

6.15 *Safety Representative*

Contractor shall inform City in writing of Contractor's designated safety representative at the Site.

6.16 *Hazard Communication Programs*

Contractor shall be responsible for coordinating any exchange of material safety data sheets or other hazard communication information required to be made available to or exchanged between or among employers in accordance with Laws or Regulations.

6.17 *Emergencies and/or Rectification*

- A. In emergencies affecting the safety or protection of persons or the Work or property at the Site or adjacent thereto, Contractor is obligated to act to prevent threatened damage, injury, or loss. Contractor shall give City prompt written notice if Contractor believes that any significant changes in the Work or variations from the Contract Documents have been caused thereby or are required as a result thereof. If City determines that a change in the Contract Documents is required because of the action taken by Contractor in response to such an emergency, a Change Order may be issued.
- B. Should the Contractor fail to respond to a request from the City to rectify any discrepancies, omissions, or correction necessary to conform with the requirements of the Contract Documents, the City shall give the Contractor written notice that such work or changes are to be performed. The written notice shall direct attention to the discrepant condition and request the Contractor to take remedial action to correct the condition. In the event the Contractor does not take positive steps to fulfill this written request, or does not show just cause for not taking the proper action, within 24 hours, the City may take such remedial action with City resources or by contract. The City shall deduct an amount equal to the entire costs for such remedial action, plus 25%, from any funds due or become due the Contractor on the Project.

6.18 *Submittals*

- A. Contractor shall submit required Submittals to City for review and acceptance in accordance with the accepted Schedule of Submittals (as required by Paragraph 2.07). Each submittal will be identified as City may require.
 - 1. Submit in accordance with the General Requirements.
 - 2. Data shown on the Submittals will be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data, to demonstrate to City the services, materials, and equipment Contractor proposes to provide, and to enable City to review the information for the limited purposes required by Paragraph 6.18.C.
 - 3. Submittals submitted as herein provided by Contractor and reviewed by City for conformance with the design concept shall be executed in conformity with the Contract Documents unless otherwise required by City.
 - 4. When Submittals are submitted for the purpose of showing the installation in greater detail, their review shall not excuse Contractor from requirements shown on the Drawings and Specifications.

5. For-Information-Only submittals upon which the City is not expected to conduct review or take responsive action may be so identified in the Contract Documents.
 6. Submit required number of Samples specified in the Specifications.
 7. Clearly identify each Sample as to material, Supplier, pertinent data such as catalog numbers, the use for which intended and other data as City may require to enable City to review the submittal for the limited purposes required by Paragraph 6.18.C.
- B. Where a Submittal is required by the Contract Documents or the Schedule of Submittals, any related Work performed prior to City's review and acceptance of the pertinent submittal will be at the sole expense and responsibility of Contractor.
- C. *City's Review:*
1. City will provide timely review of required Submittals in accordance with the Schedule of Submittals acceptable to City. City's review and acceptance will be only to determine if the items covered by the submittals will, after installation or incorporation in the Work, conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.
 2. City's review and acceptance will not extend to means, methods, techniques, sequences, or procedures of construction (except where a particular means, method, technique, sequence, or procedure of construction is specifically and expressly called for by the Contract Documents) or to safety precautions or programs incident thereto. The review and acceptance of a separate item as such will not indicate approval of the assembly in which the item functions.
 3. City's review and acceptance shall not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has complied with the requirements of Section 01 33 00 and City has given written acceptance of each such variation by specific written notation thereof incorporated in or accompanying the Submittal. City's review and acceptance shall not relieve Contractor from responsibility for complying with the requirements of the Contract Documents.

6.19 *Continuing the Work*

Except as otherwise provided, Contractor shall carry on the Work and adhere to the Project Schedule during all disputes or disagreements with City. No Work shall be delayed or postponed pending resolution of any disputes or disagreements, except as City and Contractor may otherwise agree in writing.

6.20 *Contractor's General Warranty and Guarantee*

- A. Contractor warrants and guarantees to City that all Work will be in accordance with the Contract Documents and will not be defective. City and its officers, directors, members, partners, employees, agents, consultants, and subcontractors shall be entitled to rely on representation of Contractor's warranty and guarantee.
- B. Contractor's warranty and guarantee hereunder excludes defects or damage caused by:
1. abuse, modification, or improper maintenance or operation by persons other than Contractor, Subcontractors, Suppliers, or any other individual or entity for whom Contractor is responsible; or
 2. normal wear and tear under normal usage.
- C. Contractor's obligation to perform and complete the Work in accordance with the Contract Documents shall be absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents or a release of Contractor's obligation to perform the Work in accordance with the Contract Documents:
1. observations by City;
 2. recommendation or payment by City of any progress or final payment;
 3. the issuance of a certificate of Final Acceptance by City or any payment related thereto by City;
 4. use or occupancy of the Work or any part thereof by City;
 5. any review and acceptance of a Submittal by City;
 6. any inspection, test, or approval by others; or
 7. any correction of defective Work by City.
- D. The Contractor shall remedy any defects or damages in the Work and pay for any damage to other work or property resulting therefrom which shall appear within a period of two (2) years from the date of Final Acceptance of the Work unless a longer period is specified and shall furnish a good and sufficient maintenance bond, complying with the requirements of Article 5.02.B. The City will give notice of observed defects with reasonable promptness.

6.21 **Indemnification**

- A. **Contractor covenants and agrees to indemnify, hold harmless and defend, at its own expense, the City, its officers, servants and employees, from and against any and all claims arising out of, or alleged to arise out of, the work and services to be performed by the Contractor, its officers, agents, employees, subcontractors, licenses or invitees under this**

Contract. THIS INDEMNIFICATION PROVISION IS SPECIFICALLY INTENDED TO OPERATE AND BE EFFECTIVE EVEN IF IT IS ALLEGED OR PROVEN THAT ALL OR SOME OF THE DAMAGES BEING SOUGHT WERE CAUSED, IN WHOLE OR IN PART, BY ANY ACT, OMISSION OR NEGLIGENCE OF THE CITY. This indemnity provision is intended to include, without limitation, indemnity for costs, expenses and legal fees incurred by the City in defending against such claims and causes of actions.

- B. Contractor covenants and agrees to indemnify and hold harmless, at its own expense, the City, its officers, servants and employees, from and against any and all loss, damage or destruction of property of the City, arising out of, or alleged to arise out of, the work and services to be performed by the Contractor, its officers, agents, employees, subcontractors, licensees or invitees under this Contract. **THIS INDEMNIFICATION PROVISION IS SPECIFICALLY INTENDED TO OPERATE AND BE EFFECTIVE EVEN IF IT IS ALLEGED OR PROVEN THAT ALL OR SOME OF THE DAMAGES BEING SOUGHT WERE CAUSED, IN WHOLE OR IN PART, BY ANY ACT, OMISSION OR NEGLIGENCE OF THE CITY.**

6.22 *Delegation of Professional Design Services*

- A. Contractor will not be required to provide professional design services unless such services are specifically required by the Contract Documents for a portion of the Work or unless such services are required to carry out Contractor's responsibilities for construction means, methods, techniques, sequences and procedures.
- B. If professional design services or certifications by a design professional related to systems, materials or equipment are specifically required of Contractor by the Contract Documents, City will specify all performance and design criteria that such services must satisfy. Contractor shall cause such services or certifications to be provided by a properly licensed professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, and Submittals prepared by such professional. Submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to City.
- C. City shall be entitled to rely upon the adequacy, accuracy and completeness of the services, certifications or approvals performed by such design professionals, provided City has specified to Contractor performance and design criteria that such services must satisfy.
- D. Pursuant to this Paragraph 6.22, City's review and acceptance of design calculations and design drawings will be only for the limited purpose of checking for conformance with performance and design criteria given and the design concept expressed in the Contract Documents. City's review and acceptance of Submittals (except design calculations and design drawings) will be only for the purpose stated in Paragraph 6.18.C.

6.23 *Right to Audit*

- A. The City shall have the right to audit and make copies of the books, records and computations pertaining to the Contract. The Contractor shall retain such books, records, documents and other evidence pertaining to the Contract period and five years thereafter, except if an audit is in progress or audit findings are yet unresolved, in which case records shall be kept until all audit tasks are completed and resolved. These books, records, documents and other evidence shall be available, within ten (10) business days of written request. Further, the Contractor shall also require all Subcontractors, material suppliers, and other payees to retain all books, records, documents and other evidence pertaining to the Contract, and to allow the City similar access to those documents. All books and records will be made available within a 50 mile radius of the City. The cost of the audit will be borne by the City unless the audit reveals an overpayment of 1% or greater. If an overpayment of 1% or greater occurs, the reasonable cost of the audit, including any travel costs, must be borne by the Contractor which must be payable within five (5) business days of receipt of an invoice.
- B. Failure to comply with the provisions of this section shall be a material breach of the Contract and shall constitute, in the City's sole discretion, grounds for termination thereof. Each of the terms "books", "records", "documents" and "other evidence", as used above, shall be construed to include drafts and electronic files, even if such drafts or electronic files are subsequently used to generate or prepare a final printed document.

6.24 *Nondiscrimination*

- A. The City is responsible for operating Public Transportation Programs and implementing transit-related projects, which are funded in part with Federal financial assistance awarded by the U.S. Department of Transportation and the Federal Transit Administration (FTA), without discriminating against any person in the United States on the basis of race, color, or national origin.
- B. *Title VI, Civil Rights Act of 1964 as amended:* Contractor shall comply with the requirements of the Act and the Regulations as further defined in the Supplementary Conditions for any project receiving Federal assistance.

ARTICLE 7 – OTHER WORK AT THE SITE

7.01 *Related Work at Site*

- A. City may perform other work related to the Project at the Site with City's employees, or other City contractors, or through other direct contracts therefor, or have other work performed by utility owners. If such other work is not noted in the Contract Documents, then written notice thereof will be given to Contractor prior to starting any such other work; and
- B. Contractor shall afford each other contractor who is a party to such a direct contract, each utility owner, and City, if City is performing other work with City's employees or other City contractors, proper and safe access to the Site, provide a reasonable opportunity for the

introduction and storage of materials and equipment and the execution of such other work, and properly coordinate the Work with theirs. Contractor shall do all cutting, fitting, and patching of the Work that may be required to properly connect or otherwise make its several parts come together and properly integrate with such other work. Contractor shall not endanger any work of others by cutting, excavating, or otherwise altering such work; provided, however, that Contractor may cut or alter others' work with the written consent of City and the others whose work will be affected.

- C. If the proper execution or results of any part of Contractor's Work depends upon work performed by others under this Article 7, Contractor shall inspect such other work and promptly report to City in writing any delays, defects, or deficiencies in such other work that render it unavailable or unsuitable for the proper execution and results of Contractor's Work. Contractor's failure to so report will constitute an acceptance of such other work as fit and proper for integration with Contractor's Work except for latent defects in the work provided by others.

7.02 *Coordination*

- A. If City intends to contract with others for the performance of other work on the Project at the Site, the following will be set forth in Supplementary Conditions:
1. the individual or entity who will have authority and responsibility for coordination of the activities among the various contractors will be identified;
 2. the specific matters to be covered by such authority and responsibility will be itemized; and
 3. the extent of such authority and responsibilities will be provided.
- B. Unless otherwise provided in the Supplementary Conditions, City shall have authority for such coordination.

ARTICLE 8 – CITY'S RESPONSIBILITIES

8.01 *Communications to Contractor*

Except as otherwise provided in the Supplementary Conditions, City shall issue all communications to Contractor.

8.02 *Furnish Data*

City shall timely furnish the data required under the Contract Documents.

8.03 *Pay When Due*

City shall make payments to Contractor in accordance with Article 14.

8.04 *Lands and Easements; Reports and Tests*

City's duties with respect to providing lands and easements and providing engineering surveys to establish reference points are set forth in Paragraphs 4.01 and 4.05. Paragraph 4.02 refers to City's identifying and making available to Contractor copies of reports of explorations and tests of subsurface conditions and drawings of physical conditions relating to existing surface or subsurface structures at or contiguous to the Site that have been utilized by City in preparing the Contract Documents.

8.05 *Change Orders*

City shall execute Change Orders in accordance with Paragraph 10.03.

8.06 *Inspections, Tests, and Approvals*

City's responsibility with respect to certain inspections, tests, and approvals is set forth in Paragraph 13.03.

8.07 *Limitations on City's Responsibilities*

- A. The City shall not supervise, direct, or have control or authority over, nor be responsible for, Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. City will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.
- B. City will notify the Contractor of applicable safety plans pursuant to Paragraph 6.14.

8.08 *Undisclosed Hazardous Environmental Condition*

City's responsibility with respect to an undisclosed Hazardous Environmental Condition is set forth in Paragraph 4.06.

8.09 *Compliance with Safety Program*

While at the Site, City's employees and representatives shall comply with the specific applicable requirements of Contractor's safety programs of which City has been informed pursuant to Paragraph 6.14.

ARTICLE 9 – CITY'S OBSERVATION STATUS DURING CONSTRUCTION

9.01 *City's Project Manager or Duly Authorized Representative*

City will provide a Project Manager or duly authorized representative during the construction period. The duties and responsibilities and the limitations of authority of City's Project Manager or duly appointed representative during construction are set forth in the Contract Documents. City's Project Manager for this Contract is as set forth in the Supplementary Conditions. City will establish a duly authorized representative at the Preconstruction Meeting in accordance with Section 01 31 19.

9.02 *Visits to Site*

- A. City will make visits to the Site at intervals appropriate to the various stages of construction as City deems necessary in order to observe the progress that has been made and the quality of the various aspects of Contractor's executed Work. Based on information obtained during such visits and observations, City will determine, in general, if the Work is proceeding in accordance with the Contract Documents. City will not be required to make exhaustive or continuous inspections on the Site to check the quality or quantity of the Work. City's efforts will be directed toward providing City a greater degree of confidence that the completed Work will conform generally to the Contract Documents.
- B. City's visits and observations are subject to all the limitations on authority and responsibility set forth in Paragraph 8.07. Particularly, but without limitation, during or as a result of City's visits or observations of Contractor's Work, City will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work.

9.03 *Authorized Variations in Work*

City's Project Manager or duly authorized representative may authorize minor variations in the Work from the requirements of the Contract Documents which do not involve an adjustment in the Contract Price or the Contract Time and are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. These may be accomplished by a Field Order and will be binding on City and also on Contractor, who shall perform the Work involved promptly.

9.04 *Rejecting Defective Work*

City will have authority to reject Work which City's Project Manager or duly authorized representative believes to be defective, or will not produce a completed Project that conforms to the Contract Documents or that will prejudice the integrity of the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. City will have authority to conduct special inspection or testing of the Work as provided in Article 13, whether or not the Work is fabricated, installed, or completed.

9.05 *Determinations for Work Performed*

Contractor will determine the actual quantities and classifications of Work performed. City's Project Manager or duly authorized representative will review with Contractor the preliminary determinations on such matters before rendering a written recommendation. City's written decision will be final (except as modified to reflect changed factual conditions or more accurate data).

9.06 *Decisions on Requirements of Contract Documents and Acceptability of Work*

- A. City will be the initial interpreter of the requirements of the Contract Documents and judge of the acceptability of the Work thereunder.
- B. City will render a written decision on any issue referred.
- C. City's written decision on the issue referred will be final and binding on the Contractor, subject to the provisions of Paragraph 10.06.

ARTICLE 10 – CHANGES IN THE WORK; CLAIMS; EXTRA WORK

10.01 *Authorized Changes in the Work*

- A. Without invalidating the Contract and without notice to any surety, City may, at any time or from time to time, order Extra Work. Upon notice of such Extra Work, Contractor shall proceed with the Work involved only upon receiving written notice from City. Extra Work will be performed under the applicable conditions of the Contract Documents (except as otherwise specifically provided). Extra Work shall be memorialized by a Change Order which may or may not precede an order of Extra work.
- B. For minor changes of Work not requiring changes to Contract Time or Contract Price, a Field Order may be issued by the City.

10.02 *Unauthorized Changes in the Work*

Contractor shall not be entitled to an increase in the Contract Price or an extension of the Contract Time with respect to any work performed that is not required by the Contract Documents as amended, modified, or supplemented as provided in Paragraph 3.04, except in the case of an emergency as provided in Paragraph 6.17.

10.03 *Execution of Change Orders*

- A. City and Contractor shall execute appropriate Change Orders covering:
 - 1. changes in the Work which are: (i) ordered by City pursuant to Paragraph 10.01.A, (ii) required because of acceptance of defective Work under Paragraph 13.08 or City's correction of defective Work under Paragraph 13.09, or (iii) agreed to by the parties;
 - 2. changes in the Contract Price or Contract Time which are agreed to by the parties, including any undisputed sum or amount of time for Work actually performed.

10.04 *Dispute of Extra Work*

- A. Should a difference arise as to what does or does not constitute Extra Work, or as to the payment thereof, and the City insists upon its performance, the Contractor shall proceed with the work after making written request for written orders and shall keep accurate account of the actual

reasonable cost thereof. Contract Claims regarding Extra Work shall be made pursuant to Paragraph 10.06.

- B. The Contractor shall furnish the City such installation records of all deviations from the original Contract Documents as may be necessary to enable the City to prepare for permanent record a corrected set of plans showing the actual installation.
- C. The compensation agreed upon for Extra Work whether or not initiated by a Change Order shall be a full, complete and final payment for all costs Contractor incurs as a result or relating to the change or Extra Work, whether said costs are known, unknown, foreseen or unforeseen at that time, including without limitation, any costs for delay, extended overhead, ripple or impact cost, or any other effect on changed or unchanged work as a result of the change or Extra Work.

10.05 *Notification to Surety*

If the provisions of any bond require notice to be given to a surety of any change affecting the general scope of the Work or the provisions of the Contract Documents (including, but not limited to, Contract Price or Contract Time), the giving of any such notice will be Contractor's responsibility. The amount of each applicable bond will be adjusted by the Contractor to reflect the effect of any such change.

10.06 *Contract Claims Process*

- A. City's Decision Required: All Contract Claims, except those waived pursuant to Paragraph 14.09, shall be referred to the City for decision. A decision by City shall be required as a condition precedent to any exercise by Contractor of any rights or remedies he may otherwise have under the Contract Documents or by Laws and Regulations in respect of such Contract Claims.
- B. *Notice:*
 - 1. Written notice stating the general nature of each Contract Claim shall be delivered by the Contractor to City no later than 15 days after the start of the event giving rise thereto. The responsibility to substantiate a Contract Claim shall rest with the party making the Contract Claim.
 - 2. Notice of the amount or extent of the Contract Claim, with supporting data shall be delivered to the City on or before 45 days from the start of the event giving rise thereto (unless the City allows additional time for Contractor to submit additional or more accurate data in support of such Contract Claim).
 - 3. A Contract Claim for an adjustment in Contract Price shall be prepared in accordance with the provisions of Paragraph 12.01.
 - 4. A Contract Claim for an adjustment in Contract Time shall be prepared in accordance with the provisions of Paragraph 12.02.

5. Each Contract Claim shall be accompanied by Contractor's written statement that the adjustment claimed is the entire adjustment to which the Contractor believes it is entitled as a result of said event.
 6. The City shall submit any response to the Contractor within 30 days after receipt of the claimant's last submittal (unless Contract allows additional time).
- C. *City's Action:* City will review each Contract Claim and, within 30 days after receipt of the last submittal of the Contractor, if any, take one of the following actions in writing:
1. deny the Contract Claim in whole or in part;
 2. approve the Contract Claim; or
 3. notify the Contractor that the City is unable to resolve the Contract Claim if, in the City's sole discretion, it would be inappropriate for the City to do so. For purposes of further resolution of the Contract Claim, such notice shall be deemed a denial.
- D. City's written action under Paragraph 10.06.C will be final and binding, unless City or Contractor invoke the dispute resolution procedure set forth in Article 16 within 30 days of such action or denial.
- E. No Contract Claim for an adjustment in Contract Price or Contract Time will be valid if not submitted in accordance with this Paragraph 10.06.
- F. If the City fails to take any action pursuant to Paragraph 10.06 (C) the contract Claim is considered to have been denied by the City.

ARTICLE 11 – COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK; PLANS QUANTITY MEASUREMENT

11.01 Cost of the Work

- A. *Costs Included:* The term Cost of the Work means the sum of all costs, except those excluded in Paragraph 11.01.B, necessarily incurred and paid by Contractor in the proper performance of the Work. When the value of any Work covered by a Change Order, the costs to be reimbursed to Contractor will be only those additional or incremental costs required because of the change in the Work. Such costs shall not include any of the costs itemized in Paragraph 11.01.B, and shall include but not be limited to the following items:
1. Payroll costs for employees in the direct employ of Contractor in the performance of the Work under schedules of job classifications agreed upon by City and Contractor. Such employees shall include, without limitation, superintendents, foremen, and other personnel employed full time on the Work. Payroll costs for employees not employed full time on the Work shall be apportioned on the basis of their time spent on the Work. Payroll costs shall include;

- a. salaries and wages plus the cost of fringe benefits, which shall include social security contributions, unemployment, excise, and payroll taxes, workers' compensation, health and retirement benefits, bonuses, sick leave, vacation and holiday pay applicable thereto. The expenses of performing Work outside of Regular Working Hours, Weekend Working Hours, or legal holidays, shall be included in the above to the extent authorized by City.
2. Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and Suppliers' field services required in connection therewith.
3. Rentals of all construction equipment and machinery, and the parts thereof whether rented from Contractor or others in accordance with rental agreements approved by City, and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs shall be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts shall cease when the use thereof is no longer necessary for the Work.
4. Payments made by Contractor to Subcontractors for Work performed by Subcontractors. If required by City, Contractor shall obtain competitive bids from subcontractors acceptable to City and Contractor and shall deliver such bids to City, who will then determine, which bids, if any, will be acceptable. If any subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work plus a fee, the Subcontractor's Cost of the Work and fee shall be determined in the same manner as Contractor's Cost of the Work and fee as provided in this Paragraph 11.01.
5. Costs of special consultants (including but not limited to engineers, architects, testing laboratories, surveyors, attorneys, and accountants) employed for services specifically related to the Work.
6. Supplemental costs including the following:
 - a. The proportion of necessary transportation, travel, and subsistence expenses of Contractor's employees incurred in discharge of duties connected with the Work.
 - b. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office, and temporary facilities at the Site, and hand tools not owned by the workers, which are consumed in the performance of the Work, and cost, less market value, of such items used but not consumed which remain the property of Contractor.
 - c. Sales, consumer, use, and other similar taxes related to the Work, and for which Contractor is liable not covered under Paragraph 6.11, as imposed by Laws and Regulations.

- d. Deposits lost for causes other than negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, and royalty payments and fees for permits and licenses.
- e. Losses and damages (and related expenses) caused by damage to the Work, not compensated by insurance or otherwise, sustained by Contractor in connection with the performance of the Work, provided such losses and damages have resulted from causes other than the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses shall include settlements made with the written consent and approval of City. No such losses, damages, and expenses shall be included in the Cost of the Work for the purpose of determining Contractor's fee.
- f. The cost of utilities, fuel, and sanitary facilities at the Site.
- g. Minor expenses such as telegrams, long distance telephone calls, telephone and communication services at the Site, express and courier services, and similar petty cash items in connection with the Work.
- h. The costs of premiums for all bonds and insurance Contractor is required by the Contract Documents to purchase and maintain.

B. *Costs Excluded:* The term Cost of the Work shall not include any of the following items:

- 1. Payroll costs and other compensation of Contractor's officers, executives, principals (of partnerships and sole proprietorships), general managers, safety managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expeditors, timekeepers, clerks, and other personnel employed by Contractor, whether at the Site or in Contractor's principal or branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in Paragraph 11.01.A.1 or specifically covered by Paragraph 11.01.A.4, all of which are to be considered administrative costs covered by the Contractor's fee.
- 2. Expenses of Contractor's principal and branch offices other than Contractor's office at the Site.
- 3. Any part of Contractor's capital expenses, including interest on Contractor's capital employed for the Work and charges against Contractor for delinquent payments.
- 4. Costs due to the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied, and making good any damage to property.
- 5. Other overhead or general expense costs of any kind.

- C. *Contractor's Fee:* When all the Work is performed on the basis of cost-plus, Contractor's fee shall be determined as set forth in the Agreement. When the value of any Work covered by a Change Order for an adjustment in Contract Price is determined on the basis of Cost of the Work, Contractor's fee shall be determined as set forth in Paragraph 12.01.C.
- D. *Documentation:* Whenever the Cost of the Work for any purpose is to be determined pursuant to Paragraphs 11.01.A and 11.01.B, Contractor will establish and maintain records thereof in accordance with generally accepted accounting practices and submit in a form acceptable to City an itemized cost breakdown together with supporting data.

11.02 Allowances

- A. *Specified Allowance:* It is understood that Contractor has included in the Contract Price all allowances so named in the Contract Documents and shall cause the Work so covered to be performed for such sums and by such persons or entities as may be acceptable to City.
- B. *Cash Allowances:*
 - 1. Contractor agrees that:
 - a. the cash allowances include the cost to Contractor (less any applicable trade discounts) of materials and equipment required by the allowances to be delivered at the Site, and all applicable taxes; and
 - b. Contractor's costs for unloading and handling on the Site, labor, installation, overhead, profit, and other expenses contemplated for the cash allowances have been included in the allowances, and no demand for additional payment on account of any of the foregoing will be valid.
- C. *Contingency Allowance:* Contractor agrees that a contingency allowance, if any, is for the sole use of City.
- D. Prior to final payment, an appropriate Change Order will be issued to reflect actual amounts due Contractor on account of Work covered by allowances, and the Contract Price shall be correspondingly adjusted.

11.03 Unit Price Work

- A. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement.
- B. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Determinations of the actual quantities and classifications of Unit Price Work performed by Contractor will be made by

City subject to the provisions of Paragraph 9.05.

- C. Each unit price will be deemed to include an amount considered by Contractor to be adequate to cover Contractor's overhead and profit for each separately identified item. Work described in the Contract Documents, or reasonably inferred as required for a functionally complete installation, but not identified in the listing of unit price items shall be considered incidental to unit price work listed and the cost of incidental work included as part of the unit price.
- D. City may make an adjustment in the Contract Price in accordance with Paragraph 12.01 if:
1. the quantity of any item of Unit Price Work performed by Contractor differs materially and significantly from the estimated quantity of such item indicated in the Agreement; and
 2. there is no corresponding adjustment with respect to any other item of Work.
- E. *Increased or Decreased Quantities:* The City reserves the right to order Extra Work in accordance with Paragraph 10.01.
1. If the changes in quantities or the alterations do not significantly change the character of work under the Contract Documents, the altered work will be paid for at the Contract unit price.
 2. If the changes in quantities or alterations significantly change the character of work, the Contract will be amended by a Change Order.
 3. If no unit prices exist, this will be considered Extra Work and the Contract will be amended by a Change Order in accordance with Article 12.
 4. A significant change in the character of work occurs when:
 - a. the character of work for any Item as altered differs materially in kind or nature from that in the Contract or
 - b. a Major Item of work varies by more than 25% from the original Contract quantity.
 5. When the quantity of work to be done under any Major Item of the Contract is more than 125% of the original quantity stated in the Contract, then either party to the Contract may request an adjustment to the unit price on the portion of the work that is above 125%.
 6. When the quantity of work to be done under any Major Item of the Contract is less than 75% of the original quantity stated in the Contract, then either party to the Contract may request an adjustment to the unit price.

11.04 *Plans Quantity Measurement for Unclassified Excavation or Embankment*

- A. Plans quantities may or may not represent the exact quantity of work performed or material moved, handled, or placed during the execution of the Contract. The estimated bid quantities are designated as final payment quantities, unless revised by the governing Section or this Article.
- B. If the quantity measured as outlined under “Price and Payment Procedures” varies by more than 25% (or as stipulated under “Price and Payment Procedures” for specific Items) from the total estimated quantity for an individual Item originally shown in the Contract Documents, an adjustment may be made to the quantity of authorized work done for payment purposes. The party to the Contract requesting the adjustment will provide field measurements and calculations showing the final quantity for which payment will be made. Payment for revised quantity will be made at the unit price bid for that Item, except as provided for in Article 10.
- C. When quantities are revised by a change in design approved by the City, by Change Order, or to correct an error, or to correct an error on the plans, the plans quantity will be increased or decreased by the amount involved in the change, and the 25% variance will apply to the new plans quantity.
- D. If the total Contract quantity multiplied by the unit price bid for an individual Item is less than \$250 and the Item is not originally a plans quantity Item, then the Item may be paid as a plans quantity Item if the City and Contractor agree in writing to fix the final quantity as a plans quantity.
- E. For callout work or non-site specific Contracts, the plans quantity measurement requirements are not applicable.

ARTICLE 12 – CHANGE OF CONTRACT PRICE; CHANGE OF CONTRACT TIME

12.01 *Change of Contract Price*

- A. The Contract Price may only be changed by a Change Order.
- B. The value of any Work covered by a Change Order will be determined as follows:
 - 1. where the Work involved is covered by unit prices contained in the Contract Documents, by application of such unit prices to the quantities of the items involved (subject to the provisions of Paragraph 11.03); or
 - 2. where the Work involved is not covered by unit prices contained in the Contract Documents, by a mutually agreed lump sum or unit price (which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 12.01.C.2), and shall include the cost of any secondary impacts that are foreseeable at the time of pricing the cost of Extra Work; or
 - 3. where the Work involved is not covered by unit prices contained in the Contract Documents

and agreement to a lump sum or unit price is not reached under Paragraph 12.01.B.2, on the basis of the Cost of the Work (determined as provided in Paragraph 11.01) plus a Contractor's fee for overhead and profit (determined as provided in Paragraph 12.01.C).

- C. *Contractor's Fee*: The Contractor's additional fee for overhead and profit shall be determined as follows:
1. a mutually acceptable fixed fee; or
 2. if a fixed fee is not agreed upon, then a fee based on the following percentages of the various portions of the Cost of the Work:
 - a. for costs incurred under Paragraphs 11.01.A.1, 11.01.A.2. and 11.01.A.3, the Contractor's additional fee shall be 15 percent except for:
 - 1) rental fees for Contractor's own equipment using standard rental rates;
 - 2) bonds and insurance;
 - b. for costs incurred under Paragraph 11.01.A.4 and 11.01.A.5, the Contractor's fee shall be five percent (5%);
 - 1) where one or more tiers of subcontracts are on the basis of Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of Paragraphs 12.01.C.2.a and 12.01.C.2.b is that the Subcontractor who actually performs the Work, at whatever tier, will be paid a fee of 15 percent of the costs incurred by such Subcontractor under Paragraphs 11.01.A.1 and 11.01.A.2 and that any higher tier Subcontractor and Contractor will each be paid a fee of five percent (5%) of the amount paid to the next lower tier Subcontractor, however in no case shall the cumulative total of fees paid be in excess of 25%;
 - c. no fee shall be payable on the basis of costs itemized under Paragraphs 11.01.A.6, and 11.01.B;
 - d. the amount of credit to be allowed by Contractor to City for any change which results in a net decrease in cost will be the amount of the actual net decrease in cost plus a deduction in Contractor's fee by an amount equal to five percent (5%) of such net decrease.

12.02 *Change of Contract Time*

- A. The Contract Time may only be changed by a Change Order.
- B. No extension of the Contract Time will be allowed for Extra Work or for claimed delay unless the Extra Work contemplated or claimed delay is shown to be on the critical path of the Project Schedule or Contractor can show by Critical Path Method analysis how the Extra Work or claimed delay adversely affects the critical path.

12.03 *Delays*

- A. Where Contractor is reasonably delayed in the performance or completion of any part of the Work within the Contract Time due to delay beyond the control of Contractor, the Contract Time may be extended in an amount equal to the time lost due to such delay if a Contract Claim is made therefor. Delays beyond the control of Contractor shall include, but not be limited to, acts or neglect by City, acts or neglect of utility owners or other contractors performing other work as contemplated by Article 7, fires, floods, epidemics, abnormal weather conditions, or acts of God. Such an adjustment shall be Contractor's sole and exclusive remedy for the delays described in this Paragraph.
- B. If Contractor is delayed, City shall not be liable to Contractor for any claims, costs, losses, or damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by Contractor on or in connection with any other project or anticipated project.
- C. Contractor shall not be entitled to an adjustment in Contract Price or Contract Time for delays within the control of Contractor. Delays attributable to and within the control of a Subcontractor or Supplier shall be deemed to be delays within the control of Contractor.
- D. The Contractor shall receive no compensation for delays or hindrances to the Work, except when direct and unavoidable extra cost to the Contractor is caused by the failure of the City to provide information or material, if any, which is to be furnished by the City.

ARTICLE 13 – TESTS AND INSPECTIONS; CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK

13.01 *Notice of Defects*

Notice of all defective Work of which City has actual knowledge will be given to Contractor. Defective Work may be rejected, corrected, or accepted as provided in this Article 13.

13.02 *Access to Work*

City, independent testing laboratories, and governmental agencies with jurisdictional interests will have access to the Site and the Work at reasonable times for their observation, inspection, and testing. Contractor shall provide them proper and safe conditions for such access and advise them of Contractor's safety procedures and programs so that they may comply therewith as applicable.

13.03 *Tests and Inspections*

- A. Contractor shall give City timely notice of readiness of the Work for all required inspections, tests, or approvals and shall cooperate with inspection and testing personnel to facilitate required inspections or tests.
- B. If Contract Documents, Laws or Regulations of any public body having jurisdiction require any

of the Work (or part thereof) to be inspected, tested, or approved, Contractor shall assume full responsibility for arranging and obtaining such independent inspections, tests, retests or approvals, pay all costs in connection therewith, and furnish City the required certificates of inspection or approval; excepting, however, those fees specifically identified in the Supplementary Conditions or any Texas Department of Licensure and Regulation (TDLR) inspections, which shall be paid as described in the Supplementary Conditions.

- C. Contractor shall be responsible for arranging and obtaining and shall pay all costs in connection with any inspections, tests, re-tests, or approvals required for City's acceptance of materials or equipment to be incorporated in the Work; or acceptance of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in the Work. Such inspections, tests, re-tests, or approvals shall be performed by organizations acceptable to City.
- D. City may arrange for the services of an independent testing laboratory ("Testing Lab") to perform any inspections or tests ("Testing") for any part of the Work, as determined solely by City.
 - 1. City will coordinate such Testing to the extent possible, with Contractor;
 - 2. Should any Testing under this Section 13.03 D result in a "fail", "did not pass" or other similar negative result, the Contractor shall be responsible for paying for any and all retests. Contractor's cancellation without cause of City initiated Testing shall be deemed a negative result and require a retest.
 - 3. Any amounts owed for any retest under this Section 13.03 D shall be paid directly to the Testing Lab by Contractor. City will forward all invoices for retests to Contractor.
 - 4. If Contractor fails to pay the Testing Lab, City will not issue Final Payment until the Testing Lab is paid.
- E. If any Work (or the work of others) that is to be inspected, tested, or approved is covered by Contractor without written concurrence of City, Contractor shall, if requested by City, uncover such Work for observation.
- F. Uncovering Work as provided in Paragraph 13.03.E shall be at Contractor's expense.
- G. Contractor shall have the right to make a Contract Claim regarding any retest or invoice issued under Section 13.03 D.

13.04 *Uncovering Work*

- A. If any Work is covered contrary to the Contract Documents or specific instructions by the City, it must, if requested by City, be uncovered for City's observation and replaced at Contractor's expense.
- B. If City considers it necessary or advisable that covered Work be observed by City or inspected or tested by others, Contractor, at City's request, shall uncover, expose, or otherwise make available for observation, inspection, or testing as City may require, that portion of the Work in question, furnishing all necessary labor, material, and equipment.
 - 1. If it is found that the uncovered Work is defective, Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or other dispute resolution costs) arising out of or relating to such uncovering, exposure, observation, inspection, and testing, and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); or City shall be entitled to accept defective Work in accordance with Paragraph 13.08 in which case Contractor shall still be responsible for all costs associated with exposing, observing, and testing the defective Work.
 - 2. If the uncovered Work is not found to be defective, Contractor shall be allowed an extension of the Contract Time directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction.

13.05 *City May Stop the Work*

If the Work is defective, or Contractor fails to supply sufficient skilled workers or suitable materials or equipment, or fails to perform the Work in such a way that the completed Work will conform to the Contract Documents, City may order Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of City to stop the Work shall not give rise to any duty on the part of City to exercise this right for the benefit of Contractor, any Subcontractor, any Supplier, any other individual or entity, or any surety for, or employee or agent of any of them.

13.06 *Correction or Removal of Defective Work*

- A. Promptly after receipt of written notice, Contractor shall correct all defective Work pursuant to an acceptable schedule, whether or not fabricated, installed, or completed, or, if the Work has been rejected by City, remove it from the Project and replace it with Work that is not defective. Contractor shall pay all claims, costs, additional testing, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or removal (including but not limited to all costs of repair or replacement of work of others). Failure to require the removal of any defective Work shall not constitute acceptance of such Work.

- B. When correcting defective Work under the terms of this Paragraph 13.06 or Paragraph 13.07, Contractor shall take no action that would void or otherwise impair City's special warranty and guarantee, if any, on said Work.

13.07 *Correction Period*

- A. If within two (2) years after the date of Final Acceptance (or such longer period of time as may be prescribed by the terms of any applicable special guarantee required by the Contract Documents), any Work is found to be defective, or if the repair of any damages to the land or areas made available for Contractor's use by City or permitted by Laws and Regulations as contemplated in Paragraph 6.10.A is found to be defective, Contractor shall promptly, without cost to City and in accordance with City's written instructions:
1. repair such defective land or areas; or
 2. correct such defective Work; or
 3. if the defective Work has been rejected by City, remove it from the Project and replace it with Work that is not defective, and
 4. satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others or other land or areas resulting therefrom.
- B. If Contractor does not promptly comply with the terms of City's written instructions, or in an emergency where delay would cause serious risk of loss or damage, City may have the defective Work corrected or repaired or may have the rejected Work removed and replaced. All claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or other dispute resolution costs) arising out of or relating to such correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others) will be paid by Contractor.
- C. In special circumstances where a particular item of equipment is placed in continuous service before Final Acceptance of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Contract Documents.
- D. Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this Paragraph 13.07, the correction period hereunder with respect to such Work may be required to be extended for an additional period of one year after the end of the initial correction period. City shall provide 30 days written notice to Contractor should such additional warranty coverage be required. Contractor may dispute this requirement by filing a Contract Claim, pursuant to Paragraph 10.06.
- E. Contractor's obligations under this Paragraph 13.07 are in addition to any other obligation or warranty. The provisions of this Paragraph 13.07 shall not be construed as a substitute for, or a waiver of, the provisions of any applicable statute of limitation or repose.

13.08 *Acceptance of Defective Work*

If, instead of requiring correction or removal and replacement of defective Work, City prefers to accept it, City may do so. Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or other dispute resolution costs) attributable to City's evaluation of and determination to accept such defective Work and for the diminished value of the Work to the extent not otherwise paid by Contractor. If any such acceptance occurs prior to Final Acceptance, a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work, and City shall be entitled to an appropriate decrease in the Contract Price, reflecting the diminished value of Work so accepted.

13.09 *City May Correct Defective Work*

- A. If Contractor fails within a reasonable time after written notice from City to correct defective Work, or to remove and replace rejected Work as required by City in accordance with Paragraph 13.06.A, or if Contractor fails to perform the Work in accordance with the Contract Documents, or if Contractor fails to comply with any other provision of the Contract Documents, City may, after seven (7) days written notice to Contractor, correct, or remedy any such deficiency.
- B. In exercising the rights and remedies under this Paragraph 13.09, City shall proceed expeditiously. In connection with such corrective or remedial action, City may exclude Contractor from all or part of the Site, take possession of all or part of the Work and suspend Contractor's services related thereto, and incorporate in the Work all materials and equipment incorporated in the Work, stored at the Site or for which City has paid Contractor but which are stored elsewhere. Contractor shall allow City, City's representatives, agents, consultants, employees, and City's other contractors, access to the Site to enable City to exercise the rights and remedies under this Paragraph.
- C. All claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or other dispute resolution costs) incurred or sustained by City in exercising the rights and remedies under this Paragraph 13.09 will be charged against Contractor, and a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work; and City shall be entitled to an appropriate decrease in the Contract Price.
- D. Contractor shall not be allowed an extension of the Contract Time because of any delay in the performance of the Work attributable to the exercise of City's rights and remedies under this Paragraph 13.09.

ARTICLE 14 – PAYMENTS TO CONTRACTOR AND COMPLETION

14.01 *Schedule of Values*

The Schedule of Values for lump sum contracts established as provided in Paragraph 2.07 will serve as the basis for progress payments and will be incorporated into a form of Application for Payment

acceptable to City. Progress payments on account of Unit Price Work will be based on the number of units completed.

14.02 *Progress Payments*

A. *Applications for Payments:*

1. Contractor is responsible for providing all information as required to become a vendor of the City.
2. At least 20 days before the date established in the General Requirements for each progress payment, Contractor shall submit to City for review an Application for Payment filled out and signed by Contractor covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents.
3. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the Site or at another location agreed to in writing, the Application for Payment shall also be accompanied by a bill of sale, invoice, or other documentation warranting that City has received the materials and equipment free and clear of all Liens and evidence that the materials and equipment are covered by appropriate insurance or other arrangements to protect City's interest therein, all of which must be satisfactory to City.
4. Beginning with the second Application for Payment, each Application shall include an affidavit of Contractor stating that previous progress payments received on account of the Work have been applied on account to discharge Contractor's legitimate obligations associated with prior Applications for Payment.
5. The amount of retainage with respect to progress payments will be as stipulated in the Contract Documents.

B. *Review of Applications:*

1. City will, after receipt of each Application for Payment, either indicate in writing a recommendation of payment or return the Application to Contractor indicating reasons for refusing payment. In the latter case, Contractor may make the necessary corrections and resubmit the Application.
2. City's processing of any payment requested in an Application for Payment will be based on City's observations of the executed Work, and on City's review of the Application for Payment and the accompanying data and schedules, that to the best of City's knowledge:
 - a. the Work has progressed to the point indicated;
 - b. the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Final Acceptance,

the results of any subsequent tests called for in the Contract Documents, a final determination of quantities and classifications for Work performed under Paragraph 9.05, and any other qualifications stated in the recommendation).

3. Processing any such payment will not thereby be deemed to have represented that:
 - a. inspections made to check the quality or the quantity of the Work as it has been performed have been exhaustive, extended to every aspect of the Work in progress, or involved detailed inspections of the Work beyond the responsibilities specifically assigned to City in the Contract Documents; or
 - b. there may not be other matters or issues between the parties that might entitle Contractor to be paid additionally by City or entitle City to withhold payment to Contractor, or
 - c. Contractor has complied with Laws and Regulations applicable to Contractor's performance of the Work.
4. City may refuse to process the whole or any part of any payment because of subsequently discovered evidence or the results of subsequent inspections or tests, and revise or revoke any such payment previously made, to such extent as may be necessary to protect City from loss because:
 - a. the Work is defective, or the completed Work has been damaged by the Contractor or his subcontractors, requiring correction or replacement;
 - b. discrepancies in quantities contained in previous applications for payment;
 - c. the Contract Price has been reduced by Change Orders;
 - d. City has been required to correct defective Work or complete Work in accordance with Paragraph 13.09; or
 - e. City has actual knowledge of the occurrence of any of the events enumerated in Paragraph 15.02.A.

C. *Retainage:*

1. For all contracts, retainage shall be five percent (5%).

D. *Liquidated Damages:* For each calendar day that any work shall remain uncompleted after the time specified in the Contract Documents, the sum per day specified in the Agreement, will be deducted from the monies due the Contractor, not as a penalty, but as liquidated damages suffered by the City.

E. *Payment:* Contractor will be paid pursuant to the requirements of this Article 14 and payment will become due in accordance with the Contract Documents.

F. *Reduction in Payment:*

1. City may refuse to make payment of the amount requested because:
 - a. Claims have been made against City on account of Contractor's performance or furnishing of the Work;
 - b. Liens have been filed in connection with the Work, except where Contractor has delivered a specific bond satisfactory to City to secure the satisfaction and discharge of such Liens;
 - c. there are other items entitling City to a set-off against the amount recommended; or
 - d. City has actual knowledge of the occurrence of any of the events enumerated in Paragraphs 14.02.B.4.a through 14.02.B.4.e or Paragraph 15.02.A.
2. If City refuses to make payment of the amount requested, City will give Contractor written notice stating the reasons for such action and pay Contractor any amount remaining after deduction of the amount so withheld. City shall pay Contractor the amount so withheld, or any adjustment thereto agreed to by City and Contractor, when Contractor remedies the reasons for such action.

14.03 *Contractor's Warranty of Title*

Contractor warrants and guarantees that title to all Work, materials, and equipment covered by any Application for Payment, whether incorporated in the Project or not, will pass to City no later than the time of payment free and clear of all Liens.

14.04 *Partial Utilization*

A. Prior to Final Acceptance of all the Work, City may use or occupy any substantially completed part of the Work which has specifically been identified in the Contract Documents, or which City, determines constitutes a separately functioning and usable part of the Work that can be used by City for its intended purpose without significant interference with Contractor's performance of the remainder of the Work. City at any time may notify Contractor in writing to permit City to use or occupy any such part of the Work which City determines to be ready for its intended use, subject to the following conditions:

1. Contractor at any time may notify City in writing that Contractor considers any such part of the Work ready for its intended use.
2. Within a reasonable time after notification as enumerated in Paragraph 14.05.A.1, City and Contractor shall make an inspection of that part of the Work to determine its status of completion. If City does not consider that part of the Work to be substantially complete, City will notify Contractor in writing giving the reasons therefor.
3. Partial Utilization will not constitute Final Acceptance by City.

14.05 *Final Inspection*

A. Upon written notice from Contractor that the entire Work is complete in accordance with the Contract Documents:

1. City will promptly schedule a Final Inspection with Contractor.
2. City will notify Contractor in writing of all particulars in which this inspection reveals that the Work is incomplete or defective. Contractor shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

B. City reserves the right to deny request for Final Inspection if City determines that the entire Work is not sufficiently complete to warrant a Final Inspection.

14.06 *Final Acceptance*

Upon completion by Contractor to City's satisfaction, of any additional Work identified in the Final Inspection, City will issue to Contractor a letter of Final Acceptance.

14.07 *Final Payment*

A. *Application for Payment:*

1. Upon Final Acceptance, and in the opinion of City, Contractor may make an application for final payment following the procedure for progress payments in accordance with the Contract Documents.
2. The final Application for Payment shall be accompanied (except as previously delivered) by:
 - a. all documentation called for in the Contract Documents, including but not limited to the evidence of insurance required by Paragraph 5.03;
 - b. consent of the surety, if any, to final payment;
 - c. a list of all pending or released Damage Claims against City that Contractor believes are unsettled; and
 - d. affidavits of payments and complete and legally effective releases or waivers (satisfactory to City) of all Lien rights arising out of or Liens filed in connection with the Work.

B. *Payment Becomes Due:*

1. After City's acceptance of the Application for Payment and accompanying documentation, requested by Contractor, less previous payments made and any sum City is entitled, including but not limited to liquidated damages, will become due and payable.
2. After all Damage Claims have been resolved:
 - a. directly by the Contractor or;
 - b. Contractor provides evidence that the Damage Claim has been reported to Contractor's insurance provider for resolution.
3. The making of the final payment by the City shall not relieve the Contractor of any guarantees or other requirements of the Contract Documents which specifically continue thereafter.

14.08 *Final Completion Delayed and Partial Retainage Release*

- A. If final completion of the Work is significantly delayed, and if City so confirms, City may, upon receipt of Contractor's final Application for Payment, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance to be held by City for Work not fully completed or corrected is less than the retainage stipulated in Paragraph 14.02.C, and if bonds have been furnished as required in Paragraph 5.02, the written consent of the surety to the payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by Contractor to City with the Application for such payment. Such payment shall be made under the terms and conditions

governing final payment, except that it shall not constitute a waiver of Contract Claims.

- B. *Partial Retainage Release.* For a Contract that provides for a separate vegetative establishment and maintenance, and test and performance periods following the completion of all other construction in the Contract Documents for all Work locations, the City may release a portion of the amount retained provided that all other work is completed as determined by the City. Before the release, all submittals and final quantities must be completed and accepted for all other work. An amount sufficient to ensure Contract compliance will be retained.

14.09 *Waiver of Claims*

The acceptance of final payment will constitute a release of the City from all claims or liabilities under the Contract for anything done or furnished or relating to the work under the Contract Documents or any act or neglect of City related to or connected with the Contract.

ARTICLE 15 – SUSPENSION OF WORK AND TERMINATION

15.01 *City May Suspend Work*

- A. At any time and without cause, City may suspend the Work or any portion thereof by written notice to Contractor and which may fix the date on which Work will be resumed. Contractor shall resume the Work on the date so fixed. During temporary suspension of the Work covered by these Contract Documents, for any reason, the City will make no extra payment for stand-by time of construction equipment and/or construction crews.
- B. Should the Contractor not be able to complete a portion of the Project due to causes beyond the control of and without the fault or negligence of the Contractor, and should it be determined by mutual consent of the Contractor and City that a solution to allow construction to proceed is not available within a reasonable period of time, Contractor may request an extension in Contract Time, directly attributable to any such suspension.
- C. If it should become necessary to suspend the Work for an indefinite period, the Contractor shall store all materials in such a manner that they will not obstruct or impede the public unnecessarily nor become damaged in any way, and he shall take every precaution to prevent damage or deterioration of the work performed; he shall provide suitable drainage about the work, and erect temporary structures where necessary.
- D. Contractor may be reimbursed for the cost of moving his equipment off the job and returning the necessary equipment to the job when it is determined by the City that construction may be resumed. Such reimbursement shall be based on actual cost to the Contractor of moving the equipment and no profit will be allowed. Reimbursement may not be allowed if the equipment is moved to another construction project for the City.

15.02 *City May Terminate for Cause*

- A. The occurrence of any one or more of the following events by way of example, but not of

limitation, may justify termination for cause:

1. Contractor's persistent failure to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment, failure to adhere to the Project Schedule established under Paragraph 2.07 as adjusted from time to time pursuant to Paragraph 6.04.
 2. Contractor's disregard of Laws or Regulations of any public body having jurisdiction;
 3. Contractor's repeated disregard of the authority of City; or
 4. Contractor's violation in any substantial way of any provisions of the Contract Documents;
or
 5. Contractor's failure to promptly make good any defect in materials or workmanship, or defects of any nature, the correction of which has been directed in writing by the City; or
 6. Substantial indication that the Contractor has made an unauthorized assignment of the Contract or any funds due therefrom for the benefit of any creditor or for any other purpose;
or
 7. Substantial evidence that the Contractor has become insolvent or bankrupt, or otherwise financially unable to carry on the Work satisfactorily; or
 8. Contractor commences legal action in a court of competent jurisdiction against the City.
- B. If one or more of the events identified in Paragraph 15.02A. occur, City will provide written notice to Contractor and Surety to arrange a conference with Contractor and Surety to address Contractor's failure to perform the Work. Conference shall be held not later than 15 days, after receipt of notice.
1. If the City, the Contractor, and the Surety do not agree to allow the Contractor to proceed to perform the construction Contract, the City may, to the extent permitted by Laws and Regulations, declare a Contractor default and formally terminate the Contractor's right to complete the Contract. Contractor default shall not be declared earlier than 20 days after the Contractor and Surety have received notice of conference to address Contractor's failure to perform the Work.
 2. If Contractor's services are terminated, Surety shall be obligated to take over and perform the Work. If Surety does not commence performance thereof within 15 consecutive calendar days after date of an additional written notice demanding Surety's performance of its obligations, then City, without process or action at law, may take over any portion of the Work and complete it as described below.
 - a. If City completes the Work, City may exclude Contractor and Surety from the site and take possession of the Work, and all materials and equipment incorporated into the

Work stored at the Site or for which City has paid Contractor or Surety but which are stored elsewhere, and finish the Work as City may deem expedient.

3. Whether City or Surety completes the Work, Contractor shall not be entitled to receive any further payment until the Work is finished. If the unpaid balance of the Contract Price exceeds all claims, costs, losses and damages sustained by City arising out of or resulting from completing the Work, such excess will be paid to Contractor. If such claims, costs, losses and damages exceed such unpaid balance, Contractor shall pay the difference to City. Such claims, costs, losses and damages incurred by City will be incorporated in a Change Order, provided that when exercising any rights or remedies under this Paragraph, City shall not be required to obtain the lowest price for the Work performed.
 4. Neither City, nor any of its respective consultants, agents, officers, directors or employees shall be in any way liable or accountable to Contractor or Surety for the method by which the completion of the said Work, or any portion thereof, may be accomplished or for the price paid therefor.
 5. City, notwithstanding the method used in completing the Contract, shall not forfeit the right to recover damages from Contractor or Surety for Contractor's failure to timely complete the entire Contract. Contractor shall not be entitled to any claim on account of the method used by City in completing the Contract.
 6. Maintenance of the Work shall continue to be Contractor's and Surety's responsibilities as provided for in the bond requirements of the Contract Documents or any special guarantees provided for under the Contract Documents or any other obligations otherwise prescribed by law.
- C. Notwithstanding Paragraphs 15.02.B, Contractor's services will not be terminated if Contractor begins within seven days of receipt of notice of intent to terminate to correct its failure to perform and proceeds diligently to cure such failure within no more than 30 days of receipt of said notice.
- D. Where Contractor's services have been so terminated by City, the termination will not affect any rights or remedies of City against Contractor then existing or which may thereafter accrue. Any retention or payment of moneys due Contractor by City will not release Contractor from liability.
- E. If and to the extent that Contractor has provided a performance bond under the provisions of Paragraph 5.02, the termination procedures of that bond shall not supersede the provisions of this Article.

15.03 *City May Terminate For Convenience*

- A. City may, without cause and without prejudice to any other right or remedy of City, terminate the Contract. Any termination shall be effected by mailing a notice of the termination to the

Contractor specifying the extent to which performance of Work under the contract is terminated, and the date upon which such termination becomes effective. Receipt of the notice shall be deemed conclusively presumed and established when the letter is placed in the United States Postal Service Mail by the City. Further, it shall be deemed conclusively presumed and established that such termination is made with just cause as therein stated; and no proof in any claim, demand or suit shall be required of the City regarding such discretionary action.

- B. After receipt of a notice of termination, and except as otherwise directed by the City, the Contractor shall:
1. Stop work under the Contract on the date and to the extent specified in the notice of termination;
 2. place no further orders or subcontracts for materials, services or facilities except as may be necessary for completion of such portion of the Work under the Contract as is not terminated;
 3. terminate all orders and subcontracts to the extent that they relate to the performance of the Work terminated by notice of termination;
 4. transfer title to the City and deliver in the manner, at the times, and to the extent, if any, directed by the City:
 - a. the fabricated or unfabricated parts, Work in progress, completed Work, supplies and other material produced as a part of, or acquired in connection with the performance of, the Work terminated by the notice of the termination; and
 - b. the completed, or partially completed plans, drawings, information and other property which, if the Contract had been completed, would have been required to be furnished to the City.
 5. complete performance of such Work as shall not have been terminated by the notice of termination; and
 6. take such action as may be necessary, or as the City may direct, for the protection and preservation of the property related to its contract which is in the possession of the Contractor and in which the owner has or may acquire the rest.
- C. At a time not later than 30 days after the termination date specified in the notice of termination, the Contractor may submit to the City a list, certified as to quantity and quality, of any or all items of termination inventory not previously disposed of, exclusive of items the disposition of which has been directed or authorized by City.
- D. Not later than 15 days thereafter, the City shall accept title to such items provided, that the list

submitted shall be subject to verification by the City upon removal of the items or, if the items are stored, within 45 days from the date of submission of the list, and any necessary adjustments to correct the list as submitted, shall be made prior to final settlement.

- E. Not later than 60 days after the notice of termination, the Contractor shall submit his termination claim to the City in the form and with the certification prescribed by the City. Unless an extension is made in writing within such 60 day period by the Contractor, and granted by the City, any and all such claims shall be conclusively deemed waived.
- F. In such case, Contractor shall be paid for (without duplication of any items):
 - 1. completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work;
 - 2. expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials, or equipment as required by the Contract Documents in connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses; and
 - 3. reasonable expenses directly attributable to termination.
- G. In the event of the failure of the Contractor and City to agree upon the whole amount to be paid to the Contractor by reason of the termination of the Work, the City shall determine, on the basis of information available to it, the amount, if any, due to the Contractor by reason of the termination and shall pay to the Contractor the amounts determined. Contractor shall not be paid on account of loss of anticipated profits or revenue or other economic loss arising out of or resulting from such termination.

ARTICLE 16 – DISPUTE RESOLUTION

16.01 Methods and Procedures

- A. Either City or Contractor may request mediation of any Contract Claim submitted for a decision under Paragraph 10.06 before such decision becomes final and binding. The request for mediation shall be submitted to the other party to the Contract. Timely submission of the request shall stay the effect of Paragraph 10.06.E.
- B. City and Contractor shall participate in the mediation process in good faith. The process shall be commenced within 60 days of filing of the request.
- C. If the Contract Claim is not resolved by mediation, City's action under Paragraph 10.06.C or a denial pursuant to Paragraphs 10.06.C.3 or 10.06.D shall become final and binding 30 days after termination of the mediation unless, within that time period, City or Contractor:
 - 1. elects in writing to invoke any other dispute resolution process provided for in the

Supplementary Conditions; or

2. agrees with the other party to submit the Contract Claim to another dispute resolution process; or
3. gives written notice to the other party of the intent to submit the Contract Claim to a court of competent jurisdiction.

ARTICLE 17 – MISCELLANEOUS

17.01 Giving Notice

- A. Whenever any provision of the Contract Documents requires the giving of written notice, it will be deemed to have been validly given if:
 1. delivered in person to the individual or to a member of the firm or to an officer of the corporation for whom it is intended; or
 2. delivered at or sent by registered or certified mail, postage prepaid, to the last business address known to the giver of the notice.
 3. delivered by electronic means to or from the Project Manager.
- B. Business address changes must be promptly made in writing to the other party.
- C. Whenever the Contract Documents specifies giving notice by electronic means such electronic notice shall be deemed sufficient upon confirmation of receipt by the receiving party.

17.02 Computation of Times

When any period of time is referred to in the Contract Documents by days, it will be computed to exclude the first and include the last day of such period. If the last day of any such period falls on a Saturday or Sunday or on a day made a legal holiday the next Working Day shall become the last day of the period.

17.03 Cumulative Remedies

The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto are in addition to, and are not to be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by Laws or Regulations, by special warranty or guarantee, or by other provisions of the Contract Documents. The provisions of this Paragraph will be as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right, and remedy to which they apply.

17.04 *Survival of Obligations*

All representations, indemnifications, warranties, and guarantees made in, required by, or given in accordance with the Contract Documents, as well as all continuing obligations indicated in the Contract Documents, will survive final payment, completion, and acceptance of the Work or termination or completion of the Contract or termination of the services of Contractor.

17.05 *Headings*

Article and paragraph headings are inserted for convenience only and do not constitute parts of these General Conditions.

(3) Other: *[Insert full legal name of additional entity(s) that City requires to be an additional insured, i.e. Landowner, Railroad, Etc. If none then write "None"]*

[Obtain approval for the limits shown for SC 5.04A thru 5.04D. from City before finalizing Contract Documents]

SC-5.04A., "Contractor's Insurance"

The limits of liability for the insurance required by Paragraph GC-5.04 shall provide the following coverages for not less than the following amounts or greater where required by laws and regulations:

5.04A. Workers' Compensation, under Paragraph GC-5.04A.

Statutory limits

Employer's liability

\$100,000 each accident/occurrence

\$100,000 Disease - each employee

\$500,000 Disease - policy limit

SC-5.04B., "Contractor's Insurance"

5.04B. Commercial General Liability, under Paragraph GC-5.04B. Contractor's Liability Insurance under Paragraph GC-5.04B., which shall be on a per project basis covering the Contractor with minimum limits of:

\$1,000,000 each occurrence

\$2,000,000 aggregate limit

The policy must have an endorsement (Amendment – Aggregate Limits of Insurance) making the General Aggregate Limits apply separately to each job site.

The Commercial General Liability Insurance policies shall provide "X", "C", and "U" coverage's. Verification of such coverage must be shown in the Remarks Article of the Certificate of Insurance.

SC 5.04C., "Contractor's Insurance"

5.04C. Automobile Liability, under Paragraph GC-5.04C. Contractor's Liability Insurance under Paragraph GC-5.04C., which shall be in an amount not less than the following amounts:

- (1) **Automobile Liability** - a commercial business policy shall provide coverage on "Any Auto", defined as autos owned, hired and non-owned.

\$1,000,000 each accident on a combined single limit basis. Split limits are acceptable if limits are at least:

\$250,000 Bodily Injury per person /

\$500,000 Bodily Injury per accident /

\$100,000 Property Damage

SC-6.09., "Permits and Utilities"

SC-6.09A., "Contractor obtained permits and licenses"

The following are known permits and/or licenses required by the Contract to be acquired by the Contractor:

<If none then write "None".

1. <List all known permits or licenses that are being provided by the Contractor to TCEQ>

2. <List all other known permits or licenses that are being provided by the Contractor>

1
2 **SC-6.09B. "City obtained permits and licenses"**

3 The following are known permits and/or licenses required by the Contract to be acquired by the City: <If
4 none then write "None".

- 5 3. <List all known permits or licenses that are being provided by the City to TxDOT>
- 6 4. <List all known permits or licenses that are being provided by the City to USACE>
- 7 5. <List all known permits or licenses that are being provided by the City to TCEQ>
- 8 6. <List all known permits or licenses that are being provided by the City to Railroad>

9
10 **SC-6.09C. "Outstanding permits and licenses"**

11
12 The following is a list of known outstanding permits and/or licenses to be acquired, if any as of [Month
13 Day, Year this document was prepared]:

14
15 **Outstanding Permits and/or Licenses to Be Acquired**

OWNER	PERMIT OR LICENSE AND LOCATION	TARGET DATE OF POSSESSION
-------	--------------------------------	---------------------------

<If there is none then write
"None">

16
17 <Insert the following if Federal assistance is provided for in this Contract>

18 **SC-6.24B., "Title VI, Civil Rights Act of 1964 as amended"**

19
20 During the performance of this Contract, the Contractor, for itself, its assignees and successors in interest
21 (hereinafter referred to as the "Contractor") agrees as follows:

- 22
23 1. **Compliance with Regulations:** The Contractor shall comply with the Regulation relative to
24 nondiscrimination in Federally-assisted programs of the Department of Transportation (hereinafter,
25 "DOT") Title 49, Code of Federal Regulations, Part 21, as they may be amended from time to time,
26 (hereinafter referred to as the Regulations), which are herein incorporated by reference and made a part
27 of this contract.
- 28
29 2. **Nondiscrimination:** The Contractor, with regard to the work performed by it during the contract, shall
30 not discriminate on the grounds of race, color, or national origin, in the selection and retention of
31 subcontractors, including procurements of materials and leases of equipment. The Contractor shall not
32 participate either directly or indirectly in the discrimination prohibited by 49 CFR, section 21.5 of the
33 Regulations, including employment practices when the contract covers a program set forth in
34 Appendix B of the Regulations.
- 35
36 3. **Solicitations for Subcontractors, Including Procurements of Materials and Equipment:** In all
37 solicitations either by competitive bidding or negotiation made by the contractor for work to be
38 performed under a subcontract, including procurements of materials or leases of equipment, each
39 potential subcontractor or supplier shall be notified by the Contractor of the Contractor's obligations
40 under this contract and the Regulations relative to nondiscrimination on the grounds of race, color, or
41 national origin.
- 42
43 4. **Information and Reports:** The Contractor shall provide all information and reports required by the
44 Regulations or directives issued pursuant thereto, and shall permit access to its books, records,
45 accounts, other sources of information and its facilities as may be determined by City or the Texas
46 Department of Transportation to be pertinent to ascertain compliance with such Regulations, orders
47 and instructions. Where any information required of a contractor is in the exclusive possession of
48 another who fails or refuses to furnish this information the contractor shall so certify to the City, or the

1 Texas Department of Transportation, as appropriate, and shall set forth what efforts it has made to
 2 obtain the information.
 3

4 **5. Sanctions for Noncompliance:** In the event of the Contractor's noncompliance with the
 5 nondiscrimination provisions of this Contract, City shall impose such contract sanctions as it or the
 6 Texas Department of Transportation may determine to be appropriate, including, but not limited to:

- 7
- 8 a. withholding of payments to the Contractor under the Contract until the Contractor
- 9 complies, and/or
- 10 b. cancellation, termination or suspension of the Contract, in whole or in part.
- 11

12 **6. Incorporation of Provisions:** The Contractor shall include the provisions of paragraphs (1) through
 13 (6) in every subcontract, including procurements of materials and leases of equipment, unless exempt
 14 by the Regulations, or directives issued pursuant thereto. The Contractor shall take such action with
 15 respect to any subcontract or procurement as City or the Texas Department of Transportation may
 16 direct as a means of enforcing such provisions including sanctions for non-compliance: Provided,
 17 however, that, in the event a contractor becomes involved in, or is threatened with, litigation with a
 18 subcontractor or supplier as a result of such direction, the contractor may request City to enter into
 19 such litigation to protect the interests of City, and, in addition, the contractor may request the United
 20 States to enter into such litigation to protect the interests of the United States.

21
 22 Additional Title VI requirements can be found in the Appendix.

23
 24 **SC-7.02., “Coordination”**

25
 26 The individuals or entities listed below have contracts with the City for the performance of other work at
 27 the Site:
 28

Vendor	Scope of Work	Coordination Authority
<i>Freese and Nichols</i>	<i>Phase II Major Maintenance Improvements</i>	<i>CITY</i>

29
 30
 31 **SC-9.01., “City’s Project Manager”**

32
 33 The City’s Project Manager for this Contract is <Insert Name>, or his/her successor pursuant to **written**
 34 **notification from the City Engineer.**

35
 36 **SC-13.03C., “Tests and Inspections”**

37
 38 *None*

39
 40 **SC-16.01C.1, “Methods and Procedures”**

41
 42 *None*

END OF SECTION

Revision Log		
DATE	NAME	SUMMARY OF CHANGE

4/3/2019	Garver	Removed sections SC 4.01A.1 – 2, 5.04D, 8.01
4/3/2019	Garver	Updated SC 4.02A, 4.06A, 7.02, 13.03C, 16.01C.1

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SECTION 00 73 73
FORM 1295 - CERTIFICATE OF INTERESTED PARTIES

[Contractor: Replace this page with Form 1295 for this Contract, which can be obtained at www.ethics.state.tx.us/]

END OF SECTION

DIVISION 01
GENERAL REQUIREMENTS

SECTION 01 11 00 - SUMMARY OF WORK

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes description and requirements of:
1. Work covered by Contract Documents.
 2. Activities of others within Project area.
 3. Coordination of Work required by Contractor.
 4. Provisions for future Work.
- B. Work covered by Contract Documents: The completed Work will provide Owner with various water treatment plant improvements. More specifically, the Project includes, but is not limited to, construction of the following:
1. Washwater Equalization Basin pump system improvements
 2. Gravity Thickener.
 - a) Piping from the existing equalization basin to the gravity thickener
 3. Positive displacement pump station for conveyance of thickened solids.
 4. New dewatering building.
 - a) Two belt filter presses
 - b) Feed equipment
 - c) Liquid polymer feed system
 - d) Extension of plant water system
 - e) Conveyance equipment to transfer solids from the belt filter press discharge to dumpster
 - f) HVAC and plumbing
 5. Washwater Recovery Basin Pumping System Improvements
 6. Roadway access improvements for dewatered solids transport trucks from discharge of conveyor.
 7. Evaluation of automation including flow meters, mass meters, and automated valving and controls.
 8. Power and signal integration into SCADA for applicable equipment.
 9. Additional security measures such as fencing around new dewatering facility, key card entry for dewatering building, and cameras inside the dewatering building.
 10. Construction sequencing for installation and integration of new equipment into existing dewatering scheme.
 11. Geotechnical services necessary for gravity thickener and dewatering building.
- C. Except as Specifically Noted Otherwise, Provide and Pay For:
1. Insurance and bonds.
 2. Labor, materials, and equipment.
 3. Tools, equipment, and machinery required for construction.
 4. Utilities required for construction.
 5. Temporary facilities including sheeting and shoring.
 6. Traffic control and dust control measures.
 7. Other facilities and services necessary for proper execution and completion of the Work.
- D. Secure and pay for all permits including all City permits, OSHA excavation permits, Department of Transportation permits, Stormwater General Permit for Construction Activities from TCEQ, and any other government fees and licenses.
1. It is the Contractor's responsibility to maintain the required controls and record keeping to comply with the SWPPP and associated stormwater permit.
- E. Comply with codes, ordinances, regulations, orders, and other legal requirements of public authorities having bearing on the performance of the Work.

1.2 ACTIVITIES BY OTHERS

- A. OWNER, utilities, and others may perform activities within Project area while the Work is in progress.
 - 1. Schedule the Work with OWNER, utilities, and others to minimize mutual interference.
- B. Cooperate with Others to Minimize Interference and Delays.
 - 1. When cooperation fails, submit recommendations and perform Work in coordination with work of others as directed.
- C. Other ON-Going and Potential Projects that parallel the schedule of this project:
 - 1. Administration building south of proposed dewatering building.

1.3 COORDINATION OF WORK

- A. Maintain overall coordination of the Work.
- B. Obtain construction schedules from each subcontractor, and require each subcontractor to maintain schedules and coordinate modifications.
- C. Alternates: Alternates, if included, are specified in detail in the Bid Form and only those alternates that were selected by the Owner, as evidenced in the Agreement, are made a part of this Contract.

1.4 PROVISIONS FOR FUTURE WORK

- A. Provisions for future construction are as shown.

1.5 LOCATION OF WORK

- A. The Project is located generally at the Denton Water Treatment Plant and adjoining properties located at 1701 Spencer Road, Denton, TX 76205.

1.6 OWNER FURNISHED EQUIPMENT

- A. For this project's delivery, the Owner shall not be providing and/or delivering any associated equipment.

1.7 EARLY OCCUANCY OF PORTIONS OF WORK

- A. Substantially Complete all portions of Work for OWNER's occupancy including specified testing, training of OWNER's personnel, and other preparations necessary for OWNER's occupancy or use, by the number of calendar days specified for Substantial Completion herein and within the Agreement:
- B. Certificates of Substantial Completion will be executed for each designated portion of Work prior to OWNER occupancy.
 - 1. Such certificate of Substantial Completion will describe the portion of the Work to be occupied by OWNER, items that may be incomplete or defective, date of occupancy by OWNER, and other information required by OWNER and CONTRACTOR.
- C. After OWNER occupancy, allow access for OWNER's personnel, access for others authorized by OWNER, and OWNER operation of equipment and systems.

- D. Following Occupancy, OWNER will:
1. Provide power to operate equipment and systems.
 2. Repair damage caused by OWNER's occupancy.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 11 60 – PROJECT MANUAL LANGUAGE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes description and requirements of:
 - 1. Explanation of Project Manual arrangement.
 - 2. Explanation of Project Manual language.
 - 3. Reference standards.
 - 4. Method of resolving conflicts of referenced standards between Contract Documents.
- B. Related Documents and Sections:
 - 1. Section 00 72 00 – General Conditions.
 - 2. Section 00 73 00 – Supplementary Conditions.
 - 3. Section 01 60 00 – Product Requirements.

1.2 REFERENCES

- A. Construction Specifications Institute (CSI):
 - 1. Manual of Practice - MasterFormat™.
 - 2. Manual of Practice - SectionFormat™.
 - 3. Manual of Practice - PageFormat™.

1.3 PROJECT MANUAL ARRANGEMENT

- A. Document and Section numbers used in Project Manual, and Project Manual arrangement are in accordance with CSI MasterFormat™, except where departures have been deemed necessary.
- B. Sections are written in accordance with CSI SectionFormat™, Three-Part Section Format, except where departures have been deemed necessary.
- C. Page format for Sections in the Project Manual is in accordance with CSI Page Format, except where departures have been deemed necessary.

1.4 PROJECT MANUAL LANGUAGE

- A. Specification Section Paragraphs entitled "Section Includes" summarizes briefly what is generally included in the section. Requirements of Contract Documents are not limited by "Section Includes" paragraphs. Specifications have been partially streamlined by intentionally omitting words and phrases, such as "the CONTRACTOR shall," "in conformity therewith," "shall be" following "as indicated," "a," "an," "the" and "all". Assume missing portions by inference.
- B. Phrase "by ENGINEER" modifies words such as "accepted," "directed," "selected," "inspected," and "permitted," when they are unmodified.
- C. Phrase "to ENGINEER" modifies words such as "submit," "report," and "satisfactory," when they are unmodified.
- D. Colons (:) are used to introduce a list of particulars, an appositive, an amplification, or an illustrative quotation:
 - 1. When used as an appositive after designation of product, colons are used in place of words "shall be."

- E. Word "provide" means to manufacture, fabricate, deliver, furnish, install, complete, assemble, erect in place, test, render ready for use or operation, including necessary related material, labor, appurtenances, services, and incidentals.
- F. Words "CONTRACTOR shall" are implied when direction is stated in imperative mood.
- G. Term "products" includes materials and equipment as specified in Section 01 60 00.

1.5 REFERENCE STANDARDS

- A. Use edition or amendment of referenced standards in effect on date stipulated in Section 00 72 00. Use only applicable portions of referenced standards, ignoring payment stipulations and other provisions which change the duties of the ENGINEER or OWNER as described in Section 00 72 00.
- B. Equate terms relating to designer to "ENGINEER."
- C. Notify ENGINEER when referenced standard, code, or specification conflicts with Contract Documents.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 14 00 – WORK RESTRICTIONS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes description and requirements of:
 - 1. General constraints for sequencing and scheduling the Work.
 - 2. Interruption of Treatment Processes.
 - 3. Compliance with Texas Commission of Environmental Quality regulations and requirements, specifically the Owner's permit for potable water production.
 - 4. Work affected by existing site and facility.
 - 5. Work restrictions and coordination between construction operations and plant operations, including:
 - a. Access to site.
 - b. Use of site and premises.
 - c. Utilities.
 - d. Work by Others.
 - e. Work Sequence.
 - f. Temporary Services, Materials and Equipment.
- B. Related sections:
 - 1. Section 01 11 00 - Summary of Work.
 - 2. Section 01 26 00 - Contract Modification Procedures.
 - 3. Section 01 50 00 - Temporary Facilities and Controls.

1.2 GENERAL CONSTRAINTS ON SEQUENCE AND SCHEDULING OF WORK

- A. Water Projects:
 - 1. The existing Water Treatment Plant is one of two water treatment plants the Owner operates for treating and distributing potable water to the City's potable water customers. Impairing the operational capabilities of this treatment plant will result in serious financial damage to the City and result in water usage restrictions for the City's potable water customers.
 - 2. Conduct work in a manner that will not impair the operational capabilities of essential elements of the treatment process or reduce the capacity of the entire treatment plant as mandated by the Texas Commission of Environmental Quality to treat the quality of potable water to the water quality limitations specified in the discharge permit.
 - 3. The status of the treatment plant shall be defined as "operational" when it is capable of treating the rated capacity of thirty-two and one half (32.5) mgd of potable water production as set forth by the State regulations.
- B. Work Sequence and Constraints:
 - 1. Utilize description of critical events in work sequence in this Section as a guideline for scheduling and undertaking the Work.
 - 2. Work sequence and constraints presented do not include all items affecting completion of the Work, but are intended to describe critical events necessary to minimize disruption of the existing facilities and to ensure compliance to the water quality standards as mandated by the Oklahoma Department of Environmental Quality.

1.3 INTERRUPTION OF TREATMENT PROCESSES

- A. Execute the Work while the existing facility is in operation as specified in Section 01 35 20.

- B. Indicate required shutdowns of existing facilities or interruptions of existing operations on Progress Schedule. Shutdowns will be permitted to the extent that existing operation of the plant will not be jeopardized and identified constraints are satisfied.
 - C. Submit notification of required shutdowns of existing facilities at least 14 days prior to the planned date of shutdown.
 - D. The ENGINEER and the Plant Personnel will evaluate the request based on the plant's ability to reliably meet capacity demands.
 - E. Do not begin alterations until ENGINEER's written permission has been received.
 - F. Minimize shutdown times by thorough advanced planning. Have required equipment, materials, and labor on hand at time of shutdown.
 - G. Where required to minimize treatment process interruptions while complying with specified sequencing constraints, provide temporary pumping, power, lighting, controls, instrumentation, and safety devices.
- 1.4 COMPLIANCE WITH WATER QUALITY STANDARDS AS MANDATED BY THE TEXAS COMMISSION ON ENVIRONMENTAL QUALITY.
- A. The existing facility is operating under the terms of a water quality production permit with the Texas Commission on Environmental Quality. This permit specifies the water quality limits that the plant must meet prior to delivering potable water to the plant's service area. A copy of the existing permit is on file for review at the Denton Engineering Services offices and at the Lake Lewisville Treatment Plant.
 - B. Perform work in a manner that will not prevent the existing facility from achieving the final treated water quality requirements established by regulations.
 - C. Bear the cost of penalties imposed on the OWNER for potable water quality or other discharge violations caused by actions of the CONTRACTOR.
- 1.5 REQUIREMENTS FOR OPERATION OF PLANT AND MAINTAINING CONTINUOUS OPERATION OF EXISTING FACILITIES
- A. Facilities or conditions required to keep the existing plant operational include, but are not limited to, the following:
 1. Electrical power, including transformers, distribution wiring, and motor control centers.
 2. Raw Water Pump station and intake water line.
 3. Piping for conveyance of raw water, partially treated water, and final treated water between treatment units and the potable water distribution system.
 4. All existing clarifiers, filters, and solids handling facilities.
 5. Chemical storage, metering, conveyance, and control facilities. These are provided with existing storage tanks; chemical metering pumps; chlorine residual analyzers; chemical solution piping at various locations in the plant. Plant water is required at all times to permit chlorination.
 - a. Continuous addition of chemicals is required during plant operations.
 - b. The ability to continuously apply chlorine following treatment is required.
 - c. The traffic loop used for all chemical deliveries cannot be restricted by construction activities; normal deliveries shall occur as scheduled.
 6. Filters and associated systems.
 7. Liquid Oxygen Delivery, storage, distribution, and dosing facilities and equipment

8. Liquid ammonium sulfate delivery, storage, distribution, and dosing facilities and equipment
9. Washwater Disposal: Water used to backwash (washwater) the filters is conveyed via a pipeline to the plant recovery system.
10. Washwater Equalization Basin
11. Washwater Recovery Basin
12. Clearwell.
13. High Service Pumps.
14. Plant Water: Existing plant water distribution network.
15. Treated Water Flow Meter
16. Fencing and gates.
17. Lighting.
18. Heating, ventilation, and air conditions.
19. Electrical Distribution and Standby Power Facilities
20. Instrumentation, meters, controls, and telemetry equipment.
21. Safety equipment and features.
22. Parking for Staff employees and vehicles required for operation and maintenance of the existing Water Treatment Plant.
23. Telephone system.
24. Storm drainage.
25. Other incidentals necessary to continually operate the facilities.

B. Conduct the Work and provide temporary facilities required to keep the existing plant continuously operational.

C. Do not remove or demolish existing facilities required to keep the existing plant operational at the capacities specified until the existing facilities are replaced by temporary or new facilities equipment. The replacement facilities shall have been tested and demonstrated to be operational prior to removing or demolishing existing facilities.

1.6 OPERATIONS AND MAINTENANCE ACCESS

A. Provide safe, continuous access to process control equipment for plant operations personnel.

1.7 SHUTDOWN CONSTRAINTS

A. Comply with Shutdown Constraints Described in General Terms as Follows:

1. Washwater Equalization Basin can generally be taken out of service for 48 hours at a time in January and February and this should be the basis for planning. This duration will be the maximum amount of time allowed for entry and removal of equipment, personnel, and to install temporary measures for operations to resume and begins at the last filter backwash filling the Washwater Equalization Basin after which the next filter backwash will be in 48 hours. Therefore, the out of service duration must also include time for pump down and entry by Contractor as well as evacuation prior to the expiration of the 48 hour period.

1.8 UTILITIES

A. Provide advance notice to and utilize services of Texas811 System, Inc. for location and marking of underground utilities operated by utility agencies other than the OWNER. Contact information: Texas811 System, Inc., 11880 Greenville Ave Suite 120, Dallas, TX 75243, phone number 800-344-8377, website: www.texas811.org .

B. Maintain electrical, telephone, water, gas, sanitary facilities, and other utilities within existing facilities in service. Provide temporary utilities when necessary.

1.9 WORK BY OTHERS

- A. Where proper execution of the Work depends upon work by others, inspect and promptly report discrepancies and defects.

1.10 WORK SEQUENCE

- A. This possible sequence is included for informational purposes only. It is intended that Construction be performed in multiple phases as follows:

1. Work requiring partial shutdown of Existing Plant's Facilities:
 - a. All shutdowns, either Major Shutdowns or Minor Shutdowns, shall meet the requirements as specified in Section 01 31 00.
 - b. All Major Shutdowns of existing facilities shall be scheduled such that the completion of this work shall be completed prior to May 1st, the beginning date for Plant's Peak Flow Demand Period.
 - c. Perform work that requires a partial shutdown of plant during the Off-Peak Period during the calendar year. For each year, the Peak Flow Demand Period starts on May 1st and lasts through October 31st of each year. Should the Contractor not be prepared and authorized to proceed with this work between the Notice to Proceed and the following 1st of May, the CONTRACTOR shall be required to wait until the end of the Peak Flow Demand Period.
 - d. Reroute associated yard piping, chemical piping, and perform required demolition and piping interconnections. Successfully complete testing of said piping prior to any shutdown Existing Plant's Facilities.
2. General Work Constraints shall be as follows:
 - a. Unit Processes
 - 1) The Washwater Equalization Basin pump improvements and related gravity and forcemain piping to the Gravity Thickener must be complete, fully tested, operational, and in service before the dewatering process is commissioned.
 - 2) The Gravity Thickener and all related equipment and piping connections must be complete, fully tested, operational, and in service before the Thickened Residual Pump Station is commissioned.
 - 3) The 12" PD from the Dewatering Facility to Existing MH-3 must complete, fully tested, operational, and in service before the Thickened Residual Pump Station is commissioned.
 - b. Chemical Deliveries
 - 1) The traffic loop used for all chemical deliveries cannot be restricted. Normal plant operations and deliveries shall occur as scheduled.
 - a) Liquid oxygen proximity to dewatering building and delivery. During summer months, deliveries occur twice a month.
 - b) LAS is stored on the southern side of the traffic loop near the dewatering building.
3. Wash Water Recovery Basin Pumps (New):
 - a. Washwater Recovery Basin Pumps all piping must be complete, fully tested, operational, and in service before the dewatering process is fully commissioned and residuals dewatering can begin.
 - b. Washwater Equalization Pumps will continue to pump to lagoon during pump basin improvements. Owner will coordinate lagoon level and discharge to sanitary sewer.
 - c. The Washwater Recovery Basin improvements require the basin to be taken off line. This can only occur outside of peak demand season and basin may not be out

of service for longer than 60 days. This 60 day period must include construction of improvements, commissioning, and acceptance of new work.

4. Wash Water Equalization Basin Pumps (New):
 - a. Washwater Equalization pumps can be commissioned prior to dewatering facilities being commissioned by recycling Gravity Thickener Effluent back to the Washwater Equalization Basin via MH-10, MH-6 to the Washwater EQ Basin. Contractor to coordinate with the Owner regarding Filter Backwash Operations, Sedimentation Basin Blowdown, discharge to existing lagoon, adequate volume in the Washwater Equalization Basin to maintain adequate pump submergence, and coordination of Washwater Recovery Basin improvements. Solids transferred to Gravity thickener during commissioning to be removed using Thickened Residual Pump Station to MH-B. Thickened Residuals Pump Station and Gravity Thickener to be commissioned in advance of Washwater Equalization Basin pump commissioning with available raw water not laden with solids from filter backwash or sedimentation blowdown.
 - b. The new Washwater Equalization pumps cannot be used to pump to the lagoon, even on a temporary basis.
 - c. Washwater Equalization Basin can generally be taken out of service for 48 hours at a time in January and February and this should be the basis for planning. 48 hours will be the maximum amount of time allowed for entry and removal of equipment, personnel, and to install temporary measures for operations to resume.
 - d. Existing Washwater Equalization Pumps are required to maintain a flow path to discharge to the lagoons at all times throughout the project. The ability to pump to the lagoons with the existing pumps should be maintained at all times with the exception of short power related interruptions related to electrical tie-ins.

5. Gravity Thickener (New):
 - a. Construct new Gravity Thickener and associated upstream and downstream facilities.
 - b. Successfully achieve water tightness testing for new Gravity Thickener Tankage. Provide temporary pumping as required for water testing and subsequent operations testing of new Gravity Thickener.
 - c. Successfully achieve 8 hour test for new Gravity Thickener Tankage with non-potable water.
 - d. Install thickener mechanism and all related and necessary appurtenance and peripheral connections and systems.
 - e. Commission Gravity Thickener and perform performance testing.

6. Work Not Requiring Major Shutdown of Existing Facilities until Final Interties and Connections:
 - a. This Sequence of Work assumes that these major elements of work can be constructed without major shutdowns of the existing plant until final interties and connections are required:
 - 1) Gravity Thickener
 - 2) Thickened Residuals Pump Station
 - 3) Dewatering Building
 - 4) Piping alignments
 - b. Construct new structures, associated piping and all facilities which do not affect plant capacity.
 - c. Complete all water tightness tests and 8 hour tests prior to interconnecting with other facilities.
 - d. Complete testing and approval of new facilities prior to requesting to remove an existing facility from service to perform interconnections.

7. Keep existing chemical storage and feed facilities in operation during construction

1.11 TEMPORARY SERVICES, MATERIALS, AND EQUIPMENT

- A. Locate temporary facilities in a manner that minimizes interference to OWNER's operation and maintenance personnel.
- B. Unless otherwise specified, install temporary pipelines of the same size as its connection to the existing facility at the downstream end of the pipeline.
- C. Provide piping of suitable material for the material being conveyed.
- D. Provide submittals on proposed temporary electrical and instrumentation components necessary to maintain existing facilities.
- E. Dewater and promptly clean basins and channels temporarily removed from service.
- F. Dimensions for all existing structures, piping, paving, and other nonstructural items are approximate. The CONTRACTOR shall field verify all dimensions and conditions and report any discrepancies to the ENGINEER a minimum of 14 days in advance of any construction in the area.
- G. Discrepancies between coordinates, bearings and lengths, and stationing shall be resolved in the following order of precedence:
 - 1. Coordinates.
 - 2. Bearings and lengths.
 - 3. Stationing.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 26 00 – CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes description and requirements of:
 - 1. Proposal Requests.
 - 2. Claims.
 - 3. Change Orders and Written Amendments.
 - 4. Field Order Procedures.

1.2 PROPOSAL REQUEST

- A. Owner may, in anticipation of ordering an addition, deletion, or revision to the Work, request Contractor to prepare a detailed proposal of cost and times to perform contemplated change.
- B. Proposal request will include reference number for tracking purposes and detailed description of and reason for proposed change, and such additional information as appropriate and as may be required for Contractor to accurately estimate cost and time impact on Project.
- C. Proposal request is for information only; Contractor is neither authorized to execute proposed change nor to stop Work in progress as result of such request.
- D. Contractor's written proposal shall be transmitted to Engineer promptly, but not later than 14 days after Contractor's receipt of Owner's written request. Proposal shall remain firm for a maximum period of 45 days after receipt by Engineer.
- E. Owner's request for proposal or Contractor's failure to submit such proposal within the required time period will not justify a claim for an adjustment in Contract Price or Contract Times (or Milestones).

1.3 CLAIMS

- A. Include, at a minimum:
 - 1. Specific references including:
 - a. Drawing numbers.
 - b. Specification section and article/paragraph number.
 - c. Submittal type, Submittal number, date reviewed, Engineer's comment, as applicable, with appropriate attachments.
 - 2. Stipulated facts and pertinent documents, including photographs and statements.
 - 3. Interpretations relied upon.
 - 4. Description of:
 - a. Nature and extent of claim.
 - b. Who or what caused the situation.
 - c. Impact to the Work and work of others.
 - d. Discussion of claimant's justification for requesting a change to price or times or both.
 - 5. Estimated adjustment in price claimant believes it is entitled to with documentation and justification.
 - 6. Requested Change in Contract Times: Include at least;
 - a. Progress schedule documentation showing logic diagram for request.
 - b. Documentation that float times available for Work have been used.
 - c. Revised activity logic with durations including sub-network logic revisions, duration changes, and other interrelated schedule impacts, as appropriate.

7. Documentation as may be necessary as set forth below for Work Change Directive, and as Engineer may otherwise require.

1.4 CHANGE ORDERS OR WRITTEN AMENDMENTS

A. Procedure:

1. Engineer will prepare six copies of proposed Change Order or Written Amendment and transmit such with Engineer's written recommendation (Change Order only) and request to Contractor for signature.
2. Contractor shall, upon receipt, either:
 - a. Promptly sign copies, retaining one for its file, and return remaining five copies to Engineer for Owner's signature, or
 - b. Return unsigned five copies with written justification for not executing Change Order or Written Amendment.
3. Engineer will, upon receipt of Contractor signed copies, promptly forward Engineer's written recommendation and partially executed five copies for Owner's signature, or if Contractor fails to execute the Change Order or Written Amendment, Engineer will promptly so notify Owner and transmit Contractor's justification to Owner.
4. Upon receipt of Contractor-executed Change Order or Written Amendment, Owner will promptly either:
 - a. Execute Change Order or Written Amendment, retaining one copy for its file and returning four copies to Engineer, or
 - b. Return to Engineer unsigned copies with written justification for not executing Change Order or Written Amendment.
5. Upon receipt of Owner-executed Change Order or Written Amendment, Engineer will transmit two copies to Contractor, one copy to Resident Project Representative or other field representative, and retain one copy, or if Owner fails to execute the Change Order or Written Amendment, Engineer will promptly so notify Contractor and transmit Owner's justification to Contractor.
6. Upon receipt of Owner-executed Change Order, Contractor shall:
 - a. Perform Work covered by Change Order or Written Amendment.
 - b. Revise Schedule of Values to adjust Contract Price and submit with next Application for Payment.
 - c. Revise progress schedule to reflect changes in Contract Times, if any, and to adjust times for other items of Work affected by change.
 - d. Enter changes in Project record documents after completion of change related Work.

B. In signing a Change Order or Written Amendment, Owner and Contractor acknowledge and agree that:

1. Stipulated compensation (Contract Price or Contract Times, or both) set forth includes payment for:
 - a. The Cost of the Work covered by the Change Order or Written Amendment.
 - b. Contractor's fee for overhead and profit.
 - c. Interruption of progress schedule.
 - d. Delay and impact, including cumulative impact, on other Work under the Contract Documents, and
 - e. Extended overheads.
2. Change Order or Written Amendment constitutes full mutual accord and satisfaction for the change to the Work.
3. Unless otherwise stated in the Change Order or Written Amendment, all requirements of the original Contract Documents apply to the Work covered by the Change Order or Written Amendment.

1.5 FIELD ORDER PROCEDURES

- A. Engineer will issue Field Orders, with 3 copies to Contractor.
- B. Effective date of the Field Order shall be the date of signature by Engineer, unless otherwise indicated thereon.
- C. Contractor shall acknowledge receipt by signing and returning one copy to Engineer.
- D. Field Orders will be incorporated into subsequent Change Orders, as a no-cost change to the Contract.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 29 00 – PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes description and requirements of:
 - 1. Submittals Related to Payment Procedures.
 - 2. Cash Allowances.
 - 3. Schedule of Values.
 - 4. Schedule of Estimated Progress Payments.
 - 5. Payment.
 - 6. Nonpayment for Rejected or Unused Products.
 - 7. Partial Payment for Stored Materials and Equipment.
 - 8. Partial Payment for Undelivered, Project Specific Manufactured or Fabrication Equipment.

- B. Related sections:
 - 1. Section 01 32 00 – Construction Progress Documentation.
 - 2. Section 01 50 00 – Temporary Facilities and Controls.

1.2 SUBMITTALS

- A. Informational Submittals:
 - 1. Schedule of Values: Submit on Contractor's standard form.
 - 2. Schedule of Estimated Progress Payments:
 - a. Submit with initially acceptable Schedule of Values.
 - b. Submit adjustments thereto with Application for Payment.
 - 3. Application for Payment.
 - 4. Final Application for Payment.

1.3 CASH ALLOWANCES

- A. Consult with Engineer in selection of products or services. Obtain proposals from Suppliers and installers and offer recommendations.

- B. Cash allowances will be administered in accordance with the General Conditions and as specified herein.

- C. Contractor Agrees:
 - 1. The Lump Sum Work includes the allowances specified and includes all Work to perform such items covered by the Cash Allowance as approved by Owner and Engineer.
 - 2. The Allowances include the cost of material and equipment required by the allowances to be delivered to the Site and applicable taxes.
 - 3. Contractor's cost for unloading, handling, labor, installation cost, overhead, profit, and other expenses for the allowance have been included in the Lump Sum Work and not in the allowance.
 - 4. Accept payment equal to the amount of the actual invoices for services and products without markup.

- D. Expenditure of any portion of Cash Allowances shall only be done with authorization by Owner and Engineer. Cash Allowances are estimated amounts and final payment shall be based on actual costs as authorized by Change Order and the Contract Price shall be correspondingly adjusted. The Cash Allowances are specifically for the purpose of the following items:

- E. Work Change Directive Cash Allowance: The purpose of this allowance is to cover cost of unknown items that cannot be foreseen at this time. Authorization for expenditure of any portion of this allowance shall be for specifically approved work change directives and issuance of a Change Order.
- F. Independent Testing Cash Allowance: This allowance is to cover costs of specified Quality Assurance testing provided by an independent testing laboratory, agency, and special inspectors retained by the Owner. Contractor shall hire independent testing laboratory, agency, and special inspectors as acceptable to the Owner. Authorization will only be given for independent testing services performed as part of field quality assurance specified to be provided by the Owner. Any re-testing or other testing desired or specified by the Contractor shall be the responsibility of the Contractor.
- G. Field Trailer Office Equipment: This allowance is only to fund any additional Engineer's field office equipment above what is specified in Section 01 50 00.
- H. Submit, with application for payment, invoice showing date of purchase, from which the purchase was made, the date of delivery of the product or service, and the price, including delivery to the Site and applicable taxes.

1.4 SCHEDULE OF VALUES

- A. Prepare a separate Schedule of Values for each schedule of the Work under the Agreement.
- B. Upon request of Engineer, provide support documentation to support the accuracy of the Schedule of Values.
- C. Unit Price Work: Reflect unit price quantity and price breakdown from conformed Bid Form.
- D. Lump Sum Work:
 - 1. Reflect Schedule of Values format included in conformed Bid Form, specified allowances, alternates, and equipment selected by Owner, as applicable.
 - 2. List bonds and insurance premiums, mobilization, demobilization, preliminary and detailed progress schedule preparation, facility startup, and contract closeout separately.
 - 3. Break down by Division 2 through 44 with appropriate subdivision of each Specification for each Project facility. The apparent "low bidder" is required to deliver a Bid breakdown by specification within 3 working days after Bid opening.
- E. An unbalanced or front-end loaded schedule will not be acceptable.
- F. Summation of the complete Schedule of Values representing all the Work shall equal the Contract Price.
- G. Submit Schedule of Values in an electronic file in a spreadsheet format compatible with latest version of Excel.

1.5 SCHEDULE OF ESTIMATED PROGRESS PAYMENTS

- A. Show estimated payment requests throughout Contract Times aggregating initial Contract Price.
- B. Base estimated progress payments on initially acceptable progress schedule. Adjust to reflect subsequent adjustments in progress schedule and Contract Price as reflected by modifications to the Contract Documents.

1.6 APPLICATION FOR PAYMENT

- A. Transmittal Summary Form: Attach one Summary Form with each detailed Application for Payment for each schedule and include Request for Payment of Materials and Equipment on Hand as applicable. Execute certification by authorized officer of Contractor.
- B. Use detailed Application for Payment Form suitable to Engineer.
- C. Provide separate form for each schedule as applicable.
- D. Include accepted Schedule of Values for each schedule or portion of Work, the unit price breakdown for the Work to be paid on unit price basis, a listing of Owner-selected equipment, if applicable, and allowances, as appropriate.
- E. Preparation:
 - 1. Round values to nearest dollar.
 - 2. List each Change Order executed prior to date of submission as separate line item. The totals will equal those shown on the Transmittal Summary Form for each schedule as applicable.
 - 3. Submit Application for Payment, including a Transmittal Summary Form and detailed Application for Payment Form(s) for each schedule as applicable, a listing of materials on hand for each schedule as applicable, and such supporting data as may be requested by Engineer.
 - 4. Prior to submitting each request for progress payment, request Engineer's review and approval of current status of record documents as required by SC-7.11.B. Failure to properly maintain, update, and submit record documents may result in a deferral by Engineer to recommend whole or any part of Contractor's Application for Payment, either partial or final.

1.7 PAYMENT

- A. General:
 - 1. Progress payments will be made monthly.
 - 2. The date for Contractor's submission of monthly Application for Payment shall be established at the Preconstruction Conference.
 - 3. Progress payment is contingent upon applications and Contractor progress that is subject to withholdings by Owner.
- B. Payment for all the Work shown or specified in Contract Documents is included in the Contract Price. No measurement or payment will be made for individual items.
- C. Payment for Lump Sum Work covers all Work specified or shown in the Contract Documents.

1.8 NONPAYMENT FOR REJECTED OR UNUSED PRODUCTS

- A. Payment will not be made for following:
 - 1. Loading, hauling, and disposing of rejected material.
 - 2. Quantities of material wasted or disposed of in manner not called for under Contract Documents.
 - 3. Rejected loads of material, including material rejected after it has been placed by reason of failure of Contractor to conform to provisions of Contract Documents.
 - 4. Material not unloaded from transporting vehicle.
 - 5. Defective Work not accepted by Owner.
 - 6. Material remaining on hand after completion of Work.

1.9 PARTIAL PAYMENT FOR STORED MATERIALS AND EQUIPMENT

- A. Partial Payment: No partial payments will be made for materials and equipment delivered or stored unless Shop Drawings and preliminary operation and maintenance manuals are accepted by Engineer. Thereafter, partial payment for materials and equipment delivered and stored, but not yet incorporated in work, shall not exceed 90% of the equipment or material value.
- B. Final Payment: Will be made only for products incorporated in Work and following approval of final operations and maintenance manuals; remaining products, for which partial payments have been made, shall revert to Contractor unless otherwise agreed, and partial payments made for those items will be deducted from final payment.

1.10 PARTIAL PAYMENT FOR UNDELIVERED, PROJECT-SPECIFIC MANUFACTURED OR FABRICATED EQUIPMENT

- A. Notwithstanding above provisions, partial payments for undelivered (not yet delivered to Site or not stored in the vicinity of Site) products specifically manufactured for this Project, excluding off the shelf or catalog items, will be made for products listed below when all following conditions exist:
 - 1. Partial payment request is supported by written acknowledgment from Suppliers that invoice requirements have been met.
 - 2. Equipment is adequately insured, maintained, stored, and protected by appropriate security measures.
 - 3. Each equipment item is clearly marked and segregated from other items to permit inventory and accountability.
 - 4. Authorization has been provided for access to storage Site for Engineer and Owner.
 - 5. Equipment meets applicable Specifications of these Contract Documents.
- B. Applicable Items:

Specification Section	Specific Product
44 42 26.13	Gravity Thickener Mechanisms
46 76 21	Belt Filter Press

- C. Payment shall not exceed 15% of the equipment value, not including shipping and handling charges for undelivered, project-specific manufactured equipment and will only be made following Shop Drawing approval.
- D. Failure of Contractor to continue compliance with above requirements shall give cause for Owner to withhold payments made for such equipment from future partial payments.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 31 00 – PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes description and requirements of:
 - 1. Submittals Related to Project Management and Coordination.
 - 2. Utility Notification and Coordination.
 - 3. Work Sequencing /Constraints.
 - 4. Facility Operations.
 - 5. Adjacent Facilities and Properties.
 - 6. Owner's Occupancy.
 - 7. Partial Utilization by the Owner.
 - 8. Physical Conditions.
 - 9. Construction Photographs.
 - 10. Audio-Video Recordings.
 - 11. Cutting, Fitting and Patching.

- B. Related sections:
 - 1. Section 01 32 00 – Construction Progress Documentation.

1.2 SUBMITTALS

- A. Informational:
 - 1. Statement of Qualification (SOQ) for land surveyor or civil engineer.
 - 2. Photographs and other records of examination.
 - 3. Video Recordings: Submit one copy, including updated copy of project video log, within 5 days of being taken.

1.3 UTILITY NOTIFICATION AND COORDINATION

- A. Coordinate the Work with various utilities within Project limits. Notify applicable utilities prior to commencing Work, if damage occurs, or if conflicts or emergencies arise during Work.

- B. Before excavation, contact Texas811 System, Inc. for location and marking of underground utilities operated by utility agencies other than the OWNER. Contact information: Texas811 System, Inc., 11880 Greenville Ave Suite 120, Dallas, TX 75243, phone number 800-344-8377, website: www.texas811.org.

1.4 WORK SEQUENCING/CONSTRAINTS

- A. Include the following work sequences in the Progress Schedule required under Section 01 32 00.

- B. This Section identifies several construction constraints that must be reflected in the Contractor project coordination. An overall outline is presented in this Section for the Construction coordination, demolition, and seasonal/process constraints that shall be considered during construction. The sequence of Work for this Project must reflect the constraints identified herein.

- C. Definitions:
 - 1. Peak Flow Demand periods shall, in general, be from May 01 through October 31. Actual Peak Flow Demand periods shall be as determined by the Owner based on weather, flows entering plant, actual demand and plant operation requirements.

2. Low Flow Demand periods shall be any time period which is not within the defined Peak Flow Demand periods.
 3. Low flow period for a given day under any Flow Demand Period shall be from 2:00 a.m. to 6:00 a.m.
 4. Minor Shutdown: Any shutdown requiring less than 8 hours.
 5. Major Shutdown: Any shutdown other than a minor shutdown.
- D. Shutdown of Plant Operations:
1. Provide 14 days advance notice to Engineer and Owner of need for a minor shutdown.
 2. Provide 30 days advance notice to Engineer and Owner of need for a major shutdown.
 3. Contractor shall schedule a shutdown coordination meeting with Owner and Engineer one week prior to each shutdown.
 4. Do not proceed with work affecting a facility's operation without obtaining Owner and Engineer advance approval of the need for, and duration of, such work. The Owner will endeavor to grant Contractor requests where possible. However, because Owner's primary responsibility is to produce potable water, the requested timing may not be possible.
 5. Any and all plant shutdowns shall require a shutdown plan, including detailed schedule, backup tools and equipment, personnel involved, contingency plan, and any procedures involved in restarting the process or facility. Owner's approval of the Shutdown Plan is required prior to any shutdowns.
 6. Shutdowns will be allowed, but shall only be allowed in Low Flow Demand periods and with at least half of the water treatment plant's rated capacity and facilities in operation. Shutdowns may be limited to low flow periods.
 7. No minor or major shutdowns allowed within 7 days of a previous shutdown.
- E. Incorporate the Following Construction Constraints into the Work:
1. Peak Flow Demand Periods: This time period is anticipated to be during dry and hot weather periods. It is anticipated that temporary plant shutdown would be limited to minor shutdowns during low flow periods during a given day.
 2. Low Demand Flow Periods: This time period is anticipated to be during wet and cool weather periods. It is anticipated that temporary plant shutdowns could occur for up to 24 hours during this time period. Minor and major shutdowns are allowed.
 3. Influent (source) and partially treated water is available at the Lake Lewisville Water Treatment Plant site. Final tie-in and start-up will not occur until the Lake Lewisville Water Treatment Plant's improvements are substantially complete and ready for operation as evident by successful completion of Functional Testing and Performance Testing as specified in Section 01 79 00, DEMONSTRATION AND TRAINING.
 - a. Water for Functional Testing and Performance Testing will be provided by one or a combination of the following sources as chosen by Contractor and approved by Owner and Engineer:
 - 1). Potable water (use of potable water shall be at the Contractor's cost and will require an independent service).
 - 2). Partially Treated Water from the Lake Lewisville Water Treatment Plant. If this option is chosen by Contractor, Contractor will be responsible for interties and temporary routing of reclaimed water piping, and providing temporary tie-in or pumping of the effluent to the unit processes. Contractor shall submit routing, flow control, and spill prevention plan to the Owner and Engineer for approval.
 4. Start-Up of Unit Processes may occur with Lake Lewisville Water Treatment Plant's partially treated water, as specified above, or potable water, if available.
 5. An appropriate degree of treated water shall be used for Facility Performance Demonstration.

1.5 FACILITY OPERATIONS

- A. Continuous operation of Owner's facilities is of critical importance. Schedule and conduct activities to enable existing facilities to operate continuously, unless otherwise specified, and to minimize the number of shutdowns of the plant and existing unit processes.
- B. Perform Work continuously during critical connections and changeovers, as required, to prevent interruption of Owner's operations.
- C. Conduct Work outside regular working hours on prior written consent of Owner to meet Project schedule and avoid undesirable conditions.
- D. Be responsible for planning, designing, and providing various temporary services, utilities, connections, temporary piping, bypass facilities and temporary connections, and similar items to maintain continuous operations of Owner's facility. Sequences other than those specified will be considered upon written request to Owner and Engineer, provided they afford equivalent continuity of operations.
- E. Do not close lines, open or close valves, or take other action which would affect the operation of existing systems, except as specifically required by the Contract Documents and after authorization by Owner and Engineer. Such authorization will be considered within 48 hours after receipt of Contractor's written request.
- F. Any tanks or pipelines requiring drainage prior to construction will be drained by the Owner's staff to the maximum extent possible utilizing existing piping and drains where they exist. Contractor shall provide temporary pumping and effort to complete drainage of tank or pipeline as required. Provide minimum 7 days' notice to Engineer and Owner of need to drain a facility, unless otherwise specified.
- G. Power outages will be considered upon 48 hours written request to Owner and Engineer. Describe the reason, anticipated length of time, and areas affected by the outage in the written request. Provide temporary provisions for continuous power supply to critical existing facility components, is requested by Owner.
- H. Coordinate proposed work with Engineer and Owner before implementing unit shutdowns. Under no circumstances shall Work end if such actions may inadvertently cause a cessation of any facility operation. In such cases, remain onsite until necessary repairs are complete and facility is brought back online.
- I. Relocation of Existing Facilities:
 - 1. During construction, it is expected that minor relocations of Work will be necessary.
 - 2. Provide complete relocation of existing structures and Underground Facilities, including piping, utilities, equipment and structures, electrical conduit wiring, electrical duct bank, and other necessary items.
 - 3. Use only new materials for relocated facility. Match materials of existing facility, unless otherwise shown or specified.
 - 4. Perform relocations to minimize downtime of existing facilities.
 - 5. Install new portions of existing facilities in their relocated position prior to removal of existing facilities, unless otherwise accepted by Engineer.

1.6 ADJACENT FACILITIES AND PROPERTIES

- A. Examination:
 - 1. After Effective Date of the Agreement and before Work at Site is started, Contractor, Engineer, and affected property owners and utility owners shall make a thorough

examination of pre-existing conditions including existing buildings, structures, and other improvements in vicinity of Work, as applicable, which could be damaged by construction operations.

2. Periodic reexamination shall be jointly performed to include, but not limited to, cracks in structures, settlement, leakage, and similar conditions.

B. Documentation:

1. Record and submit documentation of observations made on examination inspections for signature of Engineer and Contractor and in accordance with paragraphs "Construction Photographs" and "Audio-Video Recordings".
2. Upon receipt, Engineer will review, sign, and return one record copy of documentation to Contractor to be kept on file in field office. Such documentation shall be used as indisputable evidence in ascertaining whether and to what extent damage occurred as a result of Contractor's operations, and is for the protection of adjacent property owners, Contractor, and Owner.

1.7 OWNER'S OCCUPANCY

- A. Owner will occupy the premises during the period of construction for the conduct of its normal operations. Cooperate with Owner in all construction operations to minimize conflict and to facilitate Owner usage.

1.8 PARTIAL UTILIZATION BY THE OWNER

- A. Schedule operations for completion of portions of the Work, as designated under Work Sequence/Constraints, herein, for Owner's occupancy or separate operation prior to Substantial Completion of the entire Work.

B. Unless agreed in writing prior to Owner's use, the following conditions shall apply:

1. Contractor's Responsibilities:
 - a. Allow access for Owner's personnel.
 - b. Allow operation of ventilation and electrical systems.
 - c. All other responsibilities as specified in the General Conditions.
2. Owner's Responsibilities:
 - a. Operate ventilating systems and pay cost of same.
 - b. Assume responsibility of power requirements.
 - c. Assume responsibility for security and fire protection in utilized areas, but not extending to Contractor's materials and equipment in utilized areas.
 - d. Assume responsibility for property insurance of utilized areas.
3. Other Conditions of Owner's Use: The correction period for the occupied or separately operated portion of Work shall commence at the date of Substantial Completion for that separate part.

1.9 PHYSICAL CONDITIONS

- A. Exercise reasonable care to verify locations of existing subsurface facilities and utilities.
- B. Areas immediate and adjacent to planned excavations shall be thoroughly checked by means of visual examination and with electronic metal and pipe detection equipment for indications of underground utilities and facilities.
- C. Make exploratory excavation where existing underground facilities or utilities may potentially conflict with proposed excavations and facilities or where there is reasonable cause to verify the presence or absence of, or to obtain physical information regarding underground facilities or utilities. Conduct exploratory excavations as acceptable to and in the presence of Engineer prior

to proceeding with major excavation in the area and sufficiently in advance of construction to avoid possible delays to Contractor's Work. Promptly take measurements, photographs, and obtain survey data.

1.10 CONSTRUCTION PHOTOGRAPHS

- A. Photographically document all phases of the project including preconstruction, construction progress, and post-construction.
- B. Engineer shall have the right to select the subject matter and vantage point from which photographs are to be taken.
- C. Photograph Format: Reference Section 01 34 00 for photograph requirements.
- D. Preconstruction and Post-Construction:
 - 1. After Effective Date of the Agreement and before Work at Site is started, and again upon issuance of Substantial Completion, take exposures of all areas of the Construction Site and property adjacent to perimeter of Construction Site.
 - 2. Particular emphasis shall be directed to structures both inside and outside the Site.
- E. Construction Progress Photos:
 - 1. Photographically demonstrate progress of construction, showing every aspect of Site and adjacent properties as well as interior and exterior of new or impacted structures.
 - 2. Take photos as frequent as required to document all major aspects of construction. Coordinate with Engineer.

1.11 AUDIO-VIDEO RECORDINGS

- A. Prior to beginning Work on Construction Site or of a particular area of the Work, and again within 10 days following date of Substantial Completion, video-graph Construction Site and property adjacent to Construction Site.
- B. In the case of preconstruction recording, no Work shall begin in the area prior to Engineer's review and approval of content and quality of video for that area.
- C. Particular emphasis shall be directed to physical condition of existing vegetation, structures, and pavements within Construction Site and areas adjacent to and within the right-of-way or easement, and on Contractor storage and staging areas.
- D. Engineer shall have right to select subject matter and vantage point from which videos are to be taken.
- E. Video Format and Quality:
 - 1. DVD format, with sound.
 - 2. Video:
 - a. Produce bright, sharp, and clear images with accurate colors, free of distortion and other forms of picture imperfections.
 - b. Electronically, and accurately display the month, day, year, and time of day of the recording.
 - 3. Audio:
 - a. Audio documentation shall be done clearly, precisely, and at a moderate pace.
 - b. Indicate date, project name, and a brief description of the location of taping, including:

- 3). Facility name.
- 4). Street names or easements.
- 5). Addresses of private property.
- 6). Direction of coverage, including engineering stationing, if applicable.
4. Documentation:
 - a. CD Label:
 - 1). CD number (numbered sequentially, beginning with 001).
 - 2). Project name.
 - 3). Date and time of coverage.
5. Project Video Log: Maintain an ongoing log that incorporates above noted label information for videotapes on Project.
6. Reference specification Section 01 34 00 for additional requirements.

1.12 REFERENCE POINTS AND SURVEYS

- A. Location and elevation of benchmarks are shown on Drawings.
- B. Dimensions for lines and elevations for grades of structures, appurtenances, and utilities are indicated on the Drawings, together with the other pertinent information required for laying out Work. If conditions vary from those indicated, immediately notify Engineer.
- C. Any existing survey points or other control markers destroyed without proper authorization will be replaced by Owner of the survey points or control markers at the Contractor's expense.
- D. Contractor's Responsibilities:
 1. Provide additional survey and layout required to layout the Work.
 2. Locate and protect reference points prior to starting site preparation.
 3. Check and establish exact location of existing facilities prior to construction of new facilities and any connections thereto.
 4. In event of discrepancy in data or staking provided by Owner, request clarification before proceeding with Work.
 5. Retain professional land surveyor or civil engineer registered in state of Project who shall perform or supervise engineering surveying necessary for additional construction staking and layout.
 6. Maintain complete accurate log of survey Work as it progresses as a Record Document.
 7. On request of Engineer, submit documentation.
 8. Provide competent employee(s), tools, stakes, and other equipment and materials as Engineer may require to:
 - a. Establish control points, lines, and easement boundaries.
 - b. Check layout, survey, and measurement Work performed by others.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 CUTTING, FITTING, AND PATCHING

- A. Cut, fit, adjust, or patch Work and work of others, including excavation and backfill as required, to make Work complete.
- B. Obtain prior written authorization of Engineer and Owner before commencing work to cut or otherwise alter:
 1. Structural or reinforcing steel, structural column or beam, elevated slab, trusses, or other structural member.
 2. Weather- or moisture-resistant elements.

3. Efficiency, maintenance, or safety of element.
 4. Work of others.
- C. Refinish surfaces to provide an even finish.
1. Refinish continuous surfaces to nearest intersection.
 2. Refinish entire assemblies.
 3. Finish restored surfaces to such planes, shapes, and textures that no transition between existing work and Work is evident in finished surfaces.
- D. Restore existing work, Underground Facilities, and surfaces that are to remain in completed Work including concrete-embedded piping, conduit, and other utilities as specified and as shown.
- E. Make restorations with new materials and appropriate methods as specified for new Work of similar nature; if not specified, use recommended practice of manufacturer or appropriate trade association.
- F. Fit Work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces and fill voids.
- G. Remove specimens of installed Work for testing when requested by Engineer.

END OF SECTION

SECTION 01 31 19 - PROJECT MEETINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes: Requirements for conducting conferences and meetings for the purposes of addressing issues related to the Work, reviewing and coordinating progress of the Work and other matters of common interest, and includes the following:
 - 1. General Requirements.
 - 2. Qualifications of Meeting Participants.
 - 3. Preconstruction Conference.
 - 4. Progress Meetings.
 - 5. Pre-Installation Meetings.
 - 6. Post Construction Meeting.

- B. Related sections:
 - 1. Section 26 05 00 – Common Work Results for Electrical.
 - 2. Section 26 05 73 – Electrical System Studies.
 - 3. Section 26 90 00 – General Instrumentation and Control.
 - 4. Section 26 90 30 – SCADA Computer System and Network.

1.2 GENERAL REQUIREMENTS

- A. Contractor will schedule physical arrangements for meetings throughout progress of Work, prepare meeting agenda with regular participant input and distribute with written notice of each meeting, preside at meetings, record minutes to include significant proceedings and decisions, and reproduce and distribute copies of minutes within 5 days after each meeting to participants and parties affected by meeting decisions.

1.3 QUALIFICATIONS OF MEETING PARTICIPANTS

- A. Representatives of entities participating in meetings shall be qualified and authorized to act on behalf of entity each represents.

1.4 PRECONSTRUCTION CONFERENCE

- A. Contractor shall be prepared to discuss the following subjects, as a minimum:
 - 1. Required schedules.
 - 2. Status of Bonds and insurance.
 - 3. Sequencing of critical path work items.
 - 4. Progress payment procedures.
 - 5. Project changes and clarification procedures.
 - 6. Use of site, access, office and storage areas, security and temporary facilities.
 - 7. Major product delivery and priorities.
 - 8. Contractor's safety plan and representative.

- B. Attendees will include:
 - 1. Owner's representatives.
 - 2. Contractor's office representative.
 - 3. Contractor's resident superintendent.
 - 4. Contractor's quality control representative.
 - 5. Subcontractor's representatives whom Contractor may desire or Engineer may request to attend.
 - 6. Engineer's representatives.

7. Others as appropriate.
- C. Upon issuance of Notice to Proceed, or earlier when mutually agreeable, ENGINEER will arrange a preconstruction conference in a convenient place for most persons invited, in accordance with the General Conditions.
 - D. Attending Preconstruction Conference: CONTRACTOR's superintendent, OWNER, ENGINEER, representatives of utilities, major subcontractors and others involved in performance of the Work, and others necessary to agenda.
 - E. ENGINEER will preside at conference.
 - F. Purpose of conference: To establish working understanding between parties and to discuss Construction Schedule, shop drawing and other submittals, cost breakdown of major lump sum items, processing of submittals and applications for payment, and other subjects pertinent to execution of the Work.
 - G. Agenda will include:
 1. Adequacy of distribution of Contract Documents.
 2. Distribution and discussion of list of major subcontractors and suppliers.
 3. Proposed progress schedules and critical construction sequencing.
 4. Major equipment deliveries and priorities.
 5. Project coordination.
 6. Designation of responsible personnel.
 7. Procedures and processing of:
 - a. Field decisions.
 - b. Proposal requests.
 - c. Submittals.
 - d. Change Orders.
 - e. Applications for Payment.
 - f. Record Documents.
 8. Use of premises:
 - a. Office, construction, and storage areas.
 - b. OWNER's requirements.
 9. Construction facilities, controls, and construction aids.
 10. Shoring requirements and submittal of CONTRACTOR's geotechnical report.
 11. Temporary utilities.
 12. Safety and first aid procedures.
 13. Security procedures.
 14. Housekeeping procedures.
 - H. ENGINEER will record minutes of meeting and distribute copies of minutes within 5 days of meeting to participants and interested parties.
- 1.5 PROGRESS MEETINGS
- A. CONTRACTOR will schedule regular progress meetings at site, conducted weekly, to review the Work progress, progress schedule, Shop Drawing and Sample submissions schedule, Application for Payment, contract modifications, and other matters needing discussion and resolution. At one meeting each month the Contractor's updated narrative progress report and overall schedule will be a topic of discussion.
 - B. Attendees will include:
 1. Owner's representative(s), as appropriate.
 2. Contractor, Subcontractors, and Suppliers, as appropriate.

3. Engineer's representative(s).
 4. Others as appropriate.
- C. Conduct progress meetings at least once every week in CONTRACTOR's field office, ENGINEER's field office, or other mutually agreed upon place.
 - D. Distribute to each anticipated participant written notice and agenda of each meeting at least 2 days before meeting.
 - E. Require attendance of CONTRACTOR's superintendent and subcontractors who are or are proximate to be actively involved in the Work, or who are necessary to agenda.
 - F. Invite OWNER, ENGINEER, utility companies when the Work affects their interests, and others necessary to agenda.
 - G. Complete and bring Application for Payment and Progress Schedule to progress meeting.
 - H. Prepare and distribute agenda.
 - I. Preside at meetings.
 - J. Purpose of progress meetings: To expedite work of subcontractors or other organizations that are not meeting scheduled progress, resolve conflicts, and coordinate and expedite execution of the Work.
 - K. Review progress of the Work, Progress Schedule, narrative report, Application for Payment, record documents, and additional items of current interest that are pertinent to execution of the Work.
 - L. Verify:
 1. Actual start and finish dates of completed activities since last progress meeting.
 2. Durations and progress of activities not completed.
 3. Reason, time, and cost data for Change Order Work that will be incorporated into Progress Schedule and application for payment.
 4. Percentage completion of items on Application for Payment.
 5. Reasons for required revisions to Progress Schedule and their effect on Contract Time and Contract Price.
 - M. Discuss potential problems which may impede scheduled progress and corrective measures.
 - N. CONTRACTOR will record minutes of meeting and distribute copies of minutes within 7 days of meeting to participants and interested parties.
- 1.6 QUALITY CONTROL AND COORDINATION MEETINGS
- A. Scheduled by Engineer on regular basis and as necessary to review test and inspection reports, and other matters relating to quality control of Work and work of other contractors.
 - B. Attendees will include:
 1. Contractor.
 2. Contractor's designated quality control representative.
 3. Subcontractors and Suppliers, as necessary.
 4. Engineer's representatives.

1.7 PRE-INSTALLATION MEETINGS

- A. General: Scheduled by CONTRACTOR on regular basis and as necessary to coordinate with manufacturers and installers. Meet with manufacturers and installers of major units of construction which require coordination between subcontractors. Major units of construction which require pre-installation meetings include:
 - 1. Gravity Thickener Mechanism
 - 2. Belt Filter Press
- B. Distribute to each anticipated participant written notice and agenda of each meeting at least 4 days before meeting.
- C. Schedule meeting at least 7 days in advance of installation.
- D. Conduct meetings in CONTRACTOR's field office or other mutually agreed upon place.
- E. Require attendance of Superintendent, appropriate manufacturers and installers of major units of constructions, and affected subcontractors.
- F. Invite OWNER and ENGINEER.
- G. Preside at meetings.
- H. Record minutes of meeting and distribute copies of minutes within 3 days of meeting to participants and interested parties.

1.8 FACILITY STARTUP MEETINGS

- A. Schedule and attend a minimum of 5 facility startup meetings. The first of such meetings shall be held prior to submitting the Facility Startup Plan, as specified in Section 01 79 00, DEMONSTRATION AND TRAINING, and shall include preliminary discussions regarding such plan.
- B. Agenda items shall include, but not be limited to, content of Facility Startup Plan, coordination needed between various parties in attendance, and potential problems associated with startup.
- C. Attendees will include:
 - 1. Contractor.
 - 2. Contractor's designated quality control representative.
 - 3. Subcontractors and equipment Manufacturer's representatives whom Contractor deems to be directly involved in facility startup.
 - 4. Engineer's representatives.
 - 5. Owner's operations personnel.
 - 6. Others as required by Contract Documents or as deemed necessary by Contractor.

1.9 POST CONSTRUCTION MEETING

- A. Meet with and inspect the Work at 11 months after date of Substantial Completion with OWNER and ENGINEER.
- B. Arrange meeting at least 7 days before meeting.
- C. Meet in OWNER's office or other mutually agreed upon place.
- D. Inspect the Work and draft list of items to be completed or corrected.

- E. Review service and maintenance contracts, and take appropriate corrective action when necessary.
- F. Complete or correct defective work and extend correction period accordingly.
- G. Require attendance of Superintendent, appropriate manufacturers and installers of major units of constructions, and affected subcontractors.

1.10 OTHER MEETINGS

- A. In accordance with Contract Documents and as may be required by Owner and Engineer.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 32 00 – CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Preparation, submittal, and maintenance of computerized progress schedule and reports, contract time adjustments, and payment requests, including the following:
 - 1. Preliminary Schedule.
 - 2. Baseline Schedule.
 - 3. Summary Schedule.
 - 4. Weekly Schedule.
 - 5. Schedule Updates.
 - 6. Schedule Revisions.
 - 7. Time Impact Analyses.
 - 8. Final Schedule Submittal.

- B. Related sections:
 - 1. Section 01 29 00 – Payment Procedures.
 - 2. Section 01 31 00 – Project Management and Coordination
 - 3. Section 01 31 19 – Project Meetings.
 - 4. Section 01 33 00 – Submittal Procedures.

1.2 SUBMITTALS

- A. Informational Submittals:
 - 1. Preliminary Progress Schedule: Submit at least 7 days prior to preconstruction conference.
 - 2. Detailed Progress Schedule:
 - a. Submit initial Detailed Progress Schedule within 45 days after Effective Date of the Agreement.
 - b. Submit an Updated Progress Schedule at each update, in accordance with Article Detailed Progress Schedule.
 - 3. Submit with Each Progress Schedule Submission:
 - a. Contractor's certification that Progress Schedule submission is actual schedule being utilized for execution of the Work.
 - b. Electronic files compatible with latest version of Project Planner (P3) by Primavera Systems, Inc.
 - c. Progress Schedule: Legible copies.
 - d. Narrative Progress Report: Same number of copies as specified for Progress Schedule.
 - 4. Prior to final payment, submit a final Updated Progress Schedule.

1.3 RESPONSIBLE PERSON

- A. Designate, in writing and within 5 calendar days after Notice of Award, person responsible for preparation, maintenance, updating and revision of all schedules.

- B. Qualifications of Responsible Person:
 - 1. Authority to act on behalf of CONTRACTOR.
 - 2. Five years verifiable experience in preparation of complex construction schedules for projects of similar value, size and complexity.
 - 3. Knowledge of CPM scheduling utilizing Primavera Project Planner software.

- C. References: Submit written reference of 3 project owners who have personal experience with this scheduler on previous projects. Identify name, address, telephone number, project name and cost.
- D. Scheduler shall be dedicated full time to this project, located on-site. All scheduling software and hardware shall be located on-site. Scheduler shall attend all project meetings called for under Section 01 31 19, PROJECT MEETINGS.
- E. ENGINEER reserves the right to disapprove scheduler when submitted by CONTRACTOR if not qualified. ENGINEER reserves the right to remove scheduler from the project if found to be incompetent.

1.4 SCHEDULING FORMAT AND SOFTWARE

- A. Schedule Format: Utilize critical path method (CPM) format.
- B. Prepare computerized schedule utilizing Primavera Project Planner, most current version. The CONTRACTOR shall provide one licensed copy of the scheduling software to the ENGINEER, registered in the ENGINEER's name, for the duration of the project.

1.5 PRECONSTRUCTION SCHEDULING MEETING

- A. ENGINEER will conduct Preconstruction Scheduling Meeting with CONTRACTOR's Project Manager, General Superintendent and scheduler within 7 calendar days after Notice of Award. This meeting is separate from the Preconstruction Conference Meeting and is intended to cover schedule issues exclusively.
- B. At the meeting, scheduling requirements shall be reviewed with CONTRACTOR. These include schedule preparation, reporting requirements, manpower and equipment loading, updates, revisions, and schedule delay analysis. CONTRACTOR shall present their schedule methodology, planned sequence of operations, resource loading methodology and present their proposed activity coding structure.
- C. Coding Structure: CONTRACTOR shall submit proposed coding structure, identifying the code fields and the associated code values it intends to use in the project schedule. The coding structure shall, at a minimum, include code fields for Project Segment or Phase, Area of Work, Type of Work, Submittal/Procurement/Construction and Responsibility/ Subcontractor. Refer to paragraph 1.10H for listing of activity categories to be included in the schedule.

1.6 PREPARATION

- A. Preparation and submittal of Progress Schedule represents CONTRACTOR's intention to execute the Work within specified time and constraints. Failure to conform to requirement may result in termination for cause under Article 16, SUSPENSION OF WORK AND TERMINATION, of the General Conditions.
- B. CONTRACTOR's bid covers all costs associated with the execution of the Work in accordance with the Progress Schedule.
- C. During preparation of the preliminary Progress Schedule, ENGINEER will facilitate CONTRACTOR's efforts by being available to answer questions regarding sequencing issues, scheduling constraints, interface points, and dependency relationships.
- D. Prepare schedule utilizing Precedence Diagramming Method (PDM).

- E. Prepare schedule utilizing activity durations in terms of working days. Do not exceed 15 working day duration on activities except concrete curing, submittal review, and equipment fabrication and deliveries. Where duration of continuous work exceeds 15 working days, subdivide activities by location, stationing, or other sub-element of the Work. CONTRACTOR shall coordinate holidays to be observed with the OWNER and incorporate them into the schedule as non-working days.
- F. Failure to include an activity required for execution of the Work does not excuse CONTRACTOR from completing the Work and portions thereof within specified times and at price specified in Agreement. Failure of CONTRACTOR to include required schedule constraints, sequences or milestones in schedule shall not relieve CONTRACTOR of obligation to conform to requirements of Contract. Acceptance of schedule shall not waive Contract requirements. In event of conflict between accepted schedule and Contract requirements, terms of Contract shall govern at all times, unless requirements are waived in writing by the OWNER.
- G. Reference schedule to calendar days with beginning of Contract Time as Day "1".
- H. Baseline Schedule and Project Completion: Should CONTRACTOR submit a Baseline Schedule showing project completion more than 20 working days prior to Contract completion date, OWNER may issue Change Order, at no cost to OWNER, revising time of performance of Work and Contract completion date to match CONTRACTOR's schedule completion date. Contract milestone dates, if any, shall be adjusted accordingly.
- I. Contract float is for the mutual benefit of both OWNER and CONTRACTOR. Changes to the project that can be accomplished within this available period of float may be made by OWNER without extending the Contract time, by utilizing float. No time extensions shall be granted nor delay damages owed until Work extends beyond currently accepted Contract completion date. Likewise, CONTRACTOR may utilize float to offset delays other than delays caused by OWNER. Mutual use of float shall continue until all available float shown by schedule has been utilized by either OWNER or CONTRACTOR, or both. At that time, extensions of the Contract time will be granted by OWNER for valid OWNER-caused or third party-caused delays which affect the planned completion date and which have been properly documented and demonstrated by CONTRACTOR.
- J. Resource Loading and Leveling: CONTRACTOR shall input manpower and equipment data on each schedule activity. Manpower data shall consist of the man-hours estimated to perform each task, categorized by trade. Equipment data shall consist of equipment hours estimated to perform each task, categorized by piece of equipment. CONTRACTOR shall optimize and level manpower and equipment requirements. Resource leveling shall reflect a reasonable plan for accomplishing Work. Individual activities may be sequenced within limits of available float. Critical or near critical paths resulting from use of manpower or equipment restraints shall be kept to a minimum. Near critical path identified as path with 15 or less working days of float.
- K. Schedule Logic: Schedule shall be assembled to show order in which CONTRACTOR proposes to carry out Work, indicate restrictions of access, availability of Work areas, and availability and use of manpower, materials and equipment. The following criteria shall form basis for assembly of schedule logic:
 - 1. Which activities must be completed before subsequent activities can be started or performed?
 - 2. Which activities can be performed concurrently?
 - 3. Which activities must be started immediately following completed activities?
 - 4. What major facility, equipment or manpower restrictions are required for sequencing these activities?
- L. Non-sequestering of Float: Pursuant to float sharing requirements of Contract, use of float suppression techniques such as preferential sequencing or logic, special lead or lag logic

restraints, extended activity durations or imposed dates shall be cause for rejection of any schedule submittal.

- M. Major Subcontractor, Parallel Prime Contractor Sign Off: CONTRACTOR shall provide written confirmation of concurrence from all major subcontractors and independent prime CONTRACTORS on site with all schedule submittals. Term "major subcontractor" as used in this Section means any subcontractor, at any tier, with a subcontract worth 5 percent or more of the total cost of the Work.
- N. Imposed Dates, Hidden Logic Prohibited: CONTRACTOR shall not use imposed dates or hidden logic in preparation of schedule.
- O. Interim Milestone Dates, Operational Constraints: In event there are interim milestone dates and/or operational constraints set forth in Contract, CONTRACTOR shall show them on schedule as specified in Contract. CONTRACTOR shall not use Zero Total Float constraint or Mandatory Finish Date on such Contract requirements.
- P. Schedule Windows for Owner-furnished, Contractor-installed Equipment or Materials: Immediately after Award of Contract, CONTRACTOR shall obtain from ENGINEER anticipated delivery dates of OWNER furnished equipment or materials. These dates shall be shown on schedule in same manner indicated by ENGINEER.
- Q. Cost Loading: All schedules shall be cost loaded. Only on-site construction activities shall be cost loaded. The sum total of all cost loaded activities shall equal the current value of the Contract, including change orders, at all times. Upon acceptance by OWNER, the Baseline Schedule shall also be the Schedule of Values required under Section 01 29 00, PAYMENT PROCEDURES. The monthly Schedule Updates shall be the monthly Payment Application required under Section 01 29 00, PAYMENT PROCEDURES. Submittal and acceptance of these schedules shall be a condition precedent to the making of any payments under this Contract.

1.7 SUBMITTAL OF PROGRESS SCHEDULES

- A. Submit preliminary and baseline schedule in accordance with the Conditions of the Contract as modified by this Section 01 32 00, CONSTRUCTION PROGRESS DOCUMENTATION.
- B. Submit, on a monthly basis, updated schedules as specified. Submit final schedule update as specified.
- C. Submit revised schedules and time impact analyses as specified.
- D. Submit Schedules in the Media and Number of Copies as Follows:
 - 1. Three sets of the CPM network and/or barchart (as specified by the OWNER) on D-size sheets. Color-coding to be specified by the OWNER.
 - 2. Three sets of Tabular reports listing all activities sorted numerically identifying duration, early start, late start, early finish, late finish, total float, and all predecessor/successor information.
 - 3. Two sets of portable drives, with 500 GB storage capacity containing the computerized CPM Schedule data.
 - 4. Three prints of the Summary Schedule.

1.8 PRELIMINARY SCHEDULE

- A. CONTRACTOR shall submit Preliminary Schedule within 10 calendar days after Notice To Proceed. Preliminary Schedule shall contain detailed plan of operations for first 90 calendar days of Work after receipt of Notice to Proceed.
- B. In addition to basic requirements outlined in General Conditions, show a detailed schedule, beginning with Notice to Proceed, for minimum duration of 90 days, and a summary of balance of Project through Final Completion.
- C. Show activities including, but not limited to the following:
 - 1. Notice to Proceed.
 - 2. Permits.
 - 3. Submittals, with review time. Contractor may use Schedule of Submittals specified in Section 01 33 00, SUBMITTAL PROCEDURES.
 - 4. Early procurement activities for long lead equipment and materials.
 - 5. Initial Site work.
 - 6. Earthwork.
 - 7. Specified Work sequences and construction constraints.
 - 8. Contract Milestone and Completion Dates.
 - 9. Owner-furnished products delivery dates or ranges of dates.
 - 10. Major structural, mechanical, equipment, electrical, architectural, and instrumentation and control Work.
 - 11. System startup summary.
 - 12. Project close-out summary.
 - 13. Demobilization summary.
- D. Update Preliminary Progress Schedule monthly; as part of progress payment process. Failure to do so may result in the Owner withholding all or part of the monthly progress payment until the Preliminary Progress Schedule is updated in a manner acceptable to Engineer.
- E. Format: In accordance with Article Progress Schedule Critical Path Network.
- F. Update monthly to reflect actual progress and occurrences to date, including weather delays.
- G. ENGINEER and CONTRACTOR shall meet within 7 calendar days after receipt of Preliminary Schedule to review and make necessary adjustments. CONTRACTOR shall submit revised preliminary schedule within 5 calendar days after meeting.
- H. CONTRACTOR shall submit schedule of manpower and costs for all activities on revised Preliminary Schedule with revised Preliminary Schedule. Schedule of manpower and costs shall be realistic and level so as not to have unusual manpower requirements.
- I. Schedule of costs shall be Schedule of Values required under Section 01 29 00, PAYMENT PROCEDURES for first 90 calendar days of Work. Submittal and acceptance of Preliminary Schedule is condition precedent to making of progress payments under Section 01 29 00, PAYMENT PROCEDURES and payments for mobilization costs otherwise provided for in the Contract. No pay item Work shall commence until Preliminary Schedule and schedule of costs have been accepted by OWNER.
- J. Accepted Preliminary Schedule shall be incorporated unchanged, as first 90 calendar days of activity in CONTRACTOR's Baseline Schedule.

- K. Preliminary Schedule shall be updated monthly during first 90 calendar days after Notice to Proceed. Updated Preliminary Schedule shall be the payment application required under Section 01 29 00, PAYMENT PROCEDURES.

1.9 BASELINE SCHEDULE

- A. General: Comprehensive computer-generated schedule using CPM, generally as outlined in Associated General Contractors of America (AGC) 580, "Construction Project Planning and Scheduling Guidelines." If a conflict occurs between the AGC publication and this Specification, this Specification shall govern. Adjust or confirm schedules in accordance with General Conditions on a monthly basis and submit to ENGINEER.
- B. Contents:
 - 1. Schedule shall begin with the date of Notice to Proceed and conclude with the date of Final Completion.
 - 2. Identify Work calendar basis using days as a unit of measure.
 - 3. Show complete interdependence and sequence of construction and Project-related activities reasonably required to complete the Work.
 - 4. Identify the Work of separate stages and other logically grouped activities, and clearly identify critical path of activities.
 - 5. Reflect sequences of the Work, restraints, delivery windows, review times, Contract Times and Project Milestones set forth in the Agreement and Section 01 31 00, PROJECT MANAGEMENT AND COORDINATION.
- C. No more than 45 calendar days after Notice of Award, CONTRACTOR shall submit the Baseline Schedule for all Work of the project. Baseline Schedule shall show sequence and interdependence of all activities required for complete performance of all Work, beginning with date of Notice to Proceed and concluding with date of final completion of Contract.
- D. Baseline Schedule shall conform to requirements of the following Article, "Network Details and Graphical Output."
- E. Acceptance of the Baseline Schedule by the OWNER is a condition precedent to making payments under Section 01 29 00, PAYMENT PROCEDURES after the first 90 calendar days after Notice to Proceed.

1.10 NETWORK DETAILS AND GRAPHICAL OUTPUT

- A. Produce a clear, legible, and accurate calendar based, time scaled, graphical network diagram. Group activities related to the same physical areas of the Work. Produce the network diagram based upon the early start of all activities.
- B. Include for each activity, the description, activity number, estimated duration in working days, total float and all activity relationship lines.
- C. Illustrate order and interdependence of activities and sequence in which Work is planned to be accomplished. Incorporate the basic concept of the precedence diagram network method to show how the start of one activity is dependent upon the start or completion of preceding activities and its completion restricts the start of following activities.
- D. Indicate the critical path for the project.
- E. Delineate the specified contract duration and identify the planned completion of the Work as a milestone. The time period between the planned and Contract completion dates, if any, shall be

shown on the schedule as an activity identified as project float unless a Change Order is issued pursuant to paragraph 1.6.H.

- F. Identify system shutdown dates, system tie-in dates, specified interim completion or milestone dates and contract completion date as milestones. Include, in addition to Construction Activities:
1. Submission dates and review periods for major equipment submittals, shoring submittals, and indicator pile program:
 - a. Shoring Reviews: Allow 4-week review period for each shoring submittal.
 - b. Pile Indicator Program: Allow 3-week review period for analysis of program.
 2. Any activity by the OWNER or the ENGINEER that may affect progress or required completion dates.
 3. Equipment and long-lead material deliveries over 8 weeks.
 4. Approvals required by regulatory agencies or other third parties.
 5. No activity duration exclusive of those for Submittals review and product fabrication/delivery, shall be less than 1 day and not more than 14 days, unless otherwise approved.
 6. Activity duration for Submittal review shall not be less than review time specified unless clearly identified and prior written acceptance has been obtained from Engineer.
 7. If Contractor provides an accepted schedule with an early completion date, Owner reserves the right to reduce Contract Times to match the early completion date by issuing a deductive Change Order at no change in Contract Price.
- G. Produce network diagram on 22 inch by 34 inch sheets with grid coordinate system on the border of all sheets utilizing alpha and numeric designations.
1. Title Block: Show name of Project, Owner, date submitted, revision or update number, and the name of the scheduler. Updated schedules shall indicate data date.
 2. Identify horizontally across top of schedule the time frame by year, month, and day.
 3. Identify each activity with a unique number and a brief description of the Work associated with that activity.
 4. Indicate the critical path.
 5. Show, at a minimum, the controlling relationships between activities.
 6. Plot activities on a time-scaled basis, with the length of each activity proportional to the current estimate of the duration.
 7. Plot activities on an early start basis unless otherwise requested by Engineer.
 8. Provide a legend to describe standard and special symbols used.
- H. Identify the Execution of the Following, Omitting Items Not Applicable to the Work:
1. Obtaining permits, submittals for early product procurement, and long lead time items.
 2. Mobilization and other preliminary activities.
 3. Initial Site work.
 4. Specified Work sequences, constraints, and Milestones.
 5. Substantial Completions date(s) of Subcontract Work.
 6. All required submittals and submittal review times showing 30 calendar day duration for such activities and equal amount of time for re-submittal reviews.
 7. Equipment and materials procurement/fabrication/delivery.
 8. Delivery dates for Owner-furnished products, as specified in Section 01 11 00, SUMMARY OF WORK.
 9. Excavation.
 10. Site work.
 11. Structural steel work.
 12. Architectural features work.
 13. Conveying systems work.
 14. Equipment work.
 15. Mechanical work.
 16. Electrical work.
 17. Instrumentation and control work.

18. Interfaces with Owner-furnished equipment.
19. Other important work for each major facility.
20. Shoring design and submission of detailed shoring submittals. Identify submission as a milestone.
21. Shoring review, shoring materials procurement, shoring installation and shoring removal.
22. Piles.
23. Backfill and compaction.
24. Dewatering.
25. Grading, subbase, base, paving, and curb and gutters.
26. Fencing and landscaping.
27. Concrete, including installation of forms and reinforcement, placement of concrete, curing, stripping, finishing and patching.
28. Tests for leakage of concrete structures intended to hold water.
29. Masonry.
30. Metal fastenings, framing, structures, and fabrications.
31. Wood structures, finish carpentry, architectural woodwork, and plastic fabrications.
32. Waterproofing and dampproofing, insulation, roofing and flashing, and sealants.
33. Doors and windows, including hardware and glazing.
34. Finishes including coating and painting, flooring, ceiling, and wall covering.
35. Building specialties including furnishings, laboratory equipment, and toilet and bath accessories.
36. Process equipment, including identification of ordering lead time, factory testing and installation.
37. Pumps and drives, including identification of ordering lead time, factory testing and installation.
38. Conveying equipment including hoists and cranes, conveyor systems, and materials handling equipment, including identification of ordering lead time and installation.
39. Other mechanical equipment including fans and heating, ventilating, and air conditioning equipment.
40. Trenching, pipe laying, and trench backfill and compaction.
41. Piping, fittings and appurtenances, including identification of ordering and fabrication lead time, layout, installation and testing.
42. Valves, gates and operators, including identification of order lead time, installation and testing.
43. Plumbing specialties.
44. Electric transmission, service, and distribution equipment, including identification of ordering lead time, and factory testing.
45. Other electrical work including lighting, heating and cooling, and special systems, including identification of ordering lead time.
46. Instrumentation and controls, including identification of ordering lead time.
47. Control Panel Readiness Testing as set forth in Section 26 90 00.
48. Preliminary testing of equipment, instrumentation and controls.
49. Site Acceptance Testing as set forth in Section 26 90 00.
50. Final testing, including preparation time.
51. Seven-day operational test.
52. Substantial Completion: Substantial completion activity shall meet all requirements set forth in Section 00 73 00, Supplementary Conditions.
53. Punch list work. Equipment and system startup and test activities.
54. Project closeout and cleanup.
55. Operation and maintenance training.

I. Schedule Report:

1. 8-1/2" x 11" white paper, unless otherwise approved.
2. List information for each activity in tabular format, including, at a minimum:
 - a. Activity Identification Number.
 - b. Activity Description.

- c. Original Duration.
 - d. Remaining Duration.
 - e. Early Start Date (Actual start on Updated Progress Schedules).
 - f. Early Finish Date (Actual finish on Updated Progress Schedules).
 - g. Late Start Date.
 - h. Late Finish Date.
 - i. Total Float.
3. Sort reports, in ascending order, as listed below:
- a. Activity number sequence with predecessor and successor activity.

J. Cost -Loading:

- 1. Note the estimated cost to perform each Work activity, with the exception of Submittals or Submittal reviews, in the network in a tabular listing.
- 2. The sum of all activity costs shall equal the Contract Price. An unbalanced or front-end-loaded schedule will not be acceptable.
- 3. The accepted cost-loaded Progress Schedule shall constitute the Schedule of Values specified in Section 01 29 00, PAYMENT PROCEDURES.

1.11 SUMMARY SCHEDULE

- A. Provide Summary Schedule which consolidates groups of activities associated with Major Items of Work shown on Baseline Schedule. Summary Schedule is intended to give an overall indication of the project schedule without a large amount of detail.
- B. Summary Schedule shall be updated and submitted monthly and after each Schedule Update or Schedule Revision.

1.12 SCHEDULE OF SHOP DRAWING AND SAMPLE SUBMITTALS

- A. After Preliminary Schedule has been submitted and accepted by OWNER, CONTRACTOR shall submit a list of all shop drawings and sample submittals anticipated in first 90 calendar days after Notice to Proceed using early start dates.
- B. Submittal of this preliminary list shall be a condition precedent to making of progress payments during the first 90 calendar days after Notice to Proceed.
- C. After Baseline Schedule has been submitted and accepted by OWNER, CONTRACTOR shall print out and submit list of all shop drawings and sample submittals for all Work using early start dates. This listing will contain all submittals required for the entire Work including those listed above.
- D. Submittal of final list shall be a condition precedent to making of progress payments after the first 90 calendar days after Notice to Proceed.
- E. These schedules shall conform to the requirements of Articles 11, 12, and 13 of the General Conditions.

1.13 MANPOWER SCHEDULES

- A. After Baseline Schedule has been submitted and accepted by OWNER, CONTRACTOR shall submit a schedule histogram depicting total craft manpower and craft manpower for CONTRACTOR's own labor forces and those of each subcontractor. This manpower schedule shall be submitted electronically on a portable drive in Excel format, with 1 paper copy.

- B. Submittal of this manpower data shall be a condition precedent to making of progress payments after the first 90 calendar days after Notice to Proceed.

1.14 EQUIPMENT SCHEDULE

- A. After Baseline Schedule has been submitted and accepted by OWNER, CONTRACTOR shall submit a tabular report listing each major piece of construction equipment to be used in performing the Work. This report will list major equipment for CONTRACTOR and each subcontractor. This tabular report of equipment shall be submitted electronically on a computer disk in Excel format with 1 paper copy.
- B. Submittal of this equipment data shall be a condition precedent to making of progress payments after the first 90 calendar days after Notice to Proceed.

1.15 WEATHER DAY ALLOWANCE

- A. Include as a separate identifiable activity on the critical path, an activity labeled "Weather Days Allowance." Insert this activity at the end of the schedule.
- B. Duration of Weather Days Allowance is specified in Conditions of the Contract.
- C. Insert an activity in critical path to reflect weather day occurrences when weather days are experienced and accepted by ENGINEER. Identify this activity as a weather delay.
- D. Reduce duration of Weather Days Allowance activity as weather delays are experienced and inserted into the Schedule. Remaining weather days in Weather Day Allowance at completion of project is considered float.

1.16 ALLOWANCE FOR OWNER CAUSED DELAY

- A. Include as a separate identifiable activity on the critical path, an activity labeled "Allowance for OWNER-Caused Delay." Insert this activity at the end of the schedule, following the Project Completion Milestone.
- B. Duration of this activity is specified in Bid Form. The duration of this OWNER- Caused Delay Allowance is in addition to the contractual time frame.
- C. Insert an activity in critical path to reflect OWNER-caused delay occurrences when OWNER-caused delay days are experienced and accepted by ENGINEER. Identify this activity as an OWNER-caused delay.
- D. Reduce duration of OWNER-Caused Delay Allowance activity as OWNER-caused delays are experienced and inserted into the schedule. Remaining days in OWNER- Caused Delay Allowance at completion of project is considered float.

1.17 REVIEW AND ACCEPTANCE OF SCHEDULES

- A. ENGINEER will review Baseline Schedules, Schedule Updates, Schedule Revisions and Time Impact Analyses to ascertain compliance with specified project constraints, compliance with milestone dates, reasonableness of durations and sequence, accurate inter-relationships and completeness.
- B. ENGINEER and OWNER will issue written comments following completion of review of Baseline Schedule within 21 calendar days after receipt. Written comments on review of Schedule

Updates and Schedule Revisions and Time Impact Analyses will be returned to CONTRACTOR within 14 calendar days after receipt by ENGINEER.

- C. Revise and resubmit schedule in accordance with ENGINEER's comments within 7 calendar days after receipt of such comments, or request joint meeting to resolve objections. If a meeting is requested the CONTRACTOR and all major subcontractors shall participate in the meeting with ENGINEER. Revise and resubmit schedule within 7 calendar days after meeting.
- D. When schedule reflects OWNER's and CONTRACTOR's agreement of project approach and sequence, schedule will be accepted by OWNER. Use accepted schedule for planning, organizing and directing the work and for reporting progress. Provide all items specified in Article 1.7, "Submittal of Project Schedules."
- E. Engineer's acceptance will demonstrate agreement that:
 - 1. Proposed schedule is accepted with respect to:
 - a. Contract Times, including Final Completion are within the specified times.
 - b. Specified Work sequences and constraints are shown as specified.
 - c. Access restrictions are accurately reflected.
 - d. Startup and testing times are as specified.
 - e. Submittal review times are as specified.
 - f. Startup testing duration is as specified and timing is acceptable.
 - 2. In all other respects, Engineer's acceptance of Contractor's schedule indicates that in the Engineer's judgment, the schedule represents reasonable plan for constructing Project in accordance with the Contract Documents. Engineer's review will not make any change in Contract requirements. Lack of comment on any aspect of schedule that is not in accordance with the Contract Documents will not thereby indicate acceptance of that change, unless Contractor has explicitly called the nonconformance to Engineer's attention in submittal. Schedule remains Contractor's responsibility and Contractor retains responsibility for performing all activities, for activity durations, and for activity sequences required to construct Project in accordance with the Contract Documents.
- F. Unacceptable Preliminary Progress Schedule:
 - 1. Make requested corrections; resubmit within 7 days.
 - 2. Until acceptable to Engineer as Baseline Progress Schedule, continue review and revision process, during which time Contractor shall update schedule on a monthly basis to reflect actual progress and occurrences to date.
- G. Unacceptable Detailed Progress Schedule:
 - 1. Make requested corrections; resubmit within 7 days.
 - 2. Until acceptable to Engineer as Baseline Progress Schedule, continue review and revision process.
- H. Narrative Report: All changes to activity duration and sequences, including addition or deletion of activities subsequent to Engineer's acceptance of Baseline Progress Schedule shall be delineated in Narrative Report current with proposed Updated Progress Schedule.

1.18 UPDATING THE SCHEDULE AND PROGRESS OF THE WORK

- A. Updated Progress Schedule shall reflect:
 - 1. Progress of Work to within 5 working days prior to submission.
 - 2. Approved changes in Work scope and activities modified since submission.
 - 3. Delays in Submittals or re-submittals, deliveries, or Work.
 - 4. Adjusted or modified sequences of Work.
 - 5. Other identifiable changes.
 - 6. Revised projections of progress and completion.
 - 7. Report of changed logic.

- B. Produce detailed sub schedules during Project, upon request of Owner or Engineer, to further define critical portions of the Work such as facility shutdowns.
- C. If Contractor fails to complete activity by its latest scheduled completion date and this Failure is anticipated to extend Contract Times (or Milestones), Contractor shall, within 7 days of such failure, submit a written statement as to how Contractor intends to correct nonperformance and return to acceptable current Progress Schedule. Actions by Contractor to complete the Work within Contract Times (or Milestones) will not be justification for adjustment to Contract Price or Contract Times.
- D. Owner may order Contractor to increase plant, equipment, labor force or working hours if Contractor fails to:
 - 1. Complete an activity by its completion date.
 - 2. Satisfactorily execute Work as necessary to prevent delay to overall completion of Project, at no additional cost to Owner.
- E. Update the schedule prior to monthly progress meeting. Submit a written report of significant changes in progress meeting. A detailed written list of all changes to the previous schedule submittal contained in the Schedule Update shall be submitted at the monthly progress meeting.
- F. Submit updated schedule and materials specified under Article 1.7 "Submittal of Progress Schedules," 5 calendar days before the progress meeting.
- G. Since monthly Schedule Update is the application for progress payment required under Section 01 29 00, PAYMENT PROCEDURES, submittal and acceptance of the monthly Schedule Update is a condition precedent to the making of any progress payments.
- H. Prepare update using most recent accepted version of schedule. Include:
 - 1. Actual start dates of activities that have been started.
 - 2. Actual finish dates of activities that have been completed.
 - 3. Percentage of completion of activities that have been started but not finished.
 - 4. Actual dates on which milestones were achieved.
 - 5. Activities shall not be updated by inputting percent complete figures only without also inputting actual dates.
 - 6. Retained logic shall be used in preparing Schedule Updates.
 - 7. When necessary, input remaining durations for activities whose finish dates cannot be calculated accurately with a percent complete figure only.
 - 8. Revisions to the schedule may be included that have been previously approved in under the following Article, "Revisions to Schedule."
- I. Submit written narrative report in conjunction with each Schedule Update. Describe:
 - 1. Activities added to or deleted from schedule. Identify added activities in manner distinctly different from original activity designations.
 - 2. Changes in sequence or estimated duration of activities.
 - 3. Current or anticipated problems and delays affecting progress, impact of these problems and delays and measures taken to mitigate impact.
 - 4. Assumptions made and activities affected by incorporating change order work into the schedule.
 - 5. Cost and other resource loading requirements shall be adhered to concerning activities added to or deleted from the schedule.
- J. Identify overall progress of each Major Item of Work in the Summary Schedule.

- K. Should monthly Schedule Update show project completion earlier than current Contract completion date CONTRACTOR shall show early completion time as schedule activity, identified as "Project Float."
- L. Should monthly Schedule Update show project completion later than current Contract completion date CONTRACTOR shall prepare and submit a Schedule Revision in accordance with the following Article, "Revisions to Schedule."

1.19 REVISIONS TO SCHEDULE

- A. Submit Revised Schedule within 5 Days:
 - 1. When delay in completion of any activity or group of activities indicates an overrun of the contract time or milestone dates by 20 working days or 5 percent of the remaining duration, whichever is less.
 - 2. When delays in submittals, deliveries, or work stoppages are encountered making necessary the replanning or rescheduling of activities.
 - 3. When the schedule does not represent the actual progress of activities.
 - 4. When any change to the sequence of activities, the completion date for major portions of the work, or when changes occur which affect the critical path.
 - 5. When Contract modification necessitates schedule revision, submit schedule analysis of change order work with cost proposal.
- B. Submit revised schedule and materials as specified under Article "Submittals of Progress Schedules."
- C. Make revisions on most recently accepted version of schedule.
- D. Schedule Revisions shall not be prepared or submitted with Schedule Updates. They shall be separate submittals and shall be noted as Schedule Revisions.
- E. Only upon acceptance of a revision by the OWNER shall it be reflected in the next monthly Schedule Update.
- F. Schedule Revisions submitted for the purpose of mitigating a CONTRACTOR- caused project delay (Recovery Schedule) shall not be implemented until the OWNER reviews and accepts the Schedule Revision.

1.20 PAYMENT REQUESTS AND CASH FLOW

- A. After Baseline Schedule has been submitted and accepted by the OWNER, the CONTRACTOR shall submit on a monthly basis, a tabular report showing anticipated earnings each month of the contract period. This tabulation will be based on the summation of the cost-loaded activities each month. CONTRACTOR shall submit an updated payment schedule each month showing actual earned amounts and anticipated remaining earnings.
- B. Utilize cost loaded monthly Schedule Updates as the applications for payment specified in Section 01 29 00, PAYMENT PROCEDURES. Payment application shall be a listing in Excel format of all schedule activities showing cost and percentage completion during the current month for which payment is sought. Submittal of the monthly Schedule Update shall be a condition precedent to the issuance of any payment under this Contract.

1.21 WEEKLY SCHEDULE

- A. Submit to ENGINEER, on the last working day of every week, a progress schedule showing the activities completed during the previous week and the CONTRACTOR's schedule of activities for the following 2 weeks.
- B. The Weekly Schedule may be a CPM schedule or a bar chart but shall utilize the logic and conform to the status of the current progress schedule. In the event that the Weekly Schedule no longer conforms to the current schedule CONTRACTOR may be required to revise the schedule in accordance with Article 1.19, "Revisions to Schedule."
- C. The activity designations used in the Weekly Schedule shall be consistent with those used in the Baseline Schedule and the monthly Schedule Updates.
- D. The format of the Weekly Schedule shall be as agreed upon between the CONTRACTOR and the ENGINEER.

1.22 SCHEDULE OF VALUES

- A. Requirements for Schedule of Values are specified in Section 01 29 00, PAYMENT PROCEDURES, and Paragraph 1.6.Q, Cost Loading.
- B. Submit, in conjunction with the Progress Schedule, a Schedule of Values identifying costs of all on-site construction activities as generated by the cost loaded schedule. Equate the aggregate of these costs to the Lump Sum Contract Price.

1.23 ADJUSTMENT OF CONTRACT TIMES

- A. Contract time will be adjusted only for causes specified in Contract Documents. Adjustments in the Contract time shall be governed by the principles of this Article and shall be made in accordance with the provisions of Article 11, "Amending the Contract Documents, Changes With Work" of the General Conditions.
 - 1. Non-excusable Delay: Actions or inactions of the CONTRACTOR, or events for which the CONTRACTOR has assumed contractual responsibility (including actions or inactions of subcontractors, suppliers or materialmen at any tier) which would independently delay the completion of the Work beyond the current Contract completion date shall be designated as non-excusable delay. The CONTRACTOR shall not receive any time extension for such delays.
 - 2. Excusable Delay: Events which are unforeseeable, outside the control of, and without the fault or negligence of either the OWNER or the CONTRACTOR (or any party for whom either is responsible), which would independently delay the completion of the Work beyond the current Contract completion date shall be designated as excusable delay. The CONTRACTOR is entitled to a time extension only and shall not receive any other damages.
 - 3. Compensable Delay: Actions or inactions of the OWNER, or events for which the OWNER has assumed contractual responsibility, which would independently delay the completion of the Work beyond the current Contract completion date shall be designated as compensable delay. The CONTRACTOR is entitled to a time extension and delay damages.
 - 4. Concurrent Delay: Concurrent delay is any combination of the above three types of delay occurring on the same calendar date(s), except in cases where the combination consists of two or more instances of the same type of delay occurring on the same calendar date(s). When one cause of delay is OWNER- caused or caused by an event which is beyond the control and without the fault or negligence of either the OWNER or the

CONTRACTOR and the other CONTRACTOR-caused, the CONTRACTOR is entitled only to a time extension and no delay damages.

- B. If the CONTRACTOR believes that the OWNER has impacted its work, such that the project completion date will be delayed, the CONTRACTOR must submit proof demonstrating the delay to the critical path. This proof, in the form of a Time Impact Analysis, may entitle the CONTRACTOR to an adjustment of contract time.
- C. Time Impact Analysis:
 - 1. The Time Impact Analysis submitted by the CONTRACTOR shall utilize the accepted schedule update that is current relative to the time frame of the delay event (change order, third party delay, or other OWNER-caused delay). The CONTRACTOR shall represent the delay event in the schedule by 1) inserting new activities associated with the delay event into the schedule, 2) revising activity logic, or 3) revising activity durations.
 - 2. If the project schedule's critical path and completion date are impacted as a result of adding this delay event to the schedule, a time extension equal to the magnitude of the impact may be warranted.
 - 3. The Time Impact Analysis submittal shall consist of 1) a fragment of the portion of the schedule affected by the delay event, 2) a narrative explanation of the delay issue and how it impacted the schedule, and 3) a compact disc containing the schedule file used to perform the Time Impact Analysis.
- D. When a delay to the project as a whole can be avoided by revising preferential sequencing or logic, and the CONTRACTOR chooses not to implement the revisions, the CONTRACTOR will be entitled to a time extension and no compensation for extended overhead.
- E. Indicate clearly that the CONTRACTOR has used, in full, all project float available for the work involved in the request, including any float that may exist between the CONTRACTOR's planned completion date and the Contract completion date. Utilize the latest version of the Schedule Update accepted at the time of the alleged delay, and all other relevant information, to determine the adjustment of the contract time.
- F. Float shall be for the mutual benefit of the OWNER and the CONTRACTOR. Adjustment of the Contract Times will be granted only when the Contract Float has been fully utilized and only when the revised date of completion of the Work has been pushed beyond the contract completion date. Adjustment of the Contract Times will be made only for the number of days that the planned completion of the work has been extended.
 - 1. Float time is a Project resource available to both parties to meet contract Milestones and Contract Times.
 - 2. Use of float suppression techniques, such as preferential sequencing or logic, special lead/lag logic restraints, and extended activity times are prohibited. Use of float time disclosed or implied by use of alternate float-suppression techniques shall be shared to proportionate benefit of Owner and Contractor.
 - 3. Pursuant to above float-sharing requirement, no time extensions will be granted nor delay damages paid until a delay occurs, which:
 - 4. Impacts Project's critical path,
 - 5. Consumes all available float or contingency time, and
 - 6. Extends Work beyond contract completion date.
- G. Actual delays in activities which do not affect the critical path work or which do not move the CONTRACTOR's planned completion date beyond the Contract completion date will not be the basis for an adjustment to the contract time.

- H. The CONTRACTOR shall not be entitled to job-site or home office overhead beyond the CONTRACTOR's originally planned occupancy of the site if completion of the project occurs within the specified contract time.
- I. Notify ENGINEER of a request for contract time adjustment. Submit request in accordance with GC.11, Article 11, "Amending the Contract Documents, Changes With Work" of the General Conditions. In cases where the CONTRACTOR does not submit a request for contract time adjustment for a specific change order, delay, or CONTRACTOR request within the specified period of time, then it is mutually agreed that the particular change order, delay, or CONTRACTOR request has no time impact on the Contract completion date and no time extension is required.
- J. The ENGINEER will, within 30 calendar days after receipt of a contract time adjustment, request any supporting evidence, review the facts and advise the CONTRACTOR in writing.
- K. The new Progress Schedule data, if accepted by the OWNER, shall be included in the next monthly Schedule Update.
- L. When the OWNER has not yet made a final determination as to the adjustment of the contract time, and the parties are unable to agree as to the amount of the adjustment to be reflected in the Progress Schedule, reflect that amount of time adjustment in the Progress Schedule as the ENGINEER may accept as appropriate for such interim purpose. It is understood and agreed that any such interim acceptance by the ENGINEER shall not be binding and shall be made only for the purpose of continuing to schedule the Work, until such time as a final determination as to any adjustment of the contract time acceptable to the ENGINEER has been made. Revise the Progress Schedule prepared thereafter in accordance with the final decision.
- M. Claims Based on Contract Times:
 1. Where Engineer has not yet rendered formal decision on Contractor's Claim for adjustment of Contract Times, and parties are unable to agree as to amount of adjustment to be reflected in Progress Schedule, Contractor shall reflect an interim adjustment in the Progress Schedule as acceptable to Engineer.
 2. It is understood and agreed that such interim acceptance will not be binding on either Contractor or Owner, and will be made only for the purpose of continuing to schedule Work until such time as formal decision has been rendered as to an adjustment, if any, of the Contract Times.
 3. Contractor shall revise Progress Schedule prepared thereafter in accordance with Engineer's formal decision.

1.24 FINAL SCHEDULE SUBMITTAL

- A. As a condition precedent to the release of retainage, the final Schedule Update shall be identified by the CONTRACTOR as the As-Built Schedule.
- B. The As-Built Schedule shall reflect the exact manner in which the project was constructed by reflecting actual start and completion dates for all activities accomplished on the project.
- C. The As-Built Schedule shall be signed and certified by the CONTRACTOR's Project Manager and scheduler as being an accurate record of the way in which the project was actually constructed.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 32 90 – SAFETY PLAN

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Development and maintenance of a Construction Safety Plan.

1.2 REFERENCES

- A. OSHA.

1.3 CONSTRUCTION SAFETY PLAN

- A. Detail the Methods and Procedures to comply with Federal, and Local Health and Safety Laws, Rules and Requirements for the duration of the Contract Times. Include the following:
 1. Identification of the Certified or Licensed Safety Consultant, who will prepare, initiate, maintain and supervise safety programs, and procedures.
 2. Procedures for providing workers with an awareness of safety and health hazards expected to be encountered in the course of construction.
 3. Safety equipment appropriate to the safety and health hazards expected to be encountered during construction. Include warning devices, barricades, safety equipment in public right-of-way and protected areas, and safety equipment used in multi-level structures.
 4. Methods for minimizing employees' exposure to safety and health hazards expected during construction.
 5. Procedures for reporting safety or health hazards.
 6. Procedures to follow to correct a recognized safety and health hazard.
 7. Procedures for investigation of accidents, injuries, illnesses and unusual events that have occurred at the construction site.
 8. Periodic and scheduled inspections of general work areas and specific work stations.
 9. Training for employees and workers at the jobsite.
 10. Methods of communication of safe working conditions, work practices and required personal protection equipment.
- B. Assume responsibility for every aspect of Health and Safety on the jobsite, including the health and safety of subcontractors, suppliers, and other persons on the jobsite:
 1. Forward available information and reports to the Safety Consultant who shall make the necessary recommendations concerning worker health and safety at the jobsite.
 2. Employ additional health and safety measures specified by the Safety Consultant, as necessary, for workers in accordance with OSHA guidelines.
- C. Transmit to OWNER and ENGINEER copies of reports and other documents related to accidents or injuries encountered during construction.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 33 00 – SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes description and requirements of:
 - 1. Submittals Related to Project Submittals as related to:
 - a. Action Submittals
 - b. Informational Submittals
- B. Related sections:
 - 1. 01 29 00 – Payment Procedures.
 - 2. 01 31 00 – Project Management and Coordination.
 - 3. 01 32 00 – Construction Progress Documentation.
 - 4. 01 77 00 – Closeout Procedures.
 - 5. 01 78 23 – Operation and Maintenance Data.
 - 6. 01 79 00 – Demonstration and Training.

1.2 DEFINITIONS

- A. Action Submittal: Written and graphic information submitted by Contractor that requires Engineer's approval.
- B. Informational Submittal: Information submitted by Contractor that does not require Engineer's approval.

1.3 PROCEDURES

- A. Direct Submittals to Engineer.
- B. Contractor will submit all submittals electronically using the **Info Exchange** project website to facilitate the transfer of submittals and related files.
- C. Transmittal of Submittal:
 - 1. Contractor shall:
 - a. Review each submittal and check for compliance with Contract Documents.
 - b. Stamp each submittal with uniform approval stamp before submitting to Engineer.
 - 1). Stamp to include Project name, submittal number, Specification number, Contractor's reviewer name, date of Contractor's approval and statement certifying that submittal has been reviewed, checked, and approved for compliance with Contract Documents.
 - 2). Engineer will not review submittals that do not bear Contractor's approval stamp and will return them without action.
 - 2. Complete, sign, and transmit with each submittal package, one Transmittal of Contractor's Submittal form. A blank Transmittal of Contractor's Submittal form may be provided by Engineer.
 - 3. Identify Each Submittal with the Following:
 - a. Numbering and Tracking System:
 - 1) Submittal No. 8300-001, etc.
 - b. Sequentially number each submittal.
 - c. Resubmission of submittal shall have original number with sequential alphabetic suffix (ie: Resubmittal No. 8300-001-A).

- 1). Specification section and paragraph to which submittal applies.
 - 2). Project title and Engineer's project number.
 - 3). Date of transmittal.
 - 4). Names of Contractor, subcontractor or Supplier and Manufacturer as appropriate.
4. Identify and describe each deviation or variation from Contract Documents.
- D. Format:
1. Do not base Shop Drawings on reproductions of Contract Documents.
 2. Package submittal information by individual Specification section. Do not combine different Specification sections together in submittal package, unless otherwise directed in Specification.
 3. Present in a clear and thorough manner and in sufficient detail to show kind, size, arrangement, and function of components, materials, and devices, and compliance with Contract Documents.
 4. Index with labeled tab dividers in orderly manner.
- E. Timeliness: Schedule and submit in accordance Schedule of Submittals, and requirements of individual Specification sections.
- F. Processing Time:
1. Time for review shall commence on Engineer's receipt of submittal.
 2. Engineer will act upon Contractor's submittal and transmit response to Contractor not later than 30 days after receipt, unless otherwise specified.
 3. Re-submittals will be subject to same review time.
 4. No adjustment of Contract Times or Price will be allowed due to delays in progress of Work caused by rejection and subsequent re-submittals.
- G. Re-submittals: Clearly identify each correction or change made.
- H. Incomplete Submittals:
1. Engineer will return entire submittal for Contractor's revision if preliminary review deems it incomplete.
 2. When any of the following are missing, submittal will be deemed incomplete:
 - a. Contractor's review stamp completed and signed.
 - b. Transmittal of Contractor's Submittal completed and signed.
 3. Submittals not required by Contract Documents:
 4. Will not be reviewed and will be returned stamped "Not Subject to Review."
 5. Engineer will keep one copy and return all remaining copies to Contractor.
- I. Coordination with Project:
1. It is the CONTRACTOR'S responsibility to coordinate all equipment furnished with project elevations and dimensions. Approval of the submittal does not relieve the CONTRACTOR of the responsibility.
 2. CONTRACTOR shall be responsible for coordinating all project aspects and project changes with all submittals.
- 1.4 ACTION SUBMITTALS
- A. Prepare and submit Action Submittals required by individual Specification sections.
- B. Contractor will submit all submittals electronically using the **Info Exchange** project website (or other OWNER approved system) to facilitate the transfer of submittals and related files.
- C. Shop Drawings:

1. Identify and Indicate:
 - a. Applicable Contract Drawing and Detail number, products, units and assemblies, and system or equipment identification or tag numbers.
 - b. Equipment and Component Title: Identical to title shown on Drawings.
 - c. Critical field dimensions and relationships to other critical features of Work. Note dimensions established by field measurement.
 - d. Project-specific information drawn accurately to scale.
 2. Manufacturer's standard schematic drawings and diagrams as follows:
 - a. Modify to delete information that is not applicable to the Work.
 - b. Supplement standard information to provide information specifically applicable to the Work.
 3. Product Data: Provide as specified in individual Specifications.
 4. Foreign Manufacturers: When proposed, include following additional information:
 - a. Names and addresses of at least two companies that maintain technical service representatives close to Project.
 - b. Complete list of spare parts and accessories for each piece of equipment.
- D. Samples:
1. Copies: One, unless otherwise specified in individual Specifications.
 2. Preparation: Mount, display, or package Samples in manner specified to facilitate review of quality. Attach label on unexposed side that includes the following:
 - a. Manufacturer name.
 - b. Model number.
 - c. Material.
 - d. Sample source.
 3. Manufacturer's Color Chart: Units or sections of units showing full range of colors, textures, and patterns available.
 4. Full-size Samples:
 - a. Size as indicated in individual Specification section.
 - b. Prepared from same materials to be used for the Work.
 - c. Cured and finished in manner specified.
 - d. Physically identical with product proposed for use.
- E. Action Submittal Dispositions: Engineer will review, mark, and stamp as appropriate, and distribute marked-up copies as noted:
1. Furnish as Submitted:
 - a. Contractor may incorporate product(s) or implement Work covered by submittal.
 - b. Distribution
 - 1). One electronic copy furnished to Resident Project Representative.
 - 2). One electronic copy retained in Engineer's file.
 - 3). One electronic copy returned to Contractor appropriately annotated.
 2. Furnish as Corrected or Noted:
 - a. Contractor may incorporate product(s) or implement Work covered by submittal, in accordance with Engineer's notations.
 - b. Distribution:
 - 4). One electronic copy furnished to Resident Project Representative.
 - 5). One electronic copy retained in Engineer's file.
 - 6). One electronic copy to Contractor appropriately annotated.
 3. Revise and Resubmit:
 - a. Make corrections or obtain missing portions, and resubmit.
 - b. Except for portions indicated, Contractor may begin to incorporate product(s) or implement Work covered by submittal, in accordance with Engineer's notations.
 - c. Distribution:
 - 7). One electronic copy furnished to Resident Project Representative.
 - 8). One electronic copy retained in Engineer's file.
 - 9). One electronic copy to Contractor appropriately annotated.

4. Rejected:
 - a. Contractor may not incorporate product(s) or implement Work covered by submittal.
 - b. Distribution:
 - 10). One electronic copy furnished to Resident Project Representative.
 - 11). One electronic copy retained in Engineer's file.
 - 12). One electronic copy returned to Contractor appropriately annotated.

1.5 INFORMATIONAL SUBMITTALS

- A. General:
 1. Contractor will submit all submittals electronically using the **Info Exchange** project website to facilitate the transfer of submittals and related files.
 2. Refer to individual Specification sections for specific submittal requirements.
 3. Engineer will review each submittal. If submittal meets conditions of the Contract, Engineer will forward electronic copies to appropriate parties. If Engineer determines submittal does not meet conditions of the Contract and is therefore considered unacceptable, Engineer will retain one electronic copy and return one electronic copy with review comments to Contractor, and require that submittal be corrected and resubmitted.
 4. Application for Payment: In accordance with Section 01 29 00, PAYMENT PROCEDURES.
 5. Certificates:
 - a. General:
 - 1). Provide notarized statement that includes signature of entity responsible for preparing certification.
 - 2). Signed by officer or other individual authorized to sign documents on behalf of that entity.
 6. Welding: In accordance with individual Specification sections.
 7. Installer: Prepare written statements on Manufacturer's letterhead certifying that installer complies with requirements as specified in individual Specification sections.
 8. Material Test: Prepared by qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements.
 9. Certificates of Successful Testing or Inspection: Submit when testing or inspection is required by Laws and Regulations or governing agency or specified in individual Specification sections.
 10. Manufacturer's Certificate of Compliance: In accordance with Section 01 79 00, DEMONSTRATION AND TRAINING.
 11. Manufacturer's Certificate of Proper Installation: In accordance with Section 01 79 00, DEMONSTRATION AND TRAINING.
- B. Construction Photographs and Video: In accordance with Section 01 31 00, PROJECT MANAGEMENT AND COORDINATION, and as may otherwise be required in Contract Documents.
- C. Contract Closeout Submittals: In accordance with Section 01 77 00, CLOSEOUT PROCEDURES.
- D. Contractor-Design Data:
 1. Written and graphic information.
 2. List of assumptions.
 3. List of performance and design criteria.
 4. Summary of loads or load diagram, if applicable.
 5. Calculations.
 6. List of applicable codes and regulations.
 7. Name and version of software.

8. Information requested in individual Specification section.
- E. Manufacturer's Instructions: Written or published information that documents Manufacturer's recommendations, guidelines, and procedures in accordance with individual Specification sections.
 - F. Operation and Maintenance Data: As required in Section 01 78 23, OPERATION AND MAINTENANCE DATA.
 - G. Schedules:
 1. Schedule of Submittals: Prepare separately or in combination with Progress Schedule as specified in Section 01 32 00, CONSTRUCTION PROGRESS DOCUMENTATION.
 - a. Show for Each, at a Minimum, the Following:
 - 1). Specification section number.
 - 2). Identification by numbering and tracking system as specified under Paragraph "Transmittal of Submittal".
 - 3). Estimated date of submission to Engineer, including reviewing and processing time.
 - b. On a monthly basis, submit updated schedule to Engineer if changes have occurred or re-submittals are required.
 2. Schedule of Values: In accordance with Section 01 29 00, PAYMENT PROCEDURES.
 3. Schedule of Estimated Progress Payments: In accordance with Section 01 32 00, CONSTRUCTION PROGRESS DOCUMENTATION.
 4. Progress Schedules: In accordance with Section 01 32 00, CONSTRUCTION PROGRESS DOCUMENTATION.
 - H. Special Guarantee: Supplier's written guarantee as required in individual Specification sections.
 - I. Statement of Qualification: Evidence of qualification, certification, or registration as required in Contract Documents to verify qualifications of professional land surveyor, engineer, materials testing laboratory, specialty Subcontractor, trade, Specialist, consultant, installer, and other professionals.
 - J. Submittals Required by Laws, Regulations, and Governing Agencies:
 1. Submit promptly notifications, reports, certifications, payrolls, and otherwise as may be required, directly to the applicable Federal, State, or local governing agency or their representative.
 2. Transmit to Engineer for Owner's records one electronic copy of correspondence and transmittals (to include enclosures and attachments) between Contractor and governing agency.
 - K. Test and Inspection Reports:
 1. General: Shall contain signature of person responsible for test or report.
 2. Factory:
 - a. Identification of product and Specification section, type of inspection or test with referenced standard or code.
 - b. Date of test, Project title and number, and name and signature of authorized person.
 - c. Test results.
 - d. If test or inspection deems material or equipment not in compliance with Contract Documents, identify corrective action necessary to bring into compliance.
 - e. Provide interpretation of test results, when requested by Engineer.
 - f. Other items as identified in individual Specification sections.
 3. Field: As a minimum, include the following:
 - a. Project title and number.
 - b. Date and time.

- c. Record of temperature and weather conditions.
 - d. Identification of product and Specification section.
 - e. Type and location of test, Sample, or inspection, including referenced standard or code.
 - f. Date issued, testing laboratory name, address, and telephone number, and name and signature of laboratory inspector.
 - g. If test or inspection deems material or equipment not in compliance with Contract Documents, identify corrective action necessary to bring into compliance.
 - h. Provide interpretation of test results, when requested by Engineer.
 - i. Other items as identified in individual Specification sections.
- 4. Testing and Startup Data: In accordance with Section 01 79 00, DEMONSTRATION AND TRAINING.
 - 5. Training Data: In accordance with Section 01 79 00, DEMONSTRATION AND TRAINING.

1.6 FINAL SUBMITTALS

- A. Submit final copy of all submitted information to OWNER as component of Final Close Out. Prepare final data in electronic media format.
- B. Organizational Format:
 - 1. Identify electronic files with title "FINAL PROJECT SUBMITTALS" and list each submittal with the following information on each file's cover sheet:
 - a. Project title.
 - b. Designate applicable system, equipment, material, or finish.
 - c. Identity of separate structure as applicable.
 - d. Identity of general subject matter covered in manual.
 - e. Identity of equipment number and Specification section.
 - 2. Provide Title Page file with the following:
 - a. Contractor name, address, and telephone number.
 - b. Subcontractor, Supplier, installer, or maintenance contractor's name, address, and telephone number, as appropriate.
 - 1) Identify area of responsibility of each.
 - 2) Provide name and telephone number of local source of supply for parts and replacement.
 - 3. Provide electronic searchable Table of Contents for all files:
 - a. Arranged in systematic order with consecutive page numbers.
 - b. Identify each product by product name and other identifying numbers or symbols as set forth in Contract Documents.
 - 4. Text: Manufacturer's printed data, or neatly identified
 - 5. Material shall be suitable for reproduction, with quality equal to original.
 - 6. All drawings and oversized figures shall be presented electronically in 11x 17 format.
- C. Electronic Media Format:
 - 1. Portable Document Format (PDF):
 - a. After all preliminary data has been found to be acceptable to Engineer, submit Operation and Maintenance data in PDF format on CD.
 - b. Files to be exact duplicates of Engineer-accepted preliminary data. Arrange by specification number and name.
 - c. Files to be fully functional, fully viewable and fully searchable in most recent version of Adobe Acrobat.
 - 2.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 34 00 – PHOTOGRAPHIC AND VIDEOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes Requirements for:
 - 1. Pre-construction photographs.
 - 2. Pre-construction videos.
 - 3. Post-construction photographs.
 - 4. Post-construction videos.
- B. The purpose of the photographs and videos is to document the condition of the facilities prior to the CONTRACTOR beginning work at the Project site and after Substantial Completion of the Work.
- C. Areas to be photographed and videoed shall include the site of the Work and all existing facilities either on or adjoining the Project site, including the interior of existing structures, that could be damaged as a result of the CONTRACTOR's Work.
- D. The scope of the photographic and videographic documentation shall be the sole responsibility of the CONTRACTOR, but shall be acceptable to the ENGINEER.
- E. Related sections:
 - 1. Section 01 31 00 – Project Management and Coordination
 - 2. Section 01 31 19 – Project Meetings.
 - 3. Section 01 33 00 – Submittal Procedures.
 - 4. Section 01 77 00 – Closeout Procedures.

1.2 SUBMITTALS

- A. Key Plan: Submit key plan of Project site with notation of vantage points marked for location and direction of each photograph. Include the same label information as the corresponding set of photographs.
- B. Photographs:
 - 1. Paper Media:
 - a. Submit 4 prints of each photographic view within 7 days of taking photographs.
 - b. Format:
 - 1) Four-by-six inch photos.
 - 2) Photographs shall be enclosed in clear plastic sleeves that are punched for standard three-ring binders.
 - c. Identification: On back or below each print, provide the following information:
 - 1) Name of project.
 - 2) Date photograph was taken.
 - 3) Description of vantage point, indicating location and direction by compass point.
 - 2. Digital Media:
 - a. Provide photos as individual, indexed JPG files with the following characteristics:
 - 1) Compression shall be set to preserve quality over file size.
 - 2) Highest resolution JPG images shall be submitted. Resizing to a smaller size when high resolution JPGs are available shall not be permitted.
 - 3) JPG image resolution shall be 4000 by 3000 or higher.
 - 4) Images shall have rectangular clean images. Artistic borders, beveling, drop shadows, etc. are not permitted.

- C. Videos:
 - 1. Submit 4 copies of each video within 7 days of recording.
 - 2. Videos shall be submitted in a digital color video format on a DVD suitable for playback on a standard DVD player.
 - 3. Identification: On each copy provide a label with the following information:
 - a. Name of project.
 - b. Date video was recorded.
- D. Pre-Construction Photographs and Videos: Submit prior to beginning work at the Project site or prior to the Preconstruction Conference specified in Section 01 31 19, whichever occurs earlier. Reference Section 01 31 00 for additional requirements.
- E. Post-Construction Photographs and Videos: Submit with project closeout documents as specified in Section 01 77 00. Reference Section 01 31 00 for additional requirements.

PART 2 - PRODUCTS

2.1 MEDIA

- A. Paper Media:
 - 1. Commercial grade, glossy surface, acid-free photographic paper.
- B. Digital Media:
 - 1. One hundred and twenty millimeters, 700-MB, 80-minute CD compatible with latest version of Microsoft Windows.
- C. Videos:
 - 1. One hundred and twenty millimeters, DVD compatible with standard DVD players.

PART 3 - EXECUTION

3.1 GENERAL

- A. Photographs (Paper and Digital Media):
 - 1. Date Stamp: Unless otherwise indicated, date and time stamp each photograph as it is being taken so stamp is integral to photograph.
- B. Videos:
 - 1. Display continuous running time.
 - 2. At start of each video recording, record weather conditions from local newspaper or television and the actual temperature reading at Project Site.

END OF SECTION

SECTION 01 35 00 – SPECIAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Special procedures for locating and verifying concealed existing facilities.

1.2 CONCEALED EXISTING FACILITIES

- A. Verify locations of utilities and facilities which may exist by consulting with the OWNER, utility companies, and Texas811 System, Inc. or other service available in area of Project (see dig/call information on the Drawings):
 - 1. Abide by easement and right-of-way restrictions.
- B. Notify the OWNER, owners of facilities when the Work will be in progress. Make arrangements for potential emergency repairs in accordance with requirements of owners of utility facilities, including individual or residential facilities.
- C. Assume responsibility for repair of facilities damaged by performance of the Work.
- D. Expose sanitary and storm sewers, water, gas, electric, telephone utility lines, and other underground facilities indicated to permit survey location prior to commencement of Work in affected area:
 - 1. Expose in ample time to permit relocation of interfering utilities with minimum delaying effect on contract time.
- E. Work required for raising, lowering, or relocating utilities not indicated will be performed by affected utility owners or as part of the Work at option of affected owners of utilities:
 - 1. When part of the Work, perform work in accordance with standards of affected utility owner, and adjustment to Contract Price and Contract Times will be made as stipulated in conditions of contract.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 35 20 – ALTERATION PROJECT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Requirements and procedures for performing alterations to existing facilities.
- B. Related sections:
 - 1. Section 01 14 00 – Work Restrictions.
 - 2. Section 01 50 00 – Temporary Facilities and Controls.
 - 3. Section 01 73 20 – Cutting and Patching.
 - 4. Section 01 73 80 – Selective Demolition.
 - 5. Section 01 77 00 – Closeout Procedures.

1.2 SUBMITTALS

- A. Alterations Schedule: Submit in accordance with requirements for Progress Schedules.

1.3 SEQUENCE AND SCHEDULES

- A. Perform Work in sequences and within times specified in Section 01 14 00.
- B. Submit separate detailed sub-schedule for alterations, coordinated with construction schedules. Indicate:
 - 1. Each stage of Work and dates of occupancy of areas.
 - 2. Date of Substantial Completion for each area of alterations as appropriate.
 - 3. Trades and Subcontractors employed in each stage.

1.4 WORK INVOLVED WITH EXISTING OPERATING FACILITIES

- A. Perform the Work while existing facility is in operation.
- B. Do not jeopardize operation or materially reduce efficiency of existing facility.
- C. Coordinate the WORK with OPERATION of the FACILITY:
 - 1. Do not begin alterations of designated portions of the Work until specific permission has been granted in writing by OWNER in each case.
 - 2. ENGINEER will coordinate the planned procedure with facility manager.
 - 3. Complete as quickly as possible and with as little delay as possible, connections to existing equipment and utilities, and other operations that interfere with the operation of existing facility.
- D. Operational functions of the facility that are required to be performed to facilitate the Work will be performed by facility personnel only.
- E. Plant Superintendent will cooperate in every way practicable to assist in expediting the Work.
- F. When necessary for the proper operation or maintenance of portions of the facility, reschedule Work operations so that the Work will not conflict with necessary operations or maintenance of the facility.

1.5 ALTERATIONS, CUTTING, AND PROTECTION

- A. Assign relocation, removal, cutting, and patching to trades qualified to perform in manner which causes least damage and provide means of returning surfaces to appearance of new construction.
- B. Provide weather protection, waterproofing, heat and humidity control as needed to prevent damage to remaining existing and new construction.
- C. Provide temporary enclosures as specified in Section 01 50 00 to separate construction areas from existing building and from areas occupied by OWNER, and to provide weather protection.

1.6 SALVAGE MATERIALS

- A. Salvage Materials: Equipment removed from existing facility.
- B. Materials Designated for Salvage:
 - 1. Valves
 - 2. Pumps
 - 3. Grating
 - 4. Manholes (uninstalled)
- C. Handling and Storage:
 - 1. Prevent damage to salvaged equipment during removal, handling, and transportation of salvaged materials.
 - 2. Prepare Salvaged Materials for Storage:
 - a. Valves
 - b. Pumps
 - c. Grating
 - d. Manholes (uninstalled)
 - 3. Store Salvaged Materials in locations determined by OWNER:
- D. Pay costs associated with salvaging materials, including handling, transporting, and storage.

1.7 PREPARATION

- A. Identify existing materials which shall be patched, extended, or matched.
- B. In addition to demolition specified in Section 01 73 80, and Construction specifically indicated on the Drawings, cut, move or remove items as necessary to provide access or to allow alteration and new construction to proceed, including:
 - 1. Repair or removal of hazardous or unsanitary conditions.
 - 2. Removal of abandoned items and items serving no useful purpose, such as abandoned piping, conduit and wiring.
 - 3. Removal of unsuitable or extraneous materials not marked for salvage, such as abandoned furnishings and equipment, and debris such as rotted wood, rusted metals, and deteriorated concrete.
 - 4. Cleaning of surfaces and removal of surface finishes needed to install new construction and finishes.
 - 5. Disposal of items removed and not salvaged.
- C. Cut and remove minimum amount of existing construction in manner which avoids damage to adjacent work.

- D. Cut finish surfaces such as masonry, tile, plaster, and metals by methods which terminate surfaces in straight line at natural points of division.
- E. Perform cutting and patching as specified in Section 01 73 20.

1.8 CLEANING

- A. Perform periodic and final cleaning as specified in Sections 01 50 00 and 01 77 00.
- B. Clean OWNER-occupied areas daily.
- C. Clean spillage, overspray and heavy collection of dust in OWNER-occupied areas immediately.
- D. At completion of each portion of Work, clean area and make surfaces ready for successive portions of Work.
- E. At completion of alterations in each area, provide final cleaning and return space to condition suitable for use by OWNER.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 41 00 – REGULATORY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes: Regulatory requirements:
 - 1. Building code.
 - 2. Electrical code.
 - 3. Energy code.
 - 4. Fire code.
 - 5. Mechanical code.
 - 6. Plumbing code.

1.2 REFERENCES

- A. International Code Council (ICC):
 - 1. International Building Code (IBC), 2012.
 - 2. International Energy Conservation Code (IECC), 2015.
 - 3. International Fire Code (IFC), 2012.
 - 4. International Mechanical Code (IMC), 2012.
 - 5. International Plumbing Code (IPC), 2012.
 - 6. Any amendments to the above codes made by the City of Denton
- B. National Fire Protection Association (NFPA):
 - 1. NFPA 70: National Electrical Code, 2011.
- C. National Electric Code Council:
 - 1. National Electric Code (NEC), NFPA 70, 2011

1.3 SYSTEM DESCRIPTION

- A. Design Requirements:
 - 1. Building code:
 - a. International Building Code.
 - 2. Electrical code:
 - a. NFPA 70: National Electric Code.
 - 3. Energy conservation code:
 - a. International Energy Conservation Code.
 - 4. Fire code:
 - a. International Fire Prevention Code.
 - 5. Mechanical codes:
 - a. International Mechanical Code.
 - 6. Plumbing code:
 - a. International Plumbing Code.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 42 00 - REFERENCES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes description and requirements of:
 - 1. References to Standards and Specifications of Technical Societies
 - 2. Abbreviations used to reference Technical Societies

1.2 REFERENCE TO STANDARDS AND SPECIFICATIONS OF TECHNICAL SOCIETIES

- A. Reference to standards and specifications of technical societies and reporting and resolving discrepancies associated therewith shall be as provided in the General Conditions, and as may otherwise be required herein and in the individual Specification sections.
- B. Work specified by reference to published standard or specification of government agency, technical association or trade association, professional society or institute, testing agency, or other organization shall meet requirements or surpass minimum standards of quality for materials and workmanship established by designated standard or specification.
- C. Where so specified, products or workmanship shall also meet or exceed additional prescriptive or performance requirements included within Contract Documents to establish a higher or more stringent standard of quality than required by referenced standard.
- D. Where two or more standards are specified to establish quality, product and workmanship shall meet or exceed requirements of most stringent.
- E. Where both a standard and a brand name are specified for a product in Contract Documents, proprietary product named shall meet or exceed requirements of specified reference standard.
- F. Copies of Standards and Specifications of Technical Societies:
 - 1. Copies of applicable referenced standards have not been bound in these Contract Documents.
 - 2. Where copies of standards are needed by Contractor, obtain a copy or copies directly from publication source and maintain in an orderly manner at the Site as Work Site records, available to Contractor's personnel, Subcontractors, Owner, and Engineer.

1.3 ABBREVIATIONS

- A. Abbreviations for trade organizations and government agencies: Following is a list of construction industry organizations and government agencies to which references may be made in the Contract Documents, with abbreviations used.
 - 1. AA Aluminum Association
 - 2. AABC Associated Air Balance Council
 - 3. AAMA American Architectural Manufacturers Association
 - 4. AASHTO American Association of State Highway and Transportation Officials
 - 5. ABMA American Bearing Manufacturers' Association
 - 6. ACI American Concrete Institute
 - 7. AEIC Association of Edison Illuminating Companies
 - 8. AGA American Gas Association
 - 9. AGMA American Gear Manufacturers' Association
 - 10. AI Asphalt Institute
 - 11. AISC American Institute of Steel Construction
 - 12. AISI American Iron and Steel Institute

13.	AITC	American Institute of Timber Construction
14.	ALS	American Lumber Standards
15.	AMCA	Air Movement and Control Association
16.	ANSI	American National Standards Institute
17.	APA	The Engineered Wood Association
18.	API	American Petroleum Institute
19.	APWA	American Public Works Association
20.	ARI	Air-Conditioning and Refrigeration Institute
21.	ASAE	American Society of Agricultural Engineers
22.	ASCE	American Society of Civil Engineers
23.	ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.
24.	ASME	American Society of Mechanical Engineers
25.	ASNT	American Society for Nondestructive Testing
26.	ASTM	ASTM International
27.	AWI	Architectural Woodwork Institute
28.	AWPA	American Wood Preservers' Association
29.	AWPI	American Wood Preservers' Institute
30.	AWS	American Welding Society
31.	AWWA	American Water Works Association
32.	BHMA	Builders Hardware Manufacturers' Association
33.	CBM	Certified Ballast Manufacturer
34.	CDA	Copper Development Association
35.	CGA	Compressed Gas Association
36.	CIS PI	Cast Iron Soil Pipe Institute
37.	CMAA	Crane Manufacturers' Association of America
38.	CRSI	Concrete Reinforcing Steel Institute
39.	CS	Commercial Standard
40.	CSA	Canadian Standards Association
41.	CSI	Construction Specifications Institute
42.	DIN	Deutsches Institute für Normung e.V.
43.	DIPRA	Ductile Iron Pipe Research Association
44.	EIA	Electronic Industries Alliance
45.	EJCDC	Engineers Joint Contract Documents' Committee
46.	ETL	Electrical Test Laboratories
47.	FAA	Federal Aviation Administration
48.	FCC	Federal Communications Commission
49.	FDA	Food and Drug Administration
50.	FEMA	Federal Emergency Management Agency
51.	FIPS	Federal Information Processing Standards
52.	PM	Factory Mutual
53.	Fed. Spec.	Federal Specifications (FAA Specifications)
54.	FS	Federal Specifications and Standards (Technical Specifications)
55.	GA	Gypsum Association
56.	GANA	Glass Association of North America
57.	ID	Hydraulic Institute
58.	HMI	Hoist Manufacturers' Institute
59.	IBC	International Building Code
60.	ICBO	International Conference of Building Officials
61.	ICC	International Code Council
62.	ICEA	Insulated Cable Engineers' Association
63.	IFC	International Fire Code
64.	IEEE	Institute of Electrical and Electronics Engineers, Inc.
65.	IESNA	Illuminating Engineering Society of North America
66.	IFI	Industrial Fasteners Institute
67.	IGMA	Insulating Glass Manufacturer's Alliance

68.	IMC	International Mechanical Code
69.	INDA	Association of the Non-woven Fabrics Industry
70.	IPC	International Plumbing Code
71.	ISA	Instrumentation, Systems, and Automation
72.	ISO	International Organization for Standardization
73.	ITL	Independent Testing Laboratory
74.	JIC	Joint Industry Conferences of Hydraulic Manufacturers
75.	MIA	Marble Institute of America
76.	Mil.	Military Specifications
77.	MMA	Monorail Manufacturers' Association
78.	NAAMM	National Association of Architectural Metal Manufacturers
79.	NACE	NACE International
80.	NEBB	National Environmental Balancing Bureau
81.	NEC	National Electrical Code
82.	NECA	National Electrical Contractors Association
83.	NEMA	National Electrical Manufacturers' Association
84.	NESC	National Electrical Safety Code
85.	NETA	International Electrical Testing Association
86.	NFPA	National Fire Protection Association
87.	NHLA	National Hardwood Lumber Association
88.	NICET	National Institute for Certification in Engineering Technologies
89.	NIST	National Institute of Standards and Technology
90.	NRCA	National Roofing Contractors Association
91.	NRTL	Nationally Recognized Testing Laboratories
92.	NSF	NSF International
93.	NSPE	National Society of Professional Engineers
94.	NTMA	National Terrazzo and Mosaic Association
95.	NWWDA	National Wood Window and Door Association
96.	OSHA	Occupational Safety and Health Act (both Federal and State)
97.	PCI	Pre-cast/Pre-stressed Concrete Institute
98.	PEI	Porcelain Enamel Institute
99.	PPI	Plastic Pipe Institute
100.	PS	Product Standards Section-U.S. Department of Commerce
101.	RMA	Rubber Manufacturers' Association
102.	RUS	Rural Utilities Service
103.	SAE	Society of Automotive Engineers
104.	SDI	Steel Deck Institute
105.	SDI	Steel Door Institute
106.	SJI	Steel Joist Institute
107.	SMACNA	Sheet Metal and Air Conditioning Contractors National Association
108.	SPI	Society of the Plastics Industry
109.	SSPC	The Society for Protective Coatings
110.	SWI	Steel Window Institute
111.	TEMA	Tubular Exchanger Manufacturers' Association
112.	TCA	Tile Council of North America
113.	TIA	Telecommunications Industry Association
114.	UBC	Uniform Building Code
115.	UFC	Uniform Fire Code
116.	UL	Underwriters Laboratories Inc.
117.	UMC	Uniform Mechanical Code
118.	USBR	U.S. Bureau of Reclamation
119.	WCLIB	West Coast Lumber Inspection Bureau
120.	WWPA	Western Wood Products Association

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 42 40 – ABBREVIATIONS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Abbreviations and meanings.

1.2 INTERPRETATIONS

- A. Interpret abbreviations by context in which abbreviations are used.

1.3 ABBREVIATIONS

A. Abbreviations Used to Identify Reference Standards:

1. AA Aluminum Association
2. AAMA Architectural Aluminum Manufacturers Association
3. AAN American Association of Nurserymen
4. AASHTO American Association of State Highway and Transportation Officials
5. ABC Associated Air Balance Council
6. ABPA Acoustical and Board Products Association
7. ACI American Concrete Institute
8. ACIL American Council of Independent Laboratories
9. ADC Air Diffusion Council
10. ABMA American Bearing Manufacturers' Association (formerly AFBMA, Anti-Friction Bearing Manufacturers' Association)
11. AGA American Gas Association
12. AGC Associated General Contractors
13. AGMA American Gear Manufacturers' Association
14. AI Asphalt Institute
15. AIA American Institute of Architects
16. AIMA Acoustical and Insulating Materials Association
17. AISC American Institute of Steel Construction
18. AISI American Iron and Steel Institute
19. AITC American Institute of Timber Construction
20. AMCA Air Moving and Conditioning Association
21. AMG Arizona Masonry Guild
22. ANSI American National Standards Institute
23. APA American Plywood Association
24. API American Petroleum Institute
25. ARI Air Conditioning and Refrigeration Institute
26. ASAHCA American Society of Architectural Hardware Consultants
27. ASHRAE American Society of Heating, Refrigeration and Air Conditioning Engineers
28. ASME American Society of Mechanical Engineers
29. ASTM ASTM International (Former name American Society for Testing and Materials. Still used in specifications.)
30. AWI Architectural Woodwork Institute
31. AWPA American Wood Preservers Association
32. AWPI American Wood Preservers Institute
33. AWS American Welding Society
34. AWSC American Welding Society Code
35. AWWA American Water Works Association
36. BHMA Builders Hardware Manufacturers Association
37. BIA Brick Institute of America
38. BSI Building Stone Institute

39.	CLFMI	Chain Link Fence Manufacturers Institute
40.	CPSC	U.S. Consumer Product Safety Commission
41.	CRA	California Redwood Association
42.	CRI	Carpet and Rug Institute
43.	CRSI	Concrete Reinforcing Steel Institute
44.	CS	Commercial Standards
45.	CSI	Construction Specifications Institute
46.	CTI	Ceramic Tile Institute
47.	DHI	Door and Hardware Institute
48.	EIFS	Exterior Insulation and Finish System
49.	EJCDC	Engineers Joint Contract Documents Committee
50.	FGMA	Flat Glass Marketing Association
51.	FIA	Factory Insurance Association
52.	FM	Factory Mutual
53.	FS	Federal Specifications
54.	FTI	Facing Tile Institute
55.	GA	Gypsum Association
56.	IAPMO	International Association of Plumbing and Mechanical Officials
57.	IBC	International Building Code
58.	ICBO	International Conference of Building Officials
59.	ICC	International Code Council
60.	IEEE	Institute of Electrical and Electronics Engineers
61.	MAG	Maricopa Association of Governments
62.	MIA	Marble Institute of America
63.	ML/SFA	Metal Lath/Steel Framing Association
64.	MS	Military Specifications
65.	NAAMM	National Association of Architectural Metal Manufacturers
66.	NAPA	National Asphalt Pavement Association
67.	NBHA	National Builders Hardware Association
68.	NCMA	National Concrete Masonry Association
69.	NEC	National Electrical Code
70.	NECA	National Electrical Contractors Association
71.	NETA	International Electrical Testing Association
72.	NEMA	National Electrical Manufacturers Association
73.	NFPA	National Fire Protection Association
74.	NFPA	National Forest Products Association
75.	NIST	National Institute of Standards and Technology
76.	NMWIA	National Mineral Wood Insulation Association
77.	NPCA	National Paint and Coatings Association
78.	NRCA	National Roofing Contractors Association
79.	NTMA	National Terrazzo and Mosaic Association
80.	NWMA	National Woodwork Manufacturer's Association
81.	PCA	Portland Cement Association
82.	PCI	Prestressed Concrete Institute
83.	PDCA	Paint and Decorating Contractors of America
84.	PDI	Plumbing and Drainage Institute
85.	PEI	Porcelain Enamel Institute
86.	PS	Product Standard
87.	RTI	Resilient Tile Institute
88.	SAE	Society of Automotive Engineers
89.	SCPA	Structural Clay Products Association
90.	SDI	Steel Door Institute
91.	SIGMA	Sealed Insulating Glass Manufacturers Association
92.	SJI	Steel Joist Institute
93.	SMACNA	Sheet Metal and Air Conditioning Contractors National Association
94.	SSPC	Society for Protective Coatings-Steel Structures Painting Council

95.	TCA	Tile Council of America
96.	UBC	Uniform Building Code (ICBO)
97.	UL	Underwriters Laboratories, Inc.
98.	UNS	Unified Numbering System
99.	USDA	United States Department of Agriculture
100.	VA	Vermiculite Association
101.	WCLA	West Coast Lumberman's Association
102.	WCLIB	West Coast Lumber Inspection Bureau
103.	WPA	Western Pine Association
104.	WPOA	Western Plumbing Officials Association
105.	WRC	Welding Research Council
106.	WSCPA	Western States Clay Products Association
107.	WWPA	Western Wood Products Association

B.	B.	Abbreviations Used in Specifications:
1.	a	year or years (metric unit)
2.	A	ampere or amperes
3.	am	ante meridian (before noon)
4.	ac	alternating current
5.	ac-ft	acre-foot or acre-feet
6.	atm	atmosphere
7.	AWG	American Wire Gauge
8.	bbl	barrel or barrels
9.	bd	board
10.	bhp	brake horsepower
11.	bil gal	billion gallons
12.	BOD	biochemical oxygen demand
13.	Btu	British thermal unit or units
14.	Btuh	British thermal units per hour
15.	bu	bushel or bushels
16.	C	degrees Celsius
17.	cal	calorie or calories
18.	cap	capita
19.	cd	candela or candelas
20.	cfm	cubic feet per minute
21.	Ci	curie or curies
22.	cm	centimeter or centimeters
23.	cmu	concrete masonry unit
24.	CO	carbon monoxide
25.	Co.	Company
26.	CO ₂	carbon dioxide
27.	COD	chemical oxygen demand
28.	Corp.	Corporation
29.	counts/min	counts per minute
30.	cu	cubic
31.	cu cm	cubic centimeter or centimeters
32.	cu ft	cubic foot or feet
33.	cu ft/day	cubic feet per day
34.	cu ft/hr	cubic feet per hour
35.	cu ft/min	cubic feet per minute
36.	cu ft/sec	cubic feet per second
37.	cu in	cubic inch or inches
38.	cu m	cubic meter or meters
39.	cu yd	cubic yard or yards
40.	d	day (metric units)
41.	day	day (English units)

42.	db	decibels
43.	DB	dry bulb (temperature)
44.	dc	direct current
45.	diam	diameter
46.	DO	dissolved oxygen
47.	DS	dissolved solids
48.	emf	electromotive force
49.	fpm	feet per minute
50.	F	degrees Fahrenheit
51.	ft	feet or foot
52.	fc	foot-candle or foot candles
53.	ft/day	feet per day
54.	ft/hr	feet per hour
55.	ft/min	feet per minute
56.	ft/sec	feet per second
57.	g	gram or grams
58.	G	gravitational force
59.	gal	gallon or gallons
60.	gal/day	gallons per day
61.	gal/min	gallons per minutes
62.	gal/sec	gallons per second
63.	gfd	gallons per square foot per day
64.	g/L	grams per liter
65.	gpd	gallons per day
66.	gpd/ac	gallons per day per acre
67.	gpd/cap	gallons per day per capita
68.	gpd/sq ft	gallons per day per square foot
69.	gph	gallons per hour
70.	gpm	gallons per minute
71.	gps	gallons per second
72.	h	hour or hours (metric units)
73.	ha	hectare or hectares
74.	hp	high point
75.	hp	horsepower
76.	hp-hr	horsepower-hour or horsepower-hours
77.	hr	hour or hours (English units)
78.	Hz	hertz
79.	ID	inside diameter
80.	ihp	indicated horsepower
81.	Inc.	Incorporated
82.	inch	inch
83.	inches	inches
84.	inches/sec	inches per second
85.	J	joule or joules
86.	JTU	Jackson turbidity unit or units
87.	k	kips
88.	K	kelvin
89.	K	thermal conductivity
90.	kcal	kilocalorie or kilocalories
91.	kcmil	thousand circular mils
92.	kg	kilogram or kilograms
93.	km	kilometer or kilometers
94.	kN	kilonewton or kilonewtons
95.	kPa	kilopascal or kilopascals
96.	ksi	kips per square inch
97.	kV	kilovolt or kilovolts

98.	kVA	kilovolt-ampere or kilovolt-amperes
99.	kW	kilowatt or kilowatts
100.	kWh	kilowatt hour
101.	L	liter or liters
102.	lb/1000 cu ft	pounds per thousand cubic foot
103.	lb/acre-ft	pounds per acre-foot
104.	lb/ac	pounds per acre
105.	lb/cu ft	pounds per cubic foot
106.	lb/day/cu ft	pounds per day per cubic foot
107.	lb/day/acre	pounds per day per acre
108.	lb/sq ft	pounds per square foot
109.	lin	linear, lineal
110.	lin ft	linear foot or feet
111.	lm	lumen or lumens
112.	log	logarithm (common)
113.	ln	logarithm (natural)
114.	lx	lux
115.	m	meter or meters
116.	M	molar (concentration)
117.	mA	milliampere or milliamperes
118.	max	maximum
119.	mCi	millicurie or millicuries
120.	meq	milliequivalent
121.	µF	microfarad or microfarads
122.	MFBM	thousand feet board measure
123.	mfr	manufacturer
124.	mg	milligram or milligrams
125.	mgd/ac	million gallons per day per acre
126.	mgd	million gallons per day
127.	mg/L	milligrams per liter
128.	µg/L	micrograms per liter
129.	µm	micrometer or micrometers
130.	mile	mile
131.	mil. gal	million gallons
132.	miles	miles
133.	min	minimum
134.	min	minute or minutes
135.	MLSS	mixed liquor suspended solids
136.	MLVSS	mixed liquor volatile suspended solids
137.	mm	millimeter or millimeters
138.	mol wt	molecular weight
139.	mol	mole
140.	Mpa	megapascal or megapascals
141.	mph	miles per hour
142.	MPN	most probable number
143.	mR	milliroentgen or milliroentgens
144.	Mrad	megarad or megarads
145.	mV	millivolt or millivolts
146.	MW	megawatt or megawatts
147.	N	newton or newtons
148.	N	normal (concentration)
149.	No.	number
150.	Nos	numbers
151.	NRC	noise reduction coefficient
152.	NTU or ntu	nephelometric turbidity unit
153.	oc	on center

154.	OD	outside diameter
155.	ORP	oxidation-reduction potential
156.	OT	ortho-tolidine
157.	OTA	ortho-tolidine-arsenite
158.	oz	ounce or ounces
159.	oz/sq ft	ounces per square foot
160.	Pa	pascal or pascals
161.	pl	plate or property line
162.	pm	post meridiem (afternoon)
163.	ppb	parts per billion
164.	ppm	parts per million
165.	ppt	parts per thousand
166.	pr	pair
167.	psf/hr	pounds per square foot per hour
168.	psf	pounds per square foot
169.	psi	pounds per square inch
170.	psia	pounds per square inch absolute
171.	psig	pounds per square inch gauge
172.	PVC	polyvinyl chloride
173.	qt	quart or quarts
174.	R	radius
175.	R	roentgen or roentgens
176.	rad	radiation absorbed dose
177.	RH	relative humidity
178.	rpm	revolutions per minute
179.	rps	revolutions per second
180.	S	second (metric units)
181.	S	Siemens (mho)
182.	SDI	sludge density index or silt density index
183.	sec	second (English units)
184.	SI	International System of Units
185.	sp	static pressure
186.	sp gr	specific gravity
187.	sp ht	specific heat
188.	sq	square
189.	cm ² or sq cm	square centimeter or centimeters
190.	sq ft	square feet or foot
191.	sq inch	square inch
192.	sq inches	square inches
193.	km ² or sq km	square kilometer or kilometers
194.	m ² or sq m	square meter or meters
195.	mm ² or sq mm	square millimeter or millimeters
196.	sq yd	square yard or yards
197.	SS	suspended solids
198.	STC	Sound Transmission Class
199.	SVI	sludge volume index
200.	TDS	total dissolved solids
201.	TKN	total Kjeldahl nitrogen
202.	TLM	median tolerance limit
203.	TOC	total organic carbon
204.	TOD	total oxygen demand
205.	TOW	top of weir
206.	TS	total solids
207.	TSS	total suspended solids
208.	TVS	total volatile solids

209.	U	U Factor/U Value
210.	U	Coefficient of Heat Transfer
211.	U	heat transfer coefficient
212.	UNS	Uniform Numbering System
213.	US	United States
214.	V	volt or volts
215.	VA	volt-ampere or volt-amperes
216.	W	watt or watts
217.	WB	wet bulb
218.	wg	water gauge
219.	wk	week or weeks
220.	wt	weight
221.	yd	yard or yards
222.	yr	year or years (English unit)

C. Abbreviations Used on Drawings: As listed on Drawings or in Specifications.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 45 00 – QUALITY CONTROL

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Quality control and control of installation.
 - 2. Tolerances.
 - 3. References.
 - 4. Mock-up requirements.
 - 5. Authority and duties of Owner's representative or inspector.
 - 6. Sampling and testing.
 - 7. Testing and inspection services.
 - 8. Contractor's responsibilities.

- B. Related sections:
 - 1. Section 01 45 24 - Special Tests and Inspections.

1.2 QUALITY CONTROL AND CONTROL OF INSTALLATION

- A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.
- B. Comply with manufacturers' instructions, including each step in sequence.
- C. When manufacturers' instructions conflict with Contract Documents, request clarification from Engineer before proceeding.
- D. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Perform Work by persons qualified to produce required and specified quality.
- F. Verify field measurements are as indicated on Shop Drawings or as instructed by manufacturer.
- G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, or disfigurement.
- H. When specified, products will be tested and inspected either at point of origin or at Work site:
 - 1. Notify Engineer in writing well in advance of when products will be ready for testing and inspection at point of origin.
 - 2. Do not construe that satisfactory tests and inspections at point of origin is final acceptance of products. Satisfactory tests or inspections at point of origin do not preclude retesting or re-inspection at Work site.
- I. Do not ship products which require testing and inspection at point of origin prior to testing and inspection.

1.3 TOLERANCES

- A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.

- B. Comply with manufacturers' tolerances. When Manufacturers' tolerances conflict with Contract Documents, request clarification from Engineer before proceeding.
- C. Adjust products to appropriate dimensions; position before securing products in place.

1.4 REFERENCES

- A. American Society for Testing and Materials (ASTM): E 329 - Standard for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction.
- B. For products or workmanship specified by association, trade, or other consensus standards, comply with requirements of standard, except when more rigid requirements are specified or are required by applicable codes.
- C. Conform to reference standard by date of issue current on date of Contract Documents, except where specific date is established by code.
- D. Obtain copies of standards where required by product specification sections.
- E. When specified reference standards conflict with Contract Documents, request clarification from Engineer before proceeding.

1.5 MOCK-UP REQUIREMENTS

- A. Tests will be performed under provisions identified in this Section and identified in respective product specification sections.
- B. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.
- C. Accepted mock-ups shall be comparison standard for remaining Work.
- D. Where mock-up has been accepted by Engineer and is specified in product specification sections to be removed; remove mock-up and clear area when directed to do so by Engineer.

1.6 AUTHORITY AND DUTIES OF OWNER'S REPRESENTATIVE OR INSPECTOR

- A. Owner's Project Representative employed or retained by Owner is authorized to inspect the Work.
- B. Inspections may extend to entire or part of the Work and to preparation, fabrication, and manufacture of products for the Work.
- C. Deficiencies or defects in the Work which have been observed will be called to Contractor's attention.
- D. Inspector will not:
 - 1. Alter or waive provisions of Contract Documents.
 - 2. Inspect Contractor's means, methods, techniques, sequences, or procedures for construction.
 - 3. Accept portions of the Work, issue instructions contrary to intent of Contract Documents, or act as foreman for Contractor.
 - 4. Supervise, control, or direct Contractor's safety precautions or programs; or inspect for safety conditions on Work site, or of persons thereon, whether Contractor's employees or others.

- E. Inspector will:
 - 1. Conduct on-site observations of the Work in progress to assist Engineer in determining when the Work is, in general, proceeding in accordance with Contract Documents.
 - 2. Report to Engineer whenever Inspector believes that Work is faulty, defective, does not conform to Contract Documents, or has been damaged; or whenever there is defective material or equipment; or whenever Inspector believes the Work should be uncovered for observation or requires special procedures.

1.7 SAMPLING AND TESTING

- A. General:
 - 1. Prior to delivery and incorporation in the Work, submit listing of sources of materials, when specified in sections where materials are specified.
 - 2. When specified in sections where products are specified:
 - a. Submit sufficient quantities of representative samples of character and quality required of materials to be used in the Work for testing or examination.
 - b. Test materials in accordance with standards of national technical organizations.
- B. Sampling:
 - 1. Furnish specimens of materials when requested.
 - 2. Do not use materials which are required to be tested until testing indicates satisfactory compliance with specified requirements.
 - 3. Specimens of materials will be taken for testing whenever necessary to determine quality of material.
 - 4. Assist Engineer in preparation of test specimens at site of work, such as soil samples and concrete test cylinders.
- C. Testing:
 - 1. Owner will employ and pay for services of independent testing laboratory to perform routine tests of materials to confirm compliance with requirements of Contract Documents:
 - a. Mill tests, soil compaction test, and other specified tests shall be paid for by Contractor.
 - 2. When protesting failed tests of material in place or to be used, take additional specimens and have specimens tested:
 - a. When original test proves to have been in error, file claim for reimbursement of direct costs for sampling and testing.
- D. Test standards:
 - 1. Perform sampling, specimen preparation, and testing of materials in accordance with specified standards, and when no standard is specified, in accordance with standard of nationally recognized technical organization.
 - 2. Physical characteristics of materials not particularly specified shall conform to standards published by ASTM, where applicable.
 - 3. Standards and publication references in Contract Documents shall be edition or revision in effect on date stipulated in the Contract Documents.

1.8 TESTING AND INSPECTION SERVICES

- A. Contractor will employ and pay for specified services of an independent firm; known as Contractor's independent testing firm, to perform Contractor quality control testing as required in the technical specifications for various work and materials.

- B. Owner will employ and pay for specified services of an “Owner’s independent testing firm” to perform testing and inspection as required in the technical specifications for various work and materials or stipulated in Section 01 45 24 to confirm Contractor’s compliance with Contract Documents. If Engineer or Owner’s independent testing firm is not properly certified to perform specialty inspections required by the building department, Owner will employ and pay for a quality specialty inspection firm to perform required testing and inspection.
- C. The Contractor’s independent testing firm will perform tests, inspections and other services specified in individual specification sections and as required by Owner and requested by the Engineer.
- D. The qualifications of laboratory that will perform the testing, contracted by the Owner or by the Contractor, shall be as follows:
 - 1. Has authorization to operate in the state where the project is located.
 - 2. Meets “Recommended Requirements for Independent Laboratory Qualification,” published by American Council of Independent Laboratories.
 - 3. Meets requirements of ASTM E 329.
 - 4. Laboratory Staff: Maintain full time specialist on staff to review services.
 - 5. Testing Equipment: Calibrated at reasonable intervals with devices of accuracy traceable to National Bureau of Standards (NBS) or accepted values of natural physical constants.
 - 6. Will submit copy of report of inspection of facilities made by Materials Reference Laboratory of NBS during most recent tour of inspection, with memorandum of remedies of deficiencies reported by inspection.
- E. Testing, inspections and source quality control may occur on or off project site. Perform off-site testing inspections and source quality control as required by Engineer or Owner.
- F. Reports will be submitted by Contractor’s independent testing firm and by Owner’s independent testing firm to Engineer, Contractor, and Owner in triplicate, indicating observations and results of tests and indicating compliance or non-compliance with Contract Documents. Each report shall include:
 - 1. Date issued.
 - 2. Project title and number.
 - 3. Testing laboratory name, address, and telephone number.
 - 4. Name and signature of laboratory inspector.
 - 5. Date and time of sampling or inspection.
 - 6. Record of temperature and weather conditions.
 - 7. Date of test.
 - 8. Identification of product and specification section.
 - 9. Location of sample or test in Project.
 - 10. Type of inspection or test.
 - 11. Results of tests and compliance with Contract Documents.
 - 12. Interpretation of test results, when requested by Engineer.
- G. Contractor shall cooperate with Owner’s independent testing firm, furnish samples of materials, design mix, equipment, tools, storage, safe access, and assistance by incidental labor as requested.
 - 1. Notify Engineer and Owner’s independent testing firm 48 hours prior to expected time for operations requiring testing.
 - 2. Make arrangements with Owner’s independent testing firm and pay for additional samples and tests required for Contractor’s use.
- H. Limitations of authority of testing Laboratory: Owner’s independent testing firm or Laboratory is not authorized to:
 - 1. Agency or laboratory may not release, revoke, alter, or enlarge on requirements of Contract Documents.

2. Agency or laboratory may not approve or accept any portion of the Work.
 3. Agency or laboratory may not assume duties of Contractor.
 4. Agency or laboratory has no authority to stop the Work.
- I. Testing and employment of an Owner's independent testing firm or laboratory shall not relieve Contractor of obligation to perform Work in accordance with requirements of Contract Documents.
 - J. Re-testing or re-inspection required because of non-conformance to specified requirements shall be performed by same Owner's independent testing firm on instructions by Engineer. Payment for re-testing or re-inspection will be charged to Contractor by deducting testing charges from Contract Sum/Price.
 - K. The Owner's independent testing firm responsibilities will include:
 1. Test samples of mixes submitted by Contractor.
 2. Provide qualified personnel at site. Cooperate with Engineer and Contractor in performance of services.
 3. Perform specified sampling and testing of products in accordance with specified standards.
 4. Ascertain compliance of materials and mixes with requirements of Contract Documents.
 5. Promptly notify Engineer and Contractor of observed irregularities or non-conformance of Work or products.
 6. Perform additional tests required by Engineer.
 7. Attend preconstruction meetings and progress meetings.
 - L. Owner's independent testing firm individual test reports: After each test, Owner's independent testing firm will promptly submit electronically and three hard copies of report to Engineer and to Contractor. When requested by Engineer, the Owner's independent testing firm will provide interpretation of test results. Include the following:
 1. Date issued.
 2. Project title and number.
 3. Name of inspector.
 4. Date and time of sampling or inspection.
 5. Identification of product and specifications section.
 6. Location in Project.
 7. Type of inspection or test.
 8. Date of test.
 9. Certified test results stamped and signed by a registered Engineer in the State of Texas.
 10. Summary of conformance with Contract Documents.
 - M. Owner's independent testing firm will provide monthly report of certification to identify all work performed for special inspections and other contract requirements on this project. The following certified monthly report at a minimum will include but not limited to:
 1. Results of testing.
 2. Testing logs.
 3. Outstanding deficiencies.
 4. Various statistical data.
 5. Testing curves (up to 4 types) as required by the Engineer.
- 1.9 CONTRACTOR'S RESPONSIBILITIES
- A. Cooperate with Owner's independent testing firm or laboratory personnel and provide access to construction and manufacturing operations.
 - B. Secure and deliver to Owner's independent testing firm or laboratory adequate quantities of representative samples of materials proposed to be used and which require testing.

- C. Provide to Owner's independent testing firm or laboratory and Engineer preliminary mix design proposed to be used for concrete, and other materials mixes which require control by testing laboratory.
- D. Furnish electronically and 5 hard copies of product test reports.
- E. Furnish incidental labor and facilities:
 - 1. To provide access to construction to be tested.
 - 2. To obtain and handle samples at Work site or at source of product to be tested.
 - 3. To facilitate inspections and tests.
 - 4. For storage and curing of test samples.
- F. Notify Owner's independent testing firm or laboratory 48 hours in advance of when observations, inspections and testing is needed for laboratory to schedule and perform in accordance with their notice of response time.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 45 24 – SPECIAL TESTS AND INSPECTIONS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes: This Section describes the requirements for providing special tests and inspections.
- B. Related sections:
 - 1. Section 01 45 00 - Quality Control.

1.2 REFERENCES

- A. ASTM International (ASTM):
 - 1. ASTM C140, Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.
 - 2. ASTM C270, Standard Specification for Mortar for Unit Masonry.
 - 3. ASTM C780, Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.
 - 4. ASTM C1019, Standard Test Method for Sampling and Testing Grout.
 - 5. ASTM C1314, Standard Test Method for Compressive Strength of Masonry Prisms.
- B. International Building Code (IBC).

1.3 DESCRIPTION

- A. This Section describes special tests and inspections of structural assemblies and components to be performed in compliance with IBC.
- B. These special tests and inspections are in addition to the requirements specified in Section 01 45 00, and by the individual Sections.
- C. The OWNER will employ one or more inspectors who will provide special inspections during construction.

1.4 INSPECTION

- A. Duties of Special Inspector:
 - 1. General: Required duties of the Special Inspector are described in IBC.

1.5 TESTS

- A. Selection of the material required to be tested shall be by the OWNER's Testing Laboratory and not the CONTRACTOR.

1.6 SPECIAL TESTING AND INSPECTIONS

- A. Testing laboratory: Special tests will be performed by the OWNER's testing laboratory as specified in Section 01 45 00.
- B. OWNER reserves the right to positive material identification tests.
 - 1. Contractor must make materials available for testing.

- C. The following types of work require special inspection as described in IBC. Refer to the following verification, testing and inspection schedules.
 - 1. Appendix A, Cast-In-Place Concrete Special Inspection Schedule.
 - 2. Appendix B, Essential Architectural, Mechanical and Electrical Inspection Schedule.
 - 3. Appendix C, Essential Masonry Special Inspection Schedule.
 - 4. Appendix D, Soils Verification And Inspection Schedule.
 - 5. Appendix E, Structural Steel Special Inspection Schedule.
 - 6. Appendix F. Other Special Inspection.

1.7 OTHER SPECIFIC TESTS

- A. Masonry shall be tested in accordance with IBC.
 - 1. Minimum strength of units shall be tested in accordance with ASTM C140.
 - 2. Minimum strength of grout shall be tested in accordance with ASTM C1019.
 - 3. Prior to construction, obtain samples of the aggregates, additives, and water; mix and test in laboratory in accordance with ASTM C270.
 - 4. During construction, sample and test masonry for consistency prior to use on each structure in accordance with ASTM C780.
 - 5. When approved by the building official, if installed masonry does not meet requirements, conduct prism tests in accordance with ASTM C1314.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 SCHEDULE

- A. The CONTRACTOR shall allow time necessary for Special Inspections as listed above.
- B. Sufficient notice shall be given so that the Special Inspections can be performed. This includes time for off-site Special Inspectors to plan the inspection and travel to site.

3.2 PROCEDURE

- A. The Special Inspector will immediately notify the ENGINEER of any corrections required and follow notification with appropriate documentation.
- B. The CONTRACTOR shall not proceed until the work is satisfactory to the ENGINEER.

END OF SECTION

**APPENDIX A
CAST-IN-PLACE CONCRETE SPECIAL INSPECTION SCHEDULE**

Verification and Inspection	Reference Standard	Frequency of Inspection	
		Continuous During Task Listed	Periodic During Task Listed
1. Inspection of reinforcing steel, including pre-stressing tendons, and placement.		–	X
2. Inspection of reinforcing steel welding.	IBC Table 1704.3, Item 5B	X	–
3. Inspect bolts to be installed in concrete prior to and during placement of concrete.		X	–
4. Verifying use of required design mix.		–	X
5. At the time fresh concrete is sampled to fabricate specimens for strength tests, perform slump and air content tests, and determine the temperature of the concrete.		X	–
6. Inspection of concrete and shotcrete placement for proper application techniques.		X	–
7. Inspection for maintenance of specified curing temperature and techniques.		–	X

**APPENDIX B
ESSENTIAL ARCHITECTURAL, MECHANICAL AND ELECTRICAL
INSPECTION SCHEDULE**

Verification and Inspection	Reference Standard	Frequency of Inspection	
		Continuous During Task Listed	Periodic During Task Listed
1. Suspended ceiling system including anchorage.		–	X
2. Anchorage of electrical equipment for emergency standby power.		–	X
3. Anchorage of other electrical or mechanical equipment on floors or roofs.		–	X
4. Anchorage of ducts.		–	X
5. Anchorage of pipes.		–	X
6. Steel storage racks supporting pipelines.		–	X
7. Elevator installation.		–	X

**APPENDIX C
ESSENTIAL MASONRY SPECIAL INSPECTION SCHEDULE**

Verification and Inspection	Reference Standard	Frequency of Inspection	
		Continuous During Task Listed	Periodic During Task Listed
1. From the beginning of masonry construction, the following shall be verified for compliance:			
a. Proportions of site-prepared mortar and grout.		–	X
b. Placement of masonry units and construction of mortar joints.		–	X
c. Placement of reinforcement and connectors.		–	X
d. Grout space prior to grouting.		X	–
e. Placement of grout.		X	–
2. The inspection program shall verify:			
a. Size and location of structural elements.		–	X
b. Type, size and location of anchors, including other details of anchorage of masonry to structural members, frames or other construction.		X	–
c. Specified size, grade and type of reinforcement.			X
d. Welding of reinforcing couplers.		X	–
e. Protection of masonry during cold weather (temperature below 40° F) or hot weather (temperature above 90° F).		–	X
3. Preparation of any required grout specimens, mortar specimens and/or prisms shall be observed.		X	–
4. Compliance with required inspection provisions of the construction documents and the approved submittals shall be verified.		–	X

**APPENDIX D
SOILS VERIFICATION AND INSPECTION SCHEDULE**

Verification and Inspection	Reference Standard	Frequency of Inspection	
		Continuous During Task Listed	Periodic During Task Listed
1. Verify materials below footings are adequate to achieve the design bearing capacity.		–	X
2. Verify excavations are extended to proper depth and have reached proper material.		–	X
3. Perform classification and testing of controlled fill materials.		–	X
4. Verify use of proper materials, densities, and lift thicknesses during placement and compaction of controlled fill.		X	–
5. Prior to placement of controlled fill, observe subgrade and verify that site has been prepared properly.		–	X

**APPENDIX E
STRUCTURAL STEEL SPECIAL INSPECTION SCHEDULE**

Verification and Inspection	Reference Standard	Frequency of Inspection	
		Continuous During Task Listed	Periodic During Task Listed
1. Material verification of high-strength bolts, nuts and washers:			
a. Identification markings to conform to ASTM standards specified in the approved construction documents.		–	X
b. Manufacturer's certificate of compliance required.		–	X
2. Inspection of high-strength bolting:			
a. Bearing-type connections.		–	X
b. Slip-critical connections.		X	X
3. Material verification of structural steel:			
a. Identification markings to conform to ASTM standards specified in the approved construction documents.		–	X
b. Manufacturers' certified mill test reports.		X	–
4. Material verification of weld filler materials:			
a. Identification markings to conform to AWS specification in the approved construction documents.		–	X
b. Manufacturer's certificate of compliance required.		–	X
5. Inspection of welding:			
a. Structural steel:		–	–
1) Complete and partial penetration groove welds.		X	–
2) Multi-pass fillet welds.		X	–
3) Single-pass fillet welds > 5/16".		X	–
4) Single-pass fillet welds ≤ 5/16".		–	X
5) Floor and deck welds.		–	X
b. Reinforcing steel:		–	–
1) Verification of weldability of reinforcing steel other than ASTM A706.		–	X
2) Reinforcing steel-resisting flexural and axial forces in boundary elements of special reinforced concrete shear walls and shear reinforcement.		X	–
3) Shear reinforcement.		X	–
4) "Form Saver" (reinforcing couplers).		X	–
6. Inspection of steel frame joint details for compliance with approved construction documents:			X
a. Details such as bracing and stiffening.		X	–
b. Member locations.		X	–
c. Application of joint details at each connection.		X	–
7. Seismic force resisting systems identified on structural plans.		X	–

**APPENDIX F
OTHER SPECIAL INSPECTION SCHEDULE**

Verification and Inspection	Reference Standard	Frequency of Inspection	
		Continuous During Task Listed	Periodic During Task Listed
1. Shoring of Excavations.		–	X
2. Reinforced gypsum concrete.		–	X
3. Shotcrete.		–	X
4. Smoke control system.		–	X
5. Special grading, excavating, and filling.		–	X
6. Spray applied fire resistive material.		–	X
7. Special seismic resistance details.		–	X

SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Furnishing, maintaining, and removing construction facilities and temporary controls, including temporary utilities, construction aids, barriers and enclosures, security, access roads, temporary controls, project sign, field offices and sheds, and removal after construction.
- B. Related sections:
1. Section 01 14 00 – Work Restrictions.
 2. Section 01 32 00 – Construction Progress Documentation
 3. Section 01 33 00 – Submittal Procedures
 4. Section 01 34 00 – Photographic and Videographic Documentation

1.2 REFERENCES

- A. The following is a list of standards which may be referenced in this section:
1. American Association of Nurserymen: American Standards for Nursery Stock.
 2. Federal Emergency Management Agency.
 3. NFPA, National Fire Prevention Standard for Safeguarding Building Construction Operations.
 4. Telecommunications Industry Association (TIA); Electronic Industries Alliance (EIA): 568B, Commercial Building Telecommunications Cabling Standard.
 5. U.S. Department of Agriculture: Urban Hydrology for Small Watersheds.
 6. U.S. Weather Bureau: Rainfall-Frequency Atlas of the U.S. for Durations from 30 Minutes to 24 Hours and Return Periods from 1 to 100 Years.

1.3 SUBMITTALS

- A. Informational Submittals:
1. General: For products specified to be furnished under this Section, submit product data in accordance with Section 01 33 00.
 2. For Temporary Piping Systems:
 - a. Submit layout drawings showing proposed routing of piping, including proposed pipe support and pipe restraint locations.
 - b. Submit product data for piping, fittings, appurtenances, restraints, supports, and all other components of the temporary piping system.
 - c. Submit all information at least 28 days prior to when each temporary piping system is scheduled to be installed and allow 14 days for review and comment by ENGINEER and OWNER.
 3. For Temporary Pumping Systems:
 - a. Submit pump data, performance curves, and other operating information as specified in Section 01 33 00.
 - b. Submit sketches showing layout of temporary pumping system, including pump quantity, configuration in wet well, and proposed piping layout specified in Paragraph 1.02 B.
 - c. Submit piping headloss calculations based on proposed temporary piping system layout.
 - d. Submit all information at least 28 days prior to when the temporary pumping system is scheduled to be installed and allow 14 days for review and comment by ENGINEER and OWNER.

4. Copies of permits and approvals for construction as required by Laws and Regulations and governing agencies.
5. Temporary Utility Submittals:
 - a. Electric power supply and distribution plans.
 - b. Water supply and distribution plans.
 - c. Drainage plans.
 - d. Sanitary sewer.
6. Temporary Construction Submittals:
 - a. Access Roads: Routes, cross-sections, and drainage facilities.
 - b. Parking area plans.
 - c. Contractor's field office, storage yard, and storage building plans, including gravel surfaced area.
 - d. Fencing and protective barrier locations and details.
 - e. Engineer's field office plans.
 - f. Staging area location plan.
 - g. Traffic and Pedestrian Control and Routing Plans: As specified herein, and proposed revisions thereto.
7. Temporary Control Submittals:
 - a. Noise control plan.
 - b. Plan for disposal of waste materials and intended haul routes.

1.4 MOBILIZATION

- A. Mobilization shall Include, but Not be Limited to, these Principal Items:
 1. Obtaining required permits.
 2. Moving Contractor's field office and equipment required for first month operations onto Site.
 3. Installing temporary construction power, wiring, and lighting facilities.
 4. Providing onsite communication facilities, including telephones.
 5. Providing onsite sanitary facilities and potable water facilities as specified and as required by Laws and Regulations, and governing agencies.
 6. Arrange for and erection of Contractor's work and storage yard.
 7. Posting OSHA required notices and establishing safety programs and procedures.
 8. Have Contractor's superintendent at Site full time.
- B. Use area designated for Contractor's temporary facilities as shown on Drawings.

1.5 PROTECTION OF WORK AND PROPERTY

- A. Comply with Owner's safety rules while on Owner's property.
- B. Keep Owner informed of serious onsite accidents and related claims.
- C. Use of Explosives: No blasting or use of explosives will be allowed onsite.

1.6 VEHICULAR TRAFFIC

- A. Traffic Routing Plan: Show sequences of construction affecting use of roadways, time required for each phase of the Work, provisions for decking over excavations and phasing of operations to provide necessary access, and plans for signing, barricading, and striping to provide passages for pedestrians and vehicles.

1.7 TEMPORARY UTILITIES

- A. Temporary Electrical Power:
 1. Arrange with local utility to provide adequate temporary electrical service.

2. Provide and maintain adequate jobsite power distribution facilities conforming to applicable Laws and Regulations.
 3. Provide, maintain, and pay for electric power for performance of the Work except for power required for the final 7-day operational test:
 - a. When using permanent facilities, provide separate meter and reimburse OWNER for power used in connection with performance of the Work.
- B. Temporary Electrical Lighting:
1. In work areas, provide temporary lighting sufficient to maintain lighting levels during working hours not less than lighting levels required by Occupational Safety and Health Administration (OSHA) and state agency which administers OSHA regulations where Project is located.
 2. When available, permanent lighting facilities may be used in lieu of temporary facilities:
 - a. Prior to Substantial Completion of the Work, replace bulbs, lamps, or tubes used by CONTRACTOR for lighting.
- C. Temporary Heating, Cooling, and Ventilating:
1. Heat and ventilate work areas to protect the Work from damage by freezing, high temperatures, weather, and to provide safe environment for workers.
 2. Permanent heating system may be utilized when sufficiently completed to allow safe operation.
- D. Temporary Water:
1. Pay for and construct facilities necessary to furnish potable water for human consumption and non-potable water for use during construction.
 2. Remove temporary piping and connections and restore affected portions of the facility to original condition before Substantial Completion.
 3. Pay for water used for construction prior to Substantial Completion. OWNER will provide water for 7-day final test.
- E. Temporary Sanitary Facilities:
1. Provide suitable and adequate sanitary facilities that are in compliance with applicable Laws and Regulations.
 2. At completion of the Work, remove sanitary facilities and leave site in neat and sanitary condition.
- F. Temporary Fire Protection: Provide sufficient number of fire extinguishers of type and capacity required to protect the Work and ancillary facilities.
- G. First Aid: Post first aid facilities and information posters conforming to requirements of OSHA and other applicable Laws and Regulations in readily accessible locations.
- H. Utilities in Existing Facilities: See Section 01 14 00, WORK RESTRICTIONS.
- 1.8 CONSTRUCTION AIDS
- A. Provide railings, kick plates, enclosures, safety devices, and controls required by Laws and Regulations and as required for adequate protection of life and property.
 - B. Use construction hoists, elevators, scaffolds, stages, shoring, and similar temporary facilities of ample size and capacity to adequately support and move loads.
 - C. Design temporary supports with adequate safety factor to assure adequate load bearing capability:

1. When requested, submit design calculations by professional registered engineer prior to application of loads.
 2. Submitted design calculations are for information and record purposes only.
- D. Accident Prevention:
1. Exercise precautions throughout construction for protection of persons and property.
 2. Observe safety provisions of applicable Laws and Regulations.
 3. Guard machinery and equipment, and eliminate other hazards.
 4. Make reports required by authorities having jurisdiction, and permit safety inspections of the Work.
 5. Before commencing construction work, take necessary action to comply with provisions for safety and accident prevention.
- E. Barricades:
1. Place barriers at ends of excavations and along excavations to warn pedestrian and vehicular traffic of excavations.
 2. Provide barriers with flashing lights after dark.
 3. Keep barriers in place until excavations are entirely backfilled and compacted.
 4. Barricade excavations to prevent persons from entering excavated areas in streets, roadways, parking lots, treatment plants, or other public or private areas.
- F. Warning Devices and Barricades: Adequately identify and guard hazardous areas and conditions by visual warning devices and, where necessary, physical barriers:
1. Devices shall conform to minimum requirements of OSHA and State agency which administers OSHA regulations where Project is located.
- G. Hazards in Public Right-of-Way:
1. Mark at reasonable intervals, trenches and other continuous excavations in public right-of-way, running parallel to general flow of traffic, with traffic cones, barricades, or other suitable visual markers during daylight hours:
 - a. During hours of darkness, provide markers with torches, flashers, or other adequate lights.
 2. At intersections or for pits and similar excavations, where traffic may reasonably be expected to approach head on, protect excavations by continuous barricades:
 - a. During hours of darkness, provide warning lights at close intervals.
- H. Hazards in Protected Areas: Mark or guard excavations in areas from which public is excluded, in manner appropriate for hazard.
- I. Above Grade Protection: On multi-level structures, provide safety protection that meets requirements of OSHA and State agency which administers OSHA regulations where Project is located.
- J. Protect existing structures, trees, shrubs, and other items to be preserved on Project site from injury, damage or destruction by vehicles, equipment, worker or other agents with substantial barricades or other devices commensurate with hazards.
- K. Fences:
1. Enclose site of the Work with fence adequate to protect the Work against acts of theft, violence and vandalism.
 2. Enclose temporary offices and storage areas with fence adequate to protect temporary facilities against acts of theft, violence and vandalism.
 3. When entire or part of site is to be permanently fenced, permanent fence may be built to serve for both permanent and temporary protection of the work site, provided that damaged or defaced fencing is replaced prior to Substantial Completion.

4. Protect temporary and permanent openings and close openings in existing fences to prevent intrusion by unauthorized persons. Bear responsibility for protection of plant and material on site of the Work when openings in existing fences are not closed.
5. During night hours, weekends, holidays, and other times when no work is performed at site, provide temporary closures or enlist services of security guards to protect temporary openings.
6. Fence temporary openings when openings are no longer necessary.

1.9 SECURITY

- A. Make adequate provision for protection of the work area against fire, theft, and vandalism, and for protection of public against exposure to injury.

1.10 ACCESS ROADS

- A. General:
 1. Build and maintain access roads to and on site of the Work to provide for delivery of material and for access to existing and operating plant facilities on site.
 2. Build and maintain dust free roads which are suitable for travel at 20 miles per hour.
- B. Off-Site Access Roads:
 1. Build and maintain graded earth roads.
 2. Build roads only in public right-of-way or easements obtained by OWNER.
 3. Obtain rights-of-way or easements when electing to build along other alignment.
- C. On-Site Access Roads:
 1. Maintain access roads to storage areas and other areas to which frequent access is required.
 2. Maintain similar roads to existing facilities on site of the Work to provide access for maintenance and operation.
 3. Protect buried vulnerable utilities under temporary roads with steel plates, wood planking, or bridges.
 4. Maintain on-site access roads free of mud. Under no circumstances shall vehicles leaving the site track mud off the site onto the public right-of-way.

1.11 TEMPORARY CONTROLS

- A. Dust Control:
 1. Prevent dust nuisance caused by operations, unpaved roads, excavation, backfilling, demolition, or other activities.
 2. Control dust by sprinkling with water, use of dust palliatives, modification of operations, or other means acceptable to agencies having jurisdiction.
- B. Noise Control:
 1. In inhabited areas, particularly residential, perform operations in manner to minimize noise.
 2. In residential areas, take special measures to suppress noise during night hours.
- C. Mud Control:
 1. Prevent mud nuisance caused by construction operations, unpaved roads, excavation, backfilling, demolition, or other activities.

1.12 PROJECT SIGN

- A. Provide and maintain Project identification sign consisting of painted 8 foot wide by 4 foot high exterior grade plywood and minimum 10 foot long 4 by 4 lumber posts, set in ground at least 3 feet, with exhibit lettering by professional sign painter using no more than 5 sign colors:
 - 1. List at least the title of the Project, and names of the OWNER, ENGINEER, and CONTRACTOR.
- B. Erect Project identification sign where directed.

1.13 REMOVAL

- A. Remove temporary buildings and furnishings before inspection for Substantial Completion or when directed.
- B. Clean and repair damage caused by installation or use of temporary facilities.
- C. Remove underground installations to minimum depth of 24 inches and grade to match surrounding conditions.
- D. Restore existing facilities used during construction to specified or original condition.

1.14 TEMPORARY PROCESS PIPING

- A. CONTRACTOR shall provide all piping, appurtenances, and other materials as required to provide temporary piping systems as specified herein, as indicated on the Drawings, and as needed to perform the Work.
- B. CONTRACTOR shall field route piping as needed and as field conditions dictate, unless otherwise indicated on the Drawings, and determine appropriate lengths of piping and quantity/type of pipe fittings needed to construct temporary piping system. Do not block access points such as stairs, doors, and walkways to existing facilities unless approved in writing by the OWNER.
- C. Restrain piping at valves and at fittings where piping changes direction, changes sizes, and at ends:
 - 1. When piping is buried, use concrete thrust block or mechanical restraints.
 - 2. When piping is exposed or under water, use mechanical or structural restraints.
 - 3. Determine thrust forces by multiplying the nominal cross sectional area of the piping by the operating pressure of the piping.
- D. Temporary piping systems shall be installed in a manner that will not damage existing or new facilities.
- E. Unless indicated otherwise, piping material, including gaskets, shall be suitable for the process fluid requiring temporary piping.
- F. After Temporary Piping System is no longer required:
 - 1. Remove temporary piping system.
 - 2. Clean and repair damage caused by installation or use of temporary piping system.
 - 3. Restore existing facilities to original condition.

1.15 TEMPORARY PROCESS PUMPING

- A. For this contract, no temporary pumping is believed to be required to complete the work. To achieve the Contractor's plan to complete the work, Contractor may require and shall provide temporary pumping system to pump flow as required to complete the work.
1. Anticipated pressure will vary based on headlosses developed and the final length of installed temporary piping. CONTRACTOR shall calculate headlosses and provide pump with sufficient pressure to meet flow requirements. Calculations shall be sealed and signed by a professional engineer registered in the state in which the project is located.
 2. Pump(s) shall be capable of passing a solid with a sphere size of 3 inches.
 3. Temporary pumps shall be capable of matching plant flow rates through the use of variable flow rate pumping. The use of cycled pumping (i.e, on/off) is not acceptable. Provide all wiring and controls necessary to match plant flow rate based on 4-20 mA signal available at the Operations Building.
 4. Provide and pay for all power required to operate temporary pumps.
 5. All electrical and instrumentation components will comply with applicable code requirements for the area where the temporary pump is located.
 6. Temporary pumping will be required 24 hours per day during the time period when pumping is required and is critical to the proper operation of the OWNER'S treatment plant. Provide 24-hour on-site supervision of pumps to ensure that pumps are always operational and performing as required. Notify the OWNER immediately if temporary pumping cannot be provided.
 7. CONTRACTOR shall be responsible for repairing any damage or reimbursing the OWNER for any regulatory fines or additional plant staff time resulting from the CONTRACTOR'S failure to maintain temporary pumping.
 8. Provide 100 percent backup (a.k.a., standby, redundant, etc.) pumping capacity equal to the required process flow rate. Backup system shall be capable of providing required pumping capacity immediately upon failure of primary pumping system.
 9. All necessary spare equipment and appurtenances shall be available on-site to allow immediate repair and/or replacement of any pumping system component that is not functioning properly.
- B. Providing temporary piping systems as specified in Paragraph 1.14.
- C. Temporary pumping of other process flows is not allowed unless approved in writing by the OWNER.
- D. After Temporary Process Pumping System is no Longer Required:
1. Remove temporary process pumping system.
 2. Clean and repair damage caused by installation or use of temporary process pumping system.
 3. Restore existing facilities to original condition.

PART 2 - PRODUCTS

2.1 FIELD OFFICES AND SHEDS

- A. CONTRACTOR's Field Office:
1. Maintain on Project Site weathertight space in which to keep copies of Contract Documents, progress schedule, shop drawings, and other relevant documents.
 2. Provide field office with adequate space to examine documents, and provide lighting and telephone service in that space.
- B. ENGINEER's Field Office:
1. Provide separate field office on project site for the exclusive use of the ENGINEER, as follows:

- a. Size: Approximately 12 feet by 56 feet, including a toilet room, with 8-foot minimum ceiling height.
 - b. Construction: Weathertight building constructed at the site, pre-manufactured building, or trailer, with a toilet room containing a water closet and lavatory, partitioned off from the working area. The water closet may be of the chemical type provided that it is a flush type with an approved holding tank.
 - c. Walls and Ceiling: Insulated with finished interior surfaces.
 - d. Openings: At least 6 windows and 2 entrance doors, each with cylinder lock and 4 keys.
 - e. Exterior lighting over entrance door.
 - f. Twenty 110 volts AC duplex receptacles with at least 2 in each office.
2. Arrange and Pay For:
- a. Janitorial service, including daily dusting, floor cleaning, and trash removal, and monthly comprehensive cleaning, including windows.
 - b. Heating, ventilating, and air conditioning equipment in operating condition.
 - c. Electric wiring, power, and lighting fixtures capable of providing at least 75 foot candles of light on work surfaces.
 - d. A continuous supply of toilet paper, paper hand towels and hand soap for each restroom.
 - e. Private telephone line.
 - f. Dedicated telephone line for facsimile (fax) machine.
 - g. Dedicated telephone line for computer modem.
 - h. Bottled drinking water service with dispenser.
 - i. Suitable restroom facilities with sinks with hot and cold water.
3. Provide Following Furnishings and Equipment:
- a. Four office desks with 6 drawers (2 with locks) and padded, upholstered swivel chairs.
 - b. One plan table not less than 36 inches by 96 inches.
 - c. One drafting table not less than 36 inches by 60 inches.
 - d. Two metal drafting stools with backs.
 - e. Twelve straight chairs.
 - f. Four swivel chairs.
 - g. Six metal filing cabinet, 18 inches by 30 inches by 52 inches, 4 drawers with locks.
 - h. One supply cabinet with not less than 15 square feet of shelves.
 - i. Four bookcases with not less than 12 linear feet of shelves for each bookcase.
 - j. One plan hold rolling stand of 12 binders, with binders.
 - k. Six wastebaskets.
 - l. Dry erase board 96 by 48 inches, magnetic.
 - m. Refrigerator, 6.0 cubic feet capacity.
 - n. Microwave oven, 1.0 cubic feet.
 - o. Field Office Data Service and Equipment: Provide one of the following data services (listed in order of preference and increasing cost) for the duration of the project. CONTRACTOR is responsible for all maintenance of service and hardware. Data service will be dedicated to the ENGINEER and not shared with any other party. The CONTRACTOR shall provide a durable and weather tight system for connecting the ENGINEER's trailer to the service provider's facilities at the jobsite boundary:
 - 1) Provide high-speed Internet access (DSL or cable modem); with a minimum 2.4 gigabit per second download/2.4 gigabit per second upload. This access must have a minimum of 8 (5 usable) IP addresses. In addition, it must provide an average round-trip delay of less than 150 ms to the ENGINEER's Internet gateway.
 - 2) Provide 1 ISDN BRI, coded for data use, and all associated usage charges. This BRI will be used to direct dial to the ENGINEER's remote access gateway located in the local area code where the project is located.
 - 3) Provide private line or frame-relay Internet access with a minimum 2.4 gigabit per second download/2.4 gigabit upload. This access must have a minimum

- of 8 (5 usable) IP addresses. In addition, it must provide an average round-trip delay of less than 150 ms to the ENGINEER's Internet gateway.
- p. Provide new data service hardware corresponding with above options. CONTRACTOR is responsible for all maintenance of service and hardware:
- 1) For option 1 above, provide appropriate DSL or cable modem device. In addition, provide one Cisco ASA 5505 firewall with 3DES software, part number ASA5505-50-BUN-K9 and Cisco 4 hour response onsite Smartnet Maintenance for duration of project.
 - 2) For option 2 above, provide one Cisco 804 ISDN router, part number CISCO-804 and Cisco 4 hour response onsite Smartnet Maintenance for duration of project.
 - 3) For Option 3 Above, Provide the Following:
 - a) Visual Networks IP Enterprise central office T1 drop-and-insert CSU/DSU.
 - b) Cisco 2651 VPN router bundle, Cisco part number C2651-2FE/VPN/K9 and Cisco 4 hour response onsite Smartnet Maintenance for duration of project.
 - c) Serial interface card, Cisco part number WIC-1T.
 - d) Serial cable, Cisco part number CAB-V35MT.
- q. Field Office Local Area Network: Provide the following to create a local area network for the ENGINEER:
- 1) Install Category 5e cabling to support all specified computers, printers, and other network device. This cabling should be home-run to a patch panel and meet all applicable installation standards for CAT5e. Patch panel and jack locations to be coordinated with ENGINEER.
 - 2) Provide 10/100 Ethernet Switch sized to support all specified network devices for ENGINEER with an allowance for 50 percent growth/spare ports.
 - 3) Provide APC SmartUPS RT 1500 uninterruptable power supply, model SURTA1500XL.
 - 4) Provide Category 5e patch cables for all networking equipment; both for patch panel to switch connection and for wall jack to network device connection.
- r. Field Office Computer Systems: Furnish and install 4 new complete computer systems. CONTRACTOR is responsible for all maintenance of hardware and software. Each system shall consist of, as a minimum:
- 1) Motherboard or ENGINEER-approved alternate.
 - 2) Intel® Core I5 Quatro processor.
 - 3) Minimum 500 GB hard disk.
 - 4) Minimum 8 GB RAM.
 - 5) One parallel and 2 serial ports (not including modem).
 - 6) Minimum 4 USB ports.
 - 7) Fifty-six kilobit per second voice/data internal modem.
 - 8) Nineteen-inch color LCD monitor, 1280 x 1024, 0.25mm dot pitch, non-interlaced. Brand should be ViewSonic or Engineer-approved equivalent.
 - 9) Minimum 128 MB video card.
 - 10) One hundred and one key keyboard
 - 11) MS mouse and mouse pad
 - 12) Sony DRU-840A (20x max, dual format, DVD +/R) drive, or equivalent sound card and speakers.
 - 13) Intel Etherexpress 10/100/1000 RJ-45 PCI network card.
 - 14) High definition graphics.
 - 15) Cables, connectors, and controller cards, as necessary, to provide a functioning system, including computer accessories.
 - 16) A/C surge suppressor with telephone line protection sized for computer system.
 - 17) Uninterruptable power supply, APC model SmartUPS 700 or equivalent.
 - 18) Four GB USB flash media storage device

- 19) One hundred DVD-R media.
 - 20) Microsoft Windows 7 operating system.
 - 21) Microsoft Office 2013 Professional.
 - 22) Adobe Acrobat, latest version (full package, not just the free reader).
 - 23) McAfee Virus Scan, latest version.
 - 24) Current version of Business and Legal Reports Safety Training Presentations, Product Code 11006100.
- s. Field Office Printer:
- 1) Provide a multifunctional printer with the capability of printing, copying, and scanning. The CONTRACTOR is responsible for all maintenance of equipment and related hardware and software. The printer shall consist of, as a minimum:
 - a) Double-sided printing capability.
 - b) Copy speed: 33 copies per minute.
 - c) Print speed: 30 prints per minute.
 - d) Up to 600 x 600 dpi resolution.
 - e) Original scan/copy paper size: up to 11" x 17".
 - f) Printer paper size: up to 11" x 17"
 - g) Dry, dual component toner.
 - h) Scan-to-File/ Folder/URL/FTP/Email functionality.
 - i) Full-Color VGA Touch Screen Control Panel.
 - j) 1.5 GB RAM + 250 GB HDD
 - k) Paper, toner, and other supplies for duration of project.
 - 2) Manufacturers:
 - a) Ricoh
 - b) Or equal
- t. AutoCAD LT for Windows by AutoDesk latest version.
- u. Digital Camera
- 1) See Section 01 34 00 Photographic and Videographic Documentation for requirements.
 - 2) Two Spare batteries and chargers.
 - 3) Two 4 GB compact flash cards.
- v. One telephone answering machine.
- w. One facsimile (Fax) machine capable of providing the following functions:
- 1) Unattended receiving operation for plain paper, commercial grade, 250 sheet cassette, programmable memory, and document feeder.
 - 2) Digital Modem Speed: 9,600 bits per second with automatic fallback to 7,200, 4,800, or 2,400 bits per second.
 - 3) The Terminal shall have the Following Features:
 - a) Resolution: 196 vertical by 203 horizontal lines per inch (lpi) resolution.
 - b) CCITG3, CCITG2 compatibility.
 - c) RJ11 series modular jack line connection.
 - d) Solid-state flatbed scanner.
 - e) Electro thermal recorder.
 - 4) Obtain and pay for a service contract with a local representative of the facsimile vendor or manufacturer for availability of a service representative to perform on-site service and repair.
 - 5) Provide all necessary paper and other materials required for proper operation of the facsimile.
4. Locate field office where directed.
 5. Have field office ready for occupancy within 2 weeks after start of sitework.

PART 3 - EXECUTION

3.1 ENGINEER'S FIELD OFFICE

- A. Make available for Engineer's use prior to start of the Work at Site and to remain on the Site for minimum of 15 days after final acceptance of the Work.
- B. Locate where directed by Engineer; level, block, tie down, skirt, provide stairways, and relocate when necessary and approved. Construct on proper foundations, and provide proper surface drainage and connections for utility services.
- C. Provide minimum 100 ft² of gravel or crushed rock base, minimum depth of 4", at each entrance.
- D. Raise grade under field office, as necessary, to elevation adequate to avoid flooding.
- E. Provide sanitary facilities in compliance with state and local health authorities.
- F. Exterior Door Keys: Furnish two sets of keys.
- G. Telephone:
 - 1. Provide number of incoming lines equal to that specified for telephone type.
 - 2. Provide separate analog modem line.
 - 3. Provide separate analog fax line.
 - 4. Provide appropriate jacks; locate as directed by Engineer.
 - 5. Provide all wiring necessary for a completed telephone system.
- H. Computer: Provide all required connecting cables and plugs.
- I. Telecommunications:
 - 1. Arrange and provide for telecommunication service for use during construction. Pay costs of installation, maintenance, and monthly service of internet connection.
- J. Maintain in good repair and appearance, and provide weekly cleaning service and first-aid kit supplies, and bottled water.
- K. Replenish, as needed, copy paper, facsimile paper, toner, and computer discs.

3.2 TEMPORARY UTILITIES

- A. Power:
 - 1. Electric power will be available at or near Site. Determine type and amount available and make arrangements for obtaining temporary electric power service, metering equipment, and pay all costs for electric power used during contract period, except for portions of the Work designated in writing by Engineer as substantially complete.
 - 2. Cost of electric power will be borne by Contractor.
- B. Lighting: Provide temporary lighting to meet applicable safety requirements to allow erection, application, or installation of materials and equipment, and observation or inspection of the Work.
- C. Heating, Cooling, and Ventilating:
 - 1. Provide as required to maintain adequate environmental conditions to facilitate progress of the Work, to meet specified minimum conditions for installation of materials, and to protect materials, equipment, and finishes from damage due to temperature or humidity. Costs for temporary heat shall be borne by Contractor.

2. Provide adequate forced air ventilation of enclosed areas to cure installed materials, to dispense humidity, and to prevent hazardous accumulations of dust, fumes, vapors, or gases.
3. Pay all costs of installation, maintenance, operation, removal, and fuel consumed.
4. Provide portable unit heaters, complete with controls, oil- or gas-fired, and suitably vented to outside as required for protection of health and property.

D. Water:

1. Potable water is available at the site. Secure written permission for connection and use from Owner and meet requirements for use. Contractor shall pay cost to connect water during construction. Owner shall pay cost to for water used during construction.
2. Include costs to connect and transport water to construction areas in Contract Price.
3. Provide a means to prevent water used for testing from flowing back into source pipeline.

E. Sanitary and Personnel Facilities:

1. Provide and maintain facilities for Contractor's employees, Subcontractors, and all other onsite employers' employees. Service, clean, and maintain facilities and enclosures.

F. Telephone Service:

1. Contractor: Arrange and provide onsite telephone service for use during construction by Contractor. Pay costs of installation and monthly bills.
2. Engineer: Arrange and provide onsite telephone system for use during construction. Pay for all installation and basic monthly billing charges.
3. No incoming calls allowed to Owner's plant telephone system.

G. Fire Protection: Furnish and maintain on Site adequate firefighting equipment capable of extinguishing incipient fires. Comply with applicable parts of National Fire Prevention Standard for Safeguarding Building Construction Operations (NFPA No. 241).

3.3 PROTECTION OF WORK AND PROPERTY

A. General:

1. Perform Work within right-of-way and easements in a systematic manner that minimizes inconvenience to property owners and the public.
2. Schedule the Work so construction will not interfere with irrigation of cultivated lands or pasturelands. Construction may proceed during irrigation season, provided Contractor constructs temporary irrigation ditches, turnouts, and miscellaneous structures acceptable to property owners.
3. Provide continuous access for livestock through farm areas. Do not cut off ready access to portions of farmlands in which livestock are pastured. Maintain existing fences required to restrain livestock. Keep gates closed and secure.
4. Maintain in continuous service all existing oil and gas pipelines, underground power, telephone or communication cable, water mains, irrigation lines, sewers, poles and overhead power, and all other utilities encountered along line of the Work, unless other arrangements satisfactory to owners of said utilities have been made.
5. Where completion of the Work requires temporary or permanent removal or relocation of existing utility, coordinate all activities with owner of said utility and perform all work to their satisfaction.
6. Protect, shore, brace, support, and maintain underground pipes, conduits, drains, and other underground utility construction uncovered or otherwise affected by construction operations.
7. In areas where Contractor's operations are adjacent to or near a utility, such as gas, telephone, television, electric power, water, sewer, or irrigation system, and such operations may cause damage or inconvenience, suspend operations until arrangements necessary for protection have been made by Contractor.

8. Notify property owners and utility offices that may be affected by construction operation at least 2 days in advance: Before exposing a utility, obtain utility owner's permission. Should service of a utility become interrupted due to Contractor's operation, notify proper authority immediately. Cooperate with said authority in restoring service as promptly as possible and bear costs incurred.
 9. Do not impair operation of existing sewer system. Prevent construction material, pavement, concrete, earth, volatile and corrosive wastes, and other debris from entering sewers, pump stations, or other sewer structures.
 10. Maintain original Site drainage wherever possible.
- B. Site Security:
1. Erect a temporary security fence for protection of existing facilities. Maintain fence throughout construction period. Obtain Engineer's written permission before removal of temporary security fencing.
 2. Provide and maintain additional temporary security fences as necessary to protect the Work and Contractor-furnished products not yet installed.
- C. Barricades, Lights, Signs, and Equipment:
1. Provide as required by the Department of Transportation in the state having jurisdiction and in sufficient quantity to safeguard public and the Work.
 2. Provide as necessary to prevent unauthorized entry to construction areas and affected roads, streets, and alleyways, inside and outside of fenced area, and as required to ensure public safety and the safety of Contractor's employees, other employer's employees, and others who may be affected by the Work.
 3. Provide to protect existing facilities and adjacent properties from potential damage.
 4. Locate to enable access by facility operators and property owners.
 5. Protect streets, roads, highways, and other public thoroughfares that are closed to traffic by effective barricades with acceptable warning signs.
 6. Locate barricades at the nearest intersecting public thoroughfare on each side of the blocked section.
 7. Illuminate barricades and obstructions with warning lights from sunset to sunrise.
- D. Trees and Plantings:
1. Protect from damage and preserve trees, shrubs, and other plants outside limits of the Work and within limits of the Work, which are designated on the Drawings to remain undisturbed.
- E. Existing Structures:
1. Where Contractor contemplates removal of small structures such as mailboxes, signposts, and culverts that interfere with Contractor's operations, obtain approval of property owner and Engineer.
 2. Move mailboxes to temporary locations accessible to postal service.
 3. Replace items removed in their original location and a condition equal to or better than original.
- F. Finished Construction: Protect finished floors and concrete floors exposed as well as those covered with composition tile or other applied surfacing.
- G. Waterways: Keep ditches, culverts, and natural drainages continuously free of construction materials and debris.
- H. Dewatering: Construct, maintain, and operate cofferdams, channels, flume drains, sumps, pumps, or other temporary diversion and protection works. Furnish materials required, install, maintain, and operate necessary pumping and other equipment for the environmentally safe removal and disposal of water from the various parts of the Work. Maintain foundations and parts of the Work free from water.

3.4 TEMPORARY CONTROLS

A. Air Pollution Control:

1. Minimize air pollution from construction operations.
2. Burning: Of waste materials, rubbish, or other debris will not be permitted on or adjacent to Site.
3. Conduct operations of dumping rock and of carrying rock away in trucks to cause a minimum of dust. Give unpaved streets, roads, detours, or haul roads used in construction area a dust-preventive treatment or periodically water to prevent dust. Strictly adhere to applicable environmental regulations for dust prevention.
4. Provide and maintain temporary dust-tight partitions, bulkheads, or other protective devices during construction to permit normal operation of existing facilities. Construct partitions of plywood, insulating board, plastic sheets, or similar material. Construct partitions in such a manner that dust and dirt from demolition and cutting will not enter other parts of existing building or facilities. Remove temporary partitions as soon as need no longer exists.

B. Noise Control:

1. Noise Control Plan: Propose plan to mitigate construction noise and to comply with noise control ordinances, including method of construction, equipment to be used, and acoustical treatments.

C. Water Pollution Control:

1. Divert sanitary sewage and non-storm waste flow interfering with construction and requiring diversion to sanitary sewers. Do not cause or permit action to occur which would cause an overflow to existing waterway.
2. Prior to commencing excavation and construction, obtain Engineer's agreement with detailed plans showing procedures intended to handle and dispose of sewage, groundwater, and storm water flow, including dewatering pump discharges.
3. Comply with procedures outlined in U.S. Environmental Protection Agency manuals entitled, "Guidelines for Erosion and Sedimentation Control Planning," "Implementation, Processes, Procedures, and Methods to Control Pollution Resulting from All Construction Activity," and "Erosion and Sediment Control- Surface Mining in Eastern United States."
4. Do not dispose of volatile wastes such as mineral spirits, oil, chemicals, or paint thinner in storm or sanitary drains. Disposal of wastes into streams or waterways is prohibited. Provide acceptable containers for collection and disposal of waste materials, debris, and rubbish.

- D. Erosion, Sediment, and Flood Control: Provide, maintain, and operate temporary facilities to control erosion and sediment releases, and to protect the Work and existing facilities from flooding during construction period.

3.5 STORAGE YARDS AND BUILDINGS

- A. Coordinate requirements with Section 01 60 00, PRODUCT REQUIREMENTS.

- B. Temporary Storage Yards: Construct temporary storage yards for storage of products that are not subject to damage by weather conditions.

C. Temporary Storage Buildings:

1. Provide environmental control systems that meet recommendations of manufacturers of equipment and materials stored.
2. Arrange or partition to provide security of contents and ready access for inspection and inventory.
3. Store combustible materials (paints, solvents, fuels) in a well-ventilated and remote building meeting safety standards.

4. Provide, at a minimum, one temporary storage building or storage trailer to house specified spare part during the duration of construction and until spare parts are accepted by Owner and Engineer.

3.6 ACCESS ROADS

- A. Construct access roads as required and within easements, rights-of-way, or Project limits. Obtain Engineer's approval of access roads.
- B. Maintain drainage ways. Install and maintain culverts to allow water to flow beneath access roads. Provide corrosion-resistant culvert pipe of adequate strength to resist construction loads.
- C. Provide gravel, crushed rock, or other stabilization material to permit access by all motor vehicles at all times.
- D. Maintain road grade and crown to eliminate potholes, rutting, and other irregularities that restrict access.
- E. Coordinate with Engineer detours and other operations affecting traffic and access. Provide at least 72 hours notice to Engineer of operations that will alter access to the Site.
- F. Where access road crosses existing fences, install and maintain gates.
- G. Upon completion of construction, restore ground surface disturbed by access road construction to original grade. Replace damaged or broken culverts with new culvert pipe of same diameter and material.

3.7 PARKING AREAS

- A. Control vehicular parking to preclude interference with public traffic or parking, access by emergency vehicles, Owner's operations, or construction operations.
- B. Provide parking facilities for personnel working on the Project. No employee or equipment parking will be permitted on Owner's existing parking areas, except as specifically designated for Contractor's use.

3.8 VEHICULAR TRAFFIC

- A. Comply with Laws and Regulations regarding closing or restricting use of public streets or highways. No public or private road shall be closed, except by written permission of proper authority. Assure the least possible obstruction to traffic and normal commercial pursuits.
- B. Conduct the Work to interfere as little as possible with public travel, whether vehicular or pedestrian.
- C. Whenever it is necessary to cross, close, or obstruct roads, driveways, and walks, whether public or private, provide and maintain suitable and safe bridges, detours, or other temporary expedients for accommodation of public and private travel.
- D. Coordinate traffic routing with that of others working in same or adjacent areas.

3.9 CLEANING DURING CONSTRUCTION

- A. In accordance with General Conditions, as may be specified in other Specification sections, and as required herein.

- B. Wet down exterior surfaces prior to sweeping to prevent blowing of dust and debris. At least weekly, sweep all floors (basins, tunnels, platforms, walkways, roof surfaces), and pick up all debris and dispose.
- C. Provide approved containers for collection and disposal of waste materials, debris, and rubbish. At least at weekly intervals, dispose of such waste materials, debris, and rubbish offsite.
- D. At least weekly, brush sweep entry drive and roadways, and all other streets and walkways affected by the Work and where adjacent to the Work.

END OF SECTION

SECTION 01 60 00 – PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes description and requirements of the required new products for the project:
 - 1. Providing and delivering.
 - 2. Design and environmental requirements.
 - 3. Shipment.
 - 4. Delivery and Inspection.
 - 5. Handling, Storage and Protection.
 - 6. Inspection and Installation.
- B. Related sections:
 - 1. 01 50 00 – Temporary Facilities and Controls.
 - 2. 09 90 00 – Painting and Protective Coatings.

1.2 DEFINITIONS

- A. Products:
 - 1. New items for incorporation in the Work whether purchased by Contractor or Owner for the Project, or taken from previously purchased stock and may also include existing materials or components required for reuse.
 - 2. Includes the terms material, equipment, machinery, components, subsystem, system, hardware, software, and terms of similar intent and is not intended to change meaning of such other terms used in Contract Documents, as those terms are self-explanatory and have well recognized meanings in construction industry.
 - 3. Items identified by Manufacturer's product name, including make or model designation, indicated in Manufacturer's published product literature, that is current as of the date of the Contract Documents.

1.3 DESIGN REQUIREMENTS

- A. Where Contractor design is specified, design of installation, systems, equipment, and components, including supports and anchorage, shall be in accordance with provisions of latest edition of International Building Code (IBC) by International Code Council.

1.4 ENVIRONMENTAL REQUIREMENTS

- A. Altitude: Provide materials and equipment suitable for installation and operation under rated conditions at elevations shown on Drawings.
- B. Provide equipment and devices installed outdoors or in unheated enclosures capable of continuous operation within an ambient temperature range of 0 °F to 104 °F.

1.5 PREPARATION FOR SHIPMENT

- A. When practical, have the factory assemble products, mark or tag separate parts and assemblies to facilitate field assembly. Cover machined and unpainted parts that may be damaged by the elements with strippable protective coating.
- B. Package products to facilitate handling and protect from damage during shipping, handling, and storage. Mark or tag outside of each package or crate to indicate its purchase order number,

bill of lading number, contents by name, name of Project and Contractor, equipment number, and approximate weight. Include complete packing list and bill of materials with each shipment.

- C. Extra Materials, Special Tools, Test Equipment, and Expendables:
 - 1. Furnish as Required by Individual Specifications.
 - 2. Schedule:
 - a. Ensure that shipment and delivery occur concurrently with shipment of associated equipment.
 - b. Transfer to Owner shall occur immediately subsequent to Contractor's acceptance of equipment from Supplier.
 - 3. Packaging and Shipment:
 - a. Package and ship extra materials and special tools to avoid damage during long term storage in original cartons insofar as possible, or in appropriately sized, hinged-cover, wood, plastic, or metal box.
 - b. Prominently Displayed on Each Package, the Following:
 - 1). Manufacturer's part nomenclature and number, consistent with Operation and Maintenance Manual identification system.
 - 2). Applicable equipment description.
 - 3). Quantity of parts in package.
 - 4). Equipment manufacturer.
 - 4. Deliver materials to the site.
 - 5. Notify Engineer upon arrival for transfer of materials.
 - 6. Replace extra materials and special tools found to be damaged or otherwise inoperable at time of transfer to Owner.
- D. Request a minimum 7-day advance notice of shipment from manufacturer. Upon receipt of Manufacturer's advance notice of shipment, promptly notify Engineer of anticipated date of equipment arrival.
- E. Factory Test Results: Reviewed and accepted by Engineer before product shipment as required in individual Specification sections.

1.6 DELIVERY AND INSPECTION

- A. Deliver products in accordance with accepted current Progress Schedule and coordinate to avoid conflict with the Work and conditions at Site. Deliver anchor bolts and templates sufficiently early to permit setting prior to placement of structural concrete.
- B. Deliver products in undamaged condition, in Manufacturer's original container or packaging, with identifying labels intact and legible. Include on label, date of manufacture and shelf life, where applicable.
- C. Unload products in accordance with Manufacturer's instructions for unloading or as specified, and record receipt of products at Site. Promptly inspect for completeness and evidence of damage during shipment.
- D. Remove damaged products from Site, and expedite delivery of identical new undamaged products, and remedy incomplete or lost products to provide that specified, so as not to delay progress of the Work.

1.7 HANDLING, STORAGE, AND PROTECTION

- A. Handle and store products in accordance with Manufacturer's written instructions and in a manner to prevent damage. Store in approved storage yards or sheds provided in accordance with Section 01 50 00, TEMPORARY FACILITIES AND CONTROLS. Provide Manufacturer's

recommended maintenance during storage, installation, and until products are accepted for use by Owner.

- B. Arrange storage in a manner to provide easy access for inspection. Make periodic inspections of stored products to assure that products are maintained under specified conditions, and free from damage or deterioration. Keep running account of products in storage to facilitate inspection and to estimate progress payments for products delivered, but not installed in the Work.
- C. Store electrical, instrumentation, and control products, and equipment with bearings in weather-tight structures maintained above 60 °F. Protect electrical, instrumentation, and control products, and insulation against moisture, water, and dust damage. Connect and operate continuously all space heaters furnished in electrical equipment.
- D. Store fabricated products above ground on blocking or skids, prevent soiling or staining, and store loose granular materials in well-drained area on solid surface to prevent mixing with foreign matter. Cover products that are subject to deterioration with impervious sheet coverings; provide adequate ventilation to avoid condensation.
- E. Store finished products that are ready for installation in dry and well-ventilated areas. Do not subject to extreme changes in temperature or humidity.
- F. After installation, provide coverings to protect products from damage due to traffic and construction operations. Remove coverings when no longer needed.
- G. Hazardous Materials: Prevent contamination of personnel, storage building, and Site. Meet requirements of product specification, codes, and manufacturer's instructions.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Provide the Manufacturers standard materials suitable for service conditions unless otherwise specified in the individual Specifications.
- B. Where product specifications include a named Manufacturer, with or without model number, and also include performance requirements, named Manufacturer's products must meet the performance specifications.
- C. Like items of products furnished and installed in the Work shall be end products of one Manufacturer and of the same series or family of models to achieve standardization for appearance, operation and maintenance, spare parts and replacement, Manufacturer's services, and implement same or similar process instrumentation and control functions in same or similar manner.
- D. Do not use materials and equipment removed from existing premises, except as specifically permitted by Contract Documents.
- E. Provide interchangeable components of the same Manufacturer, for similar components, unless otherwise specified.
- F. Equipment, components, systems, sub-systems: Design and manufacture with due regard for health and safety of operation, maintenance, and accessibility, durability of parts, and shall comply with applicable OSHA, State, and local health and safety regulations.

- G. Regulatory Requirement: Coating materials shall meet Federal, State, and local requirements limiting the emission of volatile organic compounds and for worker exposure.
- H. Safety Guards: Provide for all belt or chain drives, fan blades, couplings, or other moving or rotary parts. Cover rotating part on all sides. Design for easy installation and removal. Use 16-gauge or heavier; galvanized steel, aluminum coated steel, or galvanized or aluminum coated ½" mesh expanded steel. Provide galvanized steel accessories and supports, including bolts. For outdoors application, prevent entrance of rain and dripping water.
- I. Authority Having Jurisdiction (AHJ):
 - 1. Provide the Work in accordance with **the 2009 International Building Code**. Where required by the AHJ, material and equipment shall be labeled or listed by a nationally recognized testing laboratory or other organization acceptable to the AHJ in order to provide a basis for approval under NEC.
 - 2. Materials and equipment manufactured within the scope of standards published by Underwriters Laboratories, Inc. shall conform to those standards and shall have an applied UL listing mark.
- J. Equipment Finish:
 - 1. Provide Manufacturer's standard finish and color, except where specific color is indicated.
 - 2. If Manufacturer has no standard color, provide equipment with gray finish as approved by Engineer.
- K. Special Tools and Accessories: Furnish to Owner, upon acceptance of equipment, all accessories required to place each item of equipment in full operation. These accessory items include, but are not limited to, adequate oil and grease (as required for first lubrication of equipment after field testing), light bulbs, fuses, hydrant wrenches, valve keys, hand wheels, chain operators, special tools, and other spare parts as required for maintenance.
- L. Lubricant: Provide initial lubricant recommended by equipment Manufacturer in sufficient quantity to fill lubricant reservoirs and to replace consumption during testing, startup, and operation until final acceptance by Owner.

2.2 FABRICATION AND MANUFACTURE

- A. General:
 - 1. Manufacture parts to U.S.A. standard sizes and gauges.
 - 2. Two or more items of the same type shall be identical, by the same Manufacturer, and interchangeable.
 - 3. Design structural members for anticipated shock and vibratory loads.
 - 4. Use 1/4" minimum thickness for steel that will be submerged, wholly or partially, during normal operation.
 - 5. Modify standard products as necessary to meet performance Specifications.
- B. Lubrication System:
 - 1. Require no more than weekly attention during continuous operation.
 - 2. Convenient and accessible. Oil drains with bronze or stainless steel valves and fill-plugs easily accessible from the normal operating area or platform.
 - 3. Locate drains to allow convenient collection of oil during oil changes without removing equipment from its installed position.
 - 4. Provide constant-level oilers or oil level indicators for oil lubrication systems.
 - 5. For grease type bearings, which are not easily accessible, provide and install stainless steel tubing; protect and extend tubing to convenient location with suitable grease fitting.

2.3 SOURCE QUALITY CONTROL

- A. Where Specifications call for factory testing to be witnessed by Engineer, notify Engineer not less than 14 days prior to scheduled test date, unless otherwise specified.
- B. Calibration Instruments: Bear the seal of a reputable laboratory certifying instrument has been calibrated within the previous 12 months to a standard endorsed by the National Institute of Standards and Technology (NIST).
- C. Factory Tests: Perform in accordance with accepted test procedures and document successful completion.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Inspect materials and equipment for signs of pitting, rust decay, or other deleterious effects of storage. Do not install material or equipment showing such effects. Remove damaged material or equipment from the Site and expedite delivery of identical new material or equipment. Delays to the Work resulting from material or equipment damage that necessitates procurement of new products will be considered delays within Contractor's control.

3.2 INSTALLATION

- A. Equipment Drawings show general locations of equipment, devices, and raceway, unless specifically dimensioned.
- B. No shimming between machined surfaces is allowed.
- C. Install the Work in accordance with NECA Standard of Installation, unless otherwise specified.
- D. Repaint painted surfaces that are damaged prior to equipment acceptance.
- E. Do not cut or notch any structural member or building surface without specific approval of Engineer.
- F. Handle, install, connect, clean, condition, and adjust products in accordance with Manufacturer's instructions, and as may be specified. Retain a copy of Manufacturers' instruction at Site, available for review at all times.
- G. For material and equipment specifically indicated or specified to be reused in the Work:
 - 1. Use special care in removal, handling, storage, and reinstallation to assure proper function in the completed Work.
 - 2. Arrange for transportation, storage, and handling of products that require offsite storage, restoration, or renovation. Include costs for such Work in the Contract Price.

3.3 FIELD FINISHING

- A. In accordance with Section 09 90 00, PAINTING AND PROTECTIVE COATINGS and individual Specification sections.

3.4 ADJUSTMENT AND CLEANING

- A. Perform required adjustments, tests, operation checks, and other startup activities.

3.5 LUBRICANTS

- A. Fill lubricant reservoirs and replace consumption during testing, startup, and operation prior to acceptance of equipment by Owner.

END OF SECTION

SECTION 01 72 20 – FIELD ENGINEERING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes description and requirements of the required closeout procedures for the project:
 - 1. Providing and delivering informational submittals.
 - 2. Preparing, maintaining, providing and delivering Record Documents.
 - 3. Furnishing Releases from Agreements.
 - 4. Furnishing Evidence of Compliance with Requirements of Governing Authorities.
 - 5. Providing Warranties and Bonds.
 - 6. Providing Certificate of Final Completion.
- B. Related sections:
 - 1. Section 01 77 00 – Closeout Procedures.

1.2 QUALITY ASSURANCE

- A. Qualifications of Surveyor or Engineer: Registered civil engineer or land surveyor in state where Project is located.
- B. Accuracy of stakes, alignments, and grades may be checked randomly by ENGINEER:
 - 1. Notice of when checking will be conducted will be given.
 - 2. When notice of checking is given, postpone parts of the Work affected by stakes, alignments or grades to be checked until checked.
 - 3. Do not assume that ENGINEER's check substitutes or complements required field quality control procedures.

1.3 CONSTRUCTION STAKES, LINES, AND GRADES

- A. Execute the Work in accordance with the lines and grades indicated.
- B. Make distances and measurements on horizontal planes, except elevations and structural dimensions.

1.4 SURVEY REFERENCE POINTS

- A. Basic reference line, a beginning point on basic reference line, and a benchmark will be provided, by OWNER.
- B. From these reference points, establish other control and reference points as required to properly lay out the Work.
- C. Locate and protect control points prior to starting site work, and preserve permanent reference points during construction:
 - 1. Make no changes or relocations without prior written notice.
 - 2. Replace Project control point, when lost or destroyed, in accordance with original survey control.
- D. Set monuments for principal control points and protect them from being disturbed and displaced;
 - 1. Re-establish disturbed monuments.

2. When disturbed, postpone parts of the Work that are governed by disturbed monuments until such monuments are re-established.

1.5 PROJECT SURVEY REQUIREMENTS

- A. Establish minimum of 2 permanent benchmarks on site referenced to data established by survey control points.
- B. Record permanent benchmark locations with horizontal and vertical data on Project Record Documents.
- C. Assume responsibility for accuracy of stakes, alignments, and grades by performing verifications and checking in accordance with standard surveying practice.

1.6 RECORD DOCUMENTS

- A. Prepare and submit Record Documents as specified in Section 01 77 00.
- B. Maintain complete, accurate log of control points and survey.
- C. Affix civil engineer's or land surveyor's signature and registration number to Record Drawing to certify accuracy of information shown.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 73 20 – CUTTING AND PATCHING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Cutting and patching existing and new construction.
- B. Related sections:
 - 1. Section 01 33 00 – Submittal Procedures.
 - 2. Section 01 60 00 – Product Requirements.

1.2 SUBMITTALS

- A. Submit in accordance with Section 01 33 00.
- B. Cutting and Patching Plan:
 - 1. Submit details of proposed construction before cutting and patching construction commences affecting:
 - a. Work of OWNER or of others.
 - b. Structural integrity of element of Project.
 - 2. Cutting and Patching Plan shall include the following:
 - a. Identification of Work.
 - b. Description of affected construction.
 - c. Necessity for cutting, patching, alteration, or excavation.
 - d. Description of proposed construction.
 - e. Scope of cutting, patching, alteration, or excavation. Verify locations of utilities and facilities which may exist by consulting with the OWNER, utility companies, and the Oklahoma One Call System or other service available in area of Project (see dig/call information on the Drawings):

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Comply with specifications and standards for products involved.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Provide adequate temporary support as necessary to ensure structural integrity of affected portion of Work.
- B. Provide devices and methods to protect other portions of Project from damage and persons from injury.
- C. Provide protection from elements for that portion of Project which may be exposed by cutting and patching, and maintain excavations free from water.

3.2 CUTTING AND PATCHING

- A. Cut, Fit, and Patch when Required to:
 - 1. Make its several parts fit together properly.
 - 2. Remove and replace construction not conforming to Contract Documents.

3. Remove samples of installed construction as specified for testing.
 4. Provide routine penetrations of nonstructural surfaces for installation of piping and electrical conduit.
- B. Execute cutting and demolition by methods which will prevent damage and will provide proper surfaces to receive installation of repairs.
- C. Openings in Existing Concrete and Masonry:
1. Create Openings by:
 - a. Saw cutting completely through concrete or masonry, or
 - b. Scoring edges of opening with saw to at least 1 inch depth on both surfaces (when accessible) and removing concrete or masonry by chipping.
 2. Do not allow saw cuts to extend beyond limits of opening.
 3. Make corners square and true by combination of core drilling and grinding or chipping.
 4. Prevent debris from falling into adjacent tanks or channels in service or from damaging existing equipment and other facilities.
- D. Sizing of Openings in Existing Concrete or Masonry:
1. Make openings sufficiently large to permit final alignment of pipe and fittings without deflections.
 2. Allow adequate space for packing around pipes and conduit to ensure watertightness.
- E. Grouting Pipes in Place:
1. Sandblast concrete surfaces and thoroughly clean sand and other foreign material from surfaces prior to placing grout.
 2. Grout pipes, sleeves, castings, and conduits in place by pouring grout under a head of at least 4 inches. Vibrate grout into place. Completely fill the spaces occupied by pipes, sleeves, castings, and conduits.
 3. Water cure the grout.
- F. Connections to Existing Pipes:
1. Cut existing pipe square.
 2. Properly prepare the ends for the connection indicated on the Drawings.
 3. Repair any damage to existing lining and coating.
- G. Rehabilitate all areas affected by removal of existing equipment, equipment pads and bases, piping, supports, electrical panels, electric devices, and conduits such that little or no evidence of the previous installation remains:
1. Fill areas in existing floors, walls, and ceilings from removed piping, conduit and fasteners with non-shrink grout and finish smooth.
 2. Remove Concrete Bases for Equipment and Supports by:
 - a. Saw cutting clean, straight lines with a depth equal to the concrete cover over reinforcement minus 1/2 inch below finished surface. Do not cut existing reinforcement on floors.
 - b. Chip concrete within scored lines and cut exposed reinforcing steel and anchor bolts.
 - c. Patch with non-shrink grout to match adjacent grade and finish.
 3. Terminate abandoned piping and conduits with blind flanges, caps, or plugs.
- H. Treat Existing Concrete Reinforcement as Follows:
1. Where existing reinforcement is to remain, protect, clean, and extend into new concrete.
 2. Where Existing Reinforcement is not to be Retained, Cut Off as Follows:
 - a. Where new concrete joins existing concrete at the removal line, cut reinforcement flush with concrete surface at the removal line.

- b. Where concrete surface at the removal line is the finished surface, cut reinforcement 2 inches below the surface, paint ends with epoxy, and patch holes with dry pack mortar.

END OF SECTION

SECTION 01 73 40 – WORK WITHIN PUBLIC RIGHT-OF-WAY

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Requirements for maintenance, support, protection, relocation, reconstruction and adjusting-to-grade, restoration, construction of temporary and new facilities, and abandonment of existing utilities affected by construction work within the public right-of-way.

1.2 REFERENCES

- A. Texas Department of Transportation (TDOT):
 - 1. Standard Specifications.

1.3 DEFINITIONS

- A. Utility: For purpose of this Section, utility means any public or private service, such as electric light and power systems; gas distribution systems; telephone, telegraph, cable television and other communication services; water distribution; storm drain and sanitary sewer services; police and fire communication systems; street lighting and traffic signs and signals; parking meters; and steam distribution systems.
- B. For Trenching:
 - 1. Open Trench:
 - a. General: Includes excavation, pipe laying, backfilling, and pavement replacement.
 - 2. Any excavated areas shall be considered as "open trench" until all pavement replacement has been made, or until all trenches outside of pavement replacement areas have been backfilled and compacted in accordance with these Contract Documents.

1.4 DESIGN REQUIREMENTS

- A. Trenching:
 - 1. Except where otherwise specified, indicated on the Drawings, or accepted in writing by the ENGINEER, the maximum length of open trench, where construction is in any stage of completion, shall not exceed the linear footage as set forth below. Descriptions under following area designations are general in nature and may be amended in writing by the ENGINEER due to particular or peculiar field conditions:
 - a. Business District Areas C 100 Linear Feet: Store front areas.
 - b. Commercial Areas C 400 Linear Feet: Industrial, shopping centers, churches, schools, hotels, motels, markets, gas stations, government and private office buildings, hospitals, fire and police stations, and nursing homes.
 - c. Residential Areas C 1 Block or 600 Linear Feet, Whichever is the Least: Single and multi-family residences, apartments, and condominiums.
 - d. Undeveloped Areas C 1,000 Linear Feet: Parks, golf courses, farms, undeveloped subdivided land.
 - 2. Completely backfill trenches across streets and install temporary or permanent pavement as soon as possible after pipe laying.
- B. Site Conditions:
 - 1. Use substantial steel plates with adequate trench bracing to bridge across trenches at street and alley crossings, commercial driveways, and residential driveways where trench backfill and temporary patch have not been completed during regular working hours.
 - 2. Provide safe and convenient passage for pedestrians.
 - 3. Maintain access to fire stations, fire hydrant, and hospitals at all times.

4. Provide traffic control devices, barricades and signage as required by the regulating agency.

1.5 SUBMITTALS

- A. Traffic Control Plan: Submit detailed traffic control plan for acceptance by jurisdictional agency.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 73 80 – SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Demolition of portions of structures.

1.2 SUBMITTALS

- A. Shop Drawings: Include:
 - 1. Demolition methods of load bearing structures not indicated on the Drawings, signed and sealed by structural Professional Engineer registered in state where Project is located.
 - 2. Method of removing embedded relics and antiques.
- B. Submittals for Information Only:
 - 1. Permits and notices authorizing demolition.
 - 2. Certificates of severance of utility services.
 - 3. Permit for transport and disposal of debris.
 - 4. Demolition procedures and operational sequence.
- C. Project Record Documents: Include locations of service lines and capped utilities.

1.3 REGULATORY REQUIREMENTS

- A. Dispose of debris in accordance with governing regulatory agencies.
- B. Comply with applicable air pollution control regulations.
- C. Obtain permits for building demolition, transportation of debris to disposal site and dust control.

1.4 PREPARATION

- A. Obtain permission from adjacent property OWNER's when outriggers, swinging cranes, and other equipment may have to traverse adjacent property.

1.5 ENVIRONMENTAL REQUIREMENTS

- A. Do not interfere with use of adjacent buildings. Maintain free and safe passage to and from all areas.
- B. Prevent movement, settlement or collapse of structures adjacent services, sidewalks, driveways and trees. Provide and place bracing or shoring. Assume liability for movement, settlement or collapse. Promptly repair damage.
- C. Cease operations and notify ENGINEER immediately when safety of structure appears to be endangered. Take precautions to properly support structure. Do not resume operations until safety is restored.
- D. Provide erect and maintain barricades, lighting, guardrails, and protective devices as required to protect building occupants, general public, workers, and adjoining property.

1.6 EXISTING SERVICES

- A. Arrange and pay for capping and plugging utility services. Disconnect and stub off. Notify affected utility company in advance and obtain approval before starting demolition.
- B. Place markers to indicate location of disconnected services.

1.7 MAINTAINING TRAFFIC

- A. Do not close or obstruct roadways without permits.
- B. Conduct operations with minimum interference to public or private roadways.

1.8 MATERIALS

- A. Materials and Equipment to be Retained by OWNER:
 - 1. Embedded relics and antiques such as cornerstones, cornerstone contents, commemorative plaques and tablets.
 - 2. All Valves and Operators, 4" size and larger.
- B. Materials and Equipment to be Re-Installed:
 - 1. None
- C. CONTRACTOR shall furnish all materials, tools, equipment, devices, appurtenances, facilities, and services required for performing selective demolition work throughout project.
- D. Erect weatherproof closures for exterior openings. Maintain exit requirements.
- E. Erect and maintain dustproof partitions as required to prevent spread of dust, fumes and smoke to other parts of building. On completion, remove partitions and repair damaged surfaces to match adjacent surfaces.
- F. Protect interior of building from rain and water damage.
- G. Provide and maintain protective devices to prevent injury from falling objects.
- H. Locate guardrails in stairwells and around open shafts to protect workers. Post clearly visible warning signs.
- I. Cause as little inconvenience to ongoing plant operations and to adjacent occupied building areas as possible.
- J. Protect benchmarks and existing construction to remain from damage or displacement.
- K. Carefully remove designated materials and equipment to be retained by OWNER or re-installed. Deliver materials and equipment when and where directed by ENGINEER. Store and protect materials and equipment to be re-installed.

1.9 DEMOLITION

- A. Demolish designated portions of structures and appurtenances in orderly and careful manner.
- B. Assume possession of demolished materials, unless specified otherwise. Remove demolished materials from site at least weekly.

- C. Prevent airborne dust. Use water or dust palliative when necessary. Provide and maintain hoses and connections to water main or hydrant.
- D. Do not burn materials on site.
- E. Remove tanks and service piping from site.
- F. Immediately upon discovery, remove, and dispose of contaminated, vermin infested, or dangerous materials by safe means so as not to endanger health of workers and public.
- G. Remove trees and shrubs within marked areas, clear undergrowth and dead plant material as specified in Division 02.
- H. Backfill open pits and holes caused by demolition as specified in Division 02.
- I. Rough grade areas affected by demolition.
- J. Remove demolished materials, tools, and equipment upon completion of demolition.

1.10 SPECIFIC DEMOLITION
1. Not Used

1.11 REPAIR

- A. Repair damage caused by demolition. The contractor shall take appropriate precautions to protect existing treatment facilities, structures, piping, mechanical equipment, and electrical equipment, which are to remain in service during the course of construction. In the event of damage, the contractor shall make the necessary repairs to place the facilities back in service at no increase in the contract price. Such repairs shall be made to the satisfaction of the OWNER.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 75 60 – TESTING, TRAINING, AND FACILITY START-UP

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Requirements for equipment and system testing and facility start up, including the following:
 - 1. Start-Up Plan.
 - 2. Performance Testing.
 - 3. General Start-Up and Testing Procedures.
 - 4. Functional Testing.
 - 5. Operational Testing.
 - 6. Certificate of Proper Installation.
 - 7. Services of manufacturer's representatives.
 - 8. Training of OWNER's personnel.
 - 9. Final testing requirements for the complete facility.
- B. Related sections:
 - 1. Section 01 32 00 – Construction Progress Documentation.
 - 2. Section 23 05 93 – HVAC Systems Testing, Adjusting and Balancing.
 - 3. Section 26 05 00 – Common Work Results for Electrical.

1.2 GENERAL TESTING, TRAINING, AND START-UP REQUIREMENTS

- A. Contract Requirements: Testing, training, and start-up are requisite to the satisfactory completion of the Contract.
- B. Complete testing, training, and start-up within the Contract Times.
- C. Allow realistic durations in the Progress Schedule for testing, training, and start-up activities.
- D. Furnish labor, power, chemicals, tools, equipment, instruments, and services required for and incidental to completing functional testing, performance testing, and operational testing.
- E. Provide competent, experienced technical representatives of equipment manufacturers for assembly, installation and testing guidance, and operator training.

1.3 START-UP PLAN

- A. Submit start-up plan for each piece of equipment and each system not less than 3 weeks prior to planned initial start-up of equipment or system.
- B. Provide detailed sub-network of Progress Schedule with the following activities identified:
 - 1. Manufacturer's services.
 - 2. Installation certifications.
 - 3. Operator training.
 - 4. Submission of Operation and Maintenance Manual.
 - 5. Functional testing.
 - 6. Performance testing.
 - 7. Operational testing.
- C. Provide testing plan with test logs for each item of equipment and each system when specified. Include testing of alarms, control circuits, capacities, speeds, flows, pressures, vibrations, sound levels, and other parameters.

- D. Provide summary of shutdown requirements for existing systems which are necessary to complete start-up of new equipment and systems.
- E. Revise and update start-up plan based upon review comments, actual progress, or to accommodate changes in the sequence of activities.

1.4 PERFORMANCE TESTING

- A. Test equipment for proper performance at point of manufacture or assembly when specified.
- B. When Source Quality Control Testing is Specified:
 - 1. Demonstrate equipment meets specified performance requirements.
 - 2. Provide certified copies of test results.
 - 3. Do not ship equipment until certified copies have received written acceptance from ENGINEER. Written acceptance does not constitute final acceptance.
 - 4. Perform testing as specified in the equipment specification sections.
- C. Include costs associated with witnessing performance tests in the bid price. Include costs for one (1) OWNER's representative for travel, lodging, transportation to and from lodging, and \$50 (50 Dollars) for meal allowance per person per day.

1.5 GENERAL START-UP AND TESTING PROCEDURES

- A. Mechanical Systems: As specified in the individual equipment specification sections:
 - 1. Remove rust preventatives and oils applied to protect equipment during construction.
 - 2. Flush lubrication systems and dispose of flushing oils. Recharge lubrication system with lubricant recommended by manufacturer.
 - 3. Flush fuel system and provide fuel for testing and start-up.
 - 4. Install and adjust packing, mechanical seals, O-rings, and other seals. Replace defective seals.
 - 5. Remove temporary supports, bracing, or other foreign objects installed to prevent damage during shipment, storage, and erection.
 - 6. Check rotating machinery for correct direction of rotation and for freedom of moving parts before connecting driver.
 - 7. Perform cold alignment and hot alignment to manufacturer's tolerances.
 - 8. Adjust V-belt tension and variable pitch sheaves.
 - 9. Inspect hand and motorized valves for proper adjustment. Tighten packing glands to insure no leakage, but permit valve stems to rotate without galling. Verify valve seats are positioned for proper flow direction.
 - 10. Tighten leaking flanges or replace flange gasket. Inspect screwed joints for leakage.
 - 11. Install gratings, safety chains, handrails, shaft guards, and sidewalks prior to operational testing.
- B. Electrical Systems: As specified in Division 26 and the individual equipment specification sections:
 - 1. Perform insulation resistance tests on wiring except 120 volt lighting, wiring, and control wiring inside electrical panels.
 - 2. Perform continuity tests on grounding systems.
 - 3. Test and set switchgear and circuit breaker relays for proper operation.
 - 4. Perform direct current high potential tests on all cables that will operate at more than 2,000 volts. Obtain services of independent testing lab to perform tests.
 - 5. Check motors for actual full load amperage draw. Compare to nameplate value.
- C. Instrumentation Systems: As specified in Division 26 and the individual equipment specification sections:

1. Bench or field calibrate instruments and make required adjustments and control point settings.
2. Leak test pneumatic controls and instrument air piping.
3. Energize transmitting and control signal systems, verify proper operation, ranges and settings.

1.6 FUNCTIONAL TESTING

- A. Perform checkout and performance testing as specified in the individual equipment specification sections.
- B. Functionally test mechanical and electrical equipment, and instrumentation and controls systems for proper operation after general start-up and testing tasks have been completed.
- C. Demonstrate proper rotation, alignment, speed, flow, pressure, vibration, sound level, adjustments, and calibration. Perform initial checks in the presence of and with the assistance of the manufacturer's representative.
- D. Demonstrate proper operation of each instrument loop function including alarms, local and remote controls, instrumentation and other equipment functions. Generate signals with test equipment to simulate operating conditions in each control mode.
- E. Conduct continuous 8-hour test under full load conditions. Replace parts which operate improperly.

1.7 OPERATIONAL TESTING

- A. After completion of operator training, conduct operational test of the entire facility. Demonstrate satisfactory operation of equipment and systems in actual operation.
- B. Conduct operational test for continuous 7-day period.
- C. OWNER will provide operations personnel, power, fuel, and other consumables for duration of each specified test.
- D. Immediately correct defects in material, workmanship, or equipment which became evident during operational test.
- E. Repeat operational test when malfunctions or deficiencies cause shutdown or partial operation of the facility or results in performance that is less than specified.

1.8 CERTIFICATE OF PROPER INSTALLATION

- A. At completion of Functional Testing, furnish written report prepared and signed by manufacturer's authorized representative, certifying equipment:
 1. Has been properly installed, adjusted, aligned, and lubricated.
 2. Is free of any stresses imposed by connecting piping or anchor bolts.
 3. Is suitable for satisfactory full-time operation under full load conditions.
 4. Operates within the allowable limits for vibration.
 5. Controls, protective devices, instrumentation, and control panels furnished as part of the equipment package are properly installed, calibrated, and functioning.
 6. Control logic for start-up, shutdown, sequencing, interlocks, and emergency shutdown have been tested and are properly functioning.

- B. Furnish written report prepared and signed by the electrical and/or instrumentation subcontractor certifying:
 1. Motor control logic that resides in motor control centers, control panels, and circuit boards furnished by the electrical and/or instrumentation subcontractor has been calibrated and tested and is properly operating.
 2. Control logic for equipment start-up, shutdown, sequencing, interlocks and emergency shutdown has been tested and is properly operating.
 3. Co-sign the reports along with the manufacturer's representative and subcontractors.

1.9 TRAINING OF OWNER'S PERSONNEL

- A. Provide operations and maintenance training for items of mechanical, electrical and instrumentation equipment. Utilize manufacturer's representatives to conduct training sessions.
- B. Coordinate training sessions to prevent overlapping sessions. Arrange sessions so that individual operators and maintenance technicians do not attend more than 2 sessions per week.
- C. Provide Operation and Maintenance Manual for specific pieces of equipment or systems 1 month prior to training session for that piece of equipment or system.
- D. Satisfactorily complete functional testing before beginning operator training.
- E. Provide training sessions for each work shift listed below during the time periods shown. Pooling of shifts will not be permitted unless accepted by OWNER.

Shift		
Day	Tuesday, 7 a.m.-11 a.m.	Thursday, 7 a.m.-11 a.m.
Swing	Wednesday, 3 p.m.-7 p.m.	Thursday, 3 p.m.-7 p.m.
Graveyard	Monday, 11 p.m.-3 a.m.	Wednesday, 11 p.m.-3 a.m.

- F. Training Sessions: Provide training sessions for equipment as specified in the individual equipment specification sections.
- G. The CONTRACTOR shall videotape all training sessions and provide a copy for the OWNER.
- H. The CONTRACTOR shall designate and provide one or more persons to be responsible for coordinating and expediting his/her training duties. The person or persons so designated shall be present at all training coordination meetings with the OWNER.
- I. The CONTRACTOR's coordinator shall coordinate the training periods with OWNER personnel and manufacturer's representatives, and shall submit a training schedule for each piece of equipment or system for which training is to be provided. Such training schedule shall be submitted not less than 21 calendar days prior to the time that the associated training is to be provided and shall be based on the current plan of operation.

1.10 RECORD KEEPING

- A. Maintain and submit following records generated during start-up and testing phase of Project:
 1. Daily logs of equipment testing identifying all tests conducted and outcome.
 2. Logs of time spent by manufacturer's representatives performing services on the job site.
 3. Equipment lubrication records.
 4. Electrical phase, voltage, and amperage measurements.
 5. Insulation resistance measurements.

6. Data sheets of control loop testing including testing and calibration of instrumentation devices and setpoints.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 77 00 – CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes description and requirements of the required closeout procedures for the project:
 - 1. Providing and delivering informational submittals.
 - 2. Preparing, maintaining, providing and delivering Record Documents.
 - 3. Furnishing Releases from Agreements.
 - 4. Furnishing Evidence of Compliance with Requirements of Governing Authorities.
 - 5. Providing Warranties and Bonds.
 - 6. Providing Certificate of Final Completion.

- B. Related sections:
 - 1. Section 01 29 00 – Payment Procedures.
 - 2. Section 01 32 00 – Construction Progress Documentation.
 - 3. Section 01 72 20 – Field Engineering.
 - 4. Section 01 78 23 – Operation and Maintenance Data.
 - 5. Section 01 79 00 – Demonstration and Training.

1.2 SUBMITTALS

- A. Informational Submittals:
 - 1. Submit Prior to Application for Final Payment.
 - a. Record Documents: As required in General Conditions.
 - b. Approved Shop Drawings and Samples: As required in the General Conditions.
 - c. Operations and Maintenance Manuals: In accordance with Section 01 78 23, and as required in individual Specification sections.
 - d. Certificates of Testing and Inspection: As required in the General Conditions, these General Requirements sections, and the individual Specifications sections.
 - e. Training Sessions: In accordance with Section 01 79 00, and individual Specifications sections.
 - f. Certificate of Substantial Completion.
 - g. Special bonds, Special Guarantees, and Service Agreements.
 - 2. Form of Submittal:
 - a. Bind in commercial quality 8-1/2" by 11" three ring, side binders with hardback, cleanable, plastic covers.
 - 1). Label cover of each binder with typed or printed title Warranties and Bonds, with title of Project; name; address, and telephone number of Contractor and equipment Supplier, and name of responsible principal.
 - 2). Table of Contents: Neatly typed, in the sequence of the of the Project Manual, with each item identified with the number and title of the Specification section in which specified, and the name of the product or Work item.
 - 3). Separate each warranty or Bond with index tab sheets keyed to the Table of Contents. Provide full information, using separate typed sheets as necessary. List Subcontractor, Supplier, and Manufacturer, with name, address, and telephone number of responsible contact for service and warranty issues.
 - 3. Preparation of Submittal:
 - a. Obtain notarized warranties and Bonds, executed in duplicate by responsible Subcontractor, Supplier, and Manufacturer, within 10 days after completion of the applicable item or Work, except for items put into use with Owner's permission, leave date of beginning of time warranty until date of Substantial Completion is determined.

4. Time of Submission: Submit within 10 days after the date of Date of Substantial Completion and prior to submission of Final Application of Payment.
 - a. Spare parts and special tools as required by individual Specification sections.
 - b. Consent of Surety to Final Payment: As required in General Conditions.
 - c. Releases or Waivers of Liens and Claims: As required in General Conditions.
 - d. Releases from Agreements.
 - e. Final Application for Payment: Submit in accordance with procedures and requirements stated in Section 01 29 00.
 - f. Extra Materials: As required by individual Specification sections.

1.3 RECORD DOCUMENTS

- A. Quality Assurance:
 1. Furnish qualified and experienced person, whose duty and responsibility shall be to maintain record documents.
 2. Accuracy of Records:
 3. Coordinate changes within record documents, making legible and accurate entries on each sheet of Drawings and other documents where such entry is required to show change.
 4. Purpose of Project record documents is to document factual information regarding aspects of the Work, both concealed and visible, to enable future modification of the Work to proceed without lengthy and expensive Site measurement, investigation, and examination.
 5. Make entries within 24 hours after receipt of information that a change in the Work has occurred.
 6. Prior to submitting each request for progress payment, request Engineer's review and approval of current status of record documents. Failure to properly maintain, update, and submit record documents may result in a deferral by Engineer to recommend whole or any part of Contractor's Application for Payment, either partial or final.
 7. Maintain at Project site, available to OWNER and ENGINEER, 1 copy of the Contract Documents, shop drawings and other submittals, in good order.

1.4 RELEASES FROM AGREEMENTS

- A. Furnish Owner written releases from property owners or public agencies where side agreements or special easements have been made, or where Contractor's operations have not been kept within the Owner's construction right-of-way.
- B. In the Event Contractor is Unable to Secure Written Releases:
 1. Inform Owner of the reasons.
 2. Owner or its representatives will examine the Site, and Owner will direct Contractor to complete the Work that may be necessary to satisfy terms of the side agreement or special easement.
 3. Should Contractor refuse to perform this Work, Owner reserves right to have it done by separate contract and deduct cost of same from Contract Price, or require Contractor to furnish a satisfactory bond in a sum to cover legal Claims for damages.
 4. When Owner is satisfied that the Work has been completed in agreement with Contract Documents and terms of side agreement or special easement, right is reserved to waive requirement for written release if:
 5. Contractor's failure to obtain such statement is due to grantor's refusal to sign, and this refusal is not based upon any legitimate Claims that Contractor has failed to fulfill terms of side agreement or special easement, or
 6. Contractor is unable to contact or has had undue hardship in contacting grantor.

1.5 EVIDENCE OF COMPLIANCE WITH REQUIREMENTS OF GOVERNING AUTHORITIES

- A. Submit the Following:
 - 1. Certificate of Occupancy.
 - 2. Certificates of Inspection:
 - a. Mechanical.
 - b. Electrical.

1.6 WARRANTIES AND BONDS

- A. Provide executed Warranty or Guaranty Form if required by Contract Documents.
- B. Provide specified additional warranties, guarantees, and bonds from manufacturers and suppliers.

1.7 CERTIFICATE OF FINAL COMPLETION

- A. When 7-day operational test has been successfully completed, ENGINEER will certify that new facilities are operationally complete. ENGINEER will submit a list of known items (punch list) still to be completed or corrected prior to contract completion.
- B. List of items to be completed or corrected will be amended as items are resolved by CONTRACTOR.
- C. When all items have been completed or corrected, submit written certification that the entire work is complete in accordance with the Contract Documents and request final inspection.
- D. Upon completion of final inspection, ENGINEER will either prepare a written acceptance of the entire work or advise CONTRACTOR of work not complete. If necessary, inspection procedures will be repeated.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 MAINTENANCE OF RECORD DOCUMENTS

- A. General:
 - 1. Promptly following commencement of Contract Times, secure from Engineer at no cost to Contractor, one complete set of Contract Documents. Drawings will be full size.
 - 2. Label or stamp each record document with title, "RECORD DOCUMENTS," in neat large printed letters.
 - 3. Record information concurrently with construction progress and within 24 hours after receipt of information that change has occurred. Do not cover or conceal Work until required information is recorded.
- B. Preservation:
 - 1. Maintain documents in a clean, dry, legible condition and in good order. Do not use record documents for construction purposes.
 - 2. Make documents and Samples available at all times for observation by Engineer.
- C. Making Entries on Drawings:
 - 1. Use an erasable colored pencil (not ink or indelible pencil), clearly describe change by graphic line and note as required.

- a. Make annotations with erasable colored pencil conforming to the following color code:

Additions:	Red
Deletions:	Green
Comments	Blue
Dimensions:	Graphite

2. Date entries.
 3. Call attention to entry by "cloud" drawn around area or areas affected.
 4. Legibly mark to record actual changes made during construction, including, but not limited to:
 5. Depths of various elements of foundation in relation to finished first floor data if not shown or where depth differs from that shown.
 6. Horizontal and vertical locations of existing and new Underground Facilities and appurtenances, and other underground structures, equipment, or Work, and Reference to at least two measurements to permanent surface improvements.
 7. Location of internal utilities and appurtenances concealed in the construction referenced to visible and accessible features of the structure.
 8. Locate existing facilities, piping, equipment, and items critical to the interface between existing physical conditions or construction and new construction.
 9. Changes made by Addenda and Field Orders, Work Change Directive, Change Order, and Engineer's written interpretation and clarification using consistent symbols for each and showing appropriate document tracking number.
 10. Dimensions on Schematic Layouts: Show on record drawings, by dimension, the centerline of each run of items that are described in previous subparagraph above.
 11. Clearly identify the item by accurate note such as "cast iron drain," "galv. water," and the like.
 12. Show, by symbol or note, vertical location of item ("under slab," "in ceiling plenum," "exposed," and the like).
 13. Make identification so descriptive that it may be related reliably to Specifications.
 14. Mark and record field changes and detailed information contained in submittals and change orders.
 15. Record actual depths, horizontal and vertical location of underground pipes, duct banks and other buried utilities. Reference dimensions to permanent surface features.
 16. Identify specific details of pipe connections, location of existing buried features located during excavation, and the final locations of piping, equipment, electrical conduits, manholes, and pull boxes.
 17. Identify location of spare conduits including beginning, ending and routing through pull boxes, and manholes. Record spare conductors, including number and size, within spare conduits, and filled conduits.
 18. Provide schedules, lists, layout drawings, and wiring diagrams.
- D. Maintain Documents Separate From Those Used for Construction:
1. Label documents "RECORD DOCUMENTS."
- E. Keep Documents Current:
1. Record required information at the time the material and equipment is installed and before permanently concealing.
- F. Deliver record documents with transmittal letter containing date, Project title, CONTRACTOR's name and address, list of documents, and signature of CONTRACTOR.
- G. During progress meetings, record documents will be reviewed to ascertain that changes have been recorded.

H. Final Schedule Submittal in accordance with Section 01 32 00.

3.2 FINAL CLEANING

- A. At completion of the Work or of a part thereof and immediately prior to Contractor's request for certificate of Substantial Completion; or if no certificate is issued, immediately prior to Contractor's notice of completion, clean entire Site or parts thereof, as applicable.
1. Leave the Work and adjacent areas affected in a cleaned condition satisfactory to Owner.
 2. Remove grease, dirt, dust, paint or plaster splatter, stains, labels, fingerprints, and other foreign materials from exposed surfaces.
 3. Repair, patch, and touch up marred surfaces to specified finish and match adjacent surfaces.
 4. Clean all windows.
 5. Clean and wax wood, vinyl, or painted floors.
 6. Broom clean exterior paved driveways and parking areas.
 7. Hose clean sidewalks, loading areas, and others contiguous with principal structures.
 8. Rake and clean all other surfaces.
 9. Remove snow and ice from access to buildings.
 10. Replace air-handling filters and clean ducts, blowers, and coils of ventilation units operated during construction.
 11. Leave water courses, gutters, and ditches open and clean.
 12. Perform final cleaning prior to inspections for Final Acceptance.
 13. Employ skilled workers who are experienced in cleaning operations.
 14. Use cleaning materials which are recommended by manufacturers of surfaces to be cleaned.
 15. Prevent scratching, discoloring, and otherwise damaging surfaces being cleaned.
 16. Clean roofs, gutters, downspouts, and drainage systems.
 17. Broom clean exterior paved surfaces and rake clean other surfaces of site work:
 - a. Police yards and grounds to keep clean.
 18. Remove dust, cobwebs, and traces of insects and dirt.
 19. Clean grease, mastic, adhesives, dust, dirt, stains, fingerprints, paint, blemishes, sealants, plaster, concrete, and other foreign materials from sight-exposed surfaces, and fixtures and equipment.
 20. Remove non-permanent protection and labels.
 21. Polish waxed woodwork and finish hardware.
 22. Wash tile.
 23. Wax and buff hard floors, as applicable.
 24. Wash and polish glass, inside and outside.
 25. Wash and shine mirrors.
 26. Polish glossy surfaces to clear shine.
 27. Vacuum carpeted and soft surfaces.
 28. Clean permanent filters and replace disposable filters when heating, ventilation, and air conditioning units were operated during construction.
 29. Clean ducts, blowers and coils when units were operated without filters during construction.
 30. Clean light fixtures and replace burned-out or dim lamps.
- B. Use only cleaning materials recommended by Manufacturer of surfaces to be cleaned.

3.3 WASTE DISPOSAL

- A. Arrange for and dispose of surplus materials, waste products, and debris off-site:
1. Prior to making disposal on private property, obtain written permission from OWNER of such property.
- B. Do not fill ditches, washes, or drainage ways which may create drainage problems.

- C. Do not create unsightly or unsanitary nuisances during disposal operations.
- D. Maintain disposal site in safe condition and good appearance.
- E. Complete leveling and cleanup prior to Final Acceptance of the Work.

3.4 TOUCH-UP AND REPAIR

- A. Touch-up or repair finished surfaces on structures, equipment, fixtures, and installations that have been damaged prior to inspection for Final Acceptance.
- B. Refinish or replace entire surfaces which cannot be touched-up or repaired satisfactorily.

3.5 FINAL CLEANING AND DISINFECTION OF SYSTEMS OF PLANT FACILITIES

- A. Clean channels, pipe, basins, reservoirs, and tanks before running of 7-day test, or before facility goes on stream when 7-day test is not required.
- B. Wash, wherever practicable, or broom sweep channels, pipe, basins, reservoirs, and tanks.
- C. Disinfect piping intended to carry potable water as follows or in accordance with American Water Works Association Standards.
- D. Provide ample sampling outlets in pipe for testing.
- E. Fill pipe with chlorine solution of sufficient strength to retain residual of not less than 10 parts per million at end of 24 hours.
- F. After disinfection, rinse entire potable water system with potable water sufficient to reduce chlorine residual to not more than 0.6 parts per million throughout system before system is put into service.

3.6 FINAL CLEANING AND DISINFECTION OF SYSTEMS OF POTABLE WATER MAINS

- A. Clean interior of pipe and fittings.
- B. When pipe contains dirt that cannot be removed by flushing, swab pipe interiors with solution containing not less than 500 parts per million of chlorine until clean.
- C. Flush 12 inch in diameter and smaller pipe as thoroughly as available water sources will permit.
- D. Fill pipe with chlorine solution of sufficient strength to provide 10 parts per million chlorine residual at end of 24 hours.
- E. Flush pipes with potable water until chlorine residual is less than 0.6 parts per million before pipe are put into service.

3.7 CLOSEOUT DOCUMENTS

- A. Submit following Closeout Submittals upon completion of the Work and at least 7 days prior to submitting Application for Final Payment:
 1. Evidence of Compliance with Requirements of Governing Authorities.
 2. Project Record Documents.
 3. Operation and Maintenance Manuals.
 4. Warranties and Bonds.

5. Keys and Keying Schedule.
6. Evidence of Payment and Release of Stop Payment Notices as outlined in Conditions of the Contract.
7. Release of claims as outlined in Conditions of the Contract.
8. Survey Record Documents as specified in Section 01 72 20.
9. Certificate of Final Completion.

END OF SECTION

SECTION 01 78 23 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Detailed information for the preparation, submission, and Engineer's review of Operations and Maintenance (O&M) Data, as required by individual Specification sections.
- B. Related sections:
 - 1. Section 01 77 00 – Closeout Procedures.

1.2 DEFINITIONS

- A. Preliminary Data: Initial and subsequent submissions for Engineer's review.
- B. Final Data: Engineer-accepted data, submitted as specified herein.
- C. Maintenance Operation: As used on Maintenance Summary Form is defined to mean any routine operation required to ensure satisfactory performance and longevity of equipment. Examples of typical maintenance operations are lubrication, belt tensioning, adjustment of pump packing glands, and routine adjustments.

1.3 SEQUENCING AND SCHEDULING

- A. Equipment and System Data:
 - 1. Preliminary Data:
 - a. Do not submit until Shop Drawing for equipment or system has been reviewed and approved by Engineer.
 - b. Submit prior to shipment date.
 - 2. Final Data:
 - a. Submit Instructional Manual Formatted data not less than 30 days prior to equipment or system field functional testing.
- B. Materials and Finishes Data:
 - 1. Preliminary Data: Submit at least 15 days prior to request for final inspection.
 - 2. Final Data: Submit within 10 days after final inspection.

1.4 DATA FORMAT

- A. Prepare preliminary data in the form of an instructional manual. Prepare final data in the form of an instructional manual and in electronic media format.
- B. Instructional Manual Format:
 - 1. Binder: Commercial quality, permanent, three-ring or three-post binders with durable plastic cover.
 - 2. Size: 8-1/2" x 11" minimum.
 - 3. Cover: Identify manual with typed or printed title "OPERATION AND MAINTENANCE DATA" and list:
 - a. Project title.
 - b. Designate applicable system, equipment, material, or finish.
 - c. Identity of separate structure as applicable.
 - d. Identity of general subject matter covered in manual.
 - e. Identity of equipment number and Specification section.

4. Title Page:
 - a. Contractor name, address, and telephone number.
 - b. Subcontractor, Supplier, installer, or maintenance contractor's name, address, and telephone number, as appropriate.
 - 1). Identify area of responsibility of each.
 - 2). Provide name and telephone number of local source of supply for parts and replacement.
5. Table of Contents:
 - a. Neatly typewritten and arranged in systematic order with consecutive page numbers.
 - b. Identify each product by product name and other identifying numbers or symbols as set forth in Contract Documents.
6. Paper: 20-pound minimum, white for typed pages.
7. Text: Manufacturer's printed data, or neatly typewritten.
8. Three-hole punched data for binding and composition; arrange printing so that punched holes do not obliterate data.
9. Material shall be suitable for reproduction, with quality equal to original. Photocopying of material will be acceptable, except for material containing photographs.

C. Electronic Media Format:

1. Portable Document Format (PDF):
 - a. After all preliminary data has been found to be acceptable to Engineer, submit Operation and Maintenance data in PDF format on CD.
 - b. Files to be exact duplicates of Engineer-accepted preliminary data. Arrange by specification number and name.
 - c. Files to be fully functional and viewable in most recent version of Adobe Acrobat.

1.5 SUBMITTALS

A. Procedures of Submittal

1. Contractor shall:
 - a. Submit all submittals electronically using the Info Exchange project website to facilitate the transfer of submittals and related files.
 - b. Submit all required final hard copies and required electronic copies as specified herein.

B. Informational:

1. Data Outline: Submit one electronic copy via the Info Exchange website of a detailed outline of proposed organization and contents of Final Data prior to preparation of Preliminary Data.
2. Preliminary Data:
 - a. Submit one electronic copy for Engineer's review.
 - b. If data meets conditions of the Contract:
 - 1). One electronic copy will be returned to Contractor.
 - 2). One electronic copy will be forwarded to Resident Project Representative.
 - 3). One electronic copy will be retained in Engineer's file
 - c. If data does not meet conditions of the Contract:
 - 4). One electronic copy will be returned to Contractor with Engineer's comments (on separate document) for revision.
 - 5). Engineer's comments will be retained in Engineer's file.
 - 6). One electronic copy will be retained in Engineer's file.
 - 7). Re-submit one electronic copy revised in accordance with Engineer's comments.
3. Final Data: Submit two hard copies and one electronic copy in each format specified herein.

1.6 DATA FOR EQUIPMENT AND SYSTEMS

A. Content for Each Unit (or Common Units) and System:

1. Product Data:
 - a. Include only those sheets that are pertinent to specific product.
 - b. Clearly annotate each sheet to:
 - 1). Identify specific product or part installed.
 - 2). Identify data applicable to installation.
 - 3). Delete references to inapplicable information.
 - c. Function, normal operating characteristics, and limiting conditions.
 - d. Performance curves, engineering data, nameplate data, and tests.
 - e. Complete nomenclature and commercial number of replaceable parts.
 - f. Original Manufacturer's parts list, illustrations, detailed assembly drawings showing each part with part numbers and sequentially numbered parts list, and diagrams required for maintenance.
 - g. Spare parts ordering instructions.
 - h. Where applicable, identify installed spares and other provisions for future work (e.g., reserved panel space, unused components, wiring, and terminals).
2. As-installed, color-coded piping diagrams.
3. Charts of valve tag numbers, with the location and function of each valve.
4. Drawings: Supplement product data with Drawings as necessary to clearly illustrate:
 - a. Format:
 - 1). Provide reinforced, punched, binder tab; bind in with text.
 - 2). Reduced to 8-1/2" x 11", or 11" x 17" folded to 8-1/2" x 11".
 - 3). Where reduction is impractical, fold and place in 8-1/2" x 11" envelopes bound in text.
 - 4). Identify Specification section and product on Drawings and envelopes.
 - b. Relations of component parts of equipment and systems.
 - c. Control and flow diagrams.
 - d. Coordinate drawings with Project record documents to assure correct illustration of completed installation.
5. Instructions and Procedures: Within text, as required to supplement product data.
 - a. Format:
 - 1). Organize in consistent format under separate heading for each different procedure.
 - 2). Provide logical sequence of instructions for each procedure.
 - 3). Provide information sheet for Owner's personnel, including:
 - a). Proper procedures in event of failure.
 - b). Instances that might affect validity of guarantee or Bond.
 - b. Installation Instructions: Including alignment, adjusting, calibrating, and checking.
 - c. Operating Procedures:
 - 1). Startup, break-in, routine, and normal operating instructions.
 - 2). Test procedures and results of factory tests where required.
 - 3). Regulation, control, stopping, and emergency instructions.
 - 4). Description of operation sequence by control Manufacturer.
 - 5). Shutdown instructions for both short and extended duration.
 - 6). Summer and winter operating instructions, as applicable.
 - 7). Safety precautions.
 - 8). Special operating instructions.
 - d. Maintenance and Overhaul Procedures:
 - 1). Routine maintenance.
 - 2). Guide to troubleshooting.
 - 3). Disassembly, removal, repair, reinstallation, and re-assembly.
6. Guarantee, Bond, and Service Agreement: In accordance with Section 01 77 00.

B. Content for Each Electric or Electronic Item or System:

1. Description of Unit and Component Parts:
 - a. Function, normal operating characteristics, and limiting conditions.
 - b. Performance curves, engineering data, nameplate data, and tests.
 - c. Complete nomenclature and commercial number of replaceable parts.
 - d. Interconnection wiring diagrams, including control and lighting systems.
2. Circuit Directories of Panelboards:
 - a. Electrical service.
 - b. Controls.
 - c. Communications.
3. List of electrical relay settings, and control and alarm contact settings.
4. Electrical interconnection wiring diagram, including control and lighting systems.
5. As-installed control diagrams by control Manufacturer.
6. Operating Procedures:
 - a. Routine and normal operating instructions.
 - b. Sequences required.
 - c. Safety precautions.
 - d. Special operating instructions.
7. Maintenance Procedures:
 - a. Routine maintenance.
 - b. Guide to troubleshooting.
 - c. Adjustment and checking.
 - d. List of relay settings, control and alarm contact settings.
8. Manufacturer's printed operating and maintenance instructions.
9. List of original Manufacturer's spare parts, Manufacturer's current prices, and recommended quantities to be maintained in storage.

C. Maintenance Summary:

1. Compile individual Maintenance Summary for each applicable equipment item, respective unit or system, and for components or sub-units.
2. Format: Use only 8-1/2" x 11" size paper.
3. Include detailed lubrication instructions and diagrams showing points to be greased or oiled; recommend type, grade, and temperature range of lubricants and frequency of lubrication.
4. Recommended Spare Parts:
 - a. Data to be consistent with Manufacturer's Bill of Materials/Parts List furnished in O&M manuals.
 - b. "Unit" is the unit of measure for ordering the part.
 - c. "Quantity" is the number of units recommended.
 - d. "Unit Cost" is the current purchase price.

1.7 DATA FOR MATERIALS AND FINISHES

A. Content for Architectural Products, Applied Materials, and Finishes:

1. Manufacturer's data, giving full information on products:
 - a. Catalog number, size, and composition.
 - b. Color and texture designations.
 - c. Information required for reordering special-manufactured products.
2. Instructions for Care and Maintenance:
 - a. Manufacturer's recommendation for types of cleaning agents and methods.
 - b. Cautions against cleaning agents and methods that are detrimental to product.
 - c. Recommended schedule for cleaning and maintenance.
3. Content for Moisture Protection and Weather Exposed Products:
4. Manufacturer's data, giving full information on products:
 - a. Applicable standards.
 - b. Chemical composition.
 - c. Details of installation.

5. Instructions for inspection, maintenance, and repair.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 79 00 – DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes description and requirements of the required demonstration and training for the project:
 - 1. Providing and delivering informational submittals.
 - 2. Submitting required qualifications of Manufacturer' Representative.
 - 3. Preparing, maintaining, providing and delivering Manufacturer's Certificate of Compliance and Manufacturer's Certificate of Proper Installation.
 - 4. Furnishing required Training.
 - 5. Furnishing required Equipment Testing, Unit Processes and Facility Performance Demonstration.

- B. Related sections:
 - 1. Section 01 31 19 – Project Meetings.
 - 2. Section 01 32 00 – Construction Progress Documentation.
 - 3. Section 01 78 23 – Operation and Maintenance Data.
 - 4. Section 01 75 60 – Testing, Training, and Facility Start-Up.
 - 5. Section 01 79 00 – Demonstration and Training.

1.2 DEFINITIONS

- A. Person-Day: One person for 8 hours within regular Contractor working hours.

- B. Facility: Entire Project, or an agreed-upon portion including all unit processes.

- C. Functional Test: Test or tests in presence of Engineer and Owner to demonstrate that installed equipment meets Manufacturer's installation, calibration, and adjustment requirements and other requirements as specified.

- D. Performance Test: Test or tests performed after any required functional test in presence of Engineer and Owner to demonstrate and confirm individual equipment meets performance requirements specified in individual sections.

- E. Unit Process: As used in this Section, a unit process is a portion of the facility that performs a specific process function, such as, but not limited to:
 - 1. Flash Mixing.
 - 2. Flocculation/clarification.
 - 3. Chemical metering and injection (all chemical systems)
 - 4. Thickening
 - 5. Pumping
 - 6. Dewatering

- F. Facility Performance Demonstration:
 - 1. A demonstration, conducted by Contractor, with assistance of Owner, to demonstrate and document the performance of the entire operating facility, manually and automatically (if required), based on criteria developed in conjunction with Owner and as accepted by Engineer.
 - 2. Such demonstration is for the purposes of:
 - a. Verifying to Owner entire facility performs as a whole, and
 - b. Documenting performance characteristics of completed facility for Owner's records. Neither the demonstration nor the evaluation is intended in any way to

make performance of a unit process or entire facility the responsibility of Contractor, unless such performance is otherwise specified.

1.3 SUBMITTALS

- A. Informational Submittals:
1. Training Schedule: Submit not less than 21 days prior to start of equipment installation and revise as necessary for acceptance.
 2. Lesson Plan: Submit proposed lesson plan not less than 21 days prior to scheduled training and revise as necessary for acceptance.
 3. Training Session Tapes: Furnish Owner with two complete sets of tapes fully indexed and cataloged with printed label stating session and date taped.
 4. Facility Startup and Performance Demonstration Plan.
 5. Functional and performance test results.
 6. Completed Unit Process Startup Form for each unit process.
 7. Completed Facility Performance Demonstration/Certification Form.

1.4 QUALIFICATION OF MANUFACTURER'S REPRESENTATIVE

- A. Authorized representative of the Manufacturer, factory trained, and experienced in the technical applications, installation, operation, and maintenance of respective equipment, subsystem, or system, with full authority by the equipment Manufacturer to issue the certifications required of the Manufacturer. Additional qualifications may be specified elsewhere.
- B. Representative subject to acceptance by Owner and Engineer. No substitute representatives will be allowed unless prior written approval by such has been given.

1.5 FACILITY STARTUP AND PERFORMANCE DEMONSTRATION PLAN

- A. Develop a written plan, in conjunction with Owner's operations personnel; to include the following:
1. Step-by-step instructions for startup of each unit process and the complete facility.
 2. Unit Process Startup Form (sample attached), to minimally include the following:
 - a. Description of the unit process, including equipment numbers/nomenclature of each item of equipment and all included devices.
 - b. Detailed procedure for startup of the unit process, including valves to be opened/closed, order of equipment startup, etc.
 - c. Startup requirements for each unit process, including water, power, chemicals, etc.
 - d. Space for evaluation comments.
 3. Facility Performance Demonstration/Certification Form (sample attached), to minimally include the following:
 - a. Description of unit processes included in the facility startup.
 - b. Sequence of unit process startup to achieve facility startup.
 - c. Description of computerized operations, if any, included in the facility.
 - d. Contractor certification facility is capable of performing its intended function(s), including fully automatic operation.
 - e. Signature spaces for Contractor and Engineer.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 GENERAL

- A. Furnish Manufacturers' services when required by an individual specification section, to meet the requirements of this Section.
- B. Where time is necessary in excess of that stated in the Specifications for Manufacturers' services, or when a minimum time is not specified, the time required to perform the specified services shall be considered incidental.
- C. Schedule Manufacturer's services to avoid conflict with other onsite testing or other Manufacturer's onsite services.
- D. Determine, before scheduling services, that all conditions necessary to allow successful testing have been met.
- E. Only those days of service approved by Engineer will be credited to fulfill the specified minimum services.
- F. When specified in individual specification sections, Manufacturer's onsite services shall include:
 - 1. Assistance during product (system, subsystem, or component) installation to include observation, guidance, instruction of Contractor's assembly, erection, installation or application procedures.
 - 2. Inspection, checking, and adjustment as required for product (system, subsystem, or component) to function as warranted by Manufacturer and necessary to furnish Manufacturer's Certificate of Proper Installation.
 - 3. Providing, on a daily basis, copies of all Manufacturer's representatives' field notes and data to Engineer.
 - 4. Revisiting the Site as required to correct problems and until installation and operation are acceptable to Engineer.
 - 5. Resolution of assembly or installation problems attributable to or associated with, respective Manufacturer's products and systems.
 - 6. Assistance during functional and performance testing, and facility startup and evaluation.
 - 7. Training of Owner's personnel in the operation and maintenance of respective product as required.
 - 8. Additional requirements may be specified elsewhere.
- G. Facility Startup Meetings: Schedule, in accordance with requirements of Section 01 31 19, PROJECT MEETINGS, to discuss test schedule, test methods, materials, chemicals and liquids required, facilities operations interface, and Owner involvement.
- H. Contractor's Testing and Startup Representative:
 - 1. Designate and furnish one or more personnel to coordinate and expedite testing and facility startup.
 - 2. Representative(s) shall be present during startup meetings and shall be available at all times during testing and startup.
- I. Provide temporary valves, gauges, piping, test equipment and other materials and equipment required for testing and startup.
- J. Provide Subcontractor and equipment Manufacturer's with adequate staff to prevent delays. Schedule ongoing work so as not to interfere with or delay testing and startup.

- K. Owner will:
 - 1. Provide water, power, chemicals, and other items as required for startup, unless otherwise indicated.
 - 2. Operate process units and facility with support of Contractor.
 - 3. Provide labor and materials as required for laboratory analyses.

3.2 MANUFACTURER'S CERTIFICATE OF COMPLIANCE

- A. When specified in individual Specification section, submit prior to shipment of product or material.
- B. Engineer may permit use of certain materials or assemblies prior to sampling and testing if accompanied by accepted certification of compliance.
- C. Signed by product Manufacturer certifying that product or material specified conforms to or exceeds specified. Attach supporting reference data, affidavits, and certifications as appropriate.
- D. May reflect recent or previous test results on material or product, if acceptable to Engineer.

3.3 MANUFACTURER'S CERTIFICATE OF PROPER INSTALLATION

- A. When so specified, a Manufacturer's Certificate of Proper Installation form, a copy of which is attached to this Section, shall be completed and signed by the equipment Manufacturer's representative.
- B. Such form shall certify that the signing party is a duly authorized representative of the Manufacturer, is empowered by the Manufacturer to inspect, approve, and operate their equipment and is authorized to make recommendations required to assure that the equipment is complete and operational.

3.4 TRAINING

- A. General:
 - 1. Furnish Manufacturer's representatives for detailed classroom and hands-on training to Owner's personnel on operation and maintenance of specified product (system, subsystem, component) and as may be required in applicable Specifications.
 - 2. Furnish trained, articulate personnel to coordinate and expedite training, to be present during training coordination meetings with Owner, and familiar with operation and maintenance manual information specified in Section 01 78 23, OPERATION AND MAINTENANCE DATA.
 - 3. Manufacturer's representative shall be familiar with facility operation and maintenance requirements as well as with specified equipment.
 - 4. Furnish complete training materials, to include operation and maintenance data, to be retained by each trainee.
- B. Training Schedule:
 - 1. List specified equipment and systems that require training services and show:
 - a. Respective Manufacturer.
 - b. Estimated dates for installation completion.
 - c. Estimated training dates.
 - 2. Allow for multiple sessions when several shifts are involved.
 - 3. Adjust schedule to ensure training of appropriate personnel as deemed necessary by Owner, and to allow full participation by Manufacturer's representatives. Adjust schedule for interruptions in operability of equipment.

4. Coordinate with Section 01 32 00, CONSTRUCTION PROGRESS DOCUMENTATION and Section 01 75 60, TESTING, TRAINING, AND FACILITY START-UP.
- C. Lesson Plan: When Manufacturer or vendor training of Owner personnel is specified, prepare for each required course, containing the following minimum information:
1. Title and objectives.
 2. Recommended types of attendees (e.g., managers, engineers, operators, maintenance).
 3. Course description and outline of course content.
 4. Format (e.g., lecture, self-study, demonstration, hands-on).
 5. Instruction materials and equipment requirements.
 6. Resumes of instructors providing the training.
- D. Pre-startup Training:
1. Coordinate training sessions with Owner's operating personnel and Manufacturer's representatives, and with submission of operation and maintenance manuals in accordance with Section 01 78 23, OPERATIONS AND MAINTENANCE DATA.
 2. Complete at least 14 days prior to beginning of facility startup.
- E. Post-startup Training: If required in Specifications furnish and coordinate training of Owner's operating personnel by respective Manufacturer's representatives.
- F. Taping of Training Sessions:
1. Furnish audio and color video taping of all instruction sessions, including Manufacturer's representatives, hands-on equipment instruction and classroom sessions.
 2. Video training tapes shall be produced by a qualified, professional video specialist approved by Owner.
 3. Use DVD format, suitable for playback on standard equipment available commercially in the United States.

3.5 EQUIPMENT TESTING

- A. Preparation:
1. Complete installation before testing.
 2. Furnish qualified Manufacturer's representatives, when required by individual Specification sections.
 3. Obtain and submit from equipment Manufacturer's representative Manufacturer's Certificate of Proper Installation Form, in accordance with Section 01 75 60, TESTING, TRAINING, AND FACILITY START-UP, when required by individual Specification sections.
 4. Equipment Test Report Form: Provide written test report for each item of equipment to be tested, to include the minimum information:
 - a. Owner/Project Name.
 - b. Equipment or item tested.
 - c. Date and time of test.
 - d. Type of test performed (Functional or Performance).
 - e. Test method.
 - f. Test conditions.
 - g. Test results.
 - h. Signature spaces for Contractor and Engineer as witness.
 5. Cleaning and Checking: Prior to beginning functional testing:
 - a. Calibrate testing equipment in accordance with Manufacturer's instructions.
 - b. Inspect and clean equipment, devices, connected piping, and structures to ensure they are free of foreign material.
 - c. Lubricate equipment in accordance with Manufacturer's instructions.
 - d. Turn rotating equipment by hand when possible to confirm that equipment is not bound.

- e. Open and close valves by hand and operate other devices to check for binding, interference, or improper functioning.
 - f. Check power supply to electric-powered equipment for correct voltage.
 - g. Adjust clearances and torque.
 - h. Test piping for leaks.
6. Ready-to-test determination will be by Engineer-based at least on the following:
- a. Acceptable Operation and Maintenance Data.
 - b. Notification by Contractor of equipment readiness for testing.
 - c. Receipt of Manufacturer's Certificate of Proper Installation, if so specified.
 - d. Adequate completion of work adjacent to, or interfacing with, equipment to be tested.
 - e. Availability and acceptability of Manufacturer's representative, when specified, to assist in testing of respective equipment.
 - f. Satisfactory fulfillment of other specified Manufacturer's responsibilities.
 - g. Equipment and electrical tagging complete.
 - h. Delivery of all spare parts and special tools.

B. Functional Testing:

- 1. Conduct as specified in individual Specification sections.
- 2. Notify Owner and Engineer in writing at least 10 days prior to scheduled date of testing.
- 3. Prepare Equipment Test Report summarizing test method and results.
- 4. When in Engineer's opinion, equipment meets functional requirements specified such equipment will be accepted for purposes of advancing to performance testing phase, if so required by individual Specification sections. Such acceptance will be evidenced by Engineer/Owner's signature as witness on Equipment Test Report.

C. Performance Testing:

- 1. Conduct as specified in individual Specification sections.
- 2. Notify Engineer and Owner in writing at least 10 days prior to scheduled date of test.
- 3. Performance testing shall not commence until equipment has been accepted by Engineer as having satisfied functional test requirements specified.
- 4. Type of fluid, gas, or solid for testing shall be as specified.
- 5. Unless otherwise indicated, furnish labor, materials, and supplies for conducting the test and taking samples and performance measurements.
- 6. Prepare Equipment Test Report summarizing test method and results.
- 7. When, in Engineer's opinion, equipment meets performance requirements specified, such equipment will be accepted as conforming to Contract requirements. Such acceptance will be evidenced by Engineer's signature on Equipment Test Report.

3.6 STARTUP OF UNIT PROCESSES

- A. Prior to unit process startup, equipment within unit process shall be accepted by Engineer as having met functional and performance testing requirements specified.
- B. Startup sequencing of unit processes shall be as chosen by Contractor to meet schedule requirements.
- C. Make adjustments, repairs, and corrections necessary to complete unit process startup.
- D. Startup shall be considered complete when, in opinion of Engineer, unit process as operated in manner intended for 5 continuous days without significant interruption. This period is in addition to functional or performance test periods specified elsewhere.
- E. Significant Interruption: May include any of the following events:
 - 1. Failure of Contractor to provide and maintain qualified onsite startup personnel as scheduled.

2. Failure to meet specified functional operation for more than 2 consecutive hours.
3. Failure of any critical equipment or unit process that is not satisfactorily corrected within 5 hours after failure.
4. Failure of any non-critical equipment or unit process that is not satisfactorily corrected within 8 hours after failure.
5. As determined by Engineer.

F. A significant interruption will require startup then in progress to be stopped. After corrections are made; start up test period and start from beginning again.

3.7 FACILITY PERFORMANCE DEMONSTRATION

- A. When, in the opinion of Engineer, startup of all unit processes has been achieved, sequence each unit process to the point that facility is operational.
- B. Demonstrate proper operation of required interfaces within and between individual unit processes.
- C. After facility is operating, complete performance testing of equipment and systems not previously tested.
- D. Document, as defined in Facility Startup and Performance Demonstration Plan, the performance of the facility.
- E. Certify, on the Facility Performance Demonstration/Certification Form, that facility is capable of performing its intended function(s), including fully automatic operation.

3.8 SUPPLEMENTS

- A. Supplements listed below, following "End of Section," are a part of this Specification:
 1. Manufacturer's Certificate of Proper Installation Form.
 2. Unit Process Startup Form.
 3. Facility Performance Demonstration/Certification Form.

END OF SECTION

MANUFACTURER'S CERTIFICATE OF PROPER INSTALLATION

OWNER: _____ EQUIP. SERIAL NO: _____
 EQUIP. TAG NO: _____ EQUIP. SYSTEM: _____
 PROJECT NO: _____ SPEC. SECTION: _____

I hereby certify that the above referenced equipment/system has been:

(Check Applicable)

<input type="checkbox"/>	Installed in accordance with Manufacturer's recommendations.
<input type="checkbox"/>	Inspected, checked, and adjusted.
<input type="checkbox"/>	Serviced with proper initial lubricants.
<input type="checkbox"/>	Electrical and mechanical connections meet quality and safety standards.
<input type="checkbox"/>	All applicable safety equipment has been properly installed.
<input type="checkbox"/>	Functional tests.
<input type="checkbox"/>	System has been performance tested, and meets or exceeds specified performance requirements. (When complete system of one manufacturer)

Note: Attach any performance test documentation from manufacturer.

Comments:

I, the undersigned Manufacturer's Representative, hereby certify that I am (i) a duly authorized representative of the manufacturer, (ii) empowered by the manufacturer to inspect, approve, and operate its equipment, and (iii) authorized to make recommendations required to assure that the equipment furnished by the manufacturer is complete and operational, except as may be otherwise indicated herein. I further certify that all information contained herein is true and accurate.

Date: _____, 20____.

Manufacturer: _____

By Manufacturer's Authorized Representative: _____
 (Authorized Signature)

UNIT PROCESS STARTUP FORM

OWNER: _____ PROJECT: _____

Unit Process Description: (Include description and equipment number of all equipment and devices):

Startup Procedure: (Describe procedure for sequential startup and evaluation, including valves to be opened/closed, order of equipment startup, etc.):

Startup Requirements (Water, power, chemicals, etc.):

Evaluation Comments:

FACILITY PERFORMANCE DEMONSTRATION/CERTIFICATION FORM

OWNER: _____ PROJECT: _____

Unit Process Description: (List unit processes involved in facility startup):

Unit Processes Startup Sequence: (Describe sequence for startup, including computerized operations if any):

Contractor Certification that Facility is capable of performing its intended function(s), including fully automatic operation:

Contractor: _____ Date: _____, 20__

Engineer: _____ Date: _____, 20__

SECTION 01 79 01– SPARE PARTS AND MAINTENANCE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes description and requirements of the required Spare Parts and Maintenance for the project.
- B. Ninety (90) days after approval of the Shop Drawings of the equipment specified in the individual Sections, the CONTRACTOR shall furnish spare parts data and maintenance material for equipment. The data shall include a complete list of parts and supplies, with current unit prices and source or sources of supply.
- C. Spare parts and materials required to be supplied in the Contract Documents shall be furnished in manufacturer's unopened cartons, boxes, crates, or other protective covering suitable for preventing corrosion or deterioration for the maximum length of storage which may be normally anticipated. They shall be clearly marked and identified as to the name of manufacturer or supplier, applicable equipment, part number, description and location in the equipment. All parts shall be protected and packaged for a shelf life of at least 10 years.
- D. During construction, store parts in buildings or trailers with floor, roof and closed sides and in accordance with manufacturers' recommendations. Protect from weather, condensation, and humidity.
- E. Parts and materials shall be delivered to the OWNER upon Substantial Completion of the Work or start-up. CONTRACTOR shall then place them in permanent storage rooms or areas approved by the OWNER. The turnover procedures shall be developed by the ENGINEER.
- F. Provide a letter of transmittal and spare parts receiver form including the following:
 - 1. Date of letter and transfer of parts and material.
 - 2. Contract title and number.
 - 3. CONTRACTOR's name and address.
 - 4. Transmittal should list applicable specification sections for each set of spare parts supplied.
 - 5. Spare Parts Receiver Form.
- G. CONTRACTOR shall be fully responsible for loss or damage to parts and materials until they are transmitted to the OWNER.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SPARE PART RECEIVER
City of Denton
Water Treatment Plant Improvements

Project No. 18088080

SPECIFICATION SECTION 01 79 01

CONTRACTOR PLEASE FILL OUT:

MANUFACTURER: _____

ITEM DESCRIPTION: _____

COST: _____

MANUFACTURER PART NUMBER: _____

SUPPLIER: _____

CROSS REFERENCE NUMBER: _____

VENDOR INFORMATION: _____

VENDOR ORDER PART NUMBER: _____

PART TO BE USED ON
WHAT EQUIPMENT: _____

EQUIPMENT NUMBER: _____

SPECIFICATION SECTION: _____

CITY PERSONNEL FILL IN: _____

BIN NUMBER: _____

AIMS NUMBER: _____

LOCATION IN STORES: _____

RECEIVED BY: _____

END OF SECTION

SECTION 01 80 00 – POST FINAL INSPECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes description and requirements of the required Post Final Inspection for the project.
- B. Approximately **330** days after final acceptance, ENGINEER will make arrangements with OWNER and CONTRACTOR for a post final inspection and will send a written notice to said parties informing them of the date and time of the inspection.
- C. After the inspection, ENGINEER will inform CONTRACTOR of any corrections required prior to release of the balance of payment due.
- D. When the corrections have been satisfactorily completed, ENGINEER will forward to OWNER a certificate for final payment.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 80 01 – COMMISSIONING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Responsibilities of the OWNER, ENGINEER, and CONTRACTOR during the Commissioning Phase of the Project.
- B. Related sections:
 - 1. Section 01 75 60 – Testing, Training, and Facility Start-Up.

1.2 DEFINITIONS

- A. Commissioning: The sequential process in which a newly constructed facility, comprised of concrete basins interconnected with hydraulic conveyance structures and equipped with miscellaneous process oriented equipment, is put into successful operation.
- B. Automatic/SCADA Operational Mode: The definition of the automatic/SCADA operational mode centers around the designed remote control and monitoring capability of the control system.
- C. Facility Start-Up.
- D. Manual Operational Mode: This operational mode represents the lowest level of control philosophy utilized in the plant instrumentation and control design. For all practical purposes, this means that an operational control decision requiring equipment or process monitoring and/or control will require an individual to physically go to the local control for the associated task in order to operate the facility. Normal prestart-up activities of exercising of the equipment is traditionally accomplished in this mode. In the manual operational mode, the focus will be on verifying that the equipment and processes function correctly, independent of the instrumentation system and control system.
- E. Successful Operation: The resultant operation of all the processes and related controls in a manner that is consistent with the design intent and treatment objectives.

1.3 SUBMITTALS

- A. Preventive and Unscheduled Maintenance Plan: Submit detailed plan prior to start of 7-day test for providing all preventive and unscheduled maintenance of all equipment and facilities in the plant throughout the entire commissioning phase of the project prior to start of 7-day test.
- B. OWNER's Personnel Training Schedule and Plan: Submit detailed plan and schedule for training OWNER's personnel in accordance with Section 01 75 60, Testing, Training and Facility Start-Up.

1.4 REQUIREMENTS

- A. Commissioning Process will commence after successful completion of 7-day test and issuance of Substantial Completion to CONTRACTOR.
- B. Commissioning Process will be 30 days in duration.
- C. During the course of the Commissioning Process, the ENGINEER and OWNER will evaluate design related issues and recommend design modifications which shall be implemented by the CONTRACTOR through the Change Order process.

1.5 RESPONSIBILITIES

- A. Responsibilities listed do not relieve the CONTRACTOR from all other responsibilities and duties associated with project closeout as defined in the OWNER's agreement with the CONTRACTOR and DIVISION 01 of the Specifications.
1. CONTRACTOR's Responsibilities During the Commissioning Process:
 - a. All Change Order work resulting from the evaluation of design-related issues by the ENGINEER and OWNER.
 2. All preventive and unscheduled maintenance of all equipment and facilities in the plant. This shall include, but not be limited to the following:
 - a. Providing all lubricants.
 - b. Lubrication of all equipment in accordance with manufacturer's recommendations.
 - c. Perform all manufacturer recommended preventive maintenance.
 - d. Exercise all equipment not in use during Commissioning phase.
 - e. Repair all failed equipment.
 - f. Periodic check of all equipment alignment, vibration, and noise levels in accordance with Specifications.
 - g. Provide all parts required for equipment repair.
 - h. Provide all tools and miscellaneous equipment required for equipment repair.
 - i. Administration/logging/documentation of all preventive maintenance and repair work.
 - j. Cleanup associated with equipment failure and repair.
 - k. Daily cleanup of buildings.
 - l. Landscaping maintenance.
 - m. Roadway cleanup and maintenance.
 - n. Replacement of all HVAC filters.
 3. Warranty related issues/items.
 4. OWNER's personnel training required after successful completion of the 7-day testing.
 5. Assist in transition to Automatic/SCADA operational mode.
 6. Other contractual requirements including, but not limited to, incomplete work list.
- B. OWNER's Responsibilities During the Commissioning Process:
1. Provide all chemicals required for plant operations, including scheduling and securing of chemical deliveries to the plant and respective storage tanks.
 2. Perform all laboratory analysis required for plant operations.
 3. Review training schedules and plans, and schedule personnel training.
 4. Assisting ENGINEER in the evaluation of design related issues and recommendations of modifications to be implemented by the CONTRACTOR through the change order process.
 5. Provide staff for Commissioning.
 6. Operation of facilities.
- C. ENGINEER's Responsibilities During Commissioning Process:
1. Provide OWNER with programming support during the Commissioning Process.
 2. Provide liaison and coordination between CONTRACTOR and OWNER's activities.
 3. Administer Change Order work performed by CONTRACTOR.
 4. Provide coordination of all other project closeout related issues/items.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 81 00 – PROJECT DESIGN CRITERIA

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes: Project design criteria such as temperature and site elevation.

1.2 PROJECT DESIGN CRITERIA

- A. All equipment and materials for the project are to be suitable for performance in the water treatment plant environment and under following conditions:
 - 1. Design temperatures are:
 - a. Outdoor temperatures: -10 to 115 degrees Fahrenheit.
 - b. Indoor temperatures for the following buildings:
 - 1) Process areas: 40 to 110 degrees Fahrenheit.
 - 2) Electrical rooms: 40 to 85 degrees Fahrenheit.
 - 2. FEMA Zone X: Area of minimal Flood Impact.
 - 3. Frost line is assumed 30 inches below grade.
 - 4. Moisture conditions: Defined in individual equipment sections.
 - 5. Site elevation: Generally ranges from 625 to 642 feet above mean sea level.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 81 02 – SEISMIC DESIGN CRITERIA

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes: Seismic design criteria for the following:
 - 1. Anchorage of mechanical and electrical equipment.
 - 2. Seismic design and design of anchorage for small tanks fabricated off site and shipped to the Project site.
 - 3. Other structures or items as specified or indicated on the Drawings.
- B. Related sections:
 - 1. Section 01 41 00 – Regulatory Requirements.

1.2 REFERENCES

- A. American Society of Civil Engineers (ASCE):
 - 1. ASCE 7 - Minimum Design Loads for Buildings and Other Structures

1.3 SYSTEM DESCRIPTION

- A. Design requirements:
 - 1. Design in accordance with the requirements of the building code as specified in Section 01 41 00:
 - a. Soil Site Class: D
 - b. Design spectral acceleration at short period, S_{DS} : 0.129g.
 - c. Design spectral acceleration at short period, S_{D1} : 0.092g.
 - d. Seismic Design Category: B
 - e. Importance Factor, I : 1.25
 - f. Component amplification factor, a_p : In accordance with ASCE 7-10, Tables 13.5.1 and 13.6-1.
 - g. Component response modification factor, R_p : In accordance with ASCE 7-10, Tables 13.5-1 and 13.6-1.
 - h. Component importance factor, I_p : 1.50.
 - 2. Do not use friction to resist sliding due to seismic forces.
 - 3. Do not use more than 60 percent of the weight of the mechanical and electrical equipment for designing anchors for resisting overturning due to seismic forces.
 - 4. Do not use more than 60 percent of the weight of the tank for resisting overturning due to seismic forces.
 - 5. Use anchor bolts, bolts, or welded studs for anchors for resisting seismic forces. Anchor bolts used to resist seismic forces shall have a standard hex bolt head embedded in the concrete. Do not use anchor bolts fabricated from rod stock with an L or J shape.
 - 6. Do not use chemical anchors, concrete anchors, flush shells, powder actuated fasteners, sleeve anchors, or other types of anchors unless indicated on the Drawings or accepted in writing by the ENGINEER.
 - 7. Seismic forces must be resisted by direct bearing on the fasteners used to resist seismic forces. Do not use connections that use friction to resist seismic forces.

1.4 SUBMITTALS

- A. Shop drawings and calculations: Complete shop drawings and seismic calculations.
- B. Calculations shall be signed and stamped by a civil or structural engineer licensed in the state where the Project is located.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 81 04 – WIND DESIGN CRITERIA

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes: Wind design criteria.
- B. Related sections:
 - 1. Section 01 41 00 – Regulatory Requirements.

1.2 SYSTEM DESCRIPTION

- A. Design requirements:
 - 1. Building code criteria: Design for wind in accordance with building code as specified in Section 01 41 00:
 - a. Occupancy category: III.
 - b. Basic wind speed: 120 miles per hour.
 - c. Exposure category: C.
 - d. Topographic factor, K_{zt} : 1.0.
 - e. Wind importance factor, I_w : 1.15.
 - 2. Use anchor bolts, bolts, or welded studs for anchors for resisting wind forces. Anchor bolts used to resist wind forces shall have a standard hex bolt head embedded in the concrete. Do not use anchor bolts fabricated from rod stock with an L or J shape:
 - a. Do not use concrete anchors, sleeve anchors, flush shells, chemical anchors, powder actuated fasteners, or other types of anchor unless indicated on the Drawings or accepted in writing by the ENGINEER.
 - b. Wind forces must be resisted by direct bearing on the anchors used to resist wind forces. Do not use connections which use friction to resist wind forces.

1.3 SUBMITTALS

- A. Shop drawings and calculations: Complete shop drawings and seismic calculations.
- B. Calculations shall be signed and stamped by a civil or structural engineer licensed in the state where the Project is located.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

DIVISION 02
EXISTING CONDITIONS

SECTION 02 41 00 - DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Portions of buildings and other areas, equipment and materials selective demolition, and partial demolition work are as shown on Drawings and specified herein.
 - 2. Equipment and materials to be removed for construction and reinstalled for reuse or continued operation are as shown on the drawings and specified herein.
- B. Related Sections:
 - 1. Section 01 32 00 – Construction Progress Documentation.
 - 2. Section 31 23 23.13 – Fill and Backfill

1.2 SUBMITTALS

- A. Shop Drawings: Plans showing all equipment and materials to be removed and reinstalled for reuse on continued operation including interim storage plans for each item.
- B. Quality Control Submittals:
 - 1. Schedule of demolition, as part of and consistent with the progress schedule specified in Section 01 32 00, CONSTRUCTION PROGRESS DOCUMENTATION.
 - 2. Methods of demolition and equipment proposed to demolish each structure.
 - 3. Copies of any authorizations and permits required to perform Work.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 PREPARATION

- A. Utilities:
 - 1. Notify Owner and appropriate utilities 72 hours prior to turning off affected services before starting demolition or alterations.
 - 2. Remove utility lines exposed by demolition excavation.
 - 3. Remove electric, sanitary, and storm drainage adjacent to buildings to be demolished.
 - 4. Excavate utility lines serving buildings to be demolished and provide a permanent leak-proof closure for water and gas lines.
 - 5. Plug sewer lines at locations shown or at limits of excavation if not shown with min. 2,000 psi compressive strength concrete plug to prevent groundwater infiltrating sewer systems. Length of plug shall be 5 feet minimum.
- B. Removal and Storage of Equipment for Reuse:
 - 1. Do not remove equipment and materials without approval of Engineer.
 - 2. Properly store and maintain equipment and materials in same condition as when removed.
 - a. Place existing equipment to be stored on pallet in such a manner to avoid damage.
 - b. Safely secure the item on to the pallet using straps or other means.
 - c. Coordinate with Owner for relocation and on-site storage.
 - 3. Engineer will determine condition of equipment and materials prior to removal.

3.2 DEMOLITION

- A. Drawings define minimum portion of equipment to be removed and structures to be modified. Unless otherwise shown, rough cuts or breaks may be made exceeding limits of demolition shown.
- B. Provide all demolition, removal, temporary storage, and reinstallation of existing equipment as required for implementation of the work.
- C. Core drill floor slabs, catch basins, and other concrete improvements to remain in place below ground, or break holes at structure's lowest point to allow water to freely migrate through.
- D. Remove piping from areas to be backfilled. Pipe, valves, and fittings adjacent to those to be removed may also be removed as salvage.
- E. Remove all materials associated with existing equipment that is to be removed or relocated.
- F. Cut off concealed or embedded conduit, boxes, or other materials a minimum of 3/4 inch below final finished surface.
- G. Cut off drilled piers a minimum of 6 inches below bottom of new foundations.
- H. Demolish existing concrete structure to 18" below grade.

3.3 DISPOSAL

- A. Dispose of debris and other non-salvaged materials offsite in licensed landfills.

3.4 BACKFILLING

- A. Demolished Areas: Backfill to existing ground level, elevations shown, or foundation level of new construction.
- B. Backfill Material and Compaction:
 - 1. For fill in and around structures conform to Section 31 23 23.13, FILL AND BACKFILL. Top 6" of backfill to grade shall be select fill conforming to Section 31 23 23.13 FILL AND BACKFILL and shall be compacted to 90% standard proctor density.
 - 2. Do not use demolition debris as backfill material.

3.5 SALVAGE

- A. Equipment and materials not reused or reinstalled, including all metals and piping within the limits of demolition, unless otherwise specified, shall be delivered to the Owner for scrap.

END OF SECTION

DIVISION 03
CONCRETE

SECTION 03 01 00 - CONCRETE SURFACE REPAIR SYSTEMS

PART 1 - GENERAL

1.1 REFERENCES

- A. The following is a list of standards which may be referenced in this section:
1. American Association of State Highway and Transportation Officials (AASHTO): T277, Standard Method of Test for Rapid Determination of the Chloride Permeability of Concrete.
 2. ASTM International (ASTM):
 - a. C 78, Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading).
 - b. A 82, Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
 - c. C 109, Standard Test Method for Compressive Strength of Hydraulic Cement Mortars.
 - d. A 185, Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.
 - e. C 309, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - f. C 348, Standard Test Method for Flexural Strength of Hydraulic Cement Mortars.
 - g. C 469, Standard Test Method for Static Modulus of Elasticity and Poisson's Ratio of Concrete in Compression.
 - h. C 496, Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens.
 - i. C 596, Standard Test Method for Drying Shrinkage of Mortar Containing Portland Cement.
 - j. C 666, Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing.
 - k. C 672, Standard Test Method for Scaling Resistance for Concrete Surfaces Exposed to Deicing Chemicals.
 - l. C 779, Standard Test Method for Abrasion Resistance of Horizontal Concrete Surfaces.
 - m. C 882, Standard Test Method for Bond Strength of Epoxy-Resin Systems Used with Concrete by Slant Shear.
 - n. C 928, Standard Specification for Packaged, Dry, Rapid-Hardening Cementitious Materials for Concrete Repair.
 - o. C 1012, Standard Test Method for Length Change of Hydraulic Cement Mortars Exposed to a Sulfate Solution.
 - p. C 1202, Standard Test Method for Electrical Induction of Concrete's Ability to Resist Chloride Ion Penetration.
 - q. E 699, Criteria for Evaluation of Agencies Involved in Testing, Quality Assurance, and Evaluating Building Components in Accordance with Test Methods Promulgated by ASTM Committee.

1.2 DEFINITIONS

- A. Low Pressure Spray Mortar: Mortar designated by "S" before the product number, applied by low pressure spraying, or in small areas by hand troweling.
- B. Surface Repair Areas: Areas that are deemed to be defective and not meeting the density or surface specified in Section 03 30 00, CAST-IN-PLACE CONCRETE, regardless of depth of the defective area.

1.3 SUBMITTALS

- A. Information Submittals:

1. Mortar System:
 - a. Manufacturer's installation bulletin.
 - b. Manufacturer's recommended fabric size for mesh reinforcement.
2. Written description of equipment proposed for hydro-demolition surface preparation.
3. Certificates:
 - a. Certificate of Compliance that proposed product systems meet or exceed specified performance criteria when tested in accordance with Article FIELD QUALITY CONTROL.
 - b. Mortar system Manufacturer's Certificate of Proper Installation.
4. Statements of Qualification:
 - a. Independent testing laboratory.
 - b. Mortar system Manufacturer's representative.
5. Mortar system Manufacturer's proposed modified test procedures for ASTM C 109 and ASTM C 882 test methods.
6. Independent testing laboratory test report.

1.4 QUALITY ASSURANCE

A. Qualifications:

1. Independent Testing Laboratory: Based on evaluation of laboratory submitted criteria in accordance with ASTM E 699.
2. Mortar System Applicator: For low pressure spray mortar system in lieu of endorsement, complete mortar system manufacturer's demonstration in accordance with Article MANUFACTURER'S SERVICES.

PART 2 - PRODUCTS

2.1 LOW PRESSURE SPRAY MORTAR SYSTEM (FOR VERTICAL AND OVERHEAD REPAIRS)

A. Mortar:

1. One component, rheoplastic, cement based, fiber reinforced, shrinkage compensated, gray in color, with a minimum 30-minute working time.
2. Cured materials mixed to a flow of 70%, at five drops shall conform to the following criteria:
 - a. Minimum Slant Shear Bond Strength: 3,000 psi in 28 days in accordance with "modified" ASTM C 882 test method.
 - b. Minimum Compressive Strength: 11,000 psi at 28 days in accordance with ASTM C 109.
 - c. Minimum Direct Shear Bond Strength: 650 psi in 28 days in accordance with Michigan DOT.
 - d. Minimum Tensile Bond Strength (MBT In-House Test): 300 psi. in 28 days.
 - e. Minimum Flexural Properties: 1,250 psi in 28 days in accordance with ASTM C 348.
 - f. Modulus of Elasticity: 4.1 to 4.5 by 106 psi in accordance with ASTM C 469.
 - g. Maximum Permeability: 1,000 coulombs in accordance with AASHTO T 277.
 - h. System shall not produce a vapor barrier.

B. Sprayable, extremely low permeability, sulfate resistant, easy to use and requiring only the addition of water.

C. Free of chlorides and other chemicals causing corrosion.

D. Manufacturer and Product:

1. Master Builders Technologies Co., Cleveland, OH; EMACO S88CA with Concreive liquid (LPL) bonding agent for hand applied areas.
2. Sika Corp., Lyndhurst, NJ; SikaRepair 224.

2.2 POLYMER-MODIFIED REPAIR MORTAR (HORIZONTAL SURFACE REPAIR)

- A. Mortar: One component, polymer-modified, cementitious based, chloride resistant, flowable, gray in color, working time of 20 minutes minimum, surface renovation mortar conforming to the following properties:
1. Bond strength in accordance with ASTM C 1042 Test Method at 7 days: Minimum 1,750 psi.
 2. Modules of Elasticity: ASTM C469, minimum 2.0 by 10⁶ psi.
 3. Compressive Strength:
 - a. ASTM C 109 at 1 day: minimum 2,500 psi.
 - b. ASTM C 109 at 28 days: minimum 7,500 psi.
 4. Flexural Properties, ASTM C 348 at 28 days: minimum 1,200 psi.
 5. Permeability, AASHTO T 277: 800 coulombs maximum.
 6. Splitting Tensile Strength: ASTM C 496 at 7 days, minimum 450 psi.
 7. Drying Shrinkage, ASTM C 596 at 28 days: -0.090%.
 8. Freeze Thaw Resistance, ASTM C 666, at 300 cycles: 95% RDF.
 9. Abrasion Resistance: ASTM C 799, 60 minutes, 0.0165".
- B. Manufacturers and Products:
1. Master Builders Technologies Co., Cleveland, OH; EMACO R 310
 2. Or approved equal.

2.3 WATER

- A. Clean and free from oil, acid, alkali, organic matter, or other deleterious substances, meeting federal drinking water standards.

2.4 ACCESSORIES

- A. Finishing Aid Manufacturer and Product: Master Builders Inc., Cleveland, OH; CONFILM.
- B. Flexible Cementitious Rebar Coating Manufacturer and Product: Master Builders Inc., Cleveland, OH; EMACO P22.

PART 3 - EXECUTION

3.1 GENERAL

- A. Where required because of deficiencies, concrete surface repair system shall be low pressure spray mortar for structural repairs.

3.2 PREPARATION

- A. Remove unsound and deteriorated concrete from Work by high pressure water blasting machines capable of scoring concrete surfaces to minimum amplitude roughness of 3/16" or as shown. Remove to provide for maximum thickness specified for mortar.
- B. High pressure water blasting machines with 16,000 to 20,000 psi minimum.
- C. Collect and dispose of water from removal operations in manner and location acceptable to Owner.
- D. Do not use power-driven jackhammers and chipping hammers, unless water blasting is prohibited due to potential damage to installed equipment.

- E. Remove concrete minimum of 1" clearance around rebar for application and bonding of new mortar to entire periphery of exposed rebar if the following surface conditions exist:
 - 1. 50% or more of periphery around rebar is exposed during removal of concrete.
 - 2. 25% or more of periphery around rebar is exposed during removal of concrete and corrosion has eventuated to the extent that loss of section has occurred.
 - 3. Bond between existing concrete and reinforcement has deteriorated.
- F. Clean exposed reinforcing bars of rust and concrete, and coat with flexible cementitious rebar coating.
- G. Maintain surface areas free of slurry where concrete has been removed. Remove slurry from prepared areas before new mortar is applied.
- H. Clean surface areas to be filled with new mortar of laitance and contamination by high pressure water blasting not more than 24 hours before applying bonding agent, Saturated Surface Dry (SSD) existing concrete at time of application of mortar.

3.3 LOW PRESSURE SPRAY MORTAR APPLICATION

- A. Mix mortar in mortar-concrete mixer attached to pump-spray equipment for spray application. Mix with a slow speed drill and jiffler type paddle or small mortar type mixer for hand trowel application.
- B. Apply mortar by low pressure spraying with a machine such as Moynotype, MEYCO DEQUNA Model 20.
- C. Finish mortar with a hand float application to smooth even surface matching adjacent concrete. Provide finishing aid at full strength.
- D. Bonding Agent:
 - 1. Hand apply bonding agent within 20 minutes of troweling on mortar. Prevent bonding agent from drying by reapplying bonding agent to maintain surface tackiness of coat.
 - 2. Work mortar firmly and quickly into area and compact with firm trowel stroke. Finish smooth with finishing aid at full strength.

3.4 POLYMER-MODIFIED REPAIR MORTAR APPLICATION FOR REPAIR OF HORIZONTAL SURFACES

- A. Mix mortar in mortar-concrete mixer.
- B. Hand Troweling: Apply (scrub in) a bond coat slurry of the repair mortar to the SSD prepared substrate before application of the mortar. Do not apply more of the bond coat than can be covered with mortar before the bond coat dries. Do not re-temper this bond coat.
- C. Place mortar into prepared area from one side to the other.
- D. Work material firmly into the side and bottom of patch to assure a good bond. Level repair mortar and screed to elevation of existing concrete.
- E. Finish to same texture as existing concrete around patch.
- F. Use self-leveling mixture where appropriate to obtain uniform or plane surface.

3.5 CURING

- A. Water fog nozzle all of the mortar systems prior to curing in accordance with mortar system Manufacturer's instructions.
- B. Commence water curing after mortar system application and when curing will not cause erosion of mortar.
- C. Continuously cure mortar system for a period of 7 days.
- D. Do not membrane cure, unless method is part of mortar system Manufacturer's instructions and approval has been obtained.
- E. Cure intermediate layers of mortar in accordance with manufacturer's instructions.

3.6 FIELD QUALITY CONTROL

- A. Independent testing laboratory shall perform the following:
 - 1. Secure production samples of mixed materials during construction and test for compliance with the Specifications.
 - 2. Obtain actual core samples from the completed repair Work and test.
 - 3. Perform "modified" ASTM C 109 and ASTM C 882 test methods in accordance with manufacturer's approved modifications of testing procedures.
- B. Construction Testing:
 - 1. Production Samples:
 - a. Obtain mixed mortar material from shotcrete or spray equipment and produce samples, and cure samples prior to testing.
 - b. Provide minimum of three samples each test for each 1,000 square feet or portion thereof of mortar repair to be installed.
 - 2. Core Samples of In-Place Repair:
 - a. Obtain two core samples and test samples for each 2,000 square feet or portion thereof for actual repair Work:
 - b. Cores shall be either 2-1/2" or 3" in diameter and shall be cored through cured mortar repair and into base concrete to total depth equal to at least 2.5 times repair mortar thickness.
 - c. Sawcut the cores after removal to trim base concrete thickness to same thickness as mortar so that bond line is at center of repaired sample.
 - d. Samples shall be epoxy bonded to steel plates at each end using a bonding agent to prevent failure in bond to steel plates.
 - e. Sustain bond line without failure or movement with a minimum of 300 psi in direct tension. The tension test shall use eyebolts or threaded connectors tapped and threaded into base plate so that tension load is concentric with center of core sample.
- C. Repair and fill holes where core samples have been removed using same mortar used in repair.

3.7 MANUFACTURER'S SERVICES

- A. Provide mortar system manufacturer's representative at site for installation assistance, inspection and certification of proper installation, and training of mortar system applicators.
- B. Mortar System Manufacturer's Demonstration:
 - 1. Schedule a time for Manufacturer's demonstration of repair system proposed for the Project. Prepare mortar, to specified consistency, for testing and placement. Initiate curing

- on portions of each type of surface to be repaired to include overhead and vertical applications.
2. Prepare surface area in advance of demonstration and obtain manufacturer's acceptance of preparation for each type of application.
 3. Demonstrate:
 - a. Mixing and application equipment capabilities and procedures, including the flow of material from nozzle or sprayer.
 - b. Nozzle operator and person in charge of low pressure sprayer, capabilities and ability to follow prescribed application procedures and properly operate equipment and apply surface repair materials.
 4. Make compression test samples during demonstration and deliver to an independent testing laboratory for testing at 1, 7, and 28 days. Take a core of the demonstration placement and test for tensile bond at 1 day.

3.8 PROTECTION

- A. Protect adjacent surfaces, and equipment, from being damaged by overshooting of low pressure spray mortar.

3.9 CLEANING

- A. Remove overshot mortar and deposited rebound materials as Work proceeds. Remove from Work, waste materials, unsound material from concrete surfaces, material chipped from walls, water used in preparation of application and finishing.

END OF SECTION

SECTION 03 11 00 - CONCRETE FORMWORK

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Concrete formwork.
- B. Related sections:
 - 1. Section 03 30 00 – Cast-In-Place Concrete.
 - 2. Section 03 60 00 – Grout.

1.2 REFERENCES

- A. The following is a list of standards which may be referenced in this section:
 - 1. American Concrete Institute (ACI):
 - a. 117, Standard Specifications for Tolerances for Concrete Construction and Materials.
 - b. 318/318R, Building Code Requirements for Reinforced Concrete.
 - c. 347, Formwork for Concrete.

1.3 DESIGN REQUIREMENTS

- A. Design, erect, shore, brace, and maintain formwork in accordance with ACI 301, ACI 347, and ACI 318 to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads. Provide concrete finishes specified in Section 03 30 00, CAST-IN-PLACE CONCRETE.
 - 1. Formwork shop drawings shall be prepared by or under the supervision of a qualified professional engineer licensed in the state of the work.
- B. When high range water reducer (superplasticizer) is used in concrete mix, forms shall be designed for full hydrostatic pressure per ACI 347.
- C. Make joints in forms watertight.
- D. Limit panel deflection to 1/360th of each component span to achieve tolerances specified.

1.4 SUBMITTALS

- A. Shop Drawings:
 - 1. Form Ties-Tapered Through-Bolts: Proposed method of sealing form tie hole; coordinate with details shown.
 - 2. All formwork erection, shoring and removal are the responsibility of the Contractor and/or the qualified professional engineer the contractor used for the formwork drawings.
 - 3. Indicate proposed schedule and sequence of stripping formwork, shoring removal, and installing and removing re-shoring.
 - 4. Manufacturer's Data for the Following Product: Form release agent.
 - 5. Formwork drawings shall be signed and sealed by the professional engineer licensed in the state of the work and responsible for their preparation.
- B. Samples: One each as follows:
 - 1. Form ties.

1.5 QUALIFICATIONS

- A. Formwork Designer: Formwork, falsework, and shoring design shall be by a Qualified Professional Engineer licensed in the state of the work.

PART 2 - PRODUCTS

2.1 FORM MATERIALS

- A. Wall Forms and Underside of Slabs:
 - 1. Materials: Plywood, hard plastic finished plywood, overlaid waterproof particle board, or steel in "new and undamaged" condition, of sufficient strength and surface smoothness to produce specified finish.
 - 2. Circular Structures:
 - a. Conform forms to circular shape of structure.
 - b. Straight panels may be substituted for circular forms provided panels do not exceed 2' in horizontal width and angular deflection is no greater than 3-1/2° per joint.
- B. Painted Surface Forms: High density overlay plywood for flat concrete surfaces to be painted.
- C. All Other Forms: Materials as specified for wall forms.
- D. Form Release Agent:
 - 1. Material: Release agent shall not bond with, stain, or adversely affect concrete surfaces, and shall not impair subsequent treatments of concrete surfaces when applied to forms. A "ready to use" water based material formulated to reduce or eliminate surface imperfections, containing no mineral oil or organic solvents. Environmentally safe, meeting local, state, and federal regulations and can be used in potable water facilities.
 - 2. Manufacturers and Products:
 - a. Master Builders, Inc.; Rheofinish 211.
 - b. Cresset Chemical Company; Crete-Lease 20-VOC.
 - c. US Mix Products Company; US SPEC Slickote.
- E. Rustication Grooves and Beveled Edge Corner Strips: Nonabsorbent material, compatible with form surface, fully sealed on all sides prohibiting loss of paste or water between the two surfaces.
- F. Form Ties:
 - 1. Material: Steel
 - 2. Spreader Inserts:
 - a. Conical or spherical type.
 - b. Design to maintain positive contact with forming material.
 - c. Furnish units that will leave no metal closer than 1" to concrete surface when forms, inserts, and tie ends are removed.
 - 3. Wire ties not permitted.
 - 4. Flat bar ties for panel forms furnish plastic or rubber inserts with minimum 1" depth and sufficient dimensions to permit patching of tie hole.
 - 5. Water Stop Ties: For water-holding structures, basements, pipe galleries, and accessible spaces below finish grade, furnish one of the following:
 - a. Integral steel water stop 0.103" thick and 0.625" in diameter tightly and continuously welded to tie.
 - b. Neoprene water stop 3/16" thick and 15/16" diameter whose center hole is 1/2-diameter of tie, or molded plastic water stop of comparable size.
 - c. Orient water stop perpendicular to tie and symmetrical about center of tie.

- d. Design ties to prevent rotation or disturbance of center portion of tie during removal of ends and to prevent water leaking along tie.
- 6. Through-Bolts: Tapered minimum 1" diameter at smallest end.
- 7. Elastic Vinyl Plug:
 - a. Design and size of plug to allow insertion with tool to enable plug to elongate and return to original length, and diameter upon removal forming watertight seal.
 - b. Manufacturer and Product: Dayton/Richmond Co., Miamisburg, OH; A58 Sure Plug.
 - c. Recess plug 1" minimum and grout over hole. See Section 03 60 00 GROUT.

PART 3 - EXECUTION

3.1 FORM SURFACE PREPARATION

- A. Thoroughly clean form surfaces that will be in contact with concrete or that have been in contact with previously cast concrete, dirt, and other surface contaminants prior to coating surface.
- B. Exposed Wood Forms in Contact with Concrete: Apply form release agent as recommended by the manufacturer.
- C. Steel Forms: Apply form release agent to steel forms as soon as they are cleaned to prevent discoloration of concrete from rust.

3.2 ERECTION

- A. General: Unless specified otherwise, follow applicable recommendations of ACI 347.
 - 1. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
 - 2. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
 - 3.
- B. Beveled Edges (Chamfer):
 - 1. Form 3/4" bevels (chamfers) at all exposed concrete edges, unless otherwise shown.
 - 2. Where beveled edges on existing adjacent structures are other than 3/4", obtain Engineer's approval of size prior to placement of beveled edge.
- C. Wall Forms:
 - 1. Do not reuse forms with damaged surfaces.
 - 2. Locate form ties and joints in an uninterrupted uniform pattern.
 - 3. Inspect form surfaces prior to installation to assure conformance with specified tolerances.
- D. Forms for Curbs and Sidewalks:
 - 1. Provide standard steel or wood forms.
 - 2. Set forms to true lines and grades, and securely stake in position.
- E. Form Tolerances: Provide forms in accordance with ACI 117, 347 and 318 and the following tolerances for finishes specified:
 - 1. Wall Tolerances:
 - a. Straight Vertical or Horizontal Wall Surface: Flat planes within tolerance specified.
 - b. Wall Type W-A:
 - 1). Plumb within 1/4" in 10' or within 1" from top to bottom for walls over 40 feet high.

- 2). Depressions in Wall Surface: Maximum 5/16" when 10' straightedge is placed on high points in all directions.
- c. Wall Type W-B:
 - 1). Plumb within 1/8" in 10' or within 1/2" from top to bottom for walls over 40' high.
 - 2). Depressions in Wall Surface: Maximum 1/8" when 10' straightedge is placed on high points in all directions.
2. Thickness: Maximum -1/4" or +1/2" from dimension shown.
3. Form Offset: Between adjacent pieces of form work, facing material shall not exceed 1/8" where exposed to public view and 1/4" maximum for all other conditions.

3.3 ADDITIONAL REQUIREMENTS

- A. Construct forms tight enough to prevent loss of concrete mortar.
- B. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
 1. Install keyways, reglets, recesses and the like for easy removal.
 2. Do not use rust-stained steel form-facing material.
 3. Use only form or form-tying methods which do not cause spalling of the concrete upon form stripping or tie removal.
- C. Set edge forms, bulkheads and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- D. Provide temporary 12 inch wide x 18 inch high openings for cleanouts and inspection ports every 7 feet at the bottom of each lift form and where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations, where possible.
- E. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds and bulkheads required in the Work.
 1. Determine sizes and locations from trades providing such items.
 2. Openings shall be of sufficient size to permit final alignment of pipes or other items without deflection or offsets of any kind. Allow space for packing where items pass through the wall to ensure watertightness. Provide openings with continuous keyways and waterstops. Provide a slight flare to facilitate grouting and the escape of entrained air during grouting. Provide formed openings with reinforcement as indicated in the typical structural details. Reinforcing shall be at least 2 inches clear from the opening surfaces and encased items.
- F. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt and other debris just before placing concrete.
- G. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- H. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions before placing reinforcement.
- I. Embedded Items.

1. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions and directions furnished with items to be embedded.
 - a. Install anchor bolts/rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
 - b. 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.
 - c. Check special castings, channels or other metal parts that are to be embedded in the concrete prior to and again after placing the concrete.
 - d. Check nailing blocks, plugs and strips necessary for the attachment of trim, finish and similar work prior to placing the concrete.

- J. Pipes and wall spools cast in concrete.
 1. Install wall spools, wall flanges, and wall anchors before placing concrete. Do not weld, tie or otherwise connect the wall spools or anchors to the reinforcing steel.
 2. Support pipe and fabricated fittings to be encased in concrete on concrete piers or pedestals. Carry concrete supports to firm foundations so that no settlement will occur during construction.
 3. Pipes or spools located below operating water level shall have waterstop ring collars and shall be cast in place. Do not block out such piping and grout after the concrete section is cast. Pipes fitted with thrust rings shall be cast in place.

- K. Removing and reusing forms.
 1. General: Do not remove forms from concrete which has been placed with outside temperature below 50°F without first determining and verifying with Engineer if the concrete has properly set without regard for time. Do not apply loading on green concrete. Immediately after forms are removed, the surface of the concrete shall be carefully examined and any irregularities in the surface shall be repaired and finished as specified.
 - a. Leave formwork for beam soffits, joists, structural slabs, beams, girders and other structural elements that support weight of concrete in place until concrete has achieved 100 percent its 28-day design compressive strength and a minimum of 7 days.
 - b. Formwork for sides of beams, walls, columns and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50°F (10 deg C) for 48 hours after placing concrete, if concrete is hard enough to not be damaged by form-removal operations and curing and protection operations are maintained.
 - c. Leave bracing for walls until the top or roof slab concrete reaches 100% of its 28-day design compressive strength and a minimum of 7 days.
 - d. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
 2. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.
 3. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved in writing by the Engineer.

- L. Aluminum surfaces in contact with concrete.
 1. Aluminum surfaces in contact with concrete or grout or dissimilar metals shall be protected with a Mylar isolator, bituminous paint or other material approved by Engineer.

- M. Shores and reshores.

1. Comply with ACI 318 (ACI 318M) and ACI 301 for design, installation and removal of shoring and reshoring.
 - a. Do not remove shoring or reshoring until measurement of slab tolerances is complete.
2. In multistory construction, extend shoring or reshoring over a sufficient number of stories to distribute loads in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members without sufficient steel reinforcement.
3. For multi-storied structures, the shoring and reshoring diagrams and procedures shall be signed and sealed by a Registered Professional Engineer in the state where the construction is being undertaken. These diagrams and procedures shall take into account the effect of the loads on the uncured concrete and the construction load on each floor.
4. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

END OF SECTION

SECTION 03 15 00 – CONCRETE ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Waterstops.
 - 2. Joint fillers.

1.2 REFERENCES

- A. ASTM International (ASTM):
 - 1. ASTM D570 - Standard Test Method for Water Absorption of Plastics.
 - 2. ASTM D624 - Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers.
 - 3. ASTM D638 - Standard Test Method for Tensile Properties of Plastics.
 - 4. ASTM D746 - Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact.
 - 5. ASTM D747 - Standard Test Method for Apparent Bending Modulus of Plastics by Means of a Cantilever Beam.
 - 6. ASTM D792 - Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement.
 - 7. ASTM D2240 - Standard Test Method for Rubber Property – Durometer Hardness.
- B. American National Standards Institute (ANSI):
 - 1. ANSI A135.4 - Basic Hardboard.
- C. U. S. Army Corps of Engineers (USACE):
 - 1. CRD-C-572, Specification for Polyvinyl Chloride Waterstop.

1.3 SUBMITTALS

- A. Product Data:
 - 1. Polyvinyl chloride waterstops: Complete physical characteristics.
 - 2. Preformed expansion joint material: Sufficient information on each type of material for review to determine conformance of material to requirements specified.
- B. Samples:
 - 1. Polyvinyl chloride waterstop.
- C. Laboratory test reports: Indicating that average properties of polyvinyl chloride waterstops material and finish conform to requirements specified in this Section.
- D. Quality control submittals:
 - 1. Certificates of Compliance:
 - a. Written certificates that polyvinyl chloride waterstops supplied on this Project meet or exceed physical property in accordance with USACE CRD-C-572 and the requirements of this Section.
 - 2. Manufacturer's instructions: For materials specified in this Section that are specified to be installed with such instructions.

1.4 QUALITY ASSURANCE

- A. Mock-ups:

1. Welding demonstration:
 - a. Demonstrate ability to weld acceptable joints in polyvinyl chloride waterstops before installing waterstop in forms.

- B. Field joints:
 1. Polyvinyl chloride waterstops field joints: Shall be free of misalignment, bubbles, inadequate bond, porosity, cracks, offsets, and other defects which would reduce the potential resistance of the material to water pressure at any point. Replace defective joints. Remove faulty material from the site and disposed of by the CONTRACTOR at its own expense.

- C. Inspections:
 1. Quality of welded joints will be subject to acceptance of the ENGINEER.
 2. Polyvinyl chloride waterstop: The following defects that represent a partial list that will be grounds for rejection:
 - a. Offsets at joints greater than 1/16 inch or 15 percent of the material thickness, at any point, whichever is less.
 - b. Exterior crack at joint, due to incomplete bond, which is deeper than 1/16 inch or 15 percent of the material thickness, at any point, whichever is less.
 - c. Any combination of offset or crack which will result in a net reduction in the cross section of the waterstop in excess of 1/16 inch or 15 percent of the material thickness, at any point, whichever is less.
 - d. Misalignment of the joint, which will result in misalignment of the waterstop in excess of 1/2 inch in 10 feet.
 - e. Porosity in the welded joint as evidenced by visual inspection.
 - f. Bubbles or inadequate bonding.

PART 2 - PRODUCTS

2.1 WATERSTOPS

- A. Waterstops - Polyvinyl chloride (PVC):
 1. Manufacturers: One of the following or equal:
 - a. Vinylex Corporation.
 - b. Greenstreak Plastic Products Company, Inc.
 2. Type: Ribbed waterstop:
 - a. Construction joints: 6-inch wide ribbed type. Vinylex R638, Greenstreak 679, or equal.
 - b. Expansion joint for wall penetrations for concrete encased electrical duct banks: 6-inch ribbed type with hollow center bulb. Vinylex RB638H, Greenstreak 732, or equal.
 - c. Expansion joints: 9-inch wide ribbed type with hollow center bulb or tear web. Vinylex RB938H, Greenstreak 735, or equal for expansion joints 1 inch and narrower, Vinylex TWB938, Greenstreak 739 or equal for expansion joints wider than 1 inch.
 3. Dumbbell type waterstop will not be allowed unless otherwise specified or indicated on the Drawings.
 4. Provide polyvinyl chloride waterstops complying with following requirements:
 - a. Manufactured from prime virgin polyvinyl chloride plastic compound containing the plasticizers, resins, stabilizers, and other materials necessary to meet the requirements of this Section.
 - b. No scrap or reclaimed material shall be used.
 5. Properties as indicated in the following table:

Physical Characteristics	Test Method	Required Results
Specific Gravity	ASTM D 792	Not less than 1.3.
Hardness	ASTM D 2240	70 to 90 Type A15 Shore durometer.
Tensile Strength	ASTM D 638	Not less than 2,000 pounds per square inch.
Ultimate Elongation	ASTM D 638	Not less than 300 percent
Alkali Extraction	CRD-C-572	7 day weight change between minus 0.1 percent and plus 0.25 percent. Hardness change within 5 points.
Low Temperature Brittle Point	ASTM D 746	No sign of cracking or chipping at - 35 degrees Fahrenheit minimum.
Water Absorption	ASTM D 570	Not more than 0.15 percent after 24 hours.
Accelerated Extraction Tensile	CRD-C-572	Not less than 1,600 pounds per square inch.
Stiffness in Flexure	ASTM D 747	Not less than 600 pounds per square inch.
Tear Resistance	ASTM D 624	Not less than 225 pounds per inch.
Thickness	—	3/8 inch
Center Bulb		
6 inch Waterstops	—	7/8 inch or 1-inch nominal outside diameter.
9 inch Waterstops	—	1-inch nominal outside diameter. For expansion joints 1 inch and narrower and 2 inches for expansion joints wider than 1 inch.
Allowable Tolerances		
Width	—	Plus or minus 3/16 inch.
Thickness	—	Plus or minus 1/32 inch.

2.2 JOINT FILLERS

- A. Hardboard: 1/8-inch minimum thickness, in accordance with ANSI A135.4 Class 2.
- B. Preformed expansion joint materials:
 - 1. General:
 - a. Use specific type in applications as indicated on the Drawings.
 - b. No scrap or recycled material shall be used.
 - 2. Bituminous fiber expansion joint material:
 - a. Manufacturers: One of The following or equal:
 - 1). Tamms Industries, a division of Euclid Chemical Company: Hornboard/fiber.
 - 2). Approved equal.
 - 3. Synthetic sponge rubber expansion joint material:
 - a. Manufacturers: One of the following or equal:
 - 3). Tamms Industries, a division of Euclid Chemical Company: Cementone.
 - 4). Approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Waterstops - General:

1. Waterstops shall be stored so as to permit free circulation of air around the waterstop material and to prevent direct exposure to sunlight.
2. Install waterstops in concrete joints where indicated on the Drawings.
3. Carry waterstops in walls into lower slabs and join to waterstops in slabs with appropriate types of fittings.
4. In water-bearing structures: Provide all joints with waterstops, whether indicated on the Drawings or not.
5. Provide waterstops that are continuous and in longest lengths practical.
6. Set waterstops accurately to position and line as indicated on the Drawings.
7. Hold and securely fix edges in position at intervals of not more than 24 inches so that they do not move during placing of concrete.
8. Position the waterstop so that symmetrical halves of the waterstop are equally divided between the concrete pours. The center axis of the waterstop shall be coincident with the centerline of the joint.
9. Do not drive nails, screws, or other fasteners through waterstops in vicinity of construction joints.
10. Use wires at not more than 24 inches on centers near outer edge of the waterstop to tie waterstops into position.
11. Special clips may be used in lieu of wires, at contractor's option.
12. Terminate waterstops 3 inches from top of finish surfaces of walls and slabs unless otherwise specified or indicated on the Drawings.
13. When any waterstop is installed in the concrete on one side of a joint, while the other half or portion of the waterstop remains exposed to the atmosphere for more than 2 days, suitable precautions shall be taken to shade and protect the exposed waterstop from direct rays of sunlight during the entire exposure and until the exposed portion is embedded in concrete.
14. When placing concrete at waterstops in slabs, lift the edge of the waterstop while placing concrete below the waterstop. Manually force the waterstop against and into the concrete. Then cover the waterstop with fresh concrete.

B. Polyvinyl chloride waterstops:

1. Install waterstops so that joints are watertight.
2. Weld joints such as unions, crosses, ells, and tees, with thermostatically controlled equipment recommended by waterstop manufacturer:
 - a. The material shall not be damaged by heat sealing.
 - b. Make joints by overlapping then simultaneously cut the ends of the sections to be spliced so they will form a smooth even joint. Heat the cut ends with the splicing tool until the plastic melts. Press the 2 ends together until the plastic cools.
 - c. The continuity of the waterstop ribs and tubular center axis shall be maintained.
 - d. The splices shall have a tensile strength of not less than 60 percent of the unspliced materials tensile strength.
3. Butt joints of the ends of 2 identical waterstop sections may be made while the material is in the forms.
4. Joints for crosses and tees shall be factory prefabricated by the manufacturer.

C. Joints:

1. Construct construction, and expansion joints as indicated on the Drawings.
2. Preformed expansion joint material: Fasten expansion joint strips to concrete, masonry, or forms with adhesive. No nailing will be permitted, nor shall expansion joint strips be placed without fastening.

D. Hardboard:

1. When indicated on the Drawings, face surface of joint filler with hardboard.
2. Other facing materials may be used provided they furnish equivalent protection and the material is acceptable to ENGINEER.

3. Hold boards in place by nails, waterproof adhesive, or other means acceptable to the ENGINEER.

END OF SECTION

SECTION 03 15 14 – STRIP-TYPE WATERSTOPS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes: Hydrophilic rubber waterstop and non-expanding mastic waterstop.

1.2 SUBMITTALS

- A. General:
1. Submit the following items for each type, style and size of hydrophilic waterstop to be installed.
 2. Product data:
 - a. Manufacturer's product data sheets.
 - 1). Include complete physical dimensions, expansion characteristics, and laboratory test reports indicating that average material properties conform to the requirements specified.
 - 2). Provide data sheets for all materials to be included in the waterstop system.
 3. Samples:
 - a. Minimum 6-inch long samples of each type of waterstop to be used if requested by the ENGINEER.
 4. Manufacturer's installation instructions:
 - a. Installation instructions and recommended installation details for the complete waterstop system, and for each component used in that system.
- B. Where general "strip-type" waterstop is noted, provide non-expansive mastic strip waterstop.

PART 2 - PRODUCTS

2.1 HYDROPHILIC RUBBER WATERSTOP

- A. General:
1. System composed of flexible hydrophilic urethane polymer with preformed strips, adhesives, paste, fasteners, and other accessories required for a complete and watertight installation.
 - a. To ensure compatibility of materials, a single manufacturer shall provide all products and accessories for the hydrophilic waterstop system.
 - b. Products incorporating bentonite are not acceptable under this Section.
 - c. Provide waterstop and accessories resistant to degradation under cyclic wetting and drying and to chemicals typically found in wastewater treatment structures.
- B. Hydrophilic strip waterstop.
1. Pre-formed strips of flexible hydrophilic rubber designed to undergo controlled expansion when exposed to moisture.
 - a. Strips manufactured to limit expansion in directions parallel to the plane of the joint, and to direct expansion against confining material perpendicular to that plane.
 2. Provide normal or low-expansion pressure as scheduled and as indicated on the Drawings.
 3. Manufacturers. One of the following, or equal.
 - a. Hydrophilic strip.
 - 1). Adeka Ultra Seal USA: MC-2010MN.
 - 2). Greenstreak: Hydrotite CJ1020-2K.
 - b. Low expansion hydrophilic strip.
 - 1). Adeka Ultra Seal USA: KBA-1510FP.
 - 2). Greenstreak: Hydrotite CJ0725-3K.

- C. Hydrophilic paste waterstop.
 - 1. Single-component gun grade paste of hydrophilic rubber designed to undergo controlled expansion when exposed to moisture after initial curing.
 - 2. Manufacturers: One of the following, or equal.
 - a. Adeka Ultra Seal USA: P-201.
 - b. Greenstreak: Leakmaster LV-1.

2.2 MASTIC STRIP WATERSTOP

- A. General:
 - 1. System composed of flexible non-expansive hydrocarbon mastic with preformed strips, primer, and other accessories required for a complete and watertight installation.
 - 2. To ensure compatibility of materials, a single manufacturer shall provide all products and accessories for the mastic waterstop system.
 - 3. Provide waterstop and accessories resistant to degradation under cyclic wetting and drying and to chemicals typically found in wastewater treatment structures.
- B. Mastic strip waterstop.
 - 1. Pre-formed strips of flexible non-expansive hydrocarbon mastic designed to bond with cured concrete and fuse with fresh concrete during concrete curing.
 - 2. Manufacturer recommended primer adhesive as required for installation.
 - 3. Manufacturers. One of the following, or equal.
 - a. Henry Company, Sealants Division; Synko-Flex
 - b. Greenstreak; Lockstop
 - c. JP Specialities, Inc.; Earthshield Type 10.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install products in accordance with manufacturer's instructions and recommended details.
- B. Prepare concrete joint surfaces:
 - 1. Use wire brushing or scraping to expose an uncontaminated, solid surface.
 - 2. Clean prepared surface with high-pressure air or water to remove residue and debris.
 - 3. Confirm that prepared surfaces conform to manufacturer's recommendations for surface profile and moisture conditions before installing materials.
- C. Provide manufacturer's recommended lap, splice, and corner details for strip-type waterstops.
 - 1. Use hydrophilic paste at all corner joints and overlap splices of hydrophilic strips.
- D. Hydrophilic strip waterstop.
 - 1. Install primers and adhesives when recommended by the manufacturer before setting hydrophilic strips.
 - 2. Keep hydrophilic strip taut during the fastening process.
 - 3. Secure hydrophilic strip in place with concrete nails, screws, or adhesive.
 - 4. Provide installation with no gap between the hydrophilic strip and the concrete to which it is attached. At rough or irregular surfaces, set hydrophilic strip waterstop strip in a bead of hydrophilic paste.
 - a. Fill all voids and rough areas under the hydrophilic strip with hydrophilic paste.
 - b. Allow hydrophilic paste to cure in accordance with manufacturer's recommendations before encapsulating paste in fresh concrete.
- E. Mastic strip waterstop.

1. Install primers as recommended by the manufacturer before setting mastic strips. For cured concrete surfaces, use of primer is mandatory.
2. Secure mastic strip in place with concrete nails, as required.
3. Provide installation with no gap between the mastic strip and the concrete to which it is attached. At rough or irregular surfaces, press the mastic strip waterstop strip into the concrete surface to achieve continuous contact.

3.2 SCHEDULE

A. Hydrophilic waterstops.

1. Use the hydrophilic waterstop given in the table below.

Joint Type	Condition of Use	Hydrophilic Waterstop To Use
Concrete construction joints	Joint where hydrophilic strip waterstop is placed under all of the following conditions: <ol style="list-style-type: none"> 1. Slab or wall thickness is greater than 10 inches, and 2. Waterstop is placed between 2 rows of steel reinforcement. 3. Concrete cover from waterstop to nearest concrete face is at least 4 inches. 	Hydrophilic strip waterstop set in bed of hydrophilic paste waterstop. Screw strip to concrete substrate.
	Joint where hydrophilic waterstop is placed under one of the following conditions: <ol style="list-style-type: none"> 1. Waterstop is placed on 1 side of a single row of steel reinforcement, or 2. Concrete cover from waterstop to nearest concrete face is less than 4 inches. 	Low expansion hydrophilic strip waterstop set in bed of hydrophilic paste waterstop. Screw strip to concrete substrate.
Pipe penetrations through concrete	Pipe diameter less than 4 inches.	Not allowed.
	Pipe diameter of 4 to 24 inches.	Continuous bead of hydrophilic paste
	Pipe diameter greater than 24 inches.	Continuous hydrophilic strip waterstop around perimeter of pipe, with hydrophilic paste seal at lapped ends of strip.

END OF SECTION

SECTION 03 20 00 - CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Reinforcing steel and related items required for cast-in-place concrete.
- B. Related Sections:
 - 1. Section 03 11 00 – Concrete Formwork.
 - 2. Section 03 30 00 – Cast-In-Place Concrete.

1.2 SUPERVISION

- A. Workmanship: Provide qualified supervision at all times reinforcing work is in progress. Workmen shall be experienced iron workers.
- B. Codes: Reinforcement placement and detailing shall comply with practice specified in the "Manual of Standard Practice for Detailing Reinforced Concrete Structures" publication ACI 315- latest edition of the American Concrete Institute or its latest revision, unless otherwise specified herein.

1.3 SUBMITTALS

- A. Shop drawings: Shop drawings shall be prepared for all reinforcement required by the project. Shop drawings shall be logically and legibly prepared to permit reasonable ease of sorting, selecting, placing reinforcement as well as checking drawings. Preparer and fabricator shall be identified on the drawings.
 - 1. Reinforcement shall not be fabricated until the shop drawings have been processed, approved and returned.
 - 2. Check all shop drawings to verify reinforcement dimensions required by drawings are satisfied.
 - 3. Provide bar sizes, bar lengths, bar material, bar grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and lap lengths, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.
- B. Reinforcement shop drawings:
 - 1. Review of reinforcement shop drawings by the ENGINEER will be limited to general compliance with the Contract Documents.
 - 2. Submit reinforcement shop drawings in a complete package for each specific structure. Partial submittals will be rejected.
- C. Changes to reinforcing steel contract drawing requirements:
 - 1. Indicate in separate letter submitted with shop drawings any changes of requirements indicated on the Drawings for reinforcing steel.
 - 2. Such changes will not be acceptable unless the ENGINEER has accepted such changes in writing.

1.4 PRODUCT HANDLING

- A. Protection:
 - 1. Use all means necessary to protect reinforcement from dirt and other foreign substances before and after placing.

2. Store in a neat manner in logical order, bundled, tagged, off the ground, and in an area adequately isolated.
 3. Re-bundle to maintain identification when placing is interrupted.
- B. Replacement: All damaged or improperly fabricated bars shall be replaced at the Contractor's expense.

PART 2 - PRODUCTS

2.1 CONCRETE REINFORCEMENT

- A. General: All reinforcement shall be free from rust, loose mill scale, and other contaminants.
- B. Wire bar supports located between reinforcing bars and face of concrete:
1. Stainless steel. Type 304 stainless steel bar supports.
 2. Support reinforcing for concrete placed on ground using bar support chairs with Type 304 stainless steel plates for resting on ground welded to the chairs.
- C. Concrete bar supports located between reinforcing bars and face of concrete:
1. Manufactured expressly for supporting reinforcing bars.
 2. Manufactured with two annealed steel wires to securely tie concrete bar support to reinforcing steel.
 3. Manufactured with minimum $f'_c = 5,000$ psi concrete.

2.2 WELDED WIRE REINFORCEMENT (WWR):

- A. In accordance with ASTM A 185.
- B. WWR may not be used in place of reinforcing bars unless accepted in writing by the Engineer.
- C. Provide WWR in flat sheet form.
- D. If WWR is used, provide WWR having cross-sectional area per linear foot of not less than cross-sectional area per linear foot of reinforcing bars indicated on the Drawings.

2.3 ACCESSORIES:

1. General: Accessories shall be subject to Engineer's approval.
2. Tie wire - 18 gauge annealed steel wire.
3. Number of chairs shall be adequate to prevent sag during steel and concrete placement.
4. Wall layer spacers shall be 1/4 inch round "Z" bar.
5. Horizontal layer spacers shall be wire bar supports or reinforcing bars bent to support top layer.
6. Dowel bar splicer:
 - a. Dowel bar splicer shall be Richmond or approved equal, manufactured from standard specified rebar material, with NC threads and shop fabricated to specified dowel configurations.

PART 3 - EXECUTION

3.1 GENERAL

- A. Reinforcing bars and welded wire fabric reinforcement: Verify that reinforcement is new stock free from rust scale, loose mill scale, excessive rust, dirt, oil, and other coatings which adversely affect bonding capacity when placed in the work.

- B. Other trades: Coordinate all work of other trades to avoid conflict with reinforcement.
- C. Shop drawings: Check all shop drawings to verify dimensions required.

3.2 FABRICATING

- A. General: Fabricate steel reinforcement according to the American Concrete Institute (ACI) publication "ACI 117 - Specification for Tolerances for Concrete Construction and Materials". Reinforcement shall be shop fabricated except where straight bars No. 5 or smaller are required.
- B. Bending: All bending shall be by using bending jigs and mandrels. All bars shall be bent cold.
- C. Cutting: Bars shall be cut by cold shearing. Torch cutting in the field may be permitted in special situations.

3.3 PREPARATION

- A. Surface Preparation:
 - 1. Reinforcing bars: Thin coating of red rust resulting from short exposure will not be considered objectionable. Thoroughly clean any bars having rust scale, loose mill scale, or thick rust coat.
 - 2. Cleaning of reinforcement materials: Remove concrete or other deleterious coatings from dowels and other projecting bars by wire brushing or sandblasting before bars are embedded in subsequent concrete placement.

3.4 PLACING

- A. General:
 - 1. Accurately place all bars to meet tolerances as outlined in ACI 318 and tie in place before placing concrete, include dowels. Tie with 18 gauge steel wire.
 - 2. Corner bars required for horizontal reinforcing. Unless otherwise noted on plans corner bars shall be same size and spacing as horizontal bar.
 - 3. No field bending of bars will be allowed.
- B. Clearance:
 - 1. Preserve clearance between bars of 1 inch minimum, not less than one bar diameter or 1-1/3 times large aggregate, whichever is larger.
 - 2. Provide following concrete coverage over reinforcing steel unless otherwise indicated on plans:
 - a. Three inches above subgrade - in excavation.
 - b. Two inches above subgrade - slab on fill.
 - c. Two inches from form - walls exposed to water or earth and for slab over water.
 - d. One and one-half inches from form - normal cover interior walls, beams, columns, etc.
 - e. Three-fourths inch on top steel - interior slabs.
 - f. One and one-half inches on top and bottom - exterior slab.
 - 3. Lap all reinforcing bars as required by ACI 318-latest edition Class B as indicated on the drawings except where otherwise required by ACI.
 - 4. Stagger splices except where otherwise shown.
 - 5. Lap welded wire reinforcement a minimum of two spaces.
- C. Dowels: All dowels shall be placed and securely anchored before placing concrete
- D. Supports:

1. Provide a sufficient number to prevent sagging, to prevent shifting, and to support loads during construction; but in no case less than quantities and at locations as indicated in ACI 315.
2. Do not use brick, broken concrete masonry units, spalls, rocks, wood or similar materials for supporting reinforcing steel.
3. Do not use reinforcing bars that have less cover than required by the Contract Documents. Do not adjust location of reinforcement required by the Contract Documents to provide cover to these bars.
4. Wire chairs will not be accepted to hold reinforcing clearance on walls.

E. Tying of bar reinforcement:

1. Fasten bars securely in place with wire ties.
2. Tie bars sufficiently often to prevent shifting.
3. Provide at least 3 ties in each bar length.
4. Do not apply to dowel lap splices or to bars shorter than 4 feet, unless necessary for rigidity.
5. Tie slab bars at every intersection around periphery of slab.
6. Tie wall bars and slab bar intersections other than around periphery at not less than every fourth intersection, but at not greater than following maximum spacings:

Bar Size	Slab Bar Spacing Inches	Wall Bar Spacing Inches
Bars Number 5 and Smaller	60	48
Bars Number 6 through Number 9	96	60
Bars Number 10 and Number 11	120	96

7. After tying wire ties, bend ends of wire ties in towards the center of the concrete section.
 - a. The cover for wire ties shall be the same as the cover requirements for reinforcing bars.

F. Openings and obstructions:

1. Place additional reinforcing around openings as shown on the drawings and standard details.
2. Bend reinforcing around obstructions. Place extra reinforcing where cutting is authorized. Engineer's approval required before cutting steel.
3. Consult Engineer on special situations.

G. Welded Wire Reinforcement:

1. Install necessary wiring, spacing chairs, or supports to keep welded wire fabric in place while concrete is being placed.
2. Bend fabric as indicated on the Drawings or required to fit work.
3. Unroll or otherwise straighten fabric to make flat sheet before placing in the Work.
4. Lap splice welded wire fabric as indicated on the Drawings.
5. If lap splice length is not indicated on the Drawings, splice fabric in accordance with ACI 318 and ACI 350.

H. Certification: Certify material and type of deformation.

- I. Condition: All reinforcement shall be free from loose rust, dirt coating, oil, paint, or any foreign substance.

END OF SECTION

SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes cast-in-place concrete, including concrete materials, concrete accessories, concrete mixture designs, placement procedures, and finishes, for the following:
 - 1. Footings.
 - 2. Foundation walls.
 - 3. Slabs-on-grade.
 - 4. Suspended slabs.
 - 5. Concrete toppings.
 - 6. Building frame members.
 - 7. Building walls.
 - 8. Hydraulic (liquid containing) structures.

- B. Related Sections:
 - 1. Section 03 01 00 - Concrete Surface Repair
 - 2. Section 03 11 00 - Concrete Formwork
 - 3. Section 03 15 00 - Concrete Accessories
 - 4. Section 03 20 00 - Concrete Reinforcement
 - 5. Section 03 60 00 - Grout
 - 6. Section 03 60 01 - Basin Bottom Grout
 - 7. Section 03 64 00 - Concrete Repair Crack Injection

1.2 REFERENCES

- A. American Concrete Institute (ACI):
 - 1. ACI 301 – Specifications for Structural Concrete
 - 2. ACI 117 - Specifications for Tolerances for Concrete Construction and Materials
 - 3. ACI 305 - Hot Weather Concreting Standard
 - 4. ACI 306 - Cold Weather Concreting Standard
 - 5. ACI 318 - Building Code Requirements for Structural Concrete and Commentary
 - 6. ACI 350 - Code Requirements for Environmental Engineering Concrete Structures and Commentary
 - 7. ACI 211.1 – Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
 - 8. ACI 302.1R – Guide for Concrete Floor and Slab Construction
 - 9. ACI 308.1 – Standard Specification for Curing Concrete
 - 10. Manual of Concrete Practice

- B. ASTM International (ASTM):
 - 1. ASTM A615 – Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
 - 2. ASTM C31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field.
 - 3. ASTM C33 - Standard Specification for Concrete Aggregates
 - 4. ASTM C39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
 - 5. ASTM C40 - Standard Test Method for Organic Impurities in Fine Aggregates for Concrete
 - 6. ASTM C42 - Standard Test Method of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
 - 7. ASTM C88 - Standard Test Method of Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate

8. ASTM C94 - Standard Specification for Ready-Mixed Concrete
9. ASTM C114 - Standard Test Methods for Chemical Analysis of Hydraulic Cement
10. ASTM C117 - Standard Test Method for Materials Finer than 75- μ m (No. 200) Sieve in Mineral Aggregates by Washing
11. ASTM C123 - Standard Test Method for Lightweight Particles in Aggregate
12. ASTM C131 - Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
13. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
14. ASTM C142 - Standard Test Method for Clay Lumps and Friable Particles in Aggregate
15. ASTM C143 - Standard Test Method for Slump of Hydraulic-Cement Concrete
16. ASTM C150 - Standard Specification for Portland Cement
17. ASTM C156 - Standard Test Method for Water Loss [from a Mortar Specimen] Through Liquid Membrane-Forming Curing Compounds for Concrete
18. ASTM C157 - Standard Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete
19. ASTM C171 - Standard Specifications for Sheet Materials for Curing Concrete
20. ASTM C172 - Standard Practice for Sampling Freshly Mixed Concrete
21. ASTM C173 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
22. ASTM C192 – Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory
23. ASTM C231 – Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
24. ASTM C260 – Standard Specification for Air-Entraining Admixtures for Concrete
25. ASTM C295 – Standard Guide for Petrographic Examination of Aggregates for Concrete
26. ASTM C309 – Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
27. ASTM C494 – Standard Specification for Chemical Admixtures for Concrete
28. ASTM C618 – Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
29. ASTM C881 – Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete
30. ASTM C1064 – Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete
31. ASTM C1059 – Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete
32. ASTM C1077 – Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation
33. ASTM C1116 – Standard Specification for Fiber-Reinforced Concrete
34. ASTM C1315 – Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete
35. ASTM D448 – Standard Classification for Sizes of Aggregate for Road and Bridge Construction
36. ASTM D1751 – Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
37. ASTM D2240 – Standard Test Method for Rubber Property – Durometer Hardness
38. ASTM E329 – Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection
39. ASTM E1155 – Standard Test Method for Determining F_F Floor Flatness and F_L Floor Levelness Numbers
40. ASTM E1643 – Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs
41. ASTM E1745 – Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs

1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.
- B. Exposed Concrete: Concrete surface that can be seen inside or outside of structures regardless whether concrete is above water, dry at all times, or can be seen when structure is drained.
- C. Hydraulic Structures: Liquid containing basins.
- D. Defective Areas: Surface defects that include honeycomb, rock pockets, indentations greater than 3/16", cracks 0.005" wide and larger as well as any crack that leaks for liquid containing basins and below grade habitable spaces; cracks 0.010" wide and larger in non-fluid holding structures, spalls, chips, air bubbles greater than 3/4" in diameter, pinholes, bug holes, embedded debris, lift lines, sand lines, bleed lines, leakage from form joints, fins and other projections, form pop-outs, texture irregularities, and stains and other color variations that cannot be removed by cleaning.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Concrete Mixture Designs: For each concrete mixture.
 - 1. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
 - 2. Indicate amounts of mixing water to be withheld for later addition at Project site.
 - 3. Submit Shrinkage Test Results for design mixtures. See 3.13 FIELD QUALITY CONTROL, E. Shrinkage Tests - 3 for shrinkage test requirements and limitations. Any Mix Design submitted without a Shrinkage Test will not be reviewed and will be returned to the Contractor as "Rejected".
- C. Welding certificates.
- D. Qualification Data: For manufacturer testing agency.
- E. Material Certificates: For each of the following, signed by manufacturers:
 - 1. Cementitious materials.
 - 2. Admixtures.
 - 3. Curing compounds.
 - 4. Floor and slab treatments.
 - 5. Bonding agents.
 - 6. Adhesives.
 - 7. Vapor retarders.
 - 8. Semi-rigid joint filler.
 - 9. Joint-filler strips.
- F. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.
- G. Field quality-control test and inspection reports.
- H. Course Aggregate Gradation.
- I. Fine Aggregate Gradation.

- J. One copy of each 30 consecutive strength test results and mix design used from a record of past performance or one copy of the laboratory trial mix design and results and one copy of the mix design proposed for each mixture and use under this contract. If the 30 consecutive strength tests are used, the test shall have been made within the 12 month period prior to this submittal.
- K. Material Test Reports: for the following, from a testing agency acceptable to the ENGINEER, indicating compliance with requirements:
 - 1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.
- L. Ready-Mix concrete.
 - 1. Provide delivery tickets for ready-mix concrete or weigh-masters certificate per ASTM C94 including weights of cement and each size aggregate and amount of water added at the plant and record of pours. Record the amount of water added on the job on the delivery ticket. Water added at the plant shall account for moisture in both coarse and fine aggregate. If water is added on the job the total water content shall not exceed the water content of the approved design mix.
 - 2. Keep record showing time and place of each pour (placement) of concrete, together with transit-mix delivery slips certifying the contents of the pour (placement).
 - 3. Furnish records to Engineer upon request.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.
- B. Manufacturer Qualifications: A firm with a minimum of 5 years' experience in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.
 - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
 - 2. The criteria hereinafter set out are solely for the purpose of establishing required mixture proportions and do not constitute a basis for confirming the adequacy of concrete strength.
 - a. Required Average Strength Above Specified Compressive Strength: Proportions, including water-cement ratio, shall be established on the basis either of laboratory trial batches or of field experience with the materials to be employed. The proportions shall be selected to produce an average strength of 28 days exceeding the specified compressive strength by the amount indicated below, when both air content and slump are the maximums permitted by the Specifications.
 - b. Determination of the required average strength shall be in accordance with ACI 318 "Building Code Requirements for Reinforced Concrete," except that if suitable data from trial batches or field experience cannot be obtained, permission will not be granted to base concrete proportions on the water-cement ratio limits set out in the above referenced code.
 - 1). Past Plant Performance: Proportions may be established on the actual field performance of the ready-mix producer. Where the concrete production facility has a record, based on at least 30 consecutive strength tests taken within the prior 12 months representing similar materials and conditions to those expected, the strength used as the basis for selecting proportions shall exceed the required $f'c$ by at least:
 - a). 400 psi if the standard deviation is less than 300 psi;
 - b). 500 psi if the standard deviation is 300 to 400 psi;
 - c). 700 psi if the standard deviation is 400 to 500 psi;
 - d). 900 psi if the standard deviation is 500 to 600 psi;

- e). 1,200 psi if the standard deviation is above 600 psi or unknown.
 - 2). Strength data for determining standard deviation shall be considered to comply with the foregoing stipulations if they represent either a group of at least 30 consecutive tests or the statistical average of two groups totaling 30 or more tests. The tests used to establish standard deviation shall represent concrete produced to meet a specified strength or strengths within 1,000 psi of that specified for the proposed work. Changes in materials and proportions within the population of background tests shall not have been more closely restricted than they will be for the proposed work.
 - 3). Strength data for determining standard deviation shall be considered to comply with the foregoing stipulations if they represent either a group of at least 30 consecutive tests or the statistical average of two groups totaling 30 or more tests. The tests used to establish standard deviation shall represent concrete produced to meet a specified strength or strengths within 1,000 psi of that specified for the proposed work. Changes in materials and proportions within the population of background tests shall not have been more closely restricted than they will be for the proposed work.
 - 4). Laboratory Trial Batches: When the ready-mix producer does not have a record of past performance, the combination of materials and the proportions selected shall be determined from trial mixes having proportions and consistencies suitable for the work based on ACI 211.1-77.
 - a) When laboratory trial batches are used as the basis for selecting concrete proportions, strength tests shall be made in accordance with "Method of Test for Compressive Strength of Molded Concrete Cylinders" (ASTM C39) on specimens prepared in accordance with "Method of Making and Curing Test Specimens in the Laboratory" (ASTM C192). A curve shall be established showing the relationship between water-cement ratio (or cement content) and compressive strength. The curve shall be based on at least three points representing batches which produce strengths above and below that required. Each point shall represent the average of at least three specimens tested at 28 days or the earlier age designation.
 - b) The average strength required shall exceed the specified compressive strength by 1,200 psi.
 - c) The maximum permissible water-cement ratio (or minimum cement content) for the concrete to be used in the structure shall be that shown by the curve to produce the average strength indicated, but in no case shall the water-cement ratio exceed 0.42 by weight.
- C. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C1077 and ASTM E329 for testing indicated.
- 1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
 - 2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.
- D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.
- E. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
- 1. ACI 301, "Specifications for Structural Concrete."
 - 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

3. ACI 350 "Code Requirements for Environmental Engineering Concrete Structures."
 4. ACI 318 "Building Code Requirements for Reinforced Concrete."
- F. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.
- G. Pre-installation Conference: Conduct conference at Project site.
1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
 - a. Contractor's superintendent.
 - b. Independent testing agency responsible for concrete design mixtures.
 - c. Ready-mix concrete manufacturer.
 - d. Concrete subcontractor.
 2. Review special inspection and testing and inspecting agency procedure for field quality control, concrete finishes and finishing, cold and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints and joint-filler strips, semi-rigid joint fillers, forms and form removal limitations, shoring and re-shoring procedures, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, floor and slab flatness and levelness measurement, concrete repair procedures and concrete protection.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
1. Available Products: Subject to compliance with requirements products that may be incorporated into the work include, but are not limited to products specified.
 2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 FORM-FACING MATERIALS

- A. See Section 03 11 00 CONCRETE FORMWORK for additional requirements.
- B. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints. Furnish on exposed surfaces and interior surfaces.
- C. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit. Permitted to furnish on below grade exterior surfaces
- D. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.
- E. Pan-Type Forms: Glass-fiber-reinforced plastic or formed steel, stiffened to resist plastic concrete loads without detrimental deformation.

- F. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.
- G. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.
- H. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.
- I. Form-Release Agent: As specified in Section 03 11 00 CONCRETE FORMWORK.

2.3 REINFORCEMENT ACCESSORIES

- A. Expansion Joint Dowel Bars: ASTM A615/A615M, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.
 - 1. All dowels shall be placed and securely anchored before placing concrete. All dowels shall be parallel with each other and perpendicular to the joint.
- B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
 - 1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.
 - 2. Secure all reinforcement in place using steel chairs, supports, "A" bars and any other ACI approved product. Supports shall be spaced adequately to support the steel firmly in place.
 - 3. Charis will not be accepted to hold reinforcing clearance on walls.
- C. General:
 - 1. Accessories shall be subject to Engineer's approval.
 - 2. Tie wire- 18 gauge steel wire. Ends of wire shall be bent towards the interior part of the wall.
 - 3. Support above forms with fabricated steel chairs. Number of chairs shall be adequate to prevent sag during steel and concrete placement.
 - 4. Wall layer spacers shall be 1/4" ROUND "Z" BAR.
 - 5. Horizontal layer spacers shall be stand.
 - 6. Dowel Bar Splicer:
 - a. Dowel bar splicer shall be Richmond or approved equal, manufactured from standard specified rebar material with NC threads and shop fabricated to specified dowel configurations.

2.4 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
 - 1. Portland Cement (Non-hydraulic Above Grade Structures): ASTM C150, Type I or II, or combination of Type I with fly ash.
 - 2. Portland Cement (Hydraulic and/or Below Grade Structures): ASTM C150 type II or combination of Type I with fly ash.
 - 3. Fly Ash: ASTM C618, Class C or F fly ash shall not exceed 15 percent of the cementitious materials, unless written approval is given by the Engineer.
- B. Normal-Weight Aggregates: ASTM C33, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years

satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.

1. Maximum Coarse-Aggregate Size: 1" nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
3. Fine aggregate:
 - a. Provide fine aggregate for concrete or mortar consisting of clean, natural sand or of sand prepared from crushed stone or crushed gravel.
 - b. Do not provide aggregate having deleterious substances in excess of following percentages by weight of contaminating substances.
 - c. In no case shall total exceed percent listed.

Item	Test Method	Percent
Removed by decantation (dirt, silt, etc.)	ASTM C117	3
Shale or Chert	ASTM C123	1
	ASTM C295*	1
Clay Lumps	ASTM C142	1
* Test Method C123 is used to identify particles in the sample lighter than 2.40 Specific Gravity. Test Method C295 is used to identify which of the lightweight particles are shale or chert. If the results of Test Method C123 are less than 1 percent, Test Method C295 is not required.		

- d. Except as otherwise specified, grade fine aggregate from coarse to fine in accordance with ASTM C33.
4. Coarse aggregate:
 - a. Provide coarse aggregate consisting of gravel or crushed stone made up of clean, hard, durable particles free from calcareous coatings, organic matter, or other foreign substances.
 - b. Not exceeding 15 percent by weight, of thin or elongated pieces having length greater than 5 times average thickness.
 - c. Deleterious substances: Not in excess of following percentages by weight, and in no case having total of all deleterious substances exceeding 2 percent.
 - d. Coarse aggregate shall be washed prior to combining in concrete mix.

Item	Test Method	Percent
Shale or chert	ASTM C123	1.25
	ASTM C295**	1
Coal and lignite	ASTM C123	1/4
Clay lumps and friable particles	ASTM C142	1/4
Materials finer than Number 200 sieve	ASTM C117	1/2*
* Except when material finer than Number 200 sieve consists of crusher dust, maximum amount shall be 1 percent.		
** Test Method C 123 is used to identify particles in the sample lighter than 2.40 Specific Gravity. Test Method C 295 is used to identify which of the lightweight particles are shale, chert, coal, or lignite. If the results of Test Method C 123 are less than 1.25 percent (the minimum combined percentage of shale, chert, coal and lignite), Test Method C 295 is not required.		

- 5. Grading:
 - a. Aggregate for building elements and hydraulic structures: In accordance with ASTM C33, Size Number 57, except as otherwise specified or authorized in writing by the ENGINEER.

C. Water: ASTM C94 and potable (not recycled water).

2.5 ADMIXTURES

A. Air-Entraining Admixture: ASTM C260.

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

- 1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
- 2. Retarding Admixture: ASTM C494/C494M, Type B.
- 3. Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type D.
- 4. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
- 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type G.
 - a. Bayer Corporation.
 - b. ChemMasters.
 - c. Conspec Marketing & Manufacturing Co., Inc.; a Dayton Superior Company.
 - d. Davis Colors.
 - e. Elementis Pigments, Inc.

2.6 VAPOR RETARDERS

A. Plastic Vapor Retarder: ASTM E1745, Class B. Include manufacturers' recommended adhesive or pressure-sensitive tape.

- 1. Products:
 - a. Fortifiber Corporation: Moistop Ultra.
 - b. Revan Industries Inc.; Vapor Block 10.
 - c. Stego Industries, LLC; Stego Wrap, 15 mils.

B. Granular Fill: Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D448, Size 57, with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.

2.7 FLOOR AND SLAB TREATMENTS

A. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or silicate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces.

- 1. Products:
 - a. Burke by Edoco; Titan Hard.
 - b. ChemMasters; Chemisil Plus.
 - c. ChemTec international; ChemTec One.
 - d. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company
 - e. Curecrete Distribution Inc.; Ashford Formula.
 - f. Dayton Superior Corporation; Day-Chem sure Hard.
 - g. Euclid Chemical Company (The); Euco Diamond Hard.
 - h. Kaufman Products, Inc.; SureHard.
 - i. L&M Construction Chemicals, Inc.; Seal Hard.
 - j. Meadows, W. R., Inc.; Liqui-Hard.
 - k. Metalcrete Industries; Floorsaver.
 - l. Nox-Crete Products Group, Kinsman Corporation; Duranox.

- m. Symons Corporation, a Dayton Superior Company; buff Hard.
- n. US Mix Products Company; US Spec Industraseal.
- o. Vexcon Chemicals, Inc.; Vexcon StarSeal PS.

2.8 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
 - 1. Products:
 - a. Axim Concrete Technologies; Cimfilm.
 - b. Burke by Edoco; BurkeFilm.
 - c. ChemMasters; Spray-Film.
 - d. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior company; Aquafilm.
 - e. Dayton Superior Corporation; Sure Film.
 - f. Euclid Chemical Company (The); Eucobar.
 - g. Kaufman Products, Inc.; Vapor Aid.
 - h. Lambert Corporation; Lambco Skin.
 - i. L&M Construction Chemicals, Inc.; E-Con.
 - j. MBT Protection and Repair, Div., of ChemRex; Confilm.
 - k. Meadows, W. R., Inc; Sealtight Evapre.
 - l. Metalcrete Industries; Waterhold.
 - m. Nox-Crete Products Group, Kinsman Corporation; Monofilm.
 - n. Sika Corporation, Inc.; SikaFilm.
 - o. Symons Corporation, a Dayton Superior Company; Finishing Aid.
 - p. Unitex; Pro-Film.
 - q. US Mix Products Company; US Spec Monofilm ER.
 - r. Vexcon Chemicals, Inc.; Certi-Vex EnvioAssist.

- B. Absorptive Cover: AASHTO M182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.

- C. Moisture-Retaining Cover: ASTM C171, polyethylene film or white burlap-polyethylene sheet.

- D. Water: Potable.

- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C309, Type 1, Class B, dissipating.
 - 1. Products
 - a. Anti-Hydro International, Inc.; AH Curing Compound #2 DR WB.
 - b. Burke by Edoco; Aqua Resin cure.
 - c. ChemMasters; Safe-Cure Clear.
 - d. Conspec Marketing & Manufacturing co., Inc., a Dayton Superior Company; W.B. Resin cure.
 - e. Dayton Superior Corporation; Day Chem Rez cure (J-11-W).
 - f. Euclid Chemical Company (The); Kurez DR VOX.
 - g. Kaufman Products, Inc.; Thinfilm 420.
 - h. Lambert Corporation; Aqua Kure-Clear.
 - i. L&M Construction Chemicals, Inc.; L&M Cure R.
 - j. Meadows, W. R., Inc.; 100 Clear.
 - k. Nox-Crete Products Group, Kinsman Corporation; Resom Cire E/
 - l. Sykkmons Corporation, a Dayton Superior Company; Resi-Chem Clear Cure.
 - m. Tamms Industries, Inc., Horncure WB 30.
 - n. Unitex; Hydro cure 309.
 - o. US Mix Products Company; US Spec Maxcure Resin Clear.
 - p. Vexcon Chemicals, Inc.; Certi-Vex Enviocure 100.

- F. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C1315, Type 1, Class A. Compatible with penetrating liquid floor treatment for surfaces specified to receive penetrating liquid floor treatment.
 - 1. Products:
 - a. Burke by Edoco; Cureseal 1315 WB.
 - b. ChemMasters; Polyseal WB.
 - c. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Sealcure 1315 WB
 - d. Euclid Chemical Company (The); Super Diamond Clear VOX.
 - e. Kaufman Products, Inc.; Sure Cure 25 Emulsion.
 - f. Lambert Corporation; UV Safe Seal.
 - g. L&M Construction Chemicals, Inc.; Lumiseal WB Plus.
 - h. Meadows, W. R., Inc.; Vocomp-30.
 - i. Metalcrete Industries; Metcure 30.
 - j. Symons Corporation, a Dayton Superior Company; Cure 7 Seal 31 Percent E.
 - k. Tamms Industries, Inc.; LusterSeal WB 300.
 - l. Unitex; Hydro Seal 25.
 - m. US Mix Products Company; US Spec Radiance UV-25.
 - n. Vexcon Chemicals, Inc.; Vexcon Starseal 1315.

2.9 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D1751, asphalt-saturated cellulosic fiber.
- B. Semi-rigid Joint Filler: Two-component, semi-rigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 per ASTM D2240.
- C. Bonding Agent: ASTM C1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- D. Epoxy Bonding Adhesive: ASTM C881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
 - 1. Types IV and V, load bearing for bonding hardened or freshly mixed concrete to hardened concrete.

2.10 REPAIR MATERIALS

- A. See Sections 03 01 00, CONCRETE SURFACE REPAIR SYSTEMS and 03 64 00, CONCRETE REPAIR CRACK INJECTION.

2.11 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
 - 1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
- B. Cementitious Materials: Limit percentage by weight of cementitious materials other than Portland cement in concrete as follows:
 - 1. Fly Ash: 15 percent of cementitious materials maximum, unless written approval is given by the Engineer.
- C. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement for non-hydraulic structures and 0.10 percent by weight of cement for hydraulic structures.

- D. Admixtures: Use admixtures according to manufacturer's written instructions.
 - 1. Use water-reducing or high-range water-reducing admixture in concrete, as required, for placement and workability.
 - 2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
 - 3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.

2.12 CONCRETE MIXTURES

- A. Proportion normal-weight concrete mixture as follows for all structural elements:
 - 1. Minimum Compressive Strength: 4,500 psi at 28 days.
 - 2. Maximum Water-Cementitious Materials Ratio: 0.42.
 - 3. Minimum Cementitious Materials Content: 535 lb. /cu yd.
 - 4. Slump Limit: 8-inches Max for concrete with verified slump of 2 to 4-inches before adding high range water-reducing admixture or plasticizing admixture per ACI 301.
 - 5. Air Content: 5.5 percent, plus or minus 1.5 percent at point of delivery.
- B. Proportion normal-weight concrete mixture as follows for all non-structural elements:
 - 1. Minimum Compressive Strength: 3,000 psi at 28 days.
 - 2. Maximum Water-Cementitious Materials Ratio: 0.45.
 - 3. Slump Limit: 8 inch for concrete with verified slump of 2" to 4": before adding high-range water-reducing admixture or plasticizing admixture per ACI 301.
 - 4. Air content: 5 1/2%, ±1.5% at point of delivery.

2.13 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C94/C94M and ASTM C1116, and furnish batch ticket information.
 - 1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.
- B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C94/C94M. Mix concrete materials in appropriate drum-type batch machine mixer.
 - 1. For mixer capacity of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
 - 2. For mixer capacity larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd.
 - 3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.1 FORMWORK: See Section 03 11 00, CONCRETE FORMWORK.

3.2 VAPOR RETARDERS

- A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E1643 and manufacturer's written instructions.
 - 1. Lap joints 6 inches and seal with manufacturers' recommended tape.

3.3 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Engineer/Owner
 1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
 2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
 3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
 4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
 5. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
 6. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one fourth of concrete thickness as follows:
 1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
 2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
 1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
 2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Division 07 Section "Joint Sealants," are indicated.
 3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
- E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.4 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by the Engineer.
- C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
 2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
 3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
- E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 2. Maintain reinforcement in position on chairs during concrete placement.
 3. Screed slab surfaces with a straightedge and strike off to correct elevations.
 4. Slope surfaces uniformly to drains where required.
 5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.
- F. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
 2. All embedded items such as wall pipes, embed frames, steel guide rails, channels, etc. (not including conduit and reinforcing) shall be considered "massive embedments" and are required to be kept above 32 deg F during placement and for the first 48 hours after placement. Contractor shall take the necessary measures; including insulated blankets, heated blankets, and heaters; to insure items are kept above 32 deg F. All other methods shall be submitted to the Engineer for approval.
 3. Do not use frozen materials or materials containing ice or snow.
 4. Do not place concrete on frozen subgrade or on subgrade containing frozen materials. Top 12-inches of subgrade shall be thawed prior to concrete placement. Contractor is responsible for verifying that the temperature for the top 12-inches of subgrade is above 32 deg F.
 5. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- G. Hot-Weather Placement: Comply with ACI 305 and as follows:
1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is included in total amount of mixing water. Using liquid nitrogen to cool concrete is contractor's option, but liquid nitrogen should not replace 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. All other methods shall be submitted to the Engineer for approval.

3.5 CONCRETE WALL FINISHES

- A. Type W-1 (Ordinary Wall Finish or Coating):
 - 1. Patch tie holes.
 - 2. Knock off projections.
 - 3. Patch defective areas.

- B. Type W-2 (Smooth Wall Finish):
 - 1. Patch tie holes.
 - 2. Grind off projections, fins, and rough spots.
 - 3. Patch defective areas and repair rough spots resulting from form release agent failure or other reasons to provide smooth uniform appearance.

- C. Type W-5 (Finish for Painting):
 - 1. Patch tie holes.
 - 2. Grind off projections, fins, and rough spots.
 - 3. Patch and repair defective areas as specified for Type W-2.
 - 4. Apply paint or coating system as specified in Section 09 90 00 Painting and Protective Coatings.

3.6 CONCRETE SLAB FINISHES

- A. General:
 - 1. Finish slab concrete per the requirements of ACI 302.1R
 - 2. Use manual screeds, vibrating screeds, or roller compacting screeds to place concrete level and smooth.
 - 3. Do not use "Jitterbugs" or other special tools designed for the purpose of forcing coarse aggregate away from the surface and allowing a layer of mortar, which will be weak and cause surface cracks or de-lamination, to accumulate.
 - 4. Do not dust surface with dry materials.
 - 5. Use evaporation retardant.
 - 6. Round off edges of slabs with a steel edging tool, except where a cove finish is shown. Steel edging tool radius shall be 1/4" for slabs subject to wheeled traffic.

- B. Type S-1 (Steel Troweled Finish):
 - 1. Finish by screeding and floating with straightedges to bring surfaces to required finish elevation, use evaporation retardant.
 - 2. While concrete is still green, but sufficiently hardened to bear a person's weight without deep imprint, wood float to true, even plane with no coarse aggregate visible.
 - 3. Use sufficient pressure on wood floats to bring moisture to surface.
 - 4. After surface moisture has disappeared, hand trowel concrete to produce smooth, impervious surface, free from trowel marks.
 - 5. Burnish surface with an additional troweling. Final troweling shall produce a ringing sound from trowel.
 - 6. Do not use dry cement or additional water during troweling, nor will excessive troweling be permitted.
 - 7. Power Finishing:
 - a. An approved power machine may be used in lieu of hand finishing in accordance with directions of machine manufacturer.
 - b. Do not use power machine when concrete has not attained the necessary set to allow finishing without introducing high and low spots in slab.
 - c. Do first steel troweling for slab S-1 finish by hand.

- C. Type S-2 (Wood Float Finish):
 - 1. Finish slabs to receive fill and mortar setting beds by screeding with straight edges to bring surface to required finish plane.

2. Wood float finish to compact and seal surface.
 3. Remove laitance and leave surface clean.
 4. Coordinate with other finish procedures.
- D. Type S-3 (Underside Elevated Slab Finish): When forming is removed, grind off projections on underside of slab and patch defective areas, including small shallow air pockets where schedule of concrete finishes requires painting or protective coating.
- E. Type S-5 (Broomed Finish):
1. Finish as specified for Type S-1 floor finish, except omit final troweling and finish surface by drawing a fine-hair broom lightly across the surface.
 2. Broom in same direction and parallel to expansion joints, or, in the case of inclined slabs, perpendicular to slope, except for round roof slab, broom surface in radial direction.
- F. Type S-6 (Sidewalk Finish):
1. Slope walks down 1/4" per foot away from structures, unless otherwise shown.
 2. Strike off surface by means of strike board and float with wood or cork float to a true plane, then flat steel trowel before brooming.
 3. Broom surface at right angles to direction of traffic or as shown.
 4. Lay out sidewalk surfaces in blocks, as shown or as directed by Engineer, with a grooving tool.
- G. Type S-7: The top surfaces of basins in which raking mechanisms are to be installed
1. Slabs shall be finished by sweeping in cement grout with the mechanism. The cement grout to be used shall be composed of one part Portland cement and two parts sand.
 2. The sweeping-in process shall be performed under the supervision of a factory representative of the equipment manufacturer.
 3. The slab upon which the grout is to be applied shall receive a Type S-5 finish except that after leveling and floating, it shall be raked in such a manner as to provide a good bond for the grout. Raking shall develop a pattern with a depth of 1/4" every 2". Before grout is deposited on the slab, it shall be thoroughly cleaned, wet down with clean water and lightly dusted with neat cement immediately prior to placement of the grout.

3.7 SCHEDULE OF CONCRETE FINISHES

- A. Form Tolerances: As specified in Section 03 11 00, CONCRETE FORMWORK.
- B. Provide concrete finishes as scheduled:

Area	Type of Finish	Required Form Tolerances
EXTERIOR WALL SURFACES		
Above grade/exposed (above a point 12" below finish grade)	W-2	W-B
Backfilled (below a point 12" below final grade)	W-1	W-A

INTERIOR WALL SURFACES		
Hydraulic Structures including tanks, pump stations, flow channels, junction boxes, and basins	W-5	W-A
Buildings, pipe galleries, and other dry areas	W-5	W-B
EXTERIOR SLABS		
Exposed Roof slab or Slab-on-grade for non-hydraulic structures	S-5	
Roof slab or Top of Wall for Hydraulic Structures	S-1	
Other water holding tanks and basins	S-1	
Stairs and landings	S-5	
Sidewalks	S-6	
Other exterior slabs/pads	S-1	
Top surfaces of basins in which raking mechanisms are to be installed	S-7	
INTERIOR SLABS		
Non-Hydraulic areas such as pipe galleries and slabs-on-grade	S-1	
Hydraulic channels / Water Holding Structures	S-1	
Underside of elevated slabs	S-3	
Slabs to receive fill and mortar setting beds	S-2	

3.8 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by 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. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.
- D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel finish concrete surfaces.

3.9 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 305.1 for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

- C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.
- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
- E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
 - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
 - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 - a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
 - b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
 - c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.
 - 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
 - a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.
 - 4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.10 LIQUID FLOOR TREATMENTS

- A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions.
 - 1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
 - 2. Do not apply to concrete that is less than 28 days' old.
 - 3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.
- B. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller according to manufacturer's written instructions.

3.11 JOINT FILLING

- A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
 - 1. Defer joint filling until concrete has aged at least one month. Do not fill joints until construction traffic has permanently ceased.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.
- C. Install semi-rigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.12 REPAIRING CONCRETE

- A. General:
 - 1. Any areas deemed as having excessive defects or considered to have a negative effect on the structural performance of the structure shall be removed to the extents approved by the Engineer. The Engineer has the option of calling for the removal of the entire section if the damage is such that a repair will not be a suitable option. All work required to correct the defect will be the responsibility of the Contractor and will be paid for by the Contractor.
 - 2. Inject cracks as defined in 1.3.D Defective Areas with crack repair epoxy as specified in Section 03 64 00, CONCRETE REPAIR CRACK INJECTION.
 - 3. Repair concrete surfaces defects as defined in 1.3.D Defective Areas using one of the materials specified in Section 03 01 00, CONCRETE SURFACE REPAIR SYSTEMS. Select system, submit for review, and obtain approval from Engineer prior to use.
 - 4. Prior to starting the repair work, obtain quantities of color-matched repair material and manufacturer's detailed instructions for use to provide a structural repair with finish to match adjacent surface.
 - 5. Develop repair techniques with material manufacturer.
 - 6. Dress surface of repair that will remain exposed to view to match color and texture of adjacent surfaces. Repair of concrete shall provide a structurally sound surface finish, uniform in appearance or upgrade finish by other means until acceptable to Engineer.
- B. Tie Holes:
 - 1. Fill with nonshrink grout as specified in Section 03 60 00, GROUT.
 - 2. Match color of adjacent concrete.
 - 3. Compact grout using steel hammer and steel tool to drive grout to high density. Cure grout with water.
- C. Alternate Form Ties-Through-Bolts:
 - 1. Seal through-bolt hole by sandblasting or mechanically cleaning and roughening entire interior surface of hole, coating roughened surface with bonding agent and driving elastic vinyl plug and then dry packing entire hole on each side of plug with nonshrink grout, as specified in Section 03 60 00, GROUT. Use only enough water to dry pack grout. Dry pack while bonding agent is still tacky or remove bonding agent by mechanical means and reapply new bonding agent.
 - 2. Compact grout using steel hammer and steel tool to drive grout to high density. Cure grout with water.
- D. Exposed Metal Objects:
 - 1. Metal objects not intended to be exposed in as-built condition of structure including wire, nails, and bolts, shall be removed by chipping back concrete to depth of 1 inch and then cutting or removing metal object.
 - 2. Repair areas of chipped-out concrete per requirements of Section 03 01 00 CONCRETE SURFACE REPAIR SYSTEMS.

- E. Blockouts at Pipes or Other Penetrations:
 - 1. Meet details shown or submit proposed blockouts for review.
 - 2. Use nonshrink, nonmetallic grout, Category I or II as specified in Section 03 60 00, GROUT.

3.13 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports. Payment of the testing and inspection agency shall be by the Contractor from the contract allowance for independent testing in accordance with Section 01 29 00, PAYMENT PROCEDURES.
- B. Inspections:
 - 1. Steel reinforcement placement.
 - 2. Headed bolts and studs.
 - 3. Verification of use of required design mixture.
 - 4. Concrete placement, including conveying and depositing.
 - 5. Curing procedures and maintenance of curing temperature.
 - 6. Verification of concrete strength before removal of shores and forms from beams and slabs.
- C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C172 shall be performed according to the following requirements:
 - 1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd. plus one set for each additional 50 cu. yd. or fraction thereof.
 - a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 - 2. Slump: ASTM C143/C143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
 - 3. Air Content: ASTM C231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 - 4. Concrete Temperature: ASTM C1064/C1064M; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
 - 5. Compression Test Specimens: ASTM C31/C31M.
 - a. Cast and laboratory cure one set of four standard cylinder specimens for each composite sample.
 - 6. Compressive-Strength Tests: ASTM C39/C39M; test one laboratory-cured specimen at 7 days and two specimens at 28 days. The fourth cylinder will be retained for subsequent testing if required by the Engineer.
 - a. A compressive-strength test (at 28 days) shall be the average compressive strength from two specimens obtained from same composite sample.
 - 7. Strength of each concrete mixture will be satisfactory if every average of any consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
 - 8. Test results shall be reported in writing to Engineer, Owner, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

9. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Engineer but will not be used as sole basis for approval or rejection of concrete.
 10. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by the Engineer. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42/C42M or by other methods as directed by Engineer.
 11. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
 12. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.
- D. Measure floor and slab flatness and levelness according to ASTM E 1155 48 hours after finishing. Specified overall values of flatness $F(f)=25$; and levelness $F(L)=20$; with minimum local values, $F(f)=17$ and $F(L)=15$.
1. $F(L)$ value only applies to elevated slabs after shoring has been removed.
- E. Shrinkage Tests
1. Drying shrinkage tests shall be performed for the trial batch indicated in Paragraph CONCRETE MIXTURES FOR HYDRAULIC ELEMENTS for the first placement of each class of concrete for all structures noted in paragraph CONCRETE MIXTURES FOR HYDRAULIC ELEMENTS, and during construction to insure continued compliance with these Specifications. Number of field test to be determined by Engineer or Engineer's Field Representative.
 2. Drying shrinkage specimens shall be 4" by 4" by 11" prisms with an effective gauge length of 10"; fabricated, cured, dried, and measured in accordance with ASTM C157 modified as follows: specimens shall be removed from molds at an age of 23 ± 1 hours after trial batching, shall be placed immediately in water at $70 \text{ }^\circ\text{F} \pm 3 \text{ }^\circ\text{F}$ for at least 30 minutes, and shall be measured within 30 minutes thereafter to determine original length and then submerged in saturated lime water at $73 \text{ }^\circ\text{F} \pm 3 \text{ }^\circ\text{F}$. Measurement to determine expansion expressed as a percentage of original length shall be made at age 7 days. This length at age 7 days shall be the base length for drying shrinkage calculations ("0" days drying age). Specimens then shall be stored immediately in a humidity control room maintained at $73 \text{ }^\circ\text{F} \pm 3 \text{ }^\circ\text{F}$ and $50\% \pm 4\%$ relative humidity for the remainder of the test. Measurements to determine shrinkage expressed as percentage of base length shall be made and reported separately for 7, 14, 21, and 28 days of drying after 7 days of moist curing.
 3. The drying shrinkage deformation of each specimen shall be computed as the difference between the base length (at "0" days drying age) and the length after drying at each test age. The average drying shrinkage deformation of the specimens shall be computed to the nearest 0.0001" at each test age. If the drying shrinkage of any specimen departs from the average of that test age by more than 0.0004", the results obtained from that specimen shall be discarded. Results of the shrinkage test shall be reported in graphical form Length Change (in) vs. Age (days) and Length Change (%) vs. Age (days) to the nearest 0.001% of shrinkage. Compression test specimens shall be taken in each case from the same concrete used for preparing drying shrinkage specimens. These tests shall be considered a part of the normal compression tests for the project. Allowable shrinkage limitations shall be as indicated below.
 - a. Shrinkage Limitation: The maximum concrete shrinkage for specimens cast in the laboratory from the trial batch, as measured at 21-day drying age or at 28-day drying age shall be 0.036% or 0.042%, respectively. The Contractor shall only use a mix design for construction that has first met the trial batch shrinkage requirements.
 - b. The maximum concrete shrinkage for specimens cast in the field shall not exceed the trial batch maximum shrinkage requirement by more than 25%.

- c. If the required shrinkage limitation is not met during construction, the Contractor shall take any or all of the following actions at no additional cost to the Owner, for securing the specified shrinkage requirements. These actions may include changing the source of aggregates, cement and/or admixtures; reducing water content; washing of aggregate to reduce fines; increasing the number of construction joints; modifying the curing requirements; or other actions designed to minimize shrinkage or the effects of shrinkage
- F. Water Leakage Tests: In accordance with ACI 350.1.
- 1. Purpose: Determine integrity and water tightness of finished concrete surfaces. Contractor shall perform and pay for all costs associated with water leakage tests. Report all test results to the Engineer.
 - 2. All water-holding Structures:
 - a. Perform leakage tests after concrete structure is complete and capable of resisting the hydrostatic pressure of the water test. The concrete shall have achieved its full design strength.
 - b. Perform leakage test before backfill, brick facing, or other work that will cover concrete wall surfaces is begun.
 - c. Install all temporary bulkheads, cofferdams, and pipe blind flanges, and close all valves. Inspect each to see that it provides a complete seal.
 - d. Fill with water to test level shown, or maximum liquid level if no test level is given. Maintain this level for 72 hours prior to the start of the test to allow water absorption, structural deflection, and temperature to stabilize.
 - e. Measure evaporation and precipitation by floating a partially filled, transparent, calibrated, open top container.
 - f. Measure the water surface at two points 180° apart, when possible where attachments such as ladders exist, at 24-hour intervals. Using a sharp pointed hook gauge and fixed metal measure capable of reading to 1/100 of an inch. Continue the test for a period of time sufficient to produce at least 1/2" drop in the water surface based on the assumption that leakage would occur at the maximum allowable rate specified or for 72 hours whichever is the lesser time.
- G. Acceptance Criteria:
- 1. Volume loss shall not exceed 0.075% of contained liquid volume in a 24-hour period, correcting for evaporation, precipitation, and settlement.
 - 2. No damp spots or seepage visible on exterior surfaces. A damp spot is defined as sufficient moisture to be transferred to a dry hand upon touching.
- H. Repairs When Test Fails: Dewater the structure; fill leaking cracks with crack repair epoxy as specified in Section 03 64 00 CONCRETE REPAIR CRACK INJECTION. Patch areas of damp spots previously recorded, and repeat water leakage test in its entirety until the structure successfully passes the test.

END OF SECTION

SECTION 03 41 00 – PRECAST CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Precast concrete required for this Project.
 - 2. Reinforcing.
 - 3. Accessories.
- B. Related Sections:
 - 1. Section 03 11 00 – Concrete Formwork
 - 2. Section 03 20 00 – Concrete Reinforcement
 - 3. Section 03 30 00 – Cast-In-Place Concrete

1.2 QUALITY ASSURANCE

- A. Qualifications of workmen:
 - 1. Provide at least one person who shall be present at all times during execution of this portion of the work and who shall be thoroughly trained and experienced in placing and erecting the type of concrete described herein and who shall direct all work performed under this Section.
 - 2. Precast subcontractor shall be experienced in constructing the type of precast material required for the project. Submit data for approval.
 - 3. For finishing of exposed surfaces of the concrete, use only thoroughly trained and experienced journeyman concrete finishers.
 - 4. Approval required in advance in accordance with Section 01 33 00 SUBMITTAL PROCEDURES.
- B. Codes and Standards:
 - 1. Comply with all pertinent codes and regulations and publication ACI 301 of the American Concrete Institute, latest edition.
 - 2. Where provisions of pertinent codes and standards conflict with this Specification, the more stringent provisions shall govern.

1.3 SUBMITTALS

- A. Materials list: Before any precast concrete is delivered to the construction site, submit to the Engineer in accordance with Section 01 33 00 SUBMITTAL PROCEDURES a complete list of all materials proposed to be furnished and installed under this portion of the work, showing manufacturer's name and catalog number for all items such as bond breaker, inserts, chairs, and conduits.

1.4 PRODUCT HANDLING

- A. Protection: Use all means necessary to protect the materials of this Section before, during, and after installation and to protect the installed work and materials of all other trades.
- B. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Engineer and at no additional cost to the Owner.

1.5 DESIGN

- A. All design of pre-stressed members shall be done in strict accordance with procedures set forth in the current edition of ACI 318 "Building Code Requirements for Reinforced Concrete."
- B. All precast structural concrete members shall be designed to meet requirements of the Building Code.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Concrete:
 - 1. Cement shall be Portland Cement conforming to ASTM C150, Portland Cement.
 - 2. Aggregates shall conform in quality to ASTM C33 for heavyweight aggregate.
 - 3. Heavyweight aggregates shall be graded crushed stone with a resulting unit weight of concrete of up to 155 pounds per cubic foot.
 - 4. Water shall be clean and free of injurious and deleterious substances.
 - 5. Concrete strength shall be minimum 5,000 psi at 28 days.
- B. Steel:
 - 1. Pre-stressing steel shall be high tensile strength uncoated seven wire strand which is low-relaxation strand or has been stress-relieved as a unit after the wires have been formed into a strand. It shall be manufactured and tested in accordance with ASTM A416. Either 250K or 270K strand may be used.
 - 2. All reinforcing bars shall conform to the requirements of ASTM A615, Grade 60 as required.
 - 3. Welded wire fabric shall conform to the requirements of ASTM A185.
 - 4. Cast in plates shall conform to the requirement of ASTM A36, or A440 as required.

2.2 OTHER MATERIALS

- A. All other materials not specifically described but required for a complete and proper installation of the work of this Section, shall be as selected by the Contractor subject to the approval of the Engineer.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

- A. Inspections:
 - 1. Prior to all work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
 - 2. Verify that the work of this Section may be performed in strict accordance with all pertinent codes and regulations, the original design, and the manufacturer's recommendations for the items being installed.
- B. Discrepancies:
 - 1. In the event of discrepancy, immediately notify the Engineer.
 - 2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.2 QUALITY

- A. Manufacturer of precast concrete shall be adequately equipped to form, place, and cure the required precast concrete, and shall have experience to produce precast concrete of required strength and water resistance.

3.3 PLACEMENT OF REINFORCEMENT

- A. Place all reinforcement in strict accordance with the drawings and with the provisions of Section 03 20 00, CONCRETE REINFORCEMENT of these Specifications.

3.4 PLACEMENT OF CONCRETE

- A. General:
 - 1. Concrete shall be placed and compacted by tamping or vibrating to produce a dense waterproof product.
 - 2. Finish all concrete surfaces in smooth finish to the tolerances described in Section 03 30 00, CAST-IN-PLACE CONCRETE of these Specifications.
- B. Curing:
 - 1. Cure all concrete of this Section in strict accordance with the methods specified in Section 03 30 00, CAST-IN-PLACE CONCRETE or approved alternative.

3.5 OPENINGS

- A. Locations and sizes of all openings 3 inches wide or larger to be cast into the members, if not shown on the contract drawings, must be supplied when shop drawings are submitted for approval. All other openings not so located shall be job cut by the various trades requiring them. All holes less than 3 inches in dimension through precast members are to be made by drilling or cutting in the field, by the various trades requiring them. However, field holes or cuts may not be made in the precast members without prior approval of the manufacturer.

3.6 ERECTION

- A. Responsibility:
 - 1. The entire method and sequence of erection shall be the responsibility of the Contractor.
- B. Alignment:
 - 1. Set all units in true alignment in all directions.
- C. All precast concrete items with cracks or other flaws that will detract from the appearance, shall be replaced.
- D. Grind to remove sharp edges.

END OF SECTION

SECTION 03 60 00 - GROUT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Non-shrink grout.
 - 2. Topping grout.
 - 3. Concrete Fill.
 - 4. Cement grout for pipe invert fill.
 - 5. Construction joint mortar.

- B. Related Sections:
 - 1. Section 03 11 00 – Concrete Formwork.
 - 2. Section 03 30 00 – Cast-In-Place Concrete.

1.2 REFERENCES

- A. The following is a list of standards which may be referenced in this section:
 - 1. ASTM International (ASTM):
 - a. C 230, Standard Specification for Flow Table for Use in Tests of Hydraulic Cement.
 - b. C 1107, Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)

- B. Cement Grout (Non-shrink).
 - 1. Corps of Engineers (COE):
 - a. CRD-C 611, Flow of Grout for Prep laced Aggregate Concrete.
 - b. CRD-C 621, Specification for Non-shrink Grout

1.3 SUBMITTALS

- A. Product data for each type of product indicated.

- B. Certified test results verifying compliance with compressive strength, shrinkage and expansion requirements and manufacturer's literature containing instructions and recommendations on the mixing, handling, placement and appropriate uses for each type of non-shrink and epoxy grout.

- C. Fine aggregate gradation.

- D. One copy of each 30 consecutive strength test results and mix design used from a record of past performance, or one copy of laboratory trial mix and design and results, and one copy of the mix design proposed for each cementitious mixture and use under this contract.

- E. Qualification for testing agency.

- F. Material test reports: For the following from a qualified testing agency, indicating compliance with requirements:
 - 1. Aggregates, Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.
 - 2. Non-shrink grout.
 - 3. Epoxy grout.

- G. Material certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.
2. Non-shrink grout.
3. Epoxy grout.

H. Field quality-control tests and observation reports.

I. Ready mix concrete (Cement Grout)

1. Provide delivery tickets for ready-mix concrete (cement grout) or weigh master's certificate per ASTM C 94, include weights of cement and each size aggregate and amount of water added at the plant and a record of placements. Record the amount of water added at the job site on the delivery ticket. Water added at the plant shall account for the moisture in aggregate. If water is added at the job site, then the total water content shall not exceed the water content of the approved design mix.
2. Keep records showing time and place of each placement of concrete, joint mortar bed material or cement grout, together with transit delivery slips certifying the contents of the placement. Furnish records to Engineer.

J. Joint Mortar Bed: Provide material analysis and certification for each placement.

K. Shop Drawings:

1. Product data of grouts.
2. Curing method for grout.
3. Mix design of cement-sand grout mixture for pipe invert/structure fill.
4. Mix design of Joint Mortar Bed.

L. Information Submittals:

1. Manufacturer's written instructions for mixing of grout.
2. Manufacturer's Certificate of Compliance: Grout free from chlorides and other corrosion-causing chemicals.
3. Manufacturer's Certificate of Proper Installation.
4. Statements of Qualification: Non-shrink grout manufacturer's representative.
5. Test Reports: Test report for 24-hour evaluation of non-shrink grout.

1.4 QUALIFICATIONS

A. Manufacturer's qualifications for cement grout and joint mortar bed: A firm experienced in manufacturing ready-mixed concrete products and a firm that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

B. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.
2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician – Grade I, Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician – Grade II.

C. Source limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from one source and obtain admixtures through one source from a single manufacturer.

- D. Non-shrink Grout Manufacturer's Representative: Authorized and trained representative of grout manufacturer, with minimum of 1 year experience that has resulted in successful installation of grouts similar to those for this Project.
- E. For grout suppliers not listed herein, provide completed 24-hour Evaluation of Non-shrink Grout Test Form, attached at the end of this section. Independent testing laboratory to certify that testing was conducted within last 18 months.

1.5 GUARANTEE

- A. Manufacturer's guarantee shall not contain disclaimer on the product data sheet, grout bag, or container limiting responsibility to only the purchase price of products and materials furnished.
- B. Manufacturer guarantees participation with Contractor in replacing or repairing grout found defective due to faulty materials, as determined by industry standard test methods.

PART 2 - PRODUCTS

2.1 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand and source throughout project:
 1. Portland Cement: ASTM C 150, Type I or II or combination of Type I with fly ash.
 2. Fly Ash: ASTM C 618.
- B. Fine aggregates: ASTM C 33, Class 4S or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials. Aggregates shall be free of materials with deleterious reactivity to alkali in cement. Aggregates for cement grout and/or mortar bed shall be provided from the same source as aggregate for the cast-in-place concrete.
- C. Water: ASTM C 94 and potable.

2.2 ADMIXTURES

- A. Comply with Section 03 30 00 Cast-In-Place Concrete.

2.3 NONSHRINK GROUT SCHEDULE

- A. Furnish non-shrink grout for applications in grout category in the following schedule:

Application	Temperature Range	Max. Placing Time	
	40 to 100 °F	20 min	Greater than 20 min
Filling tie hole	I	I	I
Machine bases 25 hp or less	II	II	II
Through-bolt openings	II	II	II
Patching Concrete Walls	II	II	II
Machine bases 26 hp and up	III	III	III
Base plates and/or soleplates with vibration, thermal movement, etc.	III	III	III
Other applications not listed	II	II	II

2.4 NONSHRINK GROUT

A. Category I:

1. Nonmetallic and non gas-liberating.
2. Prepackaged natural aggregate grout requiring only the addition of water.
3. Test in accordance with ASTM C1107:
 - a. Flowable consistency 140%, five drops in 30 seconds, in accordance with ASTM C 230.
 - b. Flowable for 15 minutes.
4. Grout shall not bleed at maximum allowed water.
5. Minimum strength of flowable grout, 3,000 psi at 3 days, 5,000 psi at 7 days, and 7,000 psi at 28 days.
6. Manufacturers and Products:
 - a. Chemrex, Inc., Shakopee, MN; Set Grout.
 - b. Euclid Chemical Co., Cleveland, OH; NS Grout.
 - c. Dayton Superior Corp., Miamisburg, OH; 1107 Advantage Grout.
 - d. US MIX Products, Denver, CO; US Spec Multi-Purpose Grout.
 - e. L & M Construction Chemicals, Inc., Omaha, NE; Duragrout.
 - f. Master Builders.

B. Category II:

1. Nonmetallic, non gas-liberating.
2. Prepackaged natural aggregate grout requiring only the addition of water.
3. Aggregate shall show no segregation or settlement at fluid consistency - at specified times or temperatures.
4. Test in accordance with COE CRD-C 621 and ASTM C 1107, Grade B:
 - a. Fluid consistency 20 to 30 seconds in accordance with COE CRD-C 611.
 - b. Temperatures of 40, 80, and 100 °F.
5. 1 hour after mixing, pass fluid grout through flow cone with continuous flow.
6. Minimum strength of fluid grout, 3,500 psi at 1 day, 4,500 psi at 3 days, and 7,500 psi at 28 days.
7. Maintain fluid consistency when mixed in 1 to 9 yard loads in ready- mix truck.
8. Manufacturers and Products:
 - a. Chemrex, Inc., Shakopee, MN; Master Flow 928.
 - b. Five Star Products Inc., Fairfield, CT; Five Star 100.
 - c. Euclid Chemical Co., Cleveland, OH; Hi Flow Grout.
 - d. Dayton Superior Corp., Miamisburg, OH; Sure Grip High Performance Grout.
 - e. L & M Construction Chemicals, Inc., Omaha, NE; Crystex.
 - f. Master Builders.

C. Category III

1. Metallic and nongas-liberating flowable fluid.
2. Prepackaged aggregate grout requiring only the addition of water.
3. Aggregate shall show no segregation or settlement at fluid consistency at specified times or temperatures.
4. Test in accordance with CRD-C 621 and ASTM C 1107, Grade B:
 - a. Fluid consistency 20 to 30 seconds in accordance with CRD-C 611.
 - b. Temperatures of 40 and 100 °F.
5. 1 hour after mixing, pass fluid grout through flow cone with continuous flow.
6. Minimum strength of grout, 4,000 psi at 1 day, 5,000 psi at 3 days, and 9,000 psi at 28 days.
7. Maintain fluid consistency when mixed in 1 to 9 yard loads in ready-mix truck.
8. Manufacturers and Products: Chemrex, Inc., Shakopee, MN; EMBECO 885.

2.5 TOPPING GROUT AND CONCRETE/GROUT FILL

- A. Where fill is thicker than 3-inches, structural concrete 03 30 00, CAST-IN-PLACE CONCRETE, may be used when accepted by the Engineer.
- B. Grout for topping of slabs and concrete/grout fill for built-up surfaces of tank, channel and basin bottoms shall be composed of cement, fine aggregate, coarse aggregate, water and admixtures proportioned and be mixed as indicated. Bonding Agent shall be used to enhance adhesion to basin concrete. Materials and procedures indicated for normal concrete in Section 03 30 00, CAST-IN-PLACE CONCRETE, shall apply unless indicated otherwise.
- C. Topping grout and concrete/grout fill shall contain a minimum of 564 pounds of cement per cubic yard with a maximum water cement ratio of 0.45.
- D. Aggregate shall be graded as follows:

U.S. STANDARD SIEVE SIZE	PERCENT BY WEIGHT PASSING
1/2 inch	100
3/8 inch	90-100
No. 4	20-55
No. 8	5-30
No. 16	0-10
No. 30	0

- E. Final mix design shall be as determined by trial mix design as indicated in Section 03 30 00, except that drying shrinkage tests are not required.
- F. Topping grout and concrete grout/fill shall contain air-entraining agent per Section 03 30 00.
- G. Strength: Minimum compressive strength of topping grout and concrete/grout fill at 28 days shall be 4,000 psi.
- H. Topping grout used in clarifiers shall contain fiber reinforcing. Fiber shall be 100 percent virgin polypropylene fibrillated fibers specifically manufactured in a blended gradation for use as concrete secondary reinforcement. Fibers shall be added at a rate of 1.5 pounds per cubic yard of concrete. Fibers shall conform to ASTM C 1116 – Fiber Reinforced Concrete and Shotcrete. Type III.

2.6 CEMENT-GROUT (CEMENT-SAND GROUT) MIXTURE FOR PIPE INVERT/STRUCTURE FILL

- A. Prepare design mixture proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301. Submit proposed mixture design to Engineer for review. Comply with Section 03 30 00 Cast-In-Place Concrete and as follows.
 - 1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based upon laboratory trial mixtures.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than Portland cement in concrete and cement grout as follows:
 - 1. Fly Ash: 15 percent maximum unless approved in writing by the Engineer.
- C. Admixtures: All materials other than Portland cement, water and aggregates that are added to the concrete or cement grout, shall be subject to the approval of the Engineer. If so approved, use admixtures according to manufacturer’s written instructions.

1. Use water reducing, high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
 2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
 3. Use water-reducing admixture in pumped concrete, concrete for heavy-use slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
- D. Minimum compressive strength: 2,000 psi at 28 days.
- E. Air content: ASTM C 94, 5 percent, plus or minus 1.0 percent at point of delivery.
- F. Aggregate shall be sand, three parts sand to one part cementitious material by volume. The sand gradation shall be such that 100% shall pass the No. 16 sieve and not more than 30% shall be retained on a No. 30 sieve.
- G. Water – cementitious material ratio. The Contractor shall submit a proposed mix design to the Engineer for review. The amount of water shall be the minimum amount of water necessary to make a workable mixture.
- H. Slump: Maximum of 4 inches.
- 2.7 JOINT MORTAR BED
- A. Joint Mortar Bed: Mortar placed on horizontal construction joints shall be a mixture of cement, sand and water in the same proportions used in the approved 4,500 psi cast-in-place concrete mix design and/but with the coarse aggregate omitted.

PART 3 - EXECUTION

3.1 NONSHRINK GROUT

- A. General: Mix, place, and cure non-shrink grout in accordance with grout Manufacturer's representative's training instructions.
- B. Form Tie or Through-Bolt Holes: Provide non-shrink grout, Category I and II, fill space with dry pack dense grout hammered in with steel tool and hammer. Through-bolt holes; coordinate dry pack dense grout application with vinyl plug in Section 03 11 00, CONCRETE FORMWORK, and bonding agent in Section 03 30 00, CAST-IN-PLACE CONCRETE.
- C. Grouting Machinery Foundations:
1. Block out original concrete or finish off at distance shown below bottom of machinery base with grout. Prepare concrete surface by sandblasting, chipping, or by mechanical means to remove any soft material.
 2. Set machinery in position and wedge to elevation with steel wedges, or use cast-in leveling bolts.
 3. Form with watertight forms at least 2" higher than bottom of plate.
 4. Fill space between bottom of machinery base and original concrete in accordance with Manufacturer's representative's training instructions.

3.2 CEMENT GROUT

- A. Place cement grout topping over concrete slabs where indicated on the drawings. Place in accordance with the procedures of this section and the manufacturer's or suppliers of equipment recommendations. The finish surface of the grout topping shall be similar to a steel

trowel finish and which will facilitate the proper operation of the mechanical equipment. The finish of the structural slab below the cement grout topping shall be a heavy broom finish.

- B. Where cement grout is to be placed without mechanical equipment, the fresh surface of the cement grout shall be a smooth trowel finish. Placement procedure of cement grout at areas with mechanical equipment includes:
1. Notify Project Representative or Engineer a minimum of 48 hours in advance of placement.
 2. Make a trial cement grout batch of not less than 1/2 cubic yard to allow time for adjustment in mix design if required.
 3. Clean the exposed structural slab by sandblasting and washing clean.
 4. Thoroughly broom a neat cement paste containing an epoxy binder into the concrete slab surface immediately ahead of placing the cement grout topping.
 5. Where applicable, install level and trial operate mechanical screed equipment over the floor slab to provide a minimum thickness of 2 inches +/- 1/4 inch. In areas where the distance between the mechanical screed and the structural slab is less than the above clearances, grind surface as directed by Engineer to provide such clearance. The mechanical screed shall operate at a speed acceptable to the cement grout topping placement procedures. Screeding procedures shall account for the effects of differential temperatures on the mechanical screed equipment.
 6. Place cement grout topping in a continuous operation. If grouting operations are interrupted, clean the edge of the previously placed topping by water jetting and add a coat of cement paste to provide a bond to the fresh topping.
 7. Temporarily equip the mechanical screed mechanism on at least two arms with a 2-inch by 10 inch continuous wood plate with light gauge metal angles and surface plates or channels. The bottom of the screed plates or steel plates shall be adjustable and set to elevations which allow the proper operation of equipment and as recommended by the equipment manufacturer or supplier.
 8. Screed the topping immediately after consolidation with vibrators or tampers and provide a steel trowel finish.
 9. Cure cement grout topping with water and cover with PVC sheeting to prevent damage from foot traffic for seven days. When/If the cement grout topping is found not to be acceptable, remove and replace. Cement grout topping not acceptable shall include, but is not limited to, poor bonding with the concrete slab, low strength, excessive cracking and unevenness in finish or elevation.

3.3 JOINT MORTAR BED

- A. Joint Mortar Bed: Immediately prior to placement of fresh concrete at horizontal joints, or as indicated, place joint mortar bed to cover horizontal joint and protect water stop as applicable. Spread uniformly and work into all irregularities of the surface. The water cement ratio of the joint mortar bed shall not exceed that of the concrete being placed and the consistency of the mortar shall be suitable for placing and working. The fresh concrete shall then be immediately placed in a time and manner so that the joint mortar bed and the fresh concrete mix to form a homogenous concrete meeting all requirements.

3.4 NON-SHRINK GROUT

- A. Non-Shrink grout:
1. Used for repair of holes and defects and at locations indicated where epoxy grout is not indicated. Execution shall follow manufacturer's recommendations.
 2. Base plates and equipment where indicated. Execution shall follow manufacturer's recommendations.

3.5 EPOXY GROUT

- A. Epoxy Grout: Used to embed all anchor bolts and reinforcing steel set in grout, specific machinery base plates as indicated and at other locations where indicated. Execution shall follow manufacturer's recommendations.

3.6 FIELD QUALITY CONTROL

- A. Evaluation and Acceptance of Non-shrink Grout:
 - 1. Consistency: As specified in Article NON-SHRINK GROUT. Grout with consistencies outside range requirements shall be rejected.
 - 2. Segregation: As specified in Article NON-SHRINK GROUT. Grout when aggregate separates shall be rejected.

3.7 MANUFACTURER'S SERVICES

- A. General: Coordinate demonstrations, training sessions, and applicable site visits with grout manufacturer's representative.

3.8 SUPPLEMENTS

- A. The supplement listed below, following "END OF SECTION," is part of this Specification.
 - 1. 24-hour Evaluation of Non-shrink Grout Test Form and Grout Testing Procedures.

END OF SECTION

SUPPLEMENT 1

(Test Lab Name)

(Address)

(Phone No.)

24-HOUR EVALUATION OF NONSHRINK GROUT TEST FORM

OBJECTIVE: Define standard set of test procedures for an independent testing laboratory to perform and complete within a 24-hour period.

SCOPE: Utilize test procedures providing 24-hour results to duplicate field grouting demands. Intent of evaluation is to establish grout manufacturer's qualifications.

PRIOR TO TEST: Obtain five bags of each type of grout.
1. From intended grout supplier for Project.
2. Five bags of grout shall be of same lot number.

ANSWER THE FOLLOWING QUESTIONS FOR GROUT BEING TESTED FROM LITERATURE, DATA, AND PRINTING ON BAG:

- A. Product data and warranty information contained in company literature and data? Yes_____ No_____
- B. Literature and bag information meet specified requirements? Yes_____ No_____
- C. Manufacturer guarantees grout as specified in Article GUARANTEE? Yes_____ No_____
- D. Guarantee extends beyond grout replacement value and allows participation with CONTRACTOR in replacing and repairing defective areas? Yes_____ No_____
- E. Water demands and limits printed on bag? Yes_____ No_____
- F. Mixing information printed on the bag? Yes_____ No_____
- G. Temperature restrictions printed on bag? Yes_____ No_____

*Rejection of a grout will occur if one or more answers are noted NO.

GROUT TESTING PROCEDURES

A. Bagged Material:

1. List lot numbers. _____
2. List expiration date. _____
3. Weigh bags and record weight. _____

ENGINEER will disqualify grout if bag weights have misstated measure plus or minus 2 pounds by more than one out of five bags. (Accuracy of weights is required to regulate amount of water used in mixing since this will affect properties.)

B. Mixing and Consistency Determination:

1. Mix full bag of grout in 10 gallon pail.
2. Use electric drill with a paddle device to mix grout (jiffy or jiffler type paddle).
3. Use maximum water allowed per water requirements listed in bag instructions.
4. Mix grout to maximum time listed on bag instructions.
5. In accordance with COE CRD-C611 (flow cone) determine time of mixed grout through the flow cone. _____ seconds
6. Add water to attain 20 to 30 second flow in accordance with COE CRD-C611.
7. Record time of grout through cone at new water demand. _____ seconds
8. Record total water needed to attain 20 to 30 second flow. _____ pounds
9. Record percent of water. _____ percent

C. When fluid grout is specified and additional water is required beyond grout manufacturer's listed maximum water, COE CRD-C621 will be run at new water per grout ratio to determine whether grout passes using actual water requirements to be fluid. Use new water per grout ratio on remaining tests.

D. Bleed Test:

1. Fill two gallon cans half full of freshly mixed grout at ambient temperatures for each category and at required consistency for each.
2. Place one can of grout in tub of ice water and leave one can at ambient temperature.
3. Cover top of both cans with glass or plastic plate preventing evaporation.
4. Maintain 38 to 42 degrees F temperature with grout placed in ice and maintain ambient temperature for second container for 1 hour.
5. Visually check for bleeding of water at 15-minute intervals for 2 hours.
6. Perform final observation at 24 hours.
7. If grout bleeds a small amount at temperatures specified, grout will be rejected.

E. Extended Flow Time and Segregation Test (for Category II and III):

1. Divide the remaining grout into two 3 gallon cans. Place the cans into the 40 °F and 100 °F containers and leave for 20, 40, and 60 minutes. Every 20 minutes remove and check for segregation or settlement of aggregate. Use a gloved hand to reach to the bottom of the can, if more than 1/4-inch of aggregate has settled to the bottom or aggregate has segregated into clumps reject the grout.

2. Right after the settlement test mix the grout with the drill mixer for 10 seconds. Take a COE CRD-C611 flow cone test of grout and record flow time. Maintain this process for 1 hour at ambient temperatures of 40 and 100 degrees F.
 - a. 20 min _____, sec. @ 40 degrees F.
 - b. 40 min _____, sec. @ 40 degrees F.
 - c. 60 min _____, sec. @ 40 degrees F.
 - d. 20 min _____, sec. @ 100 degrees F.
 - e. 40 min _____, sec. @ 100 degrees F.
 - f. 60 min _____, sec. @ 100 degrees F.

All Category II and III grout that will not go through the flow cone with continuous flow after 60 minutes will be disqualified.

_____ _____
 Qualified Disqualified

F. 24-hour Strength Test:

1. Using grout left in mixing cans in accordance with COE CRD-C621 for mixing and consistency determination test and for extended time flow test, make minimum of nine cube samples.
2. Store cubes at 70 degrees F for 24 hours.
3. Record average compressive strength of nine cubes at 24 hours.

Grout will be disqualified if 24-hour compressive strengths are under 2,500 psi for grouts claiming fluid placement capabilities.

Grouts that have not been disqualified after these tests are qualified for use on the Project for the application indicated in Nonshrink Grout Schedule.

 Signature of Independent Testing Laboratory

 Date Test Conducted

SECTION 03 60 01 – BASIN BOTTOM GROUT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes: Grouting basin bottom slabs.
- B. Related sections:
 - 1. Section 03 30 00 – Cast-In-Place Concrete.

1.2 REFERENCES

- A. International Concrete Repair Institute (ICRI):
 - 1. 310.2 - Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays.

1.3 DEFINITIONS

- A. When grouting basin bottom slabs:
 - 1. Grout that has not bonded: Is defined as grout that, after placing and setting, has hollow sound when tapped with 4-foot long, nominal, 2-inch by 4-inch piece of lumber.
- B. Quality control submittals:
 - 1. Manufacturer's instructions:
 - a. For equipment to be used in grouting basin bottom slabs:
 - 1) Submit grout placement instructions from manufacturer of equipment designated to operate in basin.
 - 2) Include in such instructions statements on limitations and precautions to be observed when using equipment for grout placement.
- C. Jitterbug: an expanded metal or grate tamper designed for finishing concrete surfaces with a rough surface profile.

1.4 QUALITY ASSURANCE

- A. Pre-installation conference for grouting basin bottom slabs: Schedule meeting with ENGINEER not less than 24 hours before planned grouting operations to discuss method of placement of grout.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Materials for grout:
 - 1. Cement, sand, and water: As specified in Section 03 30 00.

2.2 MIXES

- A. Grout mixture:
 - 1. One part Portland cement and 4-1/2 parts sand, by weight.
 - 2. Water content:
 - a. Sufficient to allow workability for spreading grout with screeds attached to arms of equipment mechanism.

- b. Not excessive, to prevent formation of surface water, laitance, segregation, and to allow grout to stay in place after screeding.
- 3. Do not use admixtures.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface preparation:

- 1. Basin bottom slab surface preparation:
 - a. Concrete slab surfaces shall have rough texture, suitable for bonding grout.
 - b. During concrete placement: finish concrete surface with jitterbug. Do not provide a smooth troweled surface.
 - c. Roughen top of slab surface to a ICRI 310.2 surface profile of CSP-5 or rougher using one of the following methods:
 - 1) Abrasive blasting.
 - 2) Steel shotblasting.
 - 3) High/ultra high-pressure water jetting.
 - d. Clean entire slab surface as required to remove dirt, oil, curing compound, laitance, dust, and other matter that may prevent proper grout bonding.
 - e. Saturate concrete slabs with water for minimum of 3 days just before placing grout. At time grout is placed, concrete shall be saturated and surface damp.

B. Equipment preparation:

- 1. Preparation of equipment for grouting basin bottom slabs:
 - a. Setting the screeds:
 - 1) Bolt nominal 2-inch by 4-inch section of lumber blades on arms of equipment mechanism.
 - 2) Locate leading edge of lumber approximately 2 inches in front of blade and cut it parallel to centerline of arm.
 - 3) Securely nail nominal 2-inch by 6-inch screed board to ends of 2 by 4 lumber, in manner such that screed runs parallel to centerline of arm.
 - 4) Nail bent sheet metal to lower edge of screed board.
 - 5) Ensure that bottom of screed board is 1-1/2 inches below steel blades on arms of equipment mechanism.

3.2 APPLICATION

A. Grouting basin bottom slabs:

- 1. Placement, general:
 - a. Place grout in accordance with equipment manufacturer's instructions and in accordance with limitations and precautions given in such instructions.
 - b. Bring promptly to attention of the ENGINEER, conflicts between manufacturer's instructions and this Section.
- 2. Placing grout:
 - a. Use grouting equipment to apply grout for basin bottom slabs.
 - b. Perform grouting continuously without interruptions until basin slab is covered.
 - c. Place ring of grout approximately 3 feet wide on outer edge of slab and gradually widened towards center following spiral pattern until basin bottom slab is covered.
 - d. Unacceptable placing procedure: Following procedures will not be accepted:
 - 1) Grouting by circular sectors or "pie" sections.
 - 2) Grouting from center outward.
 - e. Use finishing workers to control area immediately in front of screed boards in manner so that:
 - 1) Grout is installed to specified thickness.
 - 2) No low areas occur.

- 3) No excessive amount of grout accumulates.
 - 4) Grout surface has uniform wood trowel finish without ridges, gouges, or other defect.
 - f. Coordinate grout placement rate and number of finishing workers with travel speed of arms of equipment mechanism.
 - g. Last grout area to be grouted in center may be finished by worker operating from 1 of the arms.
 - 3. Following grout placement:
 - a. After completion of slab grouting, allow mechanism to run continuously until there is no more danger that grout sloughing may occur.
 - b. Prevent dry clumps of grout or rocks from being caught under screed board and gouging finish surface of grout.
 - 4. Corrections:
 - a. Before grout has set:
 - 1) Where sloughing has occurred, remove grout from sloughed areas and place grout in low areas.
 - 2) Repair gouges in grouted surface.
 - 5. Curing:
 - a. After grout has set, water cure grout for 14 days.
 - b. Keep grout surface continuously wet for duration of curing period.
- B. Tolerances:
- 1. For grouting basin bottom slabs:
 - a. Tolerance in elevation of finished grout surface: Plus or minus 1/8 inch.
 - 1) Specified tolerance is more exacting than customary industry standards for slab finish.
 - 2) Tolerance is required for proper operation of equipment.
 - b. Thickness of grout layer:
 - 1) Not less than 1 inch at any point.
 - 2) Provide average thickness of grout as indicated on the Drawings.

3.3 FIELD QUALITY CONTROL

- A. Inspection:
- 1. Verify grout elevation tolerance on basin bottom slabs as follows:
 - a. After grout has set, operate grouting equipment with blades set to clear grout surface.
 - b. Under these conditions, blades shall not clear grout surface by more than 1/4 inch at any point:
 - 1) Excess clearance: Correct as specified in article titled "Adjusting" in this Section.

3.4 ADJUSTING

- A. Grouting basin bottom slabs:
- 1. After grout has set:
 - a. Where clearance between blades and grouted surface exceeds tolerance specified in this Section, grind high points in grout surface using terrazzo machine until specified tolerance is met.
 - b. Grout that has not bonded to concrete slab is not acceptable. Remove and replace such grout.

END OF SECTION

SECTION 03 64 00 - CONCRETE REPAIR CRACK INJECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Epoxy injection system.
- B. Related Sections:
 - 1. Section 03 30 00 – Cast-In-Place Concrete.

1.2 REFERENCES

- A. The following is a list of standards which may be referenced in this section:
 - 1. American Association of State Highway and Transportation Officials (AASHTO): T 237, Standard Method for Testing Epoxy Resin Adhesive.
 - 2. ASTM International (ASTM):
 - a. D 638, Standard Test Method for Tensile Properties of Plastics.
 - b. D 648, Standard Test Method for Deflection of Plastics Under Flexural Load.
 - c. D 695, Standard Test Method for Compressive Properties of Rigid Plastics.
 - d. D 790, Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

1.3 DEFINITIONS

- A. Large Cracks: Wider than 0.015”.
- B. Small Cracks: Width equal to 0.015” or less.

1.4 SUBMITTALS

- A. Shop Drawings:
 - 1. Physical and chemical properties for epoxy adhesives.
 - 2. Technical data for metering, mixing, and injection equipment.
- B. Information Submittals:
 - 1. Manufacturer’s recommended surface preparation procedures and application instructions for epoxy adhesives.
 - 2. Installation instructions for repairing core holes with epoxy grout.
 - 3. Manufacturer’s Certificate of Compliance: Certified test results for each batch of epoxy adhesive.
 - 4. Statements of Qualification for Epoxy Adhesive:
 - a. Manufacturer’s site representative.
 - b. Injection applicator.
 - c. Injection pump operating technician.
 - 5. Epoxy adhesive two component ratio and injection pressure test records for concrete crack repair work.

1.5 QUALITY ASSURANCE

- A. Qualifications for Epoxy Injection Staff:
 - 1. Manufacturer’s Site Representative:
 - a. Capable of instructing successful methods for restoring concrete structures utilizing epoxy injection process.

- b. Understands and is capable of explaining technical aspects of correct material selection and use.
 - c. Experienced in the operation, maintenance, and troubleshooting of application equipment.
2. Injection crew and job foreman shall provide written and verifiable evidence showing compliance with the following requirements:
- a. Licensed and certified by epoxy Manufacturer.
 - b. Minimum 3 years experience in successful epoxy injection for at least 10,000 linear feet of successful crack injection including 2,000 linear feet of wet crack injection to stop water leakage.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Packing and Shipping: Package adhesive material in new sealed containers and label with following information:
- 1. Manufacturer's name.
 - 2. Product name and lot number.
 - 3. ANSI Hazard Classification (formerly SPI Classification).
 - 4. ANSI recommended precautions for handling.
 - 5. Mix ratio by volume.
- B. Storage and Protection: Store adhesive containers at ambient temperatures below 120 °F and above 32 °F.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Epoxy Manufacturers and Products:
- 1. Sika Corp., Lyndhurst, NJ; Sikadur 35 Hi-Mod LVPL.
 - 2. Euclid Chemical Co., Cleveland, OH; Eucopoxy injection resin.

2.2 EPOXY ADHESIVE

- A. Two-component A and B structural epoxy adhesive for injection into cracks or other voids in concrete structures for bonding or grouting.
- B. Adhesive Properties: When cured for 7 days at 77, ±3 °F and conditioned at test temperature 12 hours prior to test, unless otherwise specified.

	Test Method	Large Cracks	Small Cracks
Ultimate Tensile Strength, psi	ASTM D638	8,000 min.	5,000 min.
Tensile Elongation @ Break, percent	ASTM D638	3.7 max.	3.7 max.
Flexural Strength, psi	ASTM D790	10,000 min.	10,000 min.
Flexural Modulus, psi	ASTM D790	5.5 x10 ⁵ min.	4.5 x10 ⁵ min.
Compressive Yield Strength, psi	ASTM D695*	15,000 min.	12,000 min.
Compressive Modulus, psi	ASTM D695*	3.8 x10 ⁵ min.	3.8 x10 ⁵ min.
Heat Deflection Temperature	ASTM D648*	130 °F min.	140 °F min.
Slant Shear Strength: (5,000 psi Compressive Strength Conc.)	AASHTO T 237**		
Cured 3 days @ 40 °F-Wet Concrete			3,500 psi min

	Test Method	Large Cracks	Small Cracks
	Cured 1 day @ 77 °F-Dry Concrete		5,000 psi min.
	Cured 3 days @ 77 °F ±3 °F		5,000 psi min.
* Cure test specimens so that peak exothermic temperature of adhesive does not exceed 100 °F			
**See referenced specifications for preparation method of test specimens			

2.3 SURFACE SEAL

- A. Sufficient strength and adhesion for holding injection fittings firmly in-place, and to resist pressures preventing leakage during injection.
- B. Capable of removal after injection adhesive has cured.

PART 3 - EXECUTION

3.1 GENERAL

- A. Structurally repair cracks in structures as specified in Section 03 30 00, CAST-IN-PLACE CONCRETE.
- B. Cracks: Repair by injection of epoxy adhesive.

3.2 PREPARATION

- A. Free cracks from loose matter, dirt, laitance, oil, grease, salt, and other contaminants.
- B. Clean cracks in accordance with epoxy adhesive manufacturer's instructions.
- C. Clean surfaces adjacent to cracks from dirt, dust, grease, oil, efflorescence, and other foreign matter detrimental to bond of surface seal system.
- D. Do not use acids and corrosives for cleaning, unless neutralized prior to injecting epoxy.

3.3 APPLICATION

- A. Sealing: Apply surface seal in accordance with Manufacturer's instructions to designated crack face prior to injection. Seal surface of crack to prevent escape of injection epoxy.
- B. Entry Ports:
 - 1. Establish openings for epoxy entry in surface seal along crack.
 - 2. Determine space between entry ports equal to thickness of concrete member to allow epoxy to penetrate to the full thickness of the wall.
 - 3. Provide a means to prevent concrete dusts and fines from contaminating the crack or ports when drilling.
 - 4. Space entry ports close together to allow adjustment of injection pressure to obtain minimum loss of epoxy to soil at locations where:
 - a. Cracks extend entirely through wall.
 - b. Backfill of walls on one side.
 - c. Difficult to excavate behind wall to seal both crack surfaces.
 - 5. Core drill to verify epoxy depth where only one side of wall is exposed.
- C. Epoxy Injection:
 - 1. Store epoxy at minimum of 70 °F.
 - 2. Start injection into each crack at lowest elevation entry port.

3. Continue injection at first port until adhesive begins to flow out of port at next highest elevation.
4. Plug first port and start injection at second port until adhesive flows from next port.
5. Inject entire crack with same sequence.

D. Finishing:

1. Cure epoxy adhesive after cracks have been completely filled to allow surface seal removal without draining or runback of epoxy material from cracks.
2. Remove surface seal from cured injection adhesive.
3. Finish crack face flush with adjacent concrete.
4. Indentations or protrusions caused by placement of entry ports are not acceptable.
5. Remove surface seal material and injection adhesive runs and spills from concrete surfaces.

3.4 EQUIPMENT

- A. Portable, positive displacement type pumps with in-line metering to meter and mix two adhesive components, and inject mixture into crack.
- B. Discharge Pressure: Automatic pressure controls capable of discharging mixed adhesive at pressures up to 200 psi, $\pm 5\%$, and able to maintain pressure.
- C. Automatic Shutoff Control: Provide sensors on both Component A and B reservoirs for stopping machine automatically when only one component is being pumped to mixing head.
- D. Proportioning Ratio Tolerance: Maintain epoxy adhesive Manufacturer's prescribed mix ratio within a tolerance of $\pm 5\%$ by volume at discharge pressure p to 160 psi.
- E. Ratio/Pressure Check Device:
 1. Two independent valved nozzles capable of controlling flow rate and pressure by opening or closing valve to restrict material flow.
 2. Pressure gauge capable of sensing pressure behind each valve.

3.5 FIELD QUALITY CONTROL

- A. Epoxy Adhesive Two Component Ratio Tests:
 1. Disconnect mixing head and pump two adhesive components simultaneously through ratio check device.
 2. Adjust discharge pressure to 160 psi for both adhesive components.
 3. Simultaneously discharge both adhesive components into separate calibrated containers.
 4. Compare amounts simultaneously discharged into calibrated containers during same time period to determine mix ratio.
 5. Complete test at 160 psi discharge pressure and repeat procedure for 0 psi discharge pressure.
 6. Run ratio test for each injection unit at beginning and end of each injection work day, and when injection work has stopped for more than 1-hour.
 7. Document and maintain complete accurate records of ratios and pressure checks.
- B. Injection Pressure Test:
 1. Disconnect mixing head of injection equipment and connect two adhesive component delivery lines to pressure check device.
 2. Pressure Check Device:
 - a. Two independent valved nozzles capable of controlling flow rate and pressure by opening or closing of valve.

- b. Pressure gauge capable of sensing pressure buildup behind each valve.
 3. Close valves on pressure check device and operate equipment until gauge pressure on each line reads 160 psi.
 4. Stop pumps and observe pressure; do not allow pressure gauge to drop below 150 psi within 3 minutes.
 5. Run pressure test for each injection equipment unit:
 - a. Beginning and end of each injection work day.
 - b. When injection work has stopped for more than 45 minutes.
 6. Check tolerance to verify equipment capable of meeting specified ratio tolerance.
- C. Crack Injection Tests:
 1. Initial Cores:
 - a. 4" diameter for full crack depth taken from Engineer selected locations.
 - b. Take three cores in first 100 lineal feet of crack repaired and one core sample for each 500 lineal feet thereafter.
 2. Provide suitable containers for storage, curing, and transportation of test specimens.
 3. Methods of Testing Cores:
 - a. Penetration: Visual examination.
 - b. Bond Strength/Compression Test: Concrete failure prior to adhesive failure.
 4. Test Requirements:
 - a. Penetration: Minimum of 90% of crack shall be full of epoxy adhesive.
 - b. Bond Strength/Compression Test: Concrete failure before adhesive failure, or 6,500 psi with no failure of either concrete or adhesive.
 5. Evaluation and Acceptance of Tests:
 - a. If initial cores pass tests as specified, epoxy adhesive injection Work at area represented by cores will be accepted.
 - b. If initial cores fail either by lack of penetration or bond strength, crack repair Work shall not proceed further until areas represented by cores are re-injected or repaired and retested for acceptance.
 - c. Obtain verifying core samples, number and location as selected by Engineer, after rework of areas represented by failed initial core is complete.
 6. Core Hole Repair:
 - a. Correct Work as result of testing upon notification from Engineer.
 - b. Refill initial and verifying core holes with an epoxy grout tamped and rodded in-place to form a dense fill.
 - c. Finish surface to blend with adjacent concrete.

END OF SECTION

DIVISION 04
MASONRY

SECTION 04 05 17 – MORTAR AND MASONRY GROUT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes: Mortar and grout for masonry construction.
- B. Related sections:
 - 1. Section 01 41 00 – Regulatory Requirements.

1.2 REFERENCES

- A. ASTM International (ASTM):
 - 1. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar.
 - 2. ASTM C150 - Standard Specification for Portland Cement.
 - 3. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes.
 - 4. ASTM C270 - Standard Specification for Mortar for Unit Masonry.
 - 5. ASTM C404 - Standard Specification for Aggregates for Masonry Grout.
 - 6. ASTM C476 - Standard Specification for Grout for Masonry.
 - 7. ASTM C780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.
 - 8. ASTM C1019 - Standard Test Method for Sampling and Testing Grout.

1.3 DEFINITIONS

- A. Alkali: Sum of sodium oxide and potassium oxide calculated as sodium oxide.

1.4 PERFORMANCE REQUIREMENTS

- A. Mortar color:
 - 1. To be selected by OWNER from manufacturers standard colors prior to construction.

1.5 SUBMITTALS

- A. Product data.
- B. Shop drawings.
- C. Mortar color samples.
- D. Design Mixes for mortar and grout.
- E. Test reports:
 - 1. Mortar Strength Test Results.
 - 2. Grout Strength Test Results.

1.6 QUALITY ASSURANCE

- A. Materials for mortar and grout: Do not change source of materials which will affect the appearance of finished work after the work has started unless acceptable to ENGINEER.

1.7 PROJECT CONDITIONS

- A. Environmental requirements:

1. Cold weather requirements:
 - a. Cold Weather Construction: In accordance with the building code as specified in Section 01 41 00.
 - b. Provide adequate equipment for heating mortar and grout materials when air temperature is below 40 degrees Fahrenheit.
 - 1) Temperatures of separate materials, including water, shall not exceed 140 degrees Fahrenheit when placed in mixer.
 - 2) Maintain mortar temperature on boards above freezing.
2. Hot weather requirements:
 - a. Wet mortar board before loading and cover mortar to retard drying when not being used.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Portland cement:
 1. Type II, low alkali, containing maximum 0.6 percent total alkali in accordance with ASTM C150.
- B. Hydrated lime:
 1. Type S in accordance with ASTM C207.
- C. Aggregate for mortar:
 1. Fine aggregate: Sand in accordance with ASTM C144.
- D. Aggregate for grout:
 1. Fine aggregate: Size Number 2 in accordance with ASTM C404.
 2. Coarse aggregate: Size Number 8 in accordance with ASTM C404.
- E. Admixtures:
 1. Mortar color admixture:
 - a. Containing maximum 15 percent lime proof, inorganic compounds, unless recommended otherwise by manufacturer.
 - b. Maximum 3 percent carbon black by weight of cement.
 - c. Factory blend for full color saturation of mortar joint.
 - d. Packaging for unitized jobsite mixing at ratio of 1 unit of color per sack of portland cement.
 2. Grout admixture:
 - a. Manufacturers: One of the following or equal:
 - 1) Sika Corp., Sika Grout Aid, Type II.
 - 2) Concrete Emulsions, Grout Aid GA-II.
 3. Mortar water repellent admixture:
 - a. Manufacturers: One of the following or equal:
 - 1) Sika Corp., Sikaproof 85.
 - 2) W.R. Grace, Dry Block Mortar.
 - 3) BASF, Rheapel Plus Mortar Admixture.
 4. Other admixtures:
 - a. Prohibited, unless accepted by the ENGINEER.
- F. Water: Clean, clear, potable, free of oil, soluble salts, chemicals, and other deleterious substances.
- G. Other materials:
 1. Prohibited, unless acceptable to ENGINEER.

2.2 MIXES

A. Mortar mix:

1. Portland cement-lime mortar.
2. Mortar mix proportions by volume: As indicated in the following table:

MORTAR TYPE	PARTS BY VOLUME OF PORTLAND CEMENT	PARTS BY VOLUME OF HYDRATED LIME	AGGREGATE MEASURED IN A DAMP LOOSE CONDITION
S	1	Greater than 1/4 to 1/2	Not less than 2-1/4 and not more than 3 times the sum of the separate volumes of cementitious materials
N	1	Greater than 1/2 to 1 1/4	Not less than 2-1/4 and not more than 3 times the sum of the separate volumes of cementitious materials

3. Mortar mixing:
 - a. Mix on jobsite in accordance with ASTM C270.
 - b. Mix in mechanical mixer and only in quantities needed for immediate use.
 - c. Mix for minimum 3 minutes, and maximum of 5 minutes after materials have been added to mixer.
4. Measurement by volume: Measurement of constituents shall be accomplished by the use of a container of known capacity.
5. Water shall be mixed with the dry ingredients in sufficient amount to provide a workable mixture which will adhere to the vertical surfaces of masonry units.
 - a. Use no mortar which has been standing for more than 1 hour after being mixed.
6. Whenever 90 minutes has elapsed since last batch was mixed, completely empty mixer drum of materials and wash down before placing next batch of materials.

B. Grout mix:

1. Grout design requirements: unless otherwise accepted by the Engineer.
 - a. Design Strength: 3,000 PSI.
 - b. Design Water/Cement Ratio: 0.50 Max.
 - c. Slump: 8 to 11 inches.
2. Grout mix proportions by volume: As indicated in the following table:

TYPE OF GROUT	PARTS BY VOLUME OF PORTLAND CEMENT	PARTS BY VOLUME OF HYDRATED LIME	AGGREGATE MEASURED IN A DAMP LOOSE CONDITION	
			Fine Aggregate	Coarse Aggregate
Fine grout	1	0-1/10	2-1/4 to 3 times the sum of the volumes of the cementitious materials	-
Coarse grout	1	0-1/10	2-1/4 to 3 times the sum of the volumes of the cementitious materials	1 to 2 times the sum of the volumes of the cementitious materials

3. Grout mixing:
 - a. Mix on jobsite or in a transit mix in accordance with ASTM C476.
 - b. Use within 90 minutes after addition of mixing water.
 - c. Mix for minimum of 5 minutes after ingredients are added and until uniform mix is attained. Grout shall have sufficient water added to produce pouring consistency without segregation.
4. Use coarse grout for hollow cell masonry units with minimum 4-inch cell dimensions in both horizontal directions.
 - a. Calculate cell dimension for this criterion by subtracting diameter(s) of any horizontal reinforcement crossing the cell from clear cell dimensions of the masonry unit.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install according to 04 22 00 Unit Masonry Assemblies.

3.2 FIELD QUALITY CONTROL

- A. Testing of grout and mortar:
 1. During progress of construction, the OWNER will have tests made to determine whether the grout and mortar, as being produced, complies with Specifications.
 2. Compressive strength tests for mortar: In accordance with ASTM C780, Annex A7 as modified in the following paragraphs.
 - a. Spread mortar on the masonry units in a layer 1/2 to 5/8 inch thick.
 - b. Allow mortar to stand for one minute, then remove and place in a 2-inch by 4-inch cylinder mold. Place mortar in two layers compressing the mortar using the flat end of a stick or fingers. Lightly tap the mold on opposite sides. Level off and immediately cover molds, keeping them damp until taken to the laboratory.
 - c. After 48 hour set, remove mortar specimens from molds and store in a fog room until tested. Water curing (curing in tanks) is not permitted.
 - d. Test specimens in damp condition.
 3. Compressive strength test for grout: In accordance with ASTM C1019.
 4. The ENGINEER will make and deliver test specimens to the laboratory and testing expense will be borne by the OWNER.
 5. Required number of tests:
 - a. At least 2 test specimens of grout and mortar will be made per week.

6. Do not use grout and mortar that does not meet specification.
 - a. Remove such mortar and grout from Project site.
7. Make provisions for and furnish grout and mortar for test specimens, and provide manual assistance to the ENGINEER in preparing test specimens.
8. Assume responsibility for care of and providing proper curing conditions for test specimens.

3.3 ADJUSTING

- A. Repair of defective masonry:
 1. Remove and replace or repair defective work.
 2. Do not patch, repair, or cover defective work without inspection by the ENGINEER.
 3. Provide repairs having strength equal to or greater than specified strength for areas involved.

END OF SECTION

SECTION 04 05 23 – MASONRY ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Adjustable wall ties.
 - 2. Control joint filler.
 - 3. Reinforcing bars.
 - 4. Water repellent.
 - 5. Wire joint reinforcement, single Wythe type.
- B. Related sections:
 - 1. Section 04 22 00 – Unit Masonry Assemblies.

1.2 REFERENCES

- A. ASTM International (ASTM):
 - 1. ASTM A82 - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
 - 2. ASTM A615 - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
 - 3. ASTM A641 - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
 - 4. ASTM A951 - Standard Specification for Masonry Joint Reinforcement.
 - 5. ASTM C549 - Standard Specification for Perlite Loose Fill Insulation.
 - 6. ASTM D2000 - Standard Classification System for Rubber Products in Automotive Applications.
 - 7. ASTM D2287 - Standard Specification for Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds.

1.3 SUBMITTALS

- A. Shop drawings including the following:
 - 1. Reinforcing including bond beams, lintels, jambs, end of walls, etc.
 - 2. Control joint detail and layout.
 - 3. Framing around all openings, joists, beams, purlins, etc.
 - 4. Embed materials and locations (and product info, unless by others).
- B. Product data.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

- A. Adjustable wall ties: 2-piece zinc coated fabrications, minimum 3/16-inch diameter steel wire formed into hook or pin and eye pieces, capable of restraining compression and tension forces from veneer.
 - 1. Manufacturers: One of the following or equal:
 - a. AA Wire Products Co., AA303.
 - b. Dur-O-Wal, Inc., D/A 515.
 - c. Wire-Bond, 1800 Hook and 1801 Eye.
- B. Control joint filler: The key shall be of the width and shape as indicated on the Drawings. In accordance with ASTM D 2000 or ASTM D 2287.
 - 1. Manufacturers: One of the following or equal:

- a. AA Wire Products, Inc., AA2000 Blok-Tite.
 - b. Dur-O-Wall, Rapid Poly-Joint.
 - c. Vert-A-Joint Co., Vert-A-Joint.
- C. Reinforcing bars: In accordance with ASTM A 615, Grade 60, deformed billet steel bars.
- D. Water repellent: Water based, methacrylate polymer with aqueous polysiloxane.
- E. Wire joint reinforcement, single Wythe type: In accordance with ASTM A 951 with ASTM A 82, 9 gaugewire side rails and 9-gauge cross ties, sized to suit application, and galvanized in accordance with ASTM A 153, Class B (minimum 1.5 ounces zinc per square foot).
 - 1. Manufacturers: One of the following or equal:
 - a. AA Wire Products, Co., AA500 Blok-Lok.
 - b. Dur-O-Wal, Inc., Ladur-type.
 - c. Wire-Bond, Ladder Type, Series 200.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install products as specified in Section 04 22 00.

END OF SECTION

SECTION 04 22 00 - UNIT MASONRY ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes unit masonry assemblies consisting of the following:
 - 1. Concrete Masonry Units (CMU's).
 - 2. Split-face masonry veneer.
 - 3. Thru-wall flashing.
 - 4. Miscellaneous masonry accessories.

- B. Related Sections:
 - 1. Section 03 30 00 – Cast-In-Place Concrete.
 - 2. Section 04 05 17 – Mortar and Masonry Grout
 - 3. Section 04 05 23 – Masonry Accessories.
 - 4. Section 04 22 16 – Anchored CMU Veneer.
 - 5. Section 05 12 00 – Structural Steel.
 - 6. Section 05 50 00 – Metal Fabrications.
 - 7. Section 07 92 00 – Joint Sealants.

- C. Products furnished, but not installed, under this Section include the following:
 - 1. Section 03 30 00 - Cast-in-Place Concrete.
 - 2. Anchor sections of adjustable masonry anchors for connecting to structural frame, installed under Section 05 12 00 - Structural Steel.

- D. Products installed, but not furnished, under this Section include the following:
 - 1. Steel lintels for unit masonry, furnished under Section 05 50 00 - Metal Fabrications.
 - 2. Insulation in cavity walls, Division 07.
 - 3. Control joint sealing, Division 07.

1.2 DEFINITIONS

- A. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.3 PERFORMANCE REQUIREMENTS

- A. Provide structural unit masonry that develops net-area compressive strengths (f_m) of 1500 psi at 28 days.

- B. Determine net-area compressive strength (f_m) of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to the current adopted Edition of the International Building Code.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.

- B. Samples of face block veneer for approval of Engineer.

- C. Shop Drawings: For the following:
 - 1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.

- D. Qualification Data: For testing agency.

- E. Material Certificates: Include statements of material properties indicating compliance with requirements including compliance with standards and type designations within standards. Provide for each type and size of the following:
 - 1. Masonry units.
 - a. Include material test reports substantiating compliance with requirements.
 - 2. Cementitious materials. Include brand, type, and name of manufacturer.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency qualified according to ASTM C1093 for testing indicated, as documented according to ASTM E548.
- B. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, through one source from a single manufacturer for each product required.
- C. ACI Publications: Comply with the latest Edition of the following except as modified by requirements in the Contract Documents:
 - 1. ACI 530, Building Code Requirements for Masonry Structures.
 - 2. ACI 530.1, Specification for Masonry Structures.
- D. ANSI "American Standard Building Code Requirements for Masonry" and "Building Code Requirements for Reinforced Masonry".
- E. Contractor/Fabricator Qualifications: Provide documentation of prior work experience with projects of similar size, design, and unit type as this project and whose work has resulted in construction projects with a record of successful in-service performance.
 - 1. Masonry Contractor/Installer: A firm with a minimum of 5 years experience in CMU and face brick installations with a minimum of 5 commercial type projects similar in size to this specific project and able to provide references and similar project information if so requested.
- F. Conduct initial "Coordination" conference to review Contract Documents and requirements prior to any submittal. Require representatives of each entity directly concerned with Unit Masonry shall attend, including but not limited to:
 - 1. Engineer or representative.
 - 2. Contractor's superintendent.
 - 3. Independent testing agency responsible for masonry testing.
 - 4. Unit masonry subcontractor.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units and face block veneer on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry. Store and handle to avoid chipping.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- D. Deliver pre-blended, dry mortar mix in moisture-resistant containers designed for lifting and emptying into dispensing silo. Store pre-blended, dry mortar mix in delivery containers on

elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.

- E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.7 PROJECT CONDITIONS

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
 - 1. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.
- B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.
- C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
 - 1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
 - 2. Protect sills, ledges, and projections from mortar droppings.
 - 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
 - 4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
- D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530-05/ASCE 5-05/TMS 402-05.
- E. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40° F and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.
- F. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530-05/ASCE 5-05/TMS 402-05.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
 - 2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
- B. Regional Materials: Provide Concrete Masonry Units that have been manufactured within 500 miles of Project site from aggregates and cement that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.

2.2 MASONRY UNITS, GENERAL

- A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to exceed tolerances and to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects, including dimensions that vary from specified dimensions by more than stated tolerances, will be exposed in the completed Work or will impair the quality of completed masonry.
- B. Unless otherwise indicated, 2 or 3 cell units 7-5/8" x 15-5/8" x width indicated, plus all closers, jamb units and other special sizes and shapes required to bond with and complete the work.
- C. Conform to ASTM C90, cured 28 days minimum and dries for shrinkage.
- D. Do not use damaged units in the work.
- E. Do not use chipped units in exposed locations.

2.3 CONCRETE MASONRY UNITS (CMUS)

- A. Shapes: Provide shapes indicated and as follows:
 - 1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
 - 2. Provide square-edged units for outside corners, unless otherwise indicated.
- B. Concrete Masonry Units: ASTM C90.
 - 1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi.
 - 2. Weight Classification: Normal weight.
 - 3. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.
- C. Integral Water Repellent: Provide units made with integral water repellent for exterior units.
 - 1. Integral Water Repellent: Liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive according to ASTM E514, with test period extended to 24 hours, show no visible water or leaks on the back of test specimen.
 - a. Available products:
 - 1) Addiment Incorporated; Block Plus W-10.
 - 2) Grace Construction Products, a unit of W. R. Grace & Co. – Conn.; Dry-Block.
 - 3) Master Builders, Inc.; Rheopel.

2.4 SPLIT FACE BLOCK

- A. Regional Materials: Provide brick from materials that have been manufactured within 500 miles of Project site from aggregates and cement that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.
- B. Split face block and color to be selected by the Engineer or Owner. Block to be modular. Material cost to be included in the base bid.
 - 1. Color to match the existing Blower Building (gray). Provide samples of split face block for comparison and Engineer/Owner's approval prior to installation.
- C. Furnish matching solid block for all locations where holes would otherwise be exposed.
- D. Deliver to job stacked. Do not use chipped block in exposed locations.

2.5 CONCRETE AND MASONRY LINTELS

- A. Provide masonry lintels complying with requirements below.
 - 1. Masonry Lintels: Built-in-place masonry lintels made from bond beam concrete masonry units with reinforcing bars placed as indicated and filled with grout. Temporarily support built-in-place lintels until cured.
- B. Provide concrete lintels complying with requirements below.
 - 1. ASTM C1623, matching CMU's in color, texture, and density classification; and with reinforcing bars indicated. Provide lintels with net-area compressive strength not less than CMU's.
 - 2. Precast or formed-in-place concrete lintels complying with requirements in Section 03 30 00. And with reinforcing bars indicated.

2.6 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
- B. Hydrated Lime: ASTM C207, Type S.
- C. Portland Cement-Lime Mix: Packaged blend of portland cement complying with ASTM C 150, Type I or Type III, and hydrated lime complying with ASTM C 207, Type S.
- D. Masonry Cement: ASTM C 91.
 - 1. Available Products:
 - a. Capital Materials Corporation; Flamingo Color Masonry Cement.
 - b. Essroc, Italcementi Group; Brixment or Velvet.
 - c. Holcim (US) Inc.; Mortamix Masonry Cement, Rainbow Mortamix Custom Buff Masonry Cement, or White Mortamix Masonry Cement.
 - d. Lafarge North America Inc.; Magnolia Masonry Cement, Lafarge Masonry Cement Florida Super Masonry, Trinity Super White Masonry Type S, or Trinity White Masonry Type N.
 - e. Lehigh Cement Company; Lehigh Masonry Cement or Lehigh White Masonry Cement.
 - f. National Cement Company, Inc.; Coosa Masonry Cement.
 - 2. Regional Materials: Provide aggregate for mortar, cement, and lime that have been extracted, harvested, or recovered, as well as manufacture, within 500 miles of Project site.
- E. Mortar Cement: ASTM C1329.
 - 1. Available Products:
 - a. Lafarge North America Inc.; Lafarge Mortar Cement or Magnolia Superbond Mortar Cement.
- F. Aggregate for Mortar: ASTM C144.
 - 1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
 - 2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
 - 3. Sand shall be clean, well screened, natural, ASTM C144.
- G. Aggregate for Grout: ASTM C404.

- H. Water: Potable.
- I. Grout shall be 3,000 psi pea gravel concrete with a maximum water/cement of 0.50. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with concrete masonry units, containing integral water repellent by same manufacturer.
 - 1. Available Products:
 - a. Addiment Incorporated; Mortar Tite.
 - b. Grace Construction Products, a unit of W. R. Grace & Co. – Conn; Dry-Block Mortar Admixture.
 - c. Master Builders, Inc.; Rheomix Rheopel.

2.7 REINFORCEMENT

- A. As specified in Section 04 05 23 – Masonry Accessories, and Section 04 22 16 – Anchored CMU Veneer.

2.8 TIES AND ANCHORS

- A. As specified in Section 04 22 16 – Anchored CMU Veneer.

2.9 CLEAR SURFACE TREATMENT REPELLENTS

- A. In addition to the integral water repellent provided within the concrete masonry units and the integral water repellent provided within the mortar, provide a compatible clear surface treatment repellent post applied in accordance with the manufacturers recommendations to all concrete masonry work.
 - 1. Water based, clear, specially formulated VOC compliant penetrating sealer consisting of water based blends of silanes and siloxanes to provide maximum water repellency when post applied to integrally water-repellent -treated concrete masonry unit construction.
- B. Available Products:
 - 1. INFINISEAL ® DB by Grave Construction Products.
 - 2. Approved Equal.

2.10 MISCELLANEOUS MASONRY ACCESSORIES

- A. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.
- B. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene.
- C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).
- D. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells with loops for holding reinforcing bars in center of cells. Units are formed from 0.142-inch steel wire, hot-dip galvanized after fabrication. Provide units with either two loops or four loops as needed for number of bars indicated.
 - 1. Available Products:
 - a. Dayton Superior Corporation, Dur-O-Wal Division; D/A 810, D/A 812 or D/A 817.
 - b. Heckmann Building Products Inc.; No. 376 Rebar Positioner.
 - c. Hohmann & Barnard, Inc.; #RB or #RB-Twin Rebar Positioner.
 - d. Wire-Bond; O-Ring or Double O-Ring Rebar Positioner.

2.11 EXPANSION AND CONTROL JOINT MATERIALS

- A. Backer rod and sealant in expansion joints and sealant in control joints as specified in Section 07 92 00.

2.12 THROUGH-WALL FLASHING

- A. Where shown built into masonry, and unless noted otherwise, use 5 oz. copper fabric flashing. Seal all laps with flashing mastic.

2.13 WEEP HOLE/VENT PRODUCTS

- A. Weeps: Mortar Net USA, Ltd. "Mortar Net Weeps Vents" or approved equal.

2.14 MASONRY CLEANERS

- A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.
 - 1. Available Manufacturers:
 - a. Diedrich Technologies, Inc.
 - b. EaCo Chem, Inc.
 - c. ProSoCo, Inc.

2.15 MORTAR AND GROUT MIXES

- A. As specified in Section 04 05 17 Mortar and Masonry Grout.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
 - 1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
 - 2. Verify that foundations are within tolerances specified.
 - 3. Verify that reinforcing dowels are properly placed.
- B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. No masonry work when ambient temperature is below 35 degrees Fahrenheit; do not build on frozen work or surface with water or frost film; protect masonry from freezing for 48 hours after being laid.
- B. Lay out coursing with story pole prior to laying masonry to insure joints of uniform thickness.
- C. Lay in plumb, true to line level course, head joints aligned; adjust to final position before mortar stiffens.

- D. Keep cavities, chases, etc., free of debris or mortar droppings.
- E. Unless otherwise required, completely fill spaces around built-in items with mortar; fill heads and jambs of hollow metal frames with mortar as the wall is laid. Install anchors, flashing, etc., as the wall is laid.
- F. Tolerance of offset between vertical faces of block masonry: 1/8".
- G. Rake control joints to depth of 3/8" and leave ready for sealant.
- H. Step back unfinished work for joining with new; do not "tooth" unless specifically approved. Protect tops or openings in exposed masonry walls from rain or snow with a strong waterproof membrane, adequately secured in place.
- I. Do not use mortar that has begun to set; do not use mortar more than 2-1/2 hours after mixing when air temperature is 80 Degrees Fahrenheit or higher or more than 3-1/2 hours after mixing when air temperature is less than 80 Degrees Fahrenheit.
- J. Brace walls to resist lateral loads in accordance with "American Standard Building Code Requirements for Masonry".
- K. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.
- L. Build chases and recesses to accommodate items specified in this and other Sections.
- M. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.
- N. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
- O. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.
 - 1. Mix units from several pallets or cubes as they are placed.
- P. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.
- Q. Comply with construction tolerances in ACI 530-05/ASCE 5-05/TMS 402-05 and with the following:
 - 1. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
 - 2. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
 - 3. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
 - 4. For exposed bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch. Do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.

5. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.
6. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.
7. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch from one masonry unit to the next.

3.3 LAYING MASONRY WALLS

A. Laying Concrete Block.

1. General: Cut block with masonry saws. Set head joints in running bond. For other joints, provide full mortar coverage in joints on horizontal and vertical face shells, none on web edges. Bond each course at corners. Remove sharp edges and irregularities at exposed corners of concrete block work with an abrasive block.
2. Joints: 3/8" wide, struck flush.
3. Lintels: Unless otherwise noted or indicated, construct of U-shape units filled with 3000 psi concrete, extending at least 8" beyond each side of opening. Reinforce as indicated, but not less than one No. 5 bar.
4. Joint Reinforcing: Place in first (continuous) and second bed joints (to 2 feet each side of opening) above and below openings and continuous in every second bed joint throughout remainder of structure, Lap splices 6". Bend longitudinal wires around corners to provide a continuous bond.
5. Anchors: Space not more than 16 inches o. c. vertically and 24" o. c. horizontally, with not less than 1 anchor for each 2 sq. ft. of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 8 inches around the perimeter.

3.4 MORTAR BEDDING AND JOINTING

- A. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.
- B. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint), unless otherwise indicated.
- C. Lay hollow brick and concrete masonry units as follows:
 1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
 2. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
 3. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.
- D. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

3.5 MASONRY JOINT REINFORCEMENT

- A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap joint reinforcement a minimum of 6 inches.
 1. Space reinforcement not more than 16 inches o.c.
 2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
 3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings.
 - a. Reinforcement above is in addition to continuous reinforcement.

- B. Interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.
- C. Provide continuity at wall intersections by using prefabricated T-shaped units.
- D. Provide continuity at corners by using prefabricated L-shaped units.
- E. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.6 CONTROL AND EXPANSION JOINTS

- A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.
- B. Form control joints in concrete masonry as follows:
 1. Install preformed control-joint gaskets designed to fit standard sash block.
 2. Unless indicated or noted otherwise, on the exterior, control joints shall occur at all interior corners of intersecting masonry walls.
 3. Square rake mortar cleanly to depth of 3/8" to receive sealant as specified in Division 7.
- C. Provide expansion joints in exterior above grade masonry walls not to exceed 25ft O.C., placed as shown on drawings or as located and directed by Engineer.
- D. Use specified expansion joint materials in all expansion joints unless otherwise directed.
- E. Form expansion joints in brick made from clay or shale as follows:
 1. Build in compressible joint fillers where indicated.
 2. Form open joint full depth of brick wythe and of width indicated, but not less than 3/8 inch for installation of sealant and backer rod specified in Section 07 92 00.

3.7 THROUGH-WALL FLASHING

- A. Install continuous, embedded in mortar or a troweled on layer of bituminous mastic, with end joints lapped 6" and sealed with manufacturer's mylar tape, and with ends adjacent to opening jambs turned up to form a pan. Outer edge shall extend completely to face of mortar joint.
- B. At rear of through-wall flashing between stud walls and brick veneer, extend through cavity and build in as shown. Extend up between sheathing and building wrap
- C. Required Locations: Install through-wall flashing at heads and sills of windows, heads of doors in exterior walls, continuous under weep holes in brick veneer, and where shown.
- D. Where grade slopes and weep holes above grade step with the slope, through-wall flashing shall step correspondingly and shall overlap at the stepped ends a minimum of 24". Turn up ends approximately 2" and turn into head joints of masonry.

3.8 LINTELS

- A. Provide minimum bearing of 8 inches at each jamb, unless otherwise indicated.

3.9 FLASHING, WEEP HOLES, CAVITY DRAINAGE, AND VENTS

- A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.

3.10 REINFORCED UNIT MASONRY INSTALLATION

- A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
 - 1. Construct formwork to provide shape, line, and dimensions of completed masonry as needed. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
 - 2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.
- B. Placing Reinforcement: Comply with requirements in ACI 530.1/ ASCE 6/TMS 602.
- C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
 - 1. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
 - 2. Limit height of vertical grout pours to not more than 60 inches.

3.11 FIELD QUALITY CONTROL

- A. Inspectors: Owner will engage qualified independent inspectors to perform inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform inspections.
 - 1. Place grout only after inspectors have verified compliance of grout spaces and grades, sizes, and locations of reinforcement.
 - 2. Comply with Level C Quality Assurance in ACI 530-1/ASCE 6/TMS 602 Latest Edition and International Building Code Chapter 17 Structural Tests and Inspection, Latest Edition and as follows:
- B. Testing Frequency: One set of tests for each 1500 sq. ft. of wall area or portion thereof.
- C. Mortar Test (Property Specification): For each mix provided, per ASTM C 780. Test mortar for mortar air content and compressive strength.
- D. Grout Test (Compressive Strength): For each mix provided, per ASTM C 1019.

3.12 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.
- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.

2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Engineer's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent stone and non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
5. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.

3.13 CLEAR SURFACE TREATMENT REPELLENTS

- A. In addition to the integral water repellent provided within the concrete masonry units and the integral water repellent provided within the mortar, provide a compatible clear surface treatment repellent post applied in accordance with the manufacturers recommendations to all concrete masonry work.

3.14 CLEANING

- A. Clean off loose mortar without damage to CMU. Cut out defective joints, re-point and tool to match adjacent work.
- B. Insure adequate water supply for presoaking and rinsing. Delay cleaning of any section at least 28 days after topping out.
- C. Use "Sure Klean" or approved equal in strict accordance with manufacturer's instructions. Specific product shall be as recommended by the manufacturer for the type masonry involved.
- D. Protect non-masonry surfaces. Masonry below the working area shall be kept wet by flushing with water
- E. High pressure water cleaning methods are not permitted unless approved by the Engineer.

3.15 MASONRY WASTE DISPOSAL

- A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.
- B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed. Do not dispose of masonry waste as fill within 18 inches of finished grade.
- C. Excess Masonry Waste: remove excess clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION

SECTION 04 22 16 – ANCHORED CMU VENEER

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes: Anchored CMU veneer.
- B. Related sections:
 - 1. Section 01 41 00 – Regulatory Requirements.
 - 2. Section 04 05 17 – Mortar and Masonry Grout.
 - 3. Section 04 22 00 – Unit Masonry Assemblies.
 - 4. Section 07 19 00 – Water Repellant Coating.
 - 5. Section 07 92 00 – Joint Sealants.

1.2 SUBMITTALS

- A. Product data.
- B. Shop drawings: Include elevations of each wall indicating type and layout of units.
- C. Samples: Include samples of masonry units in sufficient quantity to illustrate color range.
- D. ICC ES Evaluation Report for wall ties and anchoring system.
- E. Test reports:
 - 1. Test reports for each type of CMU.
 - 2. Testing and reports are to be completed by and independent laboratory.
 - 3. Test reports shall include:
 - a. Compressive strength.
- F. Letter of certification.

1.3 QUALITY ASSURANCE

- A. Mock-up panel:
 - 1. Prior to starting construction of masonry, construct minimum 4-foot square mock-up panel.
 - 2. Use accepted materials containing each different kind and color of masonry units to illustrate wall design.
 - 3. When not accepted, construct another mock-up panel.
 - 4. When accepted, mock-up will be standard of comparison for remainder of masonry work.
 - 5. Do not destroy or move mock-up panel until work is completed and accepted by the OWNER.
 - 6. Upon completion of Project, dispose of mock-ups in legal manner at offsite location.
- B. Pre-installation meeting: Conduct prior to beginning masonry construction.
- C. A letter of certification from the supplier of the materials attesting to compliance with the applicable specifications for grades, types, or classes included in these specifications, shall be provided at the time of, or prior to, delivery of the materials to the jobsite.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Transport and handle masonry units as required to prevent discoloration, chipping, and breakage.
- B. Locate storage piles, stacks, and bins to protect materials from heavy traffic.
- C. Store masonry units off ground to prevent contamination by mud, dust, or materials likely to cause staining or other defects.
- D. Cover materials when necessary to protect from the elements.
- E. Remove chipped, cracked, and otherwise defective units from jobsite upon discovery.

1.5 PROJECT CONDITIONS

- A. Cold weather requirements:
 - 1. In accordance with building code as specified in Section 01 41 00.
 - 2. Provide adequate equipment for heating masonry materials when air temperature is below 40 degrees Fahrenheit.
- B. Hot weather requirements:
 - 1. When ambient air temperature exceeds 100 degrees Fahrenheit, or when ambient air temperature exceeds 90 degrees Fahrenheit and wind velocity is greater than 8 miles per hour, implement hot weather protection procedures.
 - 2. Wet mortarboard before loading and cover mortar to retard drying when not being used.
 - 3. Do not spread mortar beds more than 48 inches ahead of placing masonry units.
 - 4. Place masonry units within 1 minute of spreading mortar.

1.6 SEQUENCING AND SCHEDULING

- A. Order masonry units well before start of installation (8 weeks minimum) to assure adequate time for manufacturing.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

- A. CMU masonry veneer units:
 - 1. CMU masonry veneer units as specified in Section 04 22 00.
 - 2. Surface texture: As specified in Section 04 22 00.
 - 3. Size: As specified in Section 04 22 00.
 - 4. Special sizes and shapes: As required for window and door soldier coursing and custom sills where indicated on the Drawings, bond beams, piers, lintels, control joints, and other special applications to minimize cutting.
 - 5. Do not exceed variations in color and texture of samples accepted by the ENGINEER.
 - 6. Mortar and grout: As specified in Section 04 05 17.
- B. Channel slot anchor system: System consisting of channel slots fastened to the masonry wall channel slot anchors that tie the masonry veneer to channel slots, and continuous wires that are embedded in the masonry and connect to the channel slot anchors:
 - 1. Channel slot: 11 gauge, [hot-dip galvanized after fabrication in accordance with ASTM A 153.
 - a. Manufacturers: One of the following or equal:
 - 1) Hohmann and Barnard, Inc., Hauppauge, NY, Model No. 361.

- 2) Heckmann Building Products, Inc., Chicago, IL, Model No. 131.
- 2. Channel slot anchors: 11 gauge, 1-inch wide, hot-dip galvanized after fabrication in accordance with ASTM A 153, and with seismic notch for attachment to wire embedded in masonry.
 - a. Manufacturers: One of the following or equal:
 - 1) Hohmann and Barnard, Inc., Hauppauge, NY, Model No. 364SV.
 - 2) Heckmann Building Products, Inc., Chicago, IL, Model No. 362.
- 3. Wire reinforcement: 3/16 inch, cold-drawn steel wire in accordance with ASTM A 82 and hot-dip galvanized after fabrication in accordance with ASTM A 153.
 - a. Manufacturers: One of the following or equal:
 - 1) Hohmann and Barnard, Inc., Hauppauge, NY.
 - 2) Heckmann Building Products, Inc., Chicago, IL.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect adjacent construction with appropriate means from mortar droppings and other effects of laying of masonry units.
- B. Thoroughly clean foundations of laitance, grease, oil, mud, dirt, mortar droppings, and other objectionable matter.

3.2 INSTALLATION

- A. CMU masonry veneer units:
 - 1. Use dry masonry units.
 - 2. Do not use wet or frozen masonry units.
 - 3. Lay units in uniform and true courses, level, plumb, and without projections or offset from adjacent units.
 - 4. Lay units to desired height with joints of uniform thickness.
 - 5. For CMU veneer over masonry wall surfaces, install channel slot anchor system and reinforcing wires.
 - 6. Spot bedding with cement mortar at all anchor locations.
 - 7. Bond shall be plumb throughout.
 - 8. Lay units to avoid formation of cracks when units are placed.
 - 9. Lay masonry plumb, true to line, with courses level. Keep bond pattern plumb throughout. Lay masonry within the following tolerances:
 - a. Maximum variation from the plumb in the lines and surfaces of columns, walls, and in the flutes and surfaces of fluted or split faced blocks:
 - 1) In adjacent masonry units: 1/8 inch.
 - 2) In 10 feet: 1/4 inch.
 - 3) In any story or 20 feet maximum: 3/8 inch.
 - 4) In 40 feet or more: 1/2 inch.
 - b. Maximum variations from the plumb for external corners, expansion joints, and other conspicuous lines:
 - 1) In any story or 20 feet maximum: 1/4 inch.
 - 2) In 40 feet or more: 1/2 inch.
 - c. Maximum variations from the level or grades indicated on the Drawings for exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines:
 - 1) In any bay or 20 feet maximum: 1/4 inch.
 - 2) In 40 feet or more: 1/2 inch.
 - d. Maximum variations of the linear building lines from established position in plan and related portion of columns, walls, and partitions:
 - 3) In any bay or 20 feet maximum: 1/2 inch.
 - 4) In 40 feet or more: 3/4 inch.

- e. Maximum variation in cross sectional dimensions of columns and in thickness of walls:
 - 5) Minus: 1/4 inch.
 - 6) Plus: 1/2 inch.
 - f. When positions of units shift after mortar has stiffened, bond is broken, or cracks are formed, relay units in new mortar.
 - 10. Prevent mortar from staining the face of masonry to be left exposed or painted:
 - a. Immediately remove mortar in contact with face of such masonry.
 - b. Protect all sills, ledges, and projections from droppings of mortar. Protect doorjamb and corners from damage during construction.
 - 11. Protect masonry not being worked on from rain by completely covering with a weather resistive membrane.
- B. Mortar joints:
- 1. Make joints straight, clean, smooth, and uniform in thickness.
 - 2. Pointing: Tool exposed joints, slightly concave. Strike concealed joints flush.
 - 3. Joint thickness: Make vertical and horizontal joints 3/8-inch thick.
 - 4. Where fresh masonry joins totally or partially set masonry, clean and roughen set masonry before laying new units.
- C. Bond pattern:
- 1. Lay masonry units in running bond pattern, except where special patterns are indicated on the Drawings.
- D. Cutting masonry units:
- 1. When possible, use full units of the proper size in lieu of cut units. Cut units as required to form chases, openings, for anchorage, and for other appurtenances.
 - 2. Cut and fit units with power-driven carborundum or diamond disc blade saw.
- E. Control joints:
- 1. Control joint spacing:
 - a. Provide control joints in masonry walls at locations indicated on the Drawings.
 - b. If the location of control joints is not indicated on the Drawings, provide control joints at 20-foot maximum spacing. Submit proposed control joint spacing to the ENGINEER for acceptance.
 - 2. Make full height and continuous in appearance.
 - 3. Insert control joint filler in joints as wall is constructed.
 - 4. Apply sealant as specified in Section 07 92 00.
- F. Door frames:
- 1. Anchor and fully grout jambs and head of door frames connected to masonry.
 - 2. Fill frames with grout as each 2 feet of masonry is laid.
- G. Enclosures:
- 1. Where masonry units enclose conduit, pipes, stacks, ducts, and similar items, construct chases, cavities, and similar spaces as required, whether or not such spaces are indicated on the Drawings.
 - 2. Point openings around flush mounted electrical outlet boxes with mortar, including flush joints above boxes.
 - 3. Do not cover enclosures until inspected and when appropriate, tested.
- H. Other embedded items:
- 1. Build in wall plugs, accessories, flashings, pipe sleeves, and other items required to be built-in as the masonry work progresses.
- I. Patching:

1. Patch exposed masonry units in such manner that patching will be indistinguishable from similar surroundings and adjoining construction.
- J. Water curing:
1. Protect masonry units from drying too rapidly by frequently fogging or sprinkling for minimum of 3 days.
- K. Miscellaneous:
1. Build in required items, such as anchors, flashings, sleeves, frames, structural steel, lintels, anchor bolts, and metal fabrications, as required for complete installation.
- L. Water repellent:
1. Apply water repellent as specified in Section 07 19 00.
- M. Cleaning:
1. Exercise extreme care to prevent mortar splashes.
 2. Do not attach construction supports to masonry walls.
 3. Wash off brick scum and grout spills before scum and grout set.
 4. Remove grout stains from walls.
 5. Clean exposed masonry. Remove scaffolding and equipment. Dispose of debris, refuse, and surplus material offsite legally.
 6. Correct efflorescence on exposed surfaces with commercially-prepared cleaning solution acceptable to masonry unit manufacturer:
 - a. Apply cleaning solution in accordance with cleaning solution manufacturer's printed instructions.
 - b. Do not use muriatic acid as cleaning solution.
 - c. Do not use sandblast cleaning equipment.
- N. Forms and shores:
1. Where required, construct forms to the shapes indicated on the Drawings:
 - a. Construct forms sufficiently rigid to prevent deflection which may result in cracking or other damage to supported masonry and sufficiently tight to prevent leakage of mortar and grout.
 - b. Do not remove supporting forms or shores until the supported masonry has acquired sufficient strength to support safely its weight and any construction loads to which it may be subjected:
 - 1) Wait at least 16 hours after grouting masonry columns or walls before applying uniform loads.
 - 2) Wait at least 72 hours before applying concentrated loads.
- ### 3.3 PROTECTION
- A. Provide temporary protection for exposed masonry corners subject to damage.
- B. Bracing:
1. Adequately brace masonry walls over 8 feet in height to prevent overturning and to prevent collapse unless wall is adequately supported by permanent supporting elements so wall will not overturn or collapse.
 2. Keep bracing in place until permanent supporting elements of structure are in place.
- C. Limited access zone:
1. Establish limited access zone prior to start of masonry wall construction.
 2. Zone shall be immediately adjacent to wall and equal to height of wall to be constructed plus 4 feet by entire length of wall on unscaffolded side of wall.

3. Limit access to zone to workers actively engaged in constructing wall. Do not permit other persons to enter zone.
4. Keep zone in place until wall is adequately supported or braced by permanent supporting elements to prevent overturning and collapse.

3.4 FIELD QUALITY CONTROL

A. Site tests:

1. Efflorescence tests:
 - a. Perform efflorescence tests on mortar that will be exposed to weathering. Tests shall be scheduled far enough in advance of starting masonry work to permit retesting if necessary.

END OF SECTION

DIVISION 05
METALS

SECTION 05 12 00 - STRUCTURAL STEEL

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Structural steel.

- B. Related Sections :
 - 1. Section 01 31 00 – Project Management and Coordination.
 - 2. Section 01 31 19 – Project Meetings.
 - 3. Section 05 50 00 – Metal Fabrications, for steel lintels or shelf angles not attached to structural-steel frame, miscellaneous steel fabrications, and other metal items not defined as structural steel.
 - 4. Section 09 90 00 – Painting and Protective Coatings, for surface preparation and priming requirements.

1.2 DEFINITIONS

- A. Structural Steel: Elements of structural-steel frame, as classified by AISC “Code of Standard Practice for Steel Buildings and Bridges,” that support design loads.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.

- B. Shop Drawings: Show fabrication of structural-steel components.
 - 1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
 - 2. Include embedment drawings.
 - 3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.
 - 4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pre-tensioned and slip-critical high-strength bolted connections.

- C. Welding certificates.

- D. Qualification Data: For Installer and fabricator.

- E. Mill Test Reports: Signed by Manufacturers certifying that the following products comply with requirements:
 - 1. Structural steel including chemical and physical properties.
 - 2. Bolts, nuts, and washers including mechanical properties and chemical analysis.
 - 3. Shop primers.

- F. Source quality-control test reports.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who regularly erects structural steel with scope and complexity similar to that of this project.

- B. Fabricator Qualifications: A qualified fabricator who regularly fabricates structural steel with scope and complexity similar to that of this project.

- C. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."
- D. Comply with applicable provisions of the following specifications and documents:
 - 1. AISC "Code of Standard Practice for Steel Buildings and Bridges."
 - 2. AISC "Seismic Provisions for Structural Steel Buildings" and "Supplement No.2."
 - 3. AISC "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design."
 - 4. AISC "Specification for the Design of Steel Hollow Structural Sections."
 - 5. AISC "Specification for Allowable Stress Design of Single-Angle Members".
 - 6. RCSC "Specifications for Structural Joints Using ASTM A 325 or A 490 Bolts."
- E. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00, PROJECT MANAGEMENT AND COORDINATION, and Section 01 31 19, PROJECT MEETINGS.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from erosion and deterioration.
 - 1. Store fasteners in a protected place. Re-lubricate bolts and nuts that become dry.
 - 2. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.
 - 3. Do not clean and use rusty bolts.

1.6 COORDINATION

- A. Furnish anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

- A. W-Shapes: ASTM A 992.
- B. Channels, Angles, and Shapes: ASTM A 36 unless otherwise noted.
- C. Plate and Bar: ASTM A 36 unless otherwise noted.
- D. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B structural tubing.
- E. Steel Pipe: ASTM A53, Type E or S, Grade B.
 - 1. Weight Class: Standard unless otherwise indicated.
 - 2. Finish: Black, except where indicated to be galvanized.
- F. Welding Electrodes: Comply with AWS requirements. Tensile strength should be the same or greater than base metal.

2.2 BOLTS, CONNECTORS, AND ANCHORS

- A. High-Strength Bolts, Nuts, and Washers: ASTM A 325 Type 1, heavy hex steel structural bolts; ASTM A 563 heavy hex carbon steel nuts; and ASTM F 436 hardened carbon-steel washers.
 - 1. Finish: Plain unless noted or indicated otherwise.
- B. Headed and Un-headed Anchor Rods: ASTM F 1554, Grade 36, unless otherwise indicated.
 - 1. Configuration: as indicated.
 - 2. Nuts: ASTM A 563, heavy hex carbon steel.
 - 3. Plate Washers: ASTM A 36 carbon steel.
 - 4. Washers: ASTM F 436, hardened carbon steel.
 - 5. Finish: Plain, unless noted or indicated otherwise.
- C. Threaded Rods: ASTM A 36.
 - 1. Nuts: ASTM A 563 heavy hex carbon steel.
 - 2. Washers: ASTM F 436 hardened carbon steel.
 - 3. Finish: Plain, unless noted or indicated otherwise.
- D. Clevises or turnbuckles: ASTM A 108, Grade 1035, cold-finished carbon steel.
- E. Eye Bolts and Nuts: ASTM A 108, Grade 1030, cold-finished carbon steel.
- F. Sleeve Nuts: ASTM A 108, Grade 1018, cold-finished carbon steel.

2.3 PRIMER

- A. Primer: Fabricator's standard lead and chromate free non-asphaltic rust inhibiting primer.
- B. Galvanizing Repair Paint: MPI#18, MPI#19, or SSPC-Paint 20.

2.4 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC "Code of Standard Practice for Steel Buildings and Bridges" and AISC "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design".
 - 1. Camber structural-steel members where indicated.
 - 2. Identify high-strength structural steel according to ASTM A 6 and maintain markings until structural steel has been erected.
 - 3. Mark and match-mark materials for field assembly.
 - 4. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
- B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
 - 1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1.
- C. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.
- D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 3, "Power Tool Cleaning."
- F. Steel Wall-Opening Framing: Select true and straight members for fabricating steel wall-opening framing to be attached to structural steel. Straighten as required to provide uniform, square, and true members in completed wall framing.

- G. Welded Door Frames: Build up welded door frames attached to structural steel. Weld exposed joints continuously and grind smooth. Plug-weld fixed steel bar stops to frames. Secure removable stops to frames with countersunk, cross-recessed head machine screws, uniformly spaced not more than 10" o.c., unless otherwise indicated.
- H. Holes: Provide holes required for securing other work to structural steel and for passage of other work through steel framing members.
 - 1. Cut, drill, or punch holes perpendicular to steel surfaces.
 - 2. Base-Plate Holes: Cut, drill, or punch holes perpendicular to steel surfaces.
 - 3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.5 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type: Snug tightened.
- B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.
 - 1. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
 - 2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC "Code of Standard Practice for Steel Buildings and Bridges" for mill material.

2.6 SHOP PRIMING

- A. Shop prime steel surfaces except the following:
 - 1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2".
 - 2. Surfaces to be field welded.
 - 3. Surfaces to be high-strength bolted with slip-critical connections.
 - 4. Surfaces to receive sprayed fire-resistive materials.
 - 5. Galvanized surfaces.
- B. Surface Preparation: Clean the surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
 - 1. SSPC-SP 3, "Power Tool Cleaning."
- C. Priming: Immediately after surface preparation, apply primer according to Manufacturer's written instructions and at rate recommended by SSPC to provide a dry film thickness of not less than 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
 - 1. Stripe paint comers, crevices, bolts, welds, and sharp edges.
 - 2. Apply two coats of shop paint to inaccessible surfaces after assembly or erection. Change color of second coat to distinguish it from first.
- D. Painting: Apply a 1-coat, non-asphaltic primer complying with SSPC-PS Guide 7.00, "Painting System Guide 7.00: Guide for Selecting One-Coat Shop Painting Systems," to provide a dry film thickness of not less than 1.5 mils.

2.7 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123.

1. Fill vent holes and grind smooth after galvanizing.
2. Galvanize lintels and shelf angles attached to structural-steel frame and located in exterior walls.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedment, with steel erector present, for compliance with requirements.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place, unless otherwise indicated.
 1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

3.3 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC "Code of Standard Practice for Steel Buildings and Bridges" and "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design".
- B. Base and Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting base and bearing plates. Clean bottom surface of base and bearing plates.
 1. Set base and bearing plates for structural members on wedges, shims, or setting nuts as required.
 2. Weld plate washers to top of base plate.
 3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of base or bearing plate before packing with grout.
 4. Promptly pack grout solidly between bearing surfaces and base or bearing; plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow it to cure. Comply with Manufacturer's written installation instructions for shrinkage-resistant grouts.
- C. Maintain erection tolerances of structural steel within AISC "Code of Standard Practice for Steel Buildings and Bridges."
- D. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 1. Level and plumb individual members of structure.
 2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.
- E. Splice members only where indicated.

- F. Do not use thermal cutting during erection unless approved by Engineer. Finish thermally cut sections within smoothness limits in AWS D1.1.
- G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

3.4 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts according to RCSC "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type: Snug tightened, unless noted or indicated otherwise.
- B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.
 - 1. Comply with AISC "Code of Standard Practice for Steel Buildings and Bridges" and "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design", for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
 - 2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
 - 3. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC "Code of Standard Practice for Steel Buildings and Bridges" for mill material.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.
- B. Bolted Connections: Shop-bolted connections will be tested and inspected according to RCSC "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- C. Welded Connections: Field welds will be visually inspected according to AWS D1.1.
- D. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

3.6 REPAIRS AND PROTECTION

- A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and Manufacturer's written instructions.
- B. Touchup Painting: After installation, promptly clean, prepare, and prime or re-prime field connections, rust spots, and abraded surfaces of prime-painted joists and accessories, bearing plates, and abutting structural steel.
 - 1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
 - 2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.
- C. Touchup Painting: Cleaning and touchup painting are specified in Section 09 90 00, PAINTING AND PROTECTIVE COATINGS.

END OF SECTION

SECTION 05 31 00 - STEEL DECK

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Galvanized roof deck with prime painted bottom surface.
- B. Related Sections:
 - 1. Section 05 50 00 - Metal Fabrications
 - 2. Section 09 90 00 – Painting and Protective Coatings

1.2 SUBMITTALS

- A. Product Data: For each type of deck, accessory, and product indicated.
- B. Shop Drawings: Show layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.
- C. Product Certificates: For each type of steel deck, signed by product manufacturer.

1.3 QUALITY ASSURANCE

- A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI "North American Specification for the Design of Cold-Formed Steel Structural Members."

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Steel Deck:
 - a. ASC Profiles, Inc.
 - b. Canam Steel Corp.; The Canam Manac Group.
 - c. Consolidated Systems, Inc.
 - d. DACS, Inc.
 - e. D-Mac Industries Inc.
 - f. Epic Metals Corporation.
 - g. Marlyn Steel Decks, Inc.
 - h. New Millennium Building Systems, LLC.
 - i. Nucor Corp.; Vulcraft Division.
 - j. Roof Deck, Inc.
 - k. United Steel Deck, Inc.
 - l. Valley Joist; Division of EBSCO Industries, Inc.
 - m. Verco Manufacturing Co.

- n. Wheeling Corrugating Company; Div. of Wheeling-Pittsburgh Steel Corporation.
- o. Approved equal.

2.2 ROOF DECK

- A. Steel Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 30, and with the following:
 - 1. Galvanized Steel Sheet: ASTM A 653, Structural Steel (SS), Grade 33, and G90 zinc coating.
 - 2. Prime paint underside of galvanized deck with manufacturer's standard baked on, rust inhibited primer.
 - 3. Deck Profile: Type B, wide rib.
 - 4. Profile Depth: 1-1/2".
 - 5. Design Uncoated-Steel Thicknesses: As indicated.
 - 6. Span Condition: Furnish in longest practical lengths with no individual sheet shorter than that required to span 3 joists.
 - 7. Side Laps: Overlapped or interlocking seam at Contractor's option.

2.3 ACCESSORIES

- A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.
- B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.
- C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.
- D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.
- E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359" design, uncoated thickness, of same material and finish as deck; of profile indicated or required for application.
- F. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck, unless otherwise indicated.
- G. Flat Sump Plate: Single-piece steel sheet, 0.0747" thick, of same material and finish as deck. For drains, cut holes in the field.
- H. Galvanizing Repair Paint: ASTM A 780, SSPC-Paint 20 or DOD-P-21035, with dry film containing a minimum of 94% zinc/dust by weight.
- I. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

3.2 INSTALLATION, GENERAL

- A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 30, manufacturer's written instructions, and requirements in this Section.
- B. Install temporary shoring before placing deck panels, if required to meet deflection limitations.
- C. Locate deck bundles to prevent overloading of supporting members.
- D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.
- E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.
- F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.
- G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.

3.3 ROOF-DECK INSTALLATION

- A. Fasten roof-deck panels to steel supporting members using Buildex #12 screws or approved equal.
 - 1. Spacing: As noted on the drawings.
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of 1/2 of the span or 18", and as noted, and as follows:
 - 1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.
 - 2. Minimum 2 fasteners per span.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2", with end joints as follows:
 - 1. End Joints: Lapped 2" minimum.
- D. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Mechanically fasten to substrate to provide a complete deck installation.
- E. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Owner may engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Field connections will be subject to inspection.
- C. Testing agency will report inspection results promptly and in writing to Contractor and Engineer.
- D. Remove and replace work that does not comply with specified requirements.

- E. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.5 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Repair Painting: Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation, and apply repair paint.
 - 1. Apply repair paint, of same color as adjacent shop-primed deck, to bottom surfaces of deck exposed to view.
- C. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 05 40 00 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Interior wall framing.
- B. Related Sections include the following:
 - 1. Division 05 Section "Metal Fabrications" for masonry shelf angles and connections.

1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide cold-formed metal framing capable of withstanding design loads within limits and under conditions indicated.
 - 1. Design Loads: As follows:
 - a. Dead Loads: Weights of materials and construction.
 - b. Wind Loads: 5 psf.
 - c. Seismic Loads: As required by the International Building Code Latest Edition and shall not be less than 0.182WP (total weight of partition).
 - 2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
 - a. Interior Wall Framing: Horizontal deflection of 1/360 of the wall height under horizontal loads.
 - 3. Design framing systems to provide for movement of framing members without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F (67 deg C).
 - 4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:
 - a. Upward and downward movement of 1 1/2 inches (38mm), unless noted or indicated otherwise.
- B. Cold-Formed Steel Framing, General: Design according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions."

1.4 SUBMITTALS

- A. Product Data: For each type of cold-formed metal framing product and accessory indicated.
- B. Shop Drawings: Show layout, spacings, sizes, thicknesses, and types of cold-formed metal framing; fabrication; and fastening and anchorage details, including mechanical fasteners. Show reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
 - 1. For cold-formed metal framing indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

- C. Welding certificates.
- D. Qualification Data: For professional engineer.
- E. Product Test Reports: From a qualified testing agency, unless otherwise stated, indicating that each of the following complies with requirements, based on evaluation of comprehensive tests for current products:
 1. Steel sheet.
 2. Expansion anchors.
 3. Power-actuated anchors.
 4. Mechanical fasteners.
 5. Vertical deflection clips.
 6. Horizontal drift deflection clips
 7. Miscellaneous structural clips and accessories.
- F. Research/Evaluation Reports: For cold-formed metal framing.

1.5 QUALITY ASSURANCE

- A. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.
- B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of cold-formed metal framing that are similar to those indicated for this Project in material, design, and extent.
- C. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM E 329 to conduct the testing indicated.
- D. Product Tests: Mill certificates or data from a qualified independent testing agency indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements and metallic-coating thickness.
- E. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."
- F. Fire-Test-Response Characteristics: Where indicated, provide cold-formed metal framing identical to that of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.
- G. AISI Specifications and Standards: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" and its "Standard for Cold-Formed Steel Framing - General Provisions."
 1. Comply with AISI's "Standard for Cold-Formed Steel Framing - Truss Design."
 2. Comply with AISI's "Standard for Cold-Formed Steel Framing - Header Design."
- H. Comply with AISI's "Standard for Cold-Formed Steel Framing - Prescriptive Method for One and Two Family Dwellings."
- I. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering cold-formed metal framing that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide cold-formed metal framing by one of the following:
 - 1. Allied Studco.
 - 2. AllSteel Products, Inc.
 - 3. California Expanded Metal Products Company.
 - 4. Clark Steel Framing.
 - 5. Consolidated Fabricators Corp.; Building Products Division.
 - 6. Craco Metals Manufacturing, LLC.
 - 7. Custom Stud, Inc.
 - 8. Dale/Incor.
 - 9. Design Shapes in Steel.
 - 10. Dietrich Metal Framing; a Worthington Industries Company.
 - 11. Formetal Co. Inc. (The).
 - 12. Innovative Steel Systems.
 - 13. MarinoWare; a division of Ware Industries.
 - 14. Quail Run Building Materials, Inc.
 - 15. SCAFCO Corporation.
 - 16. Southeastern Stud & Components, Inc.
 - 17. Steel Construction Systems.
 - 18. Steeler, Inc.
 - 19. Super Stud Building Products, Inc.
 - 20. United Metal Products, Inc.

2.2 MATERIALS

- A. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
 - 1. Grade: As required by structural performance, or as indicated.
 - 2. Coating: G90 (Z725) or equivalent.
- B. Steel Sheet for Clips: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:
 - 1. Grade: As required by structural performance.
 - 2. Coating: G90 (Z275).

2.3 WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 68 Mil (.0713 inch).
 2. Flange Width: 1 5/8 inches.
 3. Section Properties: As required for loading conditions.
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: 68 Mil (.0713 inch).
 2. Flange Width: 1 1/4 inches (32 mm) minimum and as required for loading conditions.
- C. Vertical Deflection Clips: Manufacturer's standard bypass clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Dietrich Metal Framing; a Worthington Industries Company.
 - b. MarinoWare, a division of Ware Industries.
 - c. SCAFCO Corporation
 - d. The Steel Network, Inc.
 - e. Or approved equal.
- D. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.
1. Outer Track: Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal and lateral loads and transfer them to the primary structure, and as follows:
 - a. Minimum Base-Metal Thickness: As required for loading conditions and minimum thickness shall be 68 Mils (.0713 inch).
 - b. Flange Width: 1 inch (25mm) plus twice the design gap for other applications
 2. Inner Track: Of web depth indicated, and as follows:
 - a. Minimum Base-Metal Thickness: As required for loading conditions and minimum thickness shall be 68 Mils (.0713 inch)
 - b. Flange Width: As required for loading condition and vertical deflection noted.
- E. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure.

2.4 FRAMING ACCESSORIES

- A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.
- B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
 1. Supplementary framing.
 2. Bracing, bridging, and solid blocking.
 3. Web stiffeners.
 4. Anchor clips.
 5. End clips.
 6. Foundation clips.
 7. Gusset plates.
 8. Stud kickers, knee braces, and girts.
 9. Joist hangers and end closures.
 10. Hole reinforcing plates.

11. Backer plates.

2.5 ANCHORS, CLIPS, AND FASTENERS

- A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.
- B. Anchor Bolts: ASTM F 1554, Grade 55 threaded carbon-steel hex-headed bolts and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C unless noted or indicated otherwise.
- C. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.
- D. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing per ASTM E 1190 conducted by a qualified independent testing agency.
- E. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.
 - 1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.
- F. Welding Electrodes: Comply with AWS standards.

2.6 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: SSPC-Paint 20.
- B. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.
- C. Nonmetallic, Non-shrink Grout: Premixed, nonmetallic, noncorrosive, non-staining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107, with fluid consistency and 30-minute working time.
- D. Shims: Load bearing, high-density multi-monomer plastic, non-leaching.
- E. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch (6.4mm) thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

2.7 FABRICATION

- A. Fabricate cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.
 - 1. Fabricate framing assemblies using jigs or templates.
 - 2. Cut framing members by sawing or shearing; do not torch cut.
 - 3. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.

- a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by not less than three exposed screw threads.
- 4. Fasten other materials to cold-formed metal framing by welding, bolting, or screw fastening, according to Shop Drawings.
- B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.
- C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:
 - 1. Spacing: Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
 - 2. Squareness: Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 1/8 inch (3 mm).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Install load bearing shims or grout between the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations to ensure a uniform bearing surface on supporting concrete, steel or masonry construction.
- B. Install sealer gaskets to isolate the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

- A. Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.
- B. Install cold-formed metal framing according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions" and to manufacturer's written instructions unless more stringent requirements are indicated.
- C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.
 - 1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch (1.6 mm).
- D. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened.
 - 1. Cut framing members by sawing or shearing; do not torch cut.
 - 2. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.

- a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetration.
- E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.
- F. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.
- G. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.
- H. Install insulation, specified elsewhere, in built-up framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work and as noted or indicated.
- I. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.
- J. Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:
 - 1. Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
- K. Install horizontal bridging in stud system, spaced as indicated on Shop Drawings. Fasten at each stud intersection.
 - 1. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs with a minimum of 2 screws into each flange of the clip angle for framing members up to 6 inches (150 mm) deep.
 - 2. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
 - 3. Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.
- L. Install steel sheet diagonal bracing straps to both stud flanges, terminate at and fasten to reinforced top and bottom tracks. Fasten clip-angle connectors to multiple studs at ends of bracing and anchor to structure.
- M. Install miscellaneous framing and connections, including supplementary framing, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.4 WALL INSTALLATION

- A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.
- B. Fasten both flanges of studs to bottom track, unless otherwise indicated. Space studs as follows:

1. Stud Spacing: As indicated.
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.
- D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
1. Install single-leg deflection tracks and anchor to building structure.
 2. Install double deep-leg deflection tracks and anchor outer track to building structure.
 3. Connect vertical deflection clips to bypassing studs and anchor to building structure.
 4. Connect drift clips to cold formed metal framing and anchor to building structure.
- E. Install horizontal bridging in wall studs, spaced in rows indicated on Shop Drawings but not more than 48 inches (1220 mm) apart. Fasten at each stud intersection.
1. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches (305 mm) of single deflection track. Install a combination of flat, taut, steel sheet straps of width and thickness indicated and stud or stud-track solid blocking of width and thickness matching studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
 - a. Install solid blocking at centers indicated on Shop Drawings.
 2. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
 3. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
 4. Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.
- F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, fasteners, and stud girts, to provide a complete and stable wall-framing system.

3.5 FIELD QUALITY CONTROL

- A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Field and shop welds will be subject to testing and inspecting.
- C. Testing agency will report test results promptly and in writing to Contractor and Architect.
- D. Remove and replace work where test results indicate that it does not comply with specified requirements.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.6 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer, that ensure that cold-formed metal framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 05 50 00 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Steel framing and supports for overhead doors.
 2. Steel framing and supports for mechanical and electrical equipment.
 3. Steel framing and supports for applications where framing and supports are not specified in other Sections.
 4. Shelf angles.
 5. Loose bearing and leveling plates.
 6. Steel welded plates and angles for casting into concrete not specified in other Sections.
 7. Miscellaneous steel trim including steel angle corner guards and steel edgings.
 8. Metal ladders.
 9. Metal bollards.
 10. Pipe guards.
 11. Metal floor plate and supports.
 12. Abrasive metal nosing, treads, and thresholds.
- B. Products furnished, but not installed, under this Section include the following:
1. Loose steel lintels.
 2. Anchor bolts, steel pipe sleeves, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
- C. Related Sections:
1. Section 03 30 00 – Cast-In-Place Concrete.
 2. Section 04 22 00 – Unit Masonry Assemblies.
 3. Section 05 12 00 – Structural Steel.
 4. Section 05 51 00 – Metal Stairs.
 5. Section 05 52 13 – Pipe and Tube Railings.
 6. Section 05 53 00 – Metal Gratings and Plank.
 7. Section 07 92 00 – Joint Sealants.
 8. Section 09 90 00 – Painting and Protective Coatings.

1.2 PERFORMANCE REQUIREMENTS

- A. Structural Performance of Ladders: Provide ladders capable of withstanding the effects of loads and stresses within limits and under conditions specified in ANSI A14.3.
- B. Thermal Movements: Provide exterior metal fabrications that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change (Range): 120 °F, ambient; 180 °F, material surfaces.

1.3 SUBMITTALS

- A. Product Data: For the following:
1. Metal nosing and treads.
 2. Paint products.
 3. Fall Protection (ladder).
 4. Metal Floor Plate and support.

- B. Shop Drawings: Show fabrication and installation details for metal fabrications.
 - 1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
 - 2. Provide templates for anchors and bolts specified for installation under other Sections.
 - 3. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Samples for Verification: For each type and finish of extruded nosing and tread.
- D. Mill Certificates: Signed by Manufacturers of stainless-steel sheet certifying that products furnished comply with requirements.
- E. Welding certificates.

1.4 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1, "Structural Welding Code--Steel."
 - 2. AWS D1.2, "Structural Welding Code--Aluminum."
 - 3. AWS D1.3, "Structural Welding Code--Sheet Steel."
 - 4. AWS D1.6, "Structural Welding Code--Stainless Steel."

1.5 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication and indicate measurements on Shop Drawings.
 - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.
 - 2. Provide allowance for trimming and fitting at site.

1.6 COORDINATION

- A. Coordinate installation of anchorages for metal fabrications. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- B. Coordinate installation of steel weld plates and angles for casting into concrete that are specified in this Section but required for work of another Section. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.

2. Available Manufacturers: Subject to compliance with requirements, Manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces, unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Ferrous Metals
 1. Steel Plates, Shapes, and Bars: ASTM A 36.
 2. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304 or 316.
 3. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304 or 316.
 4. Steel Tubing: ASTM A 500, cold-formed steel tubing.
 5. Steel Pipe: ASTM A 53, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.
 6. Cast Iron: ASTM A 48, Class 30, unless another class is indicated or required by structural loads.
- C. Nonferrous Metals
 1. Aluminum Plate and Sheet: ASTM B 209, Alloy 6061-T6.
 2. Aluminum Extrusions: ASTM B 221, Alloy 6061-T6.
 3. Aluminum-Alloy Rolled Tread Plate: ASTM B 632, Alloy 6061-T6.
 4. Aluminum Castings: ASTM B 26, Alloy 443.0-F.

2.3 FASTENERS

- A. General: Unless otherwise indicated, provide Type, 304 or 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, at exterior walls. Provide stainless-steel fasteners for fastening aluminum. Select fasteners for type, grade, and class required.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A, with hex nuts, ASTM A 563; and, where indicated, flat washers.
 1. Finish: Plain or Hot Dip Zinc-coated ASTM A153 Class C, as indicated.
- C. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, nuts and, where indicated, flat washers; ASTM F 593, AISI Type 316, Condition CW for bolts and ASTM F 594 for AISI Type 316, Condition CW nuts.
 1. All threads on stainless steel rods/bolts shall be protected with anti-seize lubricant suitable for submerged stainless bolts and complying with Federal Specification MIL-A-907E.
- D. Anchor Bolts: ASTM F 1554, Grade 36 or Grade 55, as required or shown on the drawings.
 1. Provide hot-dip or mechanically deposited, zinc-coated anchor bolts where item being fastened is indicated to be galvanized.
- E. Machine Screws: ASME B 18.6.3.
- F. Lag Bolts: ASME B 18.2.1.
- G. Wood Screws: Flat head, ASME B18.6.1.
- H. Plain Washers: Round, ASME B 18.22.1.

- I. Lock Washers: Helical, spring type, ASME B 18.21.1.
- J. Cast-in-Place Anchors in Concrete: Anchors capable of sustaining, without failure, a load equal to four times the load imposed, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
 - 1. Threaded or wedge type; galvanized ferrous castings either: ASTM A 47 malleable iron or ASTM A 27, cast steel. Provide bolts, washers, and shims as needed, hot-dip galvanized per ASTM A 153.
- K. Expansion Anchors: Anchor bolt and sleeve assembly with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
 - 1. Material for Anchors in Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.
 - 2. Material for Anchors in Exterior Locations: ASTM F 593, AISI Type 316, Condition CW for bolts and ASTM F 594 for AISI Type 316, Condition CW nuts.
 - 3. Expansion anchors shall not be substituted for adhesive anchors.
- L. Adhesive Anchors:
 - 1. Threaded Rod:
 - a. ASTM F 593 stainless steel threaded rod, diameter as shown on Drawings.
 - b. Length as required to provide minimum depth of embedment.
 - c. Clean and free of grease, oil, or other deleterious material.
 - d. For hollow-unit masonry, provide galvanized or stainless steel wire cloth screen tube to fit threaded rod.
 - 2. Adhesive:
 - a. Two-component, insensitive to moisture, designed to be used in adverse freeze/thaw environments, with gray color after mixing.
 - b. Cure Temperature, Pot Life, and Workability: Compatible for intended use and environmental conditions.
 - c. Nonsag, with selected viscosity based on installation temperature and overhead application where applicable.
 - d. HILTI HIT HY-200 or approved equal.
 - 3. Packaging:
 - a. Disposable, self-contained cartridge system capable of dispensing both components in the proper mixing ratio and fitting into a manually or pneumatically operated caulking gun.
 - b. Cartridge Marking: Include manufacturer's name, product name, material type, batch serial number, and adhesive expiration date.
 - 4. Manufacturers and Products:
 - a. Hilti, Inc.
 - 1) HIT-HY 200 for concrete.
 - 2) HIT-HY 70 for hollow and grout-filled masonry.
 - b. Or Approved Equal.
 - 1) It is the contractor's responsibility to provide sufficient documentation so that the Engineer may determine if the submitted product meets or exceeds the specified product(s). If sufficient documentation is not provided in a legible manner, then the submitted product will be rejected.

2.4 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Shop Primers: Provide primers that comply with Division 9.

- C. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79.
 - 1. Use primer with a VOC content of 420 g/L (3.5 lb/gal.), or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- D. Zinc-Rich Primer: Complying with SSPC-Paint 20 or SSPC-Paint 29 and compatible with topcoat.
 - 1. Use primer with a VOC content of 420 g/L (3.5 lb/gal.), or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Available Products:
 - a. Benjamin Moore & Co.; Epoxy Zinc-Rich Primer CM18119.
 - b. Carboline Company; Carbozinc 621.
 - c. ICI Devoe Coatings; Catha-Coat 313.
 - d. International Coatings Limited; Interzinc 315 Epoxy Zinc-Rich Primer.
 - e. PPG Architectural Finishes, Inc.; Aquapon Zinc-Rich Primer 97-670.
 - f. Sherwin-Williams Company (The); Corothane I GalvaPac Zinc Primer.
 - g. Tnemec Company, Inc.; Tneme-Zinc 90-97.
- E. Galvanizing Repair Paint: High-zinc-dust-content paint for re-galvanizing welds in steel, complying with SSPC-Paint 20.
- F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.5 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. 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.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32", unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal comers to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work true to line and level with accurate angles and surfaces and straight edges.
- E. Weld comers and seams continuously to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts, unless otherwise indicated. Locate joints where least conspicuous.
- G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

- H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- I. Provide for anchorage of type indicated; coordinate with supporting structure, and space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Design and provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.
 - 1. Fabricate units from slotted channel framing where indicated.
 - 2. Furnish inserts if units are installed after concrete is placed.
- C. Galvanize miscellaneous framing and supports where indicated.
- D. Prime miscellaneous framing and supports with zinc-rich primer where indicated.

2.7 LOOSE STEEL LINTEL

- A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Weld adjoining members together to form a single unit where indicated.
- B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span but not less than 8", unless otherwise indicated.
- C. Provide galvanized loose steel lintels located in exterior walls.
- D. Prime loose steel lintels located in interior walls with zinc-rich primer.

2.8 LOOSE BEARING AND LEVELING PLATES

- A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.
- B. Galvanize plates after fabrication.
- C. Prime plates with zinc-rich primer.

2.9 STEEL WELD PLATES AND ANGLES

- A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with not less than two integrally welded steel strap anchors for embedding in concrete.

2.10 MISCELLANEOUS STEEL TRIM

- A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

- B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
 - 1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.
- C. Galvanize exterior miscellaneous steel trim.
- D. Prime interior miscellaneous steel trim, with zinc-rich primer.

2.11 METAL LADDERS

- A. General:
 - 1. Comply with the more stringent requirements of OSHA and ANSI A14.3, unless indicated otherwise.
 - 2. Space side rails 16" clear apart, unless otherwise indicated.
 - 3. Support each ladder at top and bottom and not more than 60" o.c. with welded or bolted brackets, made from same metal as ladder.
 - 4. All ladders including ladders less than 20 feet in height shall be equipped with an integral fall protection system.
- B. Extension (Pop-up). Every ladder that does not have an exterior hand hold shall be equipped with a pop-up extension designed by the ladder manufacturer.
 - 1. Pop-up extension shall be of the same material and finish as the ladder with telescoping tubular section that locks automatically when fully extended.
 - 2. Upward and downward movement shall be controlled by stainless steel spring balancing mechanisms.
 - 3. Units shall be completely assembled with fasteners for securing to the ladder rungs in accordance with the manufacturer's recommendations.
- C. Fall Prevention System (Ladder):
 - 1. All ladders, including ladders less than 20 feet in height, shall be equipped with an integral fall prevention system. The fall prevention system at each ladder shall include a permanent metal carrier rung/rail, carrier rung/rail extension as required, sliding sleeve arresting unit, ladder rung clamps, full body harness, dismount section and all other components as necessary for complete installation and system to comply with OSHA and ANSI A14.3 standards and requirements.
 - a. The fall prevention system manufacturer shall design each fall prevention system, coordinate with the ladder manufacturer and submit the fall prevention system design and detailed plans to the Engineer for approval.
 - b. The carrier rung/rail shall be Type 316 stainless steel or aluminum alloy 6105-T5.
 - c. Carrier rung/rail extensions shall be provided for safe ladder access and egress. The total carrier rung/rail length shall be as designed by the fall prevention system manufacturer.
 - d. Available Manufacturers:
 - 1). Sellstorm Manufacturing
 - 2). North Safety Products, Ltd.
 - 3). Or approved equal.
- D. Steel Ladders:
 - 1. Fit rungs in centerline of side rails; plug-weld and grind smooth on outer rail faces.
 - 2. Rung spacing shall not exceed 12 inches on center.
 - 3. Provide non-slip surfaces on top of each rung by coating with abrasive material metallurgically bonded to rung by a proprietary process.
 - 4. Available Products:
 - a. IKG Industries, a Harsco company; Mebac.
 - b. W. S. Molnar Company; SlipNOT.

5. Galvanize exterior ladders and interior ladders, unless indicated otherwise, including brackets and fasteners.

E. Aluminum Ladders:

1. Fit rungs in centerline of side rails; fasten by welding or with stainless-steel fasteners or brackets and aluminum rivets.
2. Rung spacing shall not exceed 12 inches on center.
3. Provide non-slip surfaces on top of each rung by coating with abrasive material metallurgically bonded to rung by a proprietary process.
4. Available Products:
 - a. IKG Industries, a Harsco company; Mebac.
 - b. W. S. Molnar Company; SlipNOT.

2.12 METAL FLOOR PLATE

- A. Also referenced as "Checkered" or "Check" Plate, with raised lugs on one side and smooth surface on other side.
- B. Fabricate from roller-aluminum-alloy 6061-T6, ASTM B 632 plate of thickness indicated below. Raised lug pattern shall be on top and start at 45° angle to edge of plate or tread.
- C. Provide stainless steel or aluminum angle stiffeners and/or aluminum beam supports, as indicated or required.
- D. Provide flush stainless steel bar drop handles for lifting removable sections. Provide one at each end of each section.
- E. All ends and openings shall be banded and sealed with a 1/4-inch neoprene gasket.
- F. The weight of a floor plate section shall not exceed 150 pounds.
- G. Aluminum surfaces in contact with concrete, grout or dissimilar metals will be protected with a coat of bituminous paint, Mylar isolators or other protective system, as approved by the Engineer.
- H. Available Manufacturers
 1. Thompson Fabricating, LLC; Tarrant, AL.
 2. Or approved equal.

2.13 METAL BOLLARDS

- A. Fabricate metal bollards from 6" diameter steel pipe and fill with non-structural concrete. Refer to drawings and standard details for locations and anchorage details.
- B. Paint exposed portions of pipe with an OSHA safety yellow paint.

2.14 ABRASIVE METAL NOSINGS AND TREADS

- A. Cast-Metal Units: Cast aluminum, with an integral abrasive finish consisting of aluminum oxide, silicon carbide, or a combination of both. Fabricate units in sizes and configurations indicated and in lengths necessary to accurately fit openings or conditions.
 1. Manufacturers:
 - a. American Safety Tread Co., Inc.
 - b. Baleo Inc.

- c. Barry Pattern & Foundry Co., Inc.
 - d. Granite State Casting Co.
 - e. Safe-T-Metal Co.
 - f. Wooster Products Inc.
 - 2. Nosing: Cross-hatched units, 4" wide with 1/4" lip, for casting into concrete steps.
 - 3. Nosing: Cross-hatched units, 1-1/2" x 1-1/2", for casting into concrete curbs.
 - 4. Treads: Cross-hatched units, full depth of tread with 3/4" x 3/4" nosing, for application over bent plate treads or existing stairs.
- B. Extruded Units: Aluminum, with abrasive filler consisting of aluminum oxide, silicon carbide, or a combination of both, in an epoxy-resin binder. Fabricate units in sizes and configurations indicated and in lengths necessary to accurately fit openings or conditions.
- 1. Available Manufacturers:
 - a. ACL Industries, Inc.
 - b. American Safety Tread Co., Inc.
 - c. Amstep Products.
 - d. Armstrong Products, Inc.
 - e. Baleo Inc.
 - f. Granite State Casting Co.
 - g. Wooster Products Inc.
 - 2. Provide ribbed units, with abrasive filler strips projecting 1/16" above aluminum extrusion.
 - 3. Provide solid-abrasive-type units without ribs.
 - 4. Nosing: Square-back units, 3" wide, for casting into concrete steps.
 - 5. Nosing: Beveled-back units, 3" wide with 1-3/8" lip, for surface mounting on existing stairs.
 - 6. Nosing: Two-piece units, 3" wide, with sub channel for casting into concrete steps.
 - 7. Treads: Beveled-back units, full depth of tread with 1-3/8" lip, for application over existing stairs.
- C. Provide anchors for embedding units in concrete, either integral or applied to units, as standard with Manufacturer.
- D. Drill for mechanical anchors and countersink. Locate not more than 4" from ends and not more than 12" o.c., evenly spaced between ends, unless otherwise indicated. Provide closer spacing if recommended by Manufacturer.
- 1. Provide 2 rows of holes for units more than 5" wide, with 2 holes aligned at ends and intermediate holes staggered.
- E. Apply bituminous paint, Mylar isolators or other protective system as approved by the Engineer to concealed bottoms, sides, and edges of cast-metal units set into concrete

2.15 FINISHES, GENERAL

- A. Comply with NAAMM "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish metal fabrications after assembly according to the paintings and protective coatings specification.

2.16 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:
 - 1. ASTM A 123 for galvanizing steel and iron products.
 - 2. ASTM A 153 for galvanizing steel and iron hardware.

- 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) and Items Indicated to Receive Zinc-Rich primer: SP 6/NACE No.3, "Commercial Blast Cleaning."
 - 2. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."
- C. Shop Priming: Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No.1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
 - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

2.17 STAINLESS-STEEL FINISHES

- A. Remove tool and die marks and stretch lines or blend into finish.
- B. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.
- C. Bright, Directional Satin Finish: No.4.
- D. Dull Satin Finish: No.6.
- E. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

2.18 ALUMINUM FINISHES

- A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- B. As-Fabricated Finish: AA-M10 (Mechanical Finish: as fabricated, unspecified).
- C. Class 1, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: non-specular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class 1, clear coating 0.018 mm or thicker) complying with AAMA 611.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. 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 surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. Field Welding: Comply with the following requirements:
 - 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 no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag bolts, wood screws, and other connectors.
- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- F. Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.
- 3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS
- A. General: Install framing and supports to comply with requirements of items being supported, including Manufacturers' written instructions and requirements indicated on Shop Drawings.
- B. Install pipe columns on concrete footings with grouted baseplates. Position and grout column baseplates as specified in "Installing Bearing and Leveling Plates" Article.
- 3.3 INSTALLING BEARING AND LEVELING PLATES
- A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.
- B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.
1. Use non-shrink grout, nonmetallic, in concealed locations where not exposed to moisture; use non shrink, nonmetallic grout in exposed locations, unless otherwise indicated.
 2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.
- 3.4 INSTALLING METAL BOLLARDS
- A. Anchor bollards in concrete as indicated on the drawings.
- B. Anchor bollards in place with non-structural concrete, as indicated on the drawings. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.
- C. Fill bollards solidly with concrete, mounding top surface to shed water.
1. Do not fill removable bollards with concrete.
- 3.5 INSTALLING NOSINGS, TREADS, AND THRESHOLDS
- A. Center nosing on tread widths.
- B. For nosing embedded in concrete steps or curbs, align nosing flush with riser faces and level with tread surfaces.

- C. Seal thresholds exposed to exterior with elastomeric sealant complying with Section 07 92 00, JOINT SEALANTS to provide a watertight installation.

3.6 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - 1. Apply by brush or spray to provide a minimum 2.0 mil dry film thickness.
- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 9 painting Sections.
- C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION

SECTION 05 51 00 - METAL STAIRS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Pre-engineered industrial-type stairs with aluminum grating treads.
- B. Related Sections:
 - 1. Section 03 30 00 – Cast-In-Place Concrete.
 - 2. Section 05 50 00 – Metal Fabrications.
 - 3. Section 05 52 13 – Pipe and Tube Railings.

1.2 PERFORMANCE REQUIREMENTS

- A. Comply with the more stringent of IBC, OSHA and as follows.
- B. Structural Performance of Stairs: Design and provide metal stairs capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Uniform Load: 200 lbf/sq. ft.
 - 2. Concentrated Load: 300 lbf applied on an area of 4 sq. in.
 - 3. Uniform and concentrated loads need not be assumed to act concurrently.
 - 4. Stair tread, 250psf for tread itself.
 - 5. Platform and landings: Aluminum tread with uniform live load of 200 psf or a concentrated load of 1000 lbf over one (1) sq. ft. applied at midspan, whichever produces the greater effect.
 - 6. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
 - 7. Limit deflection of treads, platforms, and framing members to L/360 or 1/4" whichever is less.
- C. Structural Performance of Railings: As specified in Section 05 52 13, PIPE AND TUBE RAILING.
- D. Seismic Performance: Provide metal stairs capable of withstanding the effects of earthquake motions determined according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures"; Section 12, "Seismic Design Requirements for Building Structures."

1.3 SUBMITTALS

- A. Product Data: For metal stairs and the following:
- B. Shop Drawings: Include sealed calculations, plans, elevations, sections, details, and attachments to other work.
 - 1. Provide templates for anchors and bolts specified for installation under other Sections.
 - 2. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation, licensed in the State where the work is located.
- C. Samples for Initial Selection: For products involving selection of color, texture, or design.
- D. Samples for Verification: For the following products, in Manufacturer's standard sizes:
 - 1. Grating treads.

- 2. Abrasive nosings.
- E. Welding certificates.
- F. Qualification Data: For professional engineer and testing agency.
- G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for stairs and railings.
 - 1. Test railings according ASTM E 894 and ASTM E 935.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.
- B. NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM AMP 510, "Metal Stairs Manual," for class of stair designated, unless more stringent requirements are indicated.
 - 1. Industrial-Type Stairs: Industrial class.
- C. Welding: Qualify procedures and personnel according to the following:
 - 1. AWS D1.2 "Structural Welding Code – Aluminum."
- D. Professional Engineer qualifications.

1.5 COORDINATION

- A. Coordinate installation of anchorages for metal stairs. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to project site in time for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
 - 2. Available Manufacturers: Subject to compliance with requirements, Manufacturers offering products that may be incorporated into the Work include, but are not limited to; Manufacturers specified.

2.2 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces, unless otherwise indicated, for components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Aluminum Extrusions: ASTM B 221, Alloy 6061- T6.
- C. Aluminum Castings: ASTM B 26, Alloy 443.0-F.

2.3 ABRASIVE NOSINGS

- A. As specified in Section 05 50 00, METAL FABRICATIONS.
- B. Provide anchors for embedding units in concrete, either integral or applied to units, as standard with Manufacturer.
- C. Apply bituminous paint to concealed bottoms, sides, and edges of cast-metal units set into concrete.
- D. Apply clear lacquer to concealed bottoms, sides, and edges of extruded units set into concrete.

2.4 FASTENERS

- A. As specified in Section 05 50 00, METAL FABRICATIONS.

2.5 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Bituminous Paint: Cold, applied asphalt emulsion complying with ASTM D 1187.
- C. Non-shrink, Nonmetallic Grout: Factory-packaged, non-staining, non-corrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by Manufacturer for interior and exterior applications.
- D. Concrete Materials and Properties: Comply with requirements in Section 03 30 00, Cast-in-Place Concrete for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi unless otherwise indicated.
- E. Non slip-Aggregate Concrete Finish: Factory-packaged abrasive aggregate made from fused, aluminum-oxide grits or crushed emery; rustproof and non-glazing; unaffected by freezing, moisture, or cleaning materials.
- F. Welded Wire Reinforcing: ASTM A 185, 6" X 6" W1.4 X W1.4, unless otherwise indicated.

2.6 FABRICATION, GENERAL

- A. Provide complete stair assemblies, including metal framing, hangers, struts, railings, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.
 - 1. Join components by welding, unless otherwise indicated.
 - 2. Use connections that maintain structural value of joined pieces.
 - 3. Fabricate treads and platforms of exterior stairs so finished walking surfaces slope to drain.
- B. Preassembled Stairs: Assemble stairs in shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32", unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

- D. Form bent-metal comers to smallest radius possible without causing grain separation or otherwise impairing work.
- E. Form exposed work true to line and level with accurate angles and surfaces and straight edges.
- F. Weld connections to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. Weld exposed comers and seams continuously, unless otherwise indicated.
 - 5. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flathead (countersunk) screws or bolts unless otherwise indicated. Locate joints where least conspicuous.
- H. Fabricate joints that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

2.7 ALUMINUM-FRAMED STAIRS

- A. Manufacturers:
 - 1. Alfab, Inc.
 - 2. American Stair, Inc.
 - 3. Sharon Companies Ltd. (The).
 - 4. Approved Equal.
- B. Stair Framing:
 - 1. Fabricate stringers of Aluminum channels.
 - a. Provide closures for exposed ends of channel stringers.
 - b. Minimum stringer size shall be C 12x10.37.
 - 2. Construct platforms of Aluminum channel headers and miscellaneous framing members as needed to comply with performance requirements.
 - 3. Weld or bolt stringers to headers; weld or bolt framing members to stringers and headers. If using bolts, fabricate and join so bolts are not exposed on finished surfaces.
 - 4. Columns shall be aluminum tube as required, minimum size AL 3x3x3/16.
 - 5. Treads shall be aluminum from rolled aluminum alloy tread, alloy T6061-T6, ATM B632 or aluminum grating as indicated. Tread plate shall have raised lugs on the top surface. Grating for treads shall have integral corrugated nosing.
 - a. Form treads with integral nosing and back edge stiffener. Form risers of same material as treads.
 - b. Weld supporting brackets to stringers and weld treads to brackets.
 - c. Fabricate platforms with integral nosings matching treads and weld to platform framing.
 - 6. Provide lateral support and bracing as required by design.
- C. Metal Bar-Grating Stairs: Form treads and platforms to configurations shown from metal bar grating; fabricate to comply with NAAMM MBG 531, "Metal Bar Grating Manua1."
 - 1. Fabricate treads and platforms from welded Aluminum grating with 1-1/2" by 3/16" bearing bars at 15/16" o.c. and crossbars at 4" o.c., NAAMM designation: W-15-4 (1-1/4"x 3/16") STEEL.

2. Surface: Serrated.
3. Fabricate grating treads with cast abrasive nosing and with steel angle or steel plate carrier at each end for stringer connections. Secure treads to stringers with bolts.
4. Fabricate grating platforms with nosing matching that on grating treads. Provide toe plates at open-sided edges of grating platforms. Weld grating to platform framing.

2.8 STAIR RAILINGS

- A. As specified in Section 05 52 13, PIPE AND TUBE RAILINGS for railings.

2.9 FINISHES

- A. Comply with NAAMM "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish metal stairs after assembly.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.
- 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 surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- E. Field Welding: Comply with the following requirements:
 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 no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- F. Place and finish concrete till for treads and platforms to comply with Section 03 30 00, CAST-IN-PLACE CONCRETE.
 1. Install abrasive nosings with anchors fully embedded in concrete, center nosings on tread width.
- G. Install pre-cast concrete treads with adhesive supplied by Manufacturer.

3.2 INSTALLING METAL STAIRS WITH GROUTED BASEPLATES

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of baseplates.

- B. Set stair baseplates on wedges, shims, or leveling nuts. After stairs have been positioned and aligned, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.
 - 1. Use nonmetallic, non-shrink grout, unless otherwise indicated.
 - 2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

END OF SECTION

SECTION 05 52 13 - PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Aluminum Railings.
 - 2. Stainless Steel Railings.
 - 3. Steel Railings.
- B. Related Sections:
 - 1. Section 05 50 00 – Metal Fabrications.
 - 2. Section 09 90 00 – Painting and Protective Coatings.

1.2 PERFORMANCE REQUIREMENTS

- A. General: In engineering railings to withstand structural loads indicated, design of railing materials shall be based on the following:
 - 1. Aluminum Railing: Design in accordance with Aluminum Design Manual, latest edition.
 - 2. Steel Railing: Design in accordance with the Steel Construction Manual, latest edition.
 - 3. Allowable Deflections: L/180 max
- B. Structural Performance: Provide railings capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Handrails:
 - a. Uniform load of 50 lbf/ ft. applied in any direction.
 - b. Concentrated load of 200 lbf applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
 - 2. Top Rails of Guards:
 - a. Uniform load of 50 lbf/ ft. (0.73 kN/m) applied in any direction.
 - b. Concentrated load of 200 lbf applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
 - 3. Infill of Guards:
 - a. Concentrated load of 200 lbf (0.89 kN) applied horizontally on an area of 1 ft².
 - b. Uniform load of 25 lbf / ft² applied horizontally.
 - c. Infill load and other loads need not be assumed to act concurrently.
- C. Thermal Movements: Provide exterior railings that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base the engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 °F, ambient; 180 °F, material surfaces.
- D. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.3 SUBMITTALS

- A. Product Data: For the following:
 - 1. Manufacturer's product lines of mechanically connected railings.
 - 2. Grout, anchoring cement, and paint products.
- B. Shop Drawings:

1. Include plans, elevations, sections, details, and attachments to other work. Also, provide locations and details for any post stiffeners, as required by design.
 2. Include structural analysis and design calculations signed and sealed by a qualified professional engineer licensed in the state of the work.
- C. Samples for Owner's Selection: For products involving selection of color, texture, or design.
- D. Samples for Verification: For each type of exposed finish required.
1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters.
 2. Fittings and brackets.
 3. Assembled Sample of railing system, made from full-size components, including top rail, post, handrail, and infill. Sample need not be full height.
 - a. Show method of finishing and connecting members at intersections.
- E. Mill Certificates: Signed by manufacturer certifying that products furnished comply with requirements.
- F. Welding certificates.
- G. Qualification Data: For testing agency.
- H. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, according to ASTM E 894 and ASTM E 935.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of railing through one source from a single Manufacturer.
- B. Welding: Qualify procedures and personnel according to the following:
1. AWS D1.1, "Structural Welding Code--Steel."
 2. AWS D1.2, "Structural Welding Code--Aluminum."
 3. AWS D1.6, "Structural Welding Code--Stainless Steel."

1.5 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication and indicate measurements on Shop Drawings.
1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating railings without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.
 2. Provide allowance for trimming and fitting at site.

1.6 COORDINATION AND SCHEDULING

- A. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- B. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

PART 2 - PRODUCTS

2.1 GENERAL

A. Metals:

1. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
2. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails, unless otherwise indicated.

B. Finishes:

1. Comply with NAAMM "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
2. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
3. 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 the 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.
4. Provide exposed fasteners with finish matching appearance, including color and texture, of railings or posts.

2.2 MATERIALS AND FINISHES

A. Aluminum

1. General: Provide alloy and temper as recommended by manufacturer to meet the type of use and finish indicated, and with not less than the strength and durability properties designated below.
2. Extruded Structural Pipe and Round Tubing: ASTM B 429, Alloy 6063-T6.
3. Drawn Seamless Tubing: ASTM B 210, Alloy 6063-T832.
4. Plate and Sheet: ASTM B 209, Alloy 6061-T6.
5. Die and Hand Forgings: ASTM B 247, Alloy 6061-T6.
6. Castings: ASTM B 26, Alloy A356.0-T6.
7. Finish, as follows:
 - a. Handrail Pipe and Posts: Anodized finish shall be AA-M32-C22-A41 and shall meet the requirements of AAMA 607.1
 - b. Cast Fittings and Toeboards: Anodized finish shall be AA-M10-C22-A41 and shall meet the requirements of AAMA 607.1
 - c. Pretreat aluminum by cleaning and removing marks before anodizing.

B. Stainless Steel

1. General: Provide type as recommended by manufacturer to meet the type of use and finish indicated, and with not less than the strength and durability properties designated below.
2. Type: 304 or 316
3. Pipe and Tubing: ASTM A 276
4. Plate and Sheet: ASTM A 666
5. Finish: Satin Finish, AISI 430/No. 4

C. Steel

1. General: Provide type as recommended by manufacturer to meet the type of use and finish indicated, and with not less than the strength and durability properties designated below.
2. Pipe: ASTM A 53
3. Tubing: ASTM A 500

4. Plate and Sheet: ASTM A 36
5. Castings: ASTM A 48
6. Finish: Provide painted finish, unless noted otherwise.
 - a. Surface Preparation: Remove loose scale, rust, grease, oil, moisture or other foreign materials to properly prepare the surface for subsequent coating application.
 - 1) Remove mill scale, rust and dirt following SSPC SP2 for hand cleaning and SSPC SP3 for power tool cleaning.
 - b. Prime and Paint, as indicated, in accordance with 09 90 00 Painting and Protective Coatings.
 - 1) Submit colors to Owner/Engineer for approval.
 - c. Galvanizing, as indicated on the drawings, shall be in accordance with ASTM A123 for shapes, plates, and bars and A 525 for sheeting.

2.3 RAIL AND POSTS

- A. Nominal 1-1/2" diameter.
- B. Rails: 1.900" outside diameter by 0.145" wall thickness. Schedule 40.
- C. Posts: 1.900" outside diameter by 0.200" wall thickness. Schedule 80.

2.4 FITTINGS

- A. General
 1. Refer to drawings for fitting, joint, and base details.
 2. Materials and finishes for all fittings, joints, and bases shall match the railing material. Alloy or material grade shall meet or exceed the alloy or material grade specified.

2.5 FASTENERS

- A. General: Provide the following:
 1. In accordance with Section 05 50 00, METAL FABRICATIONS
 2. Aluminum/Stainless Steel Railings: Type 304 or 316 stainless-steel fasteners.
 3. Steel Railings: ASTM A 307 steel fasteners.
- B. Locknuts, Washers, and Screws:
 1. Elastic Locknuts, Steel Flat Washers, RHMS Rounded Head Machine Screws; Type A 304 or A 316 stainless steel.
 2. Flat Washers: Molded Nylon
- C. Concrete Anchors: As specified in 05 50 00 Metal Fabrications.

2.6 FABRICATION

- A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.
- B. Assemble railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

- C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32" unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- D. Form work true to line and level with accurate angles and surfaces.
- E. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
- G. Non-welded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
 - 1. Fabricate splice joints for field connection using an epoxy structural adhesive if this is Manufacturer's standard splicing method.
- H. Close exposed ends of railing members with prefabricated end fittings.
- I. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4" or less.
- J. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.
- K. For railing posts set in concrete, provide steel sleeves not less than 6" long with inside dimensions not less than 1/2" greater than outside dimensions of post, with steel plate forming bottom closure.
- L. For removable railing posts, fabricate slip-fit sockets from stainless-steel tube or pipe whose ID is sized for a close fit with posts; limit movement of post without lateral load, measured at top, to not more than one-fortieth of post height. Provide socket covers designed and fabricated to resist being dislodged.
 - 1. Provide chain with eye, snap hook, and staple across gaps formed by removable railing sections at locations indicated. Fabricate from same metal as railings.
- M. Toeboards: Where indicated, provide toe boards at railings around openings and at edge of open-sided floors and platforms. Fabricate to dimensions and details indicated. Dimension between bottom of toeboard and walking surface not to exceed 1/4-inch.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements have been clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.2 INSTALLATION, GENERAL

- A. Fit exposed connections together to form tight, hairline joints and in accordance with Manufacturers written instructions.
- B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
 2. Set posts plumb within a tolerance of 1/16" in 3'.
 3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4" in 12'.
- C. Corrosion Protection: Prevent galvanic action and other forms of corrosion caused from direct contact with concrete and dissimilar metals by coating metal surfaces in accordance with manufacturers' recommendations and Section 09 90 00, PAINTING AND PROTECTIVE COATINGS.
- D. Adjust railings before anchoring to ensure matching alignment at abutting joints.
- E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.
- F. Mount handrails only on completed walls. Do not support handrails temporarily by means not satisfying structural performance requirements.

3.3 RAILING CONNECTIONS

- A. Set rails horizontal or parallel to slope of steps. Install posts and rails in the same plane. Remove projects or irregularities and provide smooth surface for sliding hand continuously along top rail. Use offset rail for use on stairs and platforms if post is attached to web of stringers or structural platform supports.
- B. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement, maximum interval of 54 feet on center and at structural joints. Provide slip-joint internal sleeve extending 2" beyond joint on either side, fasten internal sleeve securely to 1 side, and locate joint within 6" of post.

3.4 ANCHORING POSTS

- A. Where indicated, use steel pipe sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves fill annular space between the post and sleeve with non-shrink, nonmetallic grout, or anchoring cement mixed and placed to comply with anchoring material manufacturer's written instructions.
- B. Form or core-drill holes not less than 5" deep and 3/4" larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with non-shrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material per Manufacturer's written instructions.
- C. Leave anchorage joint exposed; wipe off surplus anchoring material; and leave 1/8" buildup, sloped away from post.
- D. Where indicated, anchor posts with fittings engineered for anchoring posts to concrete.
- E. Anchor posts to metal surfaces with oval flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:
 1. For aluminum pipe railings, attach posts using fittings designed and engineered for this purpose.
- F. Install removable railing sections, where indicated, in slip-fit metal sockets cast in concrete.

- G. Anchor bolts shall be stainless steel.

3.5 ANCHORING RAILING ENDS

- A. Anchor railing ends to concrete and masonry with round flanges connected to railing ends and anchored to wall construction with anchors and bolts.

3.6 ATTACHING HANDRAILS TO WALLS

- A. Attach handrails to wall with wall brackets. Provide brackets with 1-1/2" clearance from inside face of handrail and finished wall surface.
 - 1. Use type of bracket with predrilled hole for exposed bolt anchorage.
- B. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
- C. Secure wall brackets to building construction as follows:
 - 1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
 - 2. For hollow masonry anchorage, use toggle bolts.

3.7 ADJUSTING AND CLEANING

- A. Clean railing by washing thoroughly with clean water and soap and rinsing with clean water.

3.8 PROTECTION

- A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing Manufacturer. Remove protective coverings at time of Substantial Completion.
- B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION

SECTION 05 53 00 - METAL GRATINGS AND PLANK

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Metal gratings and aluminum plank.
- B. Related Sections:
 - 1. 05 50 00 - Metal Fabrications.
 - 2. 05 51 00 - Metal Stairs.
 - 3. 09 90 00 - Painting and Protective Coatings.

1.2 GENERAL REQUIREMENTS

- A. Contractor, and/or sub-contractor, is responsible for field verifying all grating and plank locations, dimensions, obstructions, openings, and any other pertinent coordination issues prior to bidding. For existing items marked to be reused, contractor is responsible for field verifying existing condition and determining whether replacement is required prior to bidding.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Include plans, elevations, sections, details, supports and attachment to other work.
 - 2. Grating and Plank: Show dimensions, weight, and location of connections to adjacent grating, supports, and other Work.
 - 3. Grating and Plank Supports: Show dimensions, size, location, and anchorage to supporting structure.
 - 4. Catalog information and catalog cuts.
 - 5. Manufacturer's specifications, to include coatings.
- B. Quality Control Submittals:
 - 1. Special handling and storage requirements.
 - 2. Installation instructions.
 - 3. Factory test reports.
 - 4. Manufacturer's Certification of Compliance for specified products.
 - 5. Written Test Report that swaged crossbars, if used on grating, meet the requirements of the specified test and additional requirements of these Specifications.

1.4 REFERENCES

- A. The following is a list of standards which may be referenced in this section:
 - 1. American Association of State Highway and Transportation, Officials (AASHTO): Standard Specifications for Highway Bridges, 14th Edition, 1989.
 - 2. American Society for Testing and Materials (ASTM):
 - a. A 36, Standard Specification for Structural Steel.
 - b. A 123, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - c. A 153, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware (R 1987).
 - d. A 167, Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.

- e. A 193, Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service.
 - f. A 194, Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service.
 - g. A 307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
 - h. A 525, Standard Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
 - i. A 569/A569M, Standard Specification for Steel, Carbon (0.15 Maximum Percent), Hot-Rolled Sheet and Strip Commercial Quality.
 - j. B 221, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.
 - k. F 844, Standard Specification for Washers, Steel, Plain (Flat), Unhardened for General Use.
3. National Association of Architectural Metal Manufacturers (NAAMM):
- a. ANSI MBG 531, Metal Bar Grating Manual.
 - b. ANSI MBG 532, Heavy-Duty Metal Bar Grating Manual.

1.5 PREPARATION FOR SHIPMENT

- A. Insofar as is practical, factory-assemble items to insure proper fit before shipping to job site.
- B. Package and clearly tag parts and assemblies that are of necessity shipped un-assembled and protect the materials from damage, and facilitate identification and final assembly in the field.

PART 2 - PRODUCTS

2.1 FOOT TRAFFIC GRATING

- A. Size: As indicated on the drawings.
- B. Type: A-19-4, unless indicated otherwise.
- C. Weight: No section shall weigh more than 150 pounds.
- D. Material:
 - 1. Aluminum Bar Type Grating:
 - a. Swage locked aluminum I-bar grating, as manufactured by:
 - 1). Thompson Fabricating, LLC, Tarrant, AL.
 - 2). Ohio Gratings, Inc., Canton, OR;
 - 3). Approved equal.
 - 2. Galvanized Steel Bar Type Grating: Press-locked, deep rectangular crossbar design, as manufactured by IKG/Borden, Clark, NJ; Type B or Type F.

2.2 LIGHT VEHICULAR TRAFFIC GRATING

- A. Size: As indicated on the drawings.
- B. Type: W-15-4, unless indicated otherwise.
- C. Weight: No section shall weigh more than 150 pounds.
- D. Material:

1. Aluminum Bar Type Grating: Press-locked deep rectangular crossbar design as manufactured by IKG/Borden, Clark, NJ, IKG/Borden; Type B or Type F.
2. Galvanized Steel Bar Type Grating:
 - a. After Fabrication: ASTM A123, zinc coating.
 - b. Manufacturer and Product: IKG/Borden, Clark, NJ; IKG/Borden heavy weld type HWF or type HWB or press locked, rectangular crossbar, Type FJ or BJ.

2.3 HEAVY VEHICULAR TRAFFIC GRATING

- A. Size: As indicated on the drawings.
- B. Type: High Load Capacity (HLC), unless indicated otherwise.
- C. Material:
 1. Galvanized Steel Bar Type:
 - a. After Fabrication: ASTM A123, zinc coating.
 - b. Manufacturer and Product: IKG/Borden, Clark, NJ; KG/Borden heavy-weld Type HWF or HWB or press-locked, rectangular crossbar, Type BJ or FJ.

2.4 ALUMINUM PLANK

- A. Acceptable Manufacturers, subject to the requirements, which may have acceptable products include, but are not limited to the following:
 1. Ohio Gratings Inc.
 2. Grating Pacific, Inc.
 3. Harsco Industrial IKG.
 4. McNichols Co.
 5. Or Approved Equal.
- B. Materials: Planks and banding are Aluminum Alloy 6063-T6, ASTM B-221.
 1. Description: Heavy Duty, Extruded Aluminum Plank.
 - a. All ends to be banded.
 2. Type(s): As indicated on the drawings, include:
 - a. Interlocking and Unpunched
 - b. Unpunched
 - c. Diagonally punched with approximately 8% openings.
 3. Top Surface: Manufacturer's standard slip-resistant finish.
 4. Finish: Mill Finish.
 5. Fabrication and Tolerances: In accordance with NAAM Metal Bar Grating Manual.
 6. Depth: As indicated on the drawings.
 7. Loading: As indicated on the drawings.
 8. Weight: No section shall weigh more than 150 pounds.

2.5 ACCESSORIES

- A. Anchor Bolts and Nuts:
 1. Carbon Steel: ASTM A307 or A36.
 2. Stainless Steel: ASTM A193 and ASTM A194, Type 316.
 3. Galvanized Steel Bolts and Nuts: ASTM A153, zinc coating for ASTM A307 or A36.
- B. Flat Washers (Unhardened): ASTM F844; use ASTM A153 for zinc coating.
- C. Removable Fastener Clips and Bolts:
 1. Removable from above grating walkway surface.
 2. Material: To match Plank or Grating material

3. Type(s):
 - a. Saddle clips
 - b. Z clips
 - c. Plank clips
 - d. Plank lugs
 - e. Countersunk land

2.6 FABRICATION

A. General:

1. Exposed Surfaces: Smooth finish and sharp, well-defined lines.
2. Furnish necessary rabbets, lugs, and brackets so work can be assembled in a neat, substantial manner.
3. Conceal fastenings where practical.
4. Drill metalwork and countersink holes as required for attaching hardware or other materials.
5. Weld Connections: Not permitted on grating except at banding bars.

B. Sizing:

1. Field measure areas to receive grating, verify dimensions of new fabricated supports, and fabricate to dimension required for specified clearances.
2. Section Length: Sufficient to prevent falling down through clear opening when oriented in the span direction when one end is touching either the concrete or the vertical leg of grating support.
3. Minimum Bearing: ANSI/NAAMM MBG 531.
4. Metal Crossbar Spacing: 4" maximum, unless otherwise shown or specified.
5. Crossbars: Flush with top of main bar and extend downward a minimum of 50% of the main bar depth.
 - a. Swaged Crossbars:
 - 1). Within 1/4" of top of grating with 1/2" minimum vertical dimension after swaging, and minimum before swaging dimension of 5/16" square.
 - 2). Crossbar Dimension After Swaging: Minimum 1/8" wider than the opening at minimum of two comers at each side of each square opening in main bar.
 - 3). Crossbars may be a special extruded shape so that after swaging the top will be flat, 3/16" wide and will be flush with the top surface of the bearing bars for a minimum of 5/8" at center between bearing bars.
 - 4). Flush crossbar meeting all of the above except that after swaging shall overlap one comer by a minimum of 1/8". A sample of one bearing bar and one crossbar shall be tested by holding the bearing bar and pulling on the crossbar. The crossbar to bearing bar shall sustain a minimum of 300 pounds without pullout of the bearing bar.
 - 5). Tightly fit main bars and crossbars allowing no differential movement.
6. Do not use weld type crossbars.
7. Banding: All ends to be banded with same material as grating or plank; ANSI/NAAMM MBG 531 and ANSI/NAAMM MBG 532.
8. Furnish stainless steel Type 316 threaded anchor studs, as fasteners for grating or plank attachment to metal supports either not embedded or partially embedded in concrete.

C. Supports:

1. Seat angles and beams where shown:
 - a. Material: To match grating or plank.
 - b. Extruded aluminum frame with slot for recessed grating clips.
2. Coordinate dimensions and fabrication with grating or plank to be supported.
3. Welded Frames with Anchors: Continuously welded.

D. Slip-Resistant Surface:

1. Rectangular Aluminum Bar Grating: As manufactured by:
 - a. IKG/Borden, Clark, NJ; EZ Weldslip-Resistant Coating.
 - b. Seidelhuber Metal Products, Inc., Hayward, CA; Safety Grit Non-Slip System.
 - c. Ohio Gratings, Inc., Canton, OH with "Slip-Not" Safety Surface manufactured by W.S. Molnar Co., Detroit, MI.
2. I-Bar grating aluminum shall incorporate a striated antiskid walking surface produced during the extrusion process, as manufactured by:
 - a. IKG/Borden, Clark, NJ.
 - b. Seidelhuber Metal Products, Inc., Hayward, CA.
 - c. Klemp Corp., Chicago, IL.

E. Aluminum:

1. ASTM B221 extruded shapes.
2. Fabricate as shown and in accordance with Manufacturer's recommendations.
3. Grind smooth sheared edges exposed in the finished work.
4. Swage crossbars, if used, with equipment strong enough to deform crossbars.
5. Eliminate any loose crossbar intersections on swaged grating.

PART 3 - EXECUTION

3.1 PREPARATION

A. Electrolytic Protection:

1. Aluminum in contact with dissimilar metals, other than stainless steel, or in contact with masonry, grout, or concrete shall be coated with a bituminous coating as specified in Section 09 90 00, Painting and Protective Coatings
2. Allow paint to dry before installation of the material.

3.2 INSTALLATION

- A. Install supports such that grating or plank sections have a solid bearing on both ends, and that rocking or wobbling movement does not occur under designed traffic loading.
- B. Install plumb or level as applicable.
- C. Install welded frames with anchors to straight plane without offsets.
- D. Anchor grating or plank securely to supports using minimum of four fastener clips and bolts per grating or plank section.
- E. Use stainless steel anchors and accessories with aluminum gratings.
- F. Completed installation shall be rigid and neat in appearance.
- G. Wherever grating or plank is pierced by pipes, ducts, and structural members, cut openings neatly and accurately to size and weld a rectangular band bar of the same height and material as bearing bars.
- H. Cutouts for circular openings are to be 2" larger in diameter than the obstruction. Cutouts for all piping 4" or less shall be made in the field.
- I. All rectangular cutouts are to be made to the next bearing bar beyond the penetration with a clearance not to exceed bearing bar spacing.
- J. Commercially Manufactured Products:

1. Install in accordance with Manufacturer's recommendations.
2. Secure grating or plank to support members with fasteners.
3. Fasteners: Field locate and install.
4. Permit each grating section or plank style grating assembly to be easily removed and replaced.

K. Protect all painted surfaces during installation.

L. Should coating become marred, prepare and touch up surface in accordance with paint Manufacturer's instructions.

END OF SECTION

DIVISION 07
THERMAL AND MOISTURE PROTECTION

SECTION 07 19 00 - WATER REPELLENT COATING

PART 1 - GENERAL

1.1 SCOPE

- A. Provide transparent water repellent coating on exterior brick surfaces.

1.2 QUALITY ASSURANCE

- A. Provide 5-year warranty for water repellent coatings, guaranteeing the installation waterproof and watertight, except for structural cracks or opening caused by settling, expansion or contraction.

1.3 SUBMITTALS

- A. Comply with Section 01 33 00, SUBMITTAL PROCEDURES.
 - 1. Product Data: Submit manufacturer's installation instructions and general recommendations.
 - 2. Warranty: Submit copy of 5-year warranty.

1.4 JOB CONDITIONS

- A. Do not proceed with the application (except with the written recommendation of the manufacturer) when ambient temperature is less than 50°F; or when rain or temperatures below 40°F are predicted for a period of 24 hours; or within 3 days after surfaces became wet from rainfall or other moisture sources.

PART 2 - PRODUCTS

2.1 TRANSPARENT WATER REPELLENT COATING:

- A. ProSoCo SureKleen Weatherseal SS or Chemstop Regular Masonry Waterproofing.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine surfaces to receive water repellent treatment and the conditions under which water repellent coat is to be applied. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.2 APPLICATION:

- A. Comply with manufacturer's instructions and recommendations, using airless spraying procedure.
 - 1. Protect adjoining work from spillage or blow-over of water repellent. Cover live plant materials with drop cloths. Clean spillage of water repellent as recommended by manufacturer, from adjoining surfaces immediately after spillage.
 - 2. Transparent Coating: Apply heavy, saturation-type, spray coating of water repellent to surfaces specified for treatment.

END OF SECTION

SECTION 07 21 00 - BUILDING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Rigid insulation.
 - 2. Perimeter insulation.
 - 3. Glass fiber blanket.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Product test reports.
- C. Research/evaluation reports.

PART 2 - PRODUCTS

2.1 RIGID INSULATION

- A. Polyisocyanurate Board Insulation: ASTM C1289, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E84.
 - 1. Wall Insulation:
 - a. 2 inches at exterior CMU walls.
 - 2. Roof Insulation:
 - a. First layer: 2 inches rigid board insulation having an R-Value of 12 or greater.
 - b. Second layer: Vapor retarder.
 - c. Third layer: 2 inches rigid board insulation having an R-Value of 12 or greater with a top surface of perlite.
 - 3. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. DiversiFoam Products.
 - b. Dow Chemical Company (The).
 - c. Owens Corning.
 - d. Pactiv Building Products.
- B. Rigid Perimeter Insulation: Expanded or extruded polystyrene plastic foam in rigid board form, 1" thick, meeting Federal Specification HH-I-524C. Board shall be in 24" widths or as shown.
- C. Vapor retarder: ASTM D 2178, Type IV; asphalt impregnated glass fiber sheet with nominal tensile strength 30 percent higher than required by ASTM D 2178 for Type IV felts.
 - 1. Manufacturers: One of the following or equal;
 - a. John Manville, Inc., Denver, CO, GlasPly Premier.
 - b. Atlas Roofing Corporation, Atlanta, GA, equivalent product.

2.2 INSULATION: GLASS-FIBER BLANKET INSULATION

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. CertainTeed Corporation.
 - 2. Guardian Building Products, Inc.

3. Johns Manville.
4. Knauf Insulation.
5. Owens Corning.

- B. Sound Insulation Batts: Unfaced, Glass-Fiber Blanket Insulation: ASTM C665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E84; passing ASTM E136 for combustion characteristics, 6" thickness.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.
- 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. Extend insulation to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.2 INSTALLATION OF PERIMETER INSULATION

- A. On horizontal surfaces under slabs, loosely lay insulation units as shown on the drawings and 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 (610 mm) in and 4" down from exterior walls.

3.3 INSTALLATION OF CAVITY-WALL INSULATION

- A. Rigid Insulation: Install pads of adhesive spaced approximately 24 inches (610 mm) o.c. both ways on inside face, and as recommended by manufacturer. Fit courses of insulation between wall ties and other obstructions, with edges butted tightly in both directions. Press units firmly against inside substrates.

3.4 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION

- A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.
- B. Rigid Insulation: Seal joints between units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by insulation manufacturer.
- C. Glass-Fiber 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.
 3. Maintain 3-inch (76-mm) clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
 4. Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.
 5. For metal-framed wall cavities where cavity heights exceed 96 inches (2438 mm), support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
- D. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation.

END OF SECTION

SECTION 07 41 13 – METAL ROOF AND WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Metal roof panels.
 - 2. Metal wall panels.

1.2 SYSTEM DESCRIPTION

- A. Materials:
 - 1. G90 hot-dipped galvanized Grade A structural quality steel in accordance with ASTM A 653 or ASTM A 792.
- B. Performance requirements:
 - 1. Wind uplift in compliance with UL Classification 580 for UL Classified 90 rated assemblies.
 - 2. Static air infiltration of 0.06 cubic feet per minute/square feet (0.028 liters/second) with 6.24 pounds per square inch (43 kilopascals) air pressure differential as tested in accordance with ASTM E 283, E 1592, E 1646, and E 1680.
 - 3. No water infiltration at inward static air pressure differential of not less than 6.24 pounds per square inch (43 kilopascals) and not more than 12 pounds per square inch (83 kilopascals) as tested in accordance with ASTM E 331.

1.3 ACTION SUBMITTALS

- A. General: Submit listed action submittals in accordance with Conditions of the Contract and as specified in Section 01 33 00, Submittal Procedures.
- B. Shop drawings: Indicate information on shop drawings as follows:
 - 1. Layout, profiles and product components including dimensions, anchorage, erection details, flashing details, elevations, plans and sections required to indicate conditions.
- C. Samples: Submit as follows:
 - 1. 12-inch by 12-inch (305 by 305 millimeters) samples of each roofing soffit and flashing product to show selected colors, finishes, and textures used on project.
- D. Product data: Submit product data, including manufacturer's SPEC-DATA® product sheet, for specified products.
 - 1. Material Safety Data Sheets (MSDS).

1.4 INFORMATION SUBMITTALS

- A. Quality Assurance:
 - 1. Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
 - 2. Manufacturer's instructions: Manufacturer's installation instructions.
 - 3. Manufacturer's field reports: Manufacturer's field reports specified.

1.5 CLOSEOUT SUBMITTALS

- A. Warranty: Submit warranty documents specified.

- B. Operation and Maintenance Data: Submit Operation and Maintenance Data for installed products.
 - 1. Include:
 - a. Manufacturer's instructions covering maintenance requirements.

1.6 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Installer experienced in performing work of this Section who has specialized in installation of work similar to that required for this project.
 - 2. Manufacturer qualifications: Manufacturer capable of providing field service representation during construction and approving erection method.
- B. Regulatory requirements:
 - 1. FM Class I-90.
 - 2. SMACNA Architectural Sheet Metal Manual.
 - 3. UL 263.
 - 4. UL 580.
 - 5. UL 790.
 - 6. UL 1897.
 - 7. UL 2218.
- C. Pre-installation meetings: Conduct pre-installation meeting to verify project requirements, manufacturer's installation instructions, and manufacturer's warranty requirements. As specified in Section 01 31 19, Project Meetings.

1.7 DELIVERY, STORAGE & HANDLING

- A. Delivery:
 - 1. Deliver materials in manufacturer's original packaging with identification labels intact.
- B. Storage and protection:
 - 1. Store materials protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.
 - 2. Stack prefinished material to prevent twisting, bending, abrasion, scratching and denting.
 - 3. Elevate one end of each skid to allow for moisture runoff.
 - 4. Prevent contact with material that may cause corrosion, discoloration, or staining.
 - 5. Provide factory-installed strippable vinyl film protective coating to panels.

1.8 PROJECT AMBIENT CONDITIONS

- A. Installation location: Assemble and erect components only when temperatures are above 40 degrees Fahrenheit (4 degrees Celsius).

1.9 SEQUENCING

- A. Sequence with other work: Comply with manufacturer's written recommendations for sequencing construction operations.

1.10 WARRANTY

- A. Project warranty: Refer to Conditions of the Contract for project warranty provisions. Provide 20-year coastal finish warranty.

- B. Manufacturer's warranty: Submit, for OWNER's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and not a limitation of, other rights OWNER may have under Contract Documents.
- C. Warranty: Commencing on date of acceptance by OWNER.

1.11 MAINTENANCE

- A. Comply with manufacturer's written instructions to maintain installed product.

1.12 EXTRA MATERIALS

- A. Provide maintenance materials as specified in Section 01 33 00, Submittal Procedures.

PART 2 - PRODUCTS

2.1 METAL ROOF PANELS

- A. Trapezoidal-Rib, Standing-Seam Metal Roof Panels: Formed with raised trapezoidal ribs at panel edges and intermediate stiffening ribs symmetrically spaced between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels and engaging opposite edge of adjacent panels.
 - 1. Material: Zinc-coated (galvanized) or Aluminum-zinc alloy-coated steel sheet, 22 gauge.
 - a. Exterior Finish: Fluoropolymer.
 - b. Color: As selected by Owner or Engineer from manufacturer's full range.
 - 2. Clips: Manufacturer's standard, floating type to accommodate thermal movement; fabricated from zinc-coated (galvanized) steel, aluminum-zinc alloy-coated steel, or stainless-steel sheet.
 - 3. Joint Type: Mechanically seamed, folded according to manufacturer's standard.
 - 4. Panel Coverage: 24 inches.
 - 5. Panel Height: 3 inches.
 - 6. Uplift Rating: UL 60.
- B. Finishes:
 - 1. Exposed Coil-Coated Finish:
 - a. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions. Two-coat Fluoropolymer shall be in addition to the manufacturer's prime/adhesive coat.
 - b. PVDF finish shall be equal to, or exceed, Kynar 500 or Hylar 500 specifications.
 - 2. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

2.2 INTERIOR AND EXTERIOR METAL WALL PANELS

- A. Tapered-Rib-Profile, Exposed-Fastener Metal Wall Panels: Formed with raised, trapezoidal major ribs and intermediate stiffening ribs symmetrically spaced between major ribs; designed to be installed by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps. Interior wall panels also noted as interior liner panels.
 - 1. Material: Zinc-coated (galvanized) or Aluminum-zinc alloy-coated steel sheet.
 - a. Exterior thickness 24 gauge
 - b. Interior thickness 28 gauge

- c. Exterior Finish:
 - 1) Exposed Coil-Coated Finish
 - a) Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions. Two-coat Fluoropolymer shall be in addition to the manufacturer's prime/adhesive coat.
 - b) PVDF finish shall be equal to, or exceed, Kynar 500 or Hylar 500 specifications.
 - d. Interior Finish: Manufacturers standard siliconized polyester or approved equal.
 - e. Color: As selected by Owner or Engineer from manufacturer's full range.
- 2. Major-Rib Spacing: 12 inches o.c.
- 3. Panel Coverage: 36 inches.
- 4. Panel Height: 1.5 inches.

B. Materials:

- 1. Metallic-Coated Steel Sheet: Restricted-flatness steel sheet, metallic coated by the hot-dip process and pre-painted by the coil-coating process to comply with ASTM A755/A755M.
 - a. Zinc-Coated (Galvanized) Steel Sheet: ASTM A653/A653M, G90 coating designation; structural quality.
 - b. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A792/A792M, Class AZ50 coating designation, Grade 40; structural quality.
 - c. Surface: Smooth, flat finish.

2.3 ACCESSORIES

- A. General: Provide all accessories as standard with metal building system manufacturer and as required, whether specified or not, whether indicated or not. Fabricate and finish accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes. Comply with indicated profiles and with dimensional and structural requirements.
 - 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.
- B. Roof Panel Accessories: Provide components required for a complete metal roof panel assembly including copings, fasciae, corner units, ridge closures, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal roof panels unless otherwise indicated.
 - 1. Closures: Provide closures at eaves and ridges, fabricated of same material as metal roof 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 cross-linked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- thick, flexible closure strips; cut or premolded to match metal roof panel profile. Provide closure strips where indicated or necessary to ensure weather tight construction.
- C. Wall Panel Accessories: Provide components required for a complete metal wall panel assembly including copings, fasciae, mullions, sills, corner units, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal wall panels unless otherwise indicated.
 - 1. Closures: Provide closures at eaves and rakes, fabricated of same material as metal wall 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 cross-linked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- thick, flexible closure strips; cut or pre-molded to match metal wall panel profile. Provide closure strips where indicated or necessary to ensure weather tight construction.
- D. Flashing and Trim: Formed from 24 gauge nominal-thickness, metallic-coated steel sheet or aluminum-zinc alloy-coated steel sheet pre-painted with coil coating; finished to match adjacent metal panels.
1. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers.
- E. Gutters: 6" K style, formed from 24 gauge nominal-thickness, metallic-coated steel sheet or aluminum-zinc alloy-coated steel sheet pre-painted with coil coating; finished to match roof fascia and rake trim. Match profile of gable trim, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 96-inch- long sections, sized according to SMACNA's "Architectural Sheet Metal Manual."
1. Gutter Supports: Fabricated from same material and finish as gutters.
 2. Strainers: Bronze, copper, or aluminum wire ball type at outlets.
- F. Downspouts: Formed from 24 gauge nominal-thickness, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet pre-painted with coil coating; finished to match metal wall panels. Fabricate in minimum 10-foot- long sections, complete with formed elbows and offsets.
1. Mounting Straps: Fabricated from same material and finish as gutters.
- G. Louvers: Refer to Section 08 90 00, Louvers and Vents, and Drawings.
- H. Roof Curbs: Fabricated from minimum 0.052-inch nominal-thickness, metallic-coated steel sheet or aluminum-zinc alloy-coated steel sheet pre-painted with coil coating; finished to match metal roof panels; with welded top box and bottom skirt, and integral full-length cricket; capable of withstanding loads of size and height indicated.
1. Curb Subframing: Fabricated from 0.064-inch nominal-thickness, angle-, C-, or Z-shaped metallic-coated steel sheet.
 2. Insulation: 1-inch- thick, rigid type.
- I. Materials:
1. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide fasteners with heads matching color of materials being fastened by means of plastic caps or factory-applied coating.
 - a. Fasteners for Metal Roof Panels: Self-drilling or self-tapping, zinc-plated, hex-head carbon-steel screws, with a stainless-steel cap or zinc-aluminum-alloy head and EPDM sealing washer.
 - b. Fasteners for Metal Wall Panels: Self-drilling or self-tapping, zinc-plated, hex-head carbon-steel screws, with EPDM sealing washers bearing on weather side of metal panels.
 - c. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws with hex washer head.
 - d. Blind Fasteners: High-strength aluminum or stainless-steel rivets.
 2. Corrosion-Resistant Coating: Cold-applied asphalt mastic, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

3. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.
4. Metal Panel Sealants:
 - a. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene-compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape of manufacturer's standard size.
 - b. Joint Sealant: ASTM C 920; one-part elastomeric polyurethane or polysulfide; of type, grade, class, and use classifications required to seal joints in metal panels and remain weather tight; and as recommended by metal building system manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with erector present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Before erection proceeds, survey elevations and locations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments to receive structural framing, with erector present, for compliance with requirements and metal building system manufacturer's tolerances.
- C. Proceed with erection only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition.
- B. Provide temporary shores, guys, braces, and other supports during erection to keep structural framing secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural framing, connections, and bracing are in place unless otherwise indicated.

3.3 METAL PANEL INSTALLATION, GENERAL

- A. Examination: Examine primary and secondary framing to verify that structural-panel support members and anchorages have been installed within alignment tolerances required by manufacturer.
 1. Examine roughing-in for components and systems penetrating metal panels, to verify actual locations of penetrations relative to seams before metal panel installation.
- B. General: Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
 1. Field cut metal panels as required for doors, windows, and other openings. Cut openings as small as possible, neatly to size required, and without damage to adjacent metal panel finishes.
 - a. Field cutting of metal panels by torch is not permitted unless approved in writing by manufacturer.
 2. Install metal panels perpendicular to structural supports unless otherwise indicated.
 3. Flash and seal metal panels with weather closures at perimeter of openings and similar elements. Fasten with self-tapping screws.
 4. Locate and space fastenings in uniform vertical and horizontal alignment.

5. Locate metal panel splices over, but not attached to, structural supports with end laps in alignment.
 6. Lap metal flashing over metal panels to allow moisture to run over and off the material.
- C. Lap-Seam Metal Panels: Install screw fasteners using power tools with controlled torque adjusted to compress EPDM washers tightly without damage to washers, screw threads, or metal panels. Install screws in predrilled holes.
1. Arrange and nest side-lap joints so prevailing winds blow over, not into, lapped joints. Lap ribbed or fluted sheets one full rib corrugation. Apply metal panels and associated items for neat and weather tight enclosure. Avoid "panel creep" or application not true to line.
- D. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with corrosion-resistant coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal roof panel manufacturer.
- E. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal panel assemblies. Provide types of gaskets, fillers, and sealants indicated; or, if not indicated, provide types recommended by metal panel manufacturer.
1. Seal metal panel end laps with double beads of tape or sealant the full width of panel. Seal side joints where recommended by metal panel manufacturer.
 2. Prepare joints and apply sealants to comply with requirements in Section 07 92 00, Joint Sealants.

3.4 METAL ROOF PANEL INSTALLATION

- A. General: Provide metal roof panels of full length from eave to ridge unless otherwise indicated or restricted by shipping limitations.
1. Install ridge caps as metal roof panel work proceeds.
 2. Flash and seal metal roof panels with weather closures at eaves and rakes. Fasten with self-tapping screws.
- B. Lap-Seam Metal Roof Panels: Fasten metal roof panels to supports with exposed fasteners at each lapped joint, at location and spacing recommended by manufacturer.
1. Provide metal-backed sealing washers under heads of exposed fasteners bearing on weather side of metal roof panels.
 2. Provide sealant tape at lapped joints of metal roof panels and between panels and protruding equipment, vents, and accessories.
 3. Apply a continuous ribbon of sealant tape to weather-side surface of fastenings on end laps and on side laps of nesting-type metal panels, on side laps of ribbed or fluted metal panels, and elsewhere as needed to make metal panels weatherproof to driving rains.
 4. At metal panel splices, nest panels with minimum 6-inch end lap, sealed with butyl-rubber sealant and fastened together by interlocking clamping plates.
- C. Metal Fascia Panels: Align bottom of metal panels and fasten with blind rivets, bolts, or self-drilling or self-tapping screws. Flash and seal metal panels with weather closures where fasciae meet soffits, along lower panel edges, and at perimeter of all openings.
- D. Metal Roof Panel Installation Tolerances: Shim and align metal roof panels within installed tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.5 METAL WALL PANEL INSTALLATION

- A. General: Install metal wall panels in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts, extending full height of building, unless otherwise indicated. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement.
1. Unless otherwise indicated, begin metal panel installation at corners with center of rib lined up with line of framing.
 2. Shim or otherwise plumb substrates receiving metal wall panels.
 3. When two rows of metal panels are required, lap panels 4 inches minimum.
 4. When building height requires two rows of metal panels at gable ends, align lap of gable panels over metal wall panels at eave height.
 5. Rigidly fasten base end of metal wall panels and allow eave end free movement due to thermal expansion and contraction. Predrill panels.
 6. Flash and seal metal wall panels with weather closures at eaves, rakes, and at perimeter of all openings. Fasten with self-tapping screws.
 7. Install screw fasteners in predrilled holes.
 8. Install flashing and trim as metal wall panel work proceeds.
 9. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated; or, if not indicated, as necessary for waterproofing.
 10. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-drilling or self-tapping screws.
 11. Provide weatherproof escutcheons for pipe and conduit penetrating exterior walls.
- B. Metal Wall Panels: Install metal wall panels on exterior side of girts. Attach metal wall panels to supports with fasteners as recommended by manufacturer.
- C. Installation Tolerances: Shim and align metal wall panels within installed tolerance of 1/4 inch in 20 feet, nonaccumulative, on level, plumb, and on location lines as indicated, and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

END OF SECTION

SECTION 07 50 00 - ROOFING, INSULATION, DAMP PROOFING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Contractor shall furnish all materials, labor, insurance, etc., to complete insulation, membrane vapor barrier and damproofing membrane as shown on drawings or called for in the specifications. All work shall be completed in a manner which is acceptable for installing roofing membrane system.

1.2 MATERIALS

- A. Roof Insulation:
 - 1. First Layer: 2" polyisocyanurate board. Roof Insulation – mechanically attached.
 - 2. Second Layer: 1/4" thick Densdeck Duraguard (thoroughly and completely adhered).
 - 3. Water Trough: 2" thick polyisocyanurate board. Insulation (thoroughly and completely adhered). Mechanical fasteners. Slope to roof drains.
- B. Mechanical Fasteners: Fiberglass Glasfast Hexcel Mechanical Fasteners at 18" o.c. each way. Securely attached to metal deck.
- C. Joint Tape: Densdeck Fiberglass 8" wide joint tape.
- D. Moisture/Vapor Vents: .063 gauge spin aluminum moisture relief vents having breathable core tex fabric for one-way venting. Jinco UF-13. Install one per 800 SF.
- E. Veral Flashing by Siplast: Aluminum metal-clad asphalt elastomer sheet; woven glass mat reinforced – Install at vertical flashing and perimeter of roof.
- F. Damproofing moistop membrane under slabs: Moistop Two as manufactured by the Fortifiber Corp. – ASTM E96. 96" width with minimum of 6" laps. All laps and projections thru membrane shall be sealed with Fortifiber Grade 495 pressure sensitive tape. Punctures to be sealed with tape.

1.3 WORKMANSHIP

- A. Care shall be taken so that insulation does not get wet or take on moisture during field storage or application. Keep protected at all times. Check moisture content at time of installation and provide reports to the Engineer.
- B. Install first layer of roof insulation on metal deck using Grefco Perma-Fasteners at 18" o.c. Joints shall be staggered with joints only occurring on flat hat sections of deck (not over flute voids).
- C. Install first layer of roof insulation with joints staggered and mechanically attached to metal deck
- D. Installation of upper layer of roof insulation shall be coordinated with roofing membrane in order that insulation is protected from elements and remains completely dry.
- E. Any detail shown on drawings which does not conform to manufacturer's requirements shall be brought to the attention of the Engineer before bidding.

PART 2 - PRODUCTS

2.1 ROOFING MEMBRANE SYSTEM

- A. Furnish all materials, labor, insurance, etc. for installing a complete 20301H-A Modified Bitumen membrane, completely and securely adhered to Densdeck substrate.
- B. Furnish in writing, a fifteen (15) year Siplast Inc. Roof Membrane Guarantee. Guarantee shall be signed and notarized by Siplast Corporate Officer.
- C. Any detail shown on drawings which does not conform to watertight installation shall be brought to the attention of the Architect before bidding.
- D. Roofing membrane and insulation shall be installed by a Siplast certified roofing contractor. Siplast shall state in writing before beginning work that roofing contractor is an approved applicator.
- E. Siplast representative shall inspect and supervise the installation of roofing and insulation installation. Provide field reports during application.
- F. Work included:
 - 1. Roof insulation, roofing membrane, cants, damproofing, installation and securing of all flashings, lead flashings, counter flashings, pitch pockets, flashings and waterproofing of roof penetrations, etc., as required for a complete installation.
 - 2. Roof guarantee – Fifteen (15) years.
- G. Work included in other sections:
 - 1. Wood nailers, sheet metal flashings and sheet metal fascia guards.

2.2 WORKMANSHIP AND INSTALLATION:

- A. Description
 - 1. Description of Systems. Roofing shall consist of a granule-surfaced fiberglass mat reinforced asphalt elastomer membrane, secured to a prepared substrate.
 - 2. Siplast Inc. – Specification 2030 I H-A.
- B. Quality Assurance
 - 1. Acceptable Products. Products of Siplast conforming to the specified requirements are acceptable.
 - 2. Acceptable Applicator. Roofing applicator shall be approved by the material manufacturer.
- C. Submittals. The following items shall be submitted and approved by the Engineer prior to delivery of materials to the job site 60 days before roofing work begins.
 - 1. Certificates. Evidence of acceptance of roof applicator by the roofing system Manufacturer.
 - 2. Samples and Manufacturer's Literature.
 - a. Two 12" x 12" samples of each sheet component of the roofing and flashing membranes.
 - b. Latest edition of the roofing system manufacturer's material specifications and installation instructions.
 - c. Descriptive list of materials proposed for use.
- D. Product Delivery, Storage and Handling

1. Delivery. Material shall be delivered in the manufacturer's original sealed and labeled containers and in quantities required to allow continuity of application.
2. Storage. Material shall be stored out of direct exposure to the elements. Roll goods shall be stored on end on a clean flat surface. Material shall be protected against moisture.
3. Handling. Material shall be handled in such a manner as to preclude damage and contamination with moisture or foreign matter.

E. Job Conditions

1. Existing Conditions. Siplast representative shall inspect installation of substrate insulation to make certain it is acceptable for roofing membrane application.
2. Environmental Requirements
 - a. Roofing shall not be applied during precipitation and shall not be started in the event there is a probability of precipitation during application.
 - b. Roofing shall not be applied when ambient temperature is below 35 °F. NOTE: Siplast should be consulted in regard to material and application for lower temperature installations.
3. Protection
 - a. Protection against staining and mechanical damage shall be provided for adjacent surfaces during application of roofing.

F. Materials

1. Roofing to consist of:
 - a. ASTM Type IV Asphalt shall be used for all moppings.
 - b. Siplast – Paradiene 20 – Applied with PA-100 asphalt.
 - c. Siplast – Paradiene 30 FR – Applied with PA-311M adherent
 - d. Siplast – Veral Flashing – Torch Applied
2. Flashing to consist of:
 - a. Glass reinforced aluminum faced asphalt elastomer sheet of 90 pounds/square minimum weight, type Veral.
 - b. Glass reinforced asphalt sheet of 70 pounds/square minimum weight, type Irex.
 - c. Lead flashing where shown.
3. Asphalt shall be certified for full compliance with the requirements for Type IV asphalt listed in Table I, ASTM D-312-71. Each container or bulk shipping ticket shall indicate the equiviscous temperature (EVT), the finished blowing temperature (FBT), and the flash point (F.P.)

G. Inspection

1. A pre-job conference including the, Engineer's Representative, Roofer and Siplast representative shall be conducted prior to the application of roofing.
2. Contractor shall verify that work penetrating the roof deck, or which may otherwise affect the roofing, has been properly completed.

H. Preparation

1. General. All surfaces shall be swept or vacuumed prior to commencement of roofing.
2. Insulation. Insulation layer shall present a smooth surface to accept the roof membrane. No more insulation shall be installed than can be covered in the same day. Insulation shall be fiberglass substrate.

I. Application

1. General. Application shall be in accordance with roofing system manufacturer's instructions and the following requirements. Application of roofing shall immediately following application of insulation (where applicable) as a continuous operation.
2. Prime metal flanges and concrete and masonry surfaces with a uniform coating of asphalt primer (ASTM D-4173).
3. Kettles and tankers shall be equipped with accurate, fully readable thermometers. Asphalt shall not be heated to or above its FP. Avoid heating at or above the FBT; should

conditions make this prohibition impractical, and exception is granted by the Engineer, heating above the FBT must not be done for more than four (4) hours. Application temperatures must be no more than 25 °F (14 °C) below the EVT or more than 25 °F (14 °C) above the EVT.

- a. If EVT information is not provided, the following asphalt temperature limits shall be observed. Maximum heating temperature shall be: Type IV – 525 °F. Minimum application temperature shall be 400°F.
 - b. Cutting or alteration of bitumens will not be permitted.
 - c. All moppings shall be a maximum of 25 pounds/square, and shall be total in coverage, leaving no breaks or voids.
4. All layers of roofing shall be laid free of wrinkles, creases or fishmouth, and shall be laid at right angles to the slope of the deck. Sheets shall be laid directly behind the torch/asphalt application. Sufficient pressure shall be exerted on the roll during application to ensure prevention of air pockets. Plies shall be fully bonded to the prepared surface and shall have minimum 4" side laps and 6" end laps.
 5. Flashing shall be accomplished using Irex reinforcing membrane and Veral flashing membrane. The reinforcing sheet shall be lapped a minimum of 3" to itself, and shall extend a minimum of 4" onto the Paradiene 30 sheet and as shown up the parapet. The flashing sheet shall be lapped a minimum of 3" to itself and shall extend a minimum of 6" onto the Paradiene 30 sheet and 10" up the parapet.
 6. At end of day's work, or when precipitation is imminent, a water cut-off shall be built at all open edges. Cut-offs can be built using asphalt or plastic cement and roofing felts, constructed to withstand protracted periods of services. Cut-offs must be completely removed prior to the resumption of roofing.
 7. Finished membrane shall be kept clean of unsightly asphalt residues with lap fully but neatly installed. Where asphalt laps on surface, it shall be sprinkled with granular Paradiene 30 surfacing.
 8. Upon completion of roofing and flashing installation, Siplast representative shall inspect roofing system and state in writing that installation is acceptable and waterproofing according to their requirements.
 9. Blisters or bubbles will not be allowed during the guarantee period. They will be corrected during this period.
 10. Contractor shall provide one way roofing vent to top of vapor barrier; one per 800 SF. Vents shall be thoroughly flashed.
 11. Provide lead Veral flashing at roof drains and vertical and edge of roof termination.

J. Substitute Roof System

1. The following substitute roof systems are approved for use in lieu of the specified roof system.
 - a. MANUFACTURER: Johns Manville, Denver, CO
 - 1). Base Ply – DynaPly
 - 2). Finish Ply – DynaKap FR
 - 3). Flashing Sheet – DynaClad
 - 4). Stripping Ply and Flashing Reinforcing Sheet – DynaPly
 - 5). Adhesive – MBR Cold Application Adhesive
 - b. MANUFACTURER: Tamko Roofing Products, Inc., Joplin, MO
 - 1). Base Ply – Awaplan Versa-Smooth
 - 2). Finish Ply – Awaplan Premium FR
 - 3). Flashing Sheet – Awaplan Heat Welding
 - 4). Stripping Ply and Flashing Reinforcing Sheet – Awaplan Versa-Smooth
 - 5). Adhesive – Tam-Pro CPA Premium SBS Adhesive
 - c. MANUFACTURER: GAF Materials Corp., Wayne, NJ

- 1). Base Ply – Ruberoid Mop Smooth
- 2). Finish Ply – Ruberoid Mop Plus
- 3). Flashing Sheet – Ruberoid Ultraclad SBS
- 4). Stripping Ply and Flashing Reinforcing Sheet – Ruberoid Mop Smooth
- 5). Adhesive – Matrix 101 System Pro SBS Adhesive

K. Roofing Accessories

1. Roofing Adhesives
 - a. Mopping Asphalt: Type IV asphalt certified for full compliance with the requirements listed in Table 1, ASTM D312. Each container or bulk shipping ticket shall indicate the equiviscous temperature, EVT, the finished blowing temperature, FBT, and the flash point FP. Mopping asphalt shall be approved in writing by the roof membrane manufacturer.
 - 1). Siplast PA-100 Asphalt by Siplast; Irving, TX.
 - b. Membrane Cold Adhesive: An asphalt, solvent blend conforming to ASTM D 4479, Type II requirements.
 - 1). Siplast PA-311 M Adhesive by Siplast; Irving, TX
2. Fire Resistant Slipsheet: A coated glass fiber sheet intended for use as a flame barrier over combustible substrates.
 - a. FR10 by Atlas Roofing Corp.: Atlanta, GA
3. Bituminous Cutback Materials
 - a. Primer: An asphalt, solvent blend conforming to ASTM D 41 requirements.
 - 1). Siplast PA-1125 Asphalt Primer by Siplast; Irving, TX.
 - b. Mastics: An asphalt cutback mastic, reinforced with non-asbestos fibers, used as a base for setting metal flanges conforming to ASTM D 4586 Type II requirements.
 - 1). Siplast PA-1021 Plastic Cement by Siplast, Irving, TX.
4. Sealant: A moisture-curing, non-slump elastomeric sealant designed for roofing application. The sealant shall be approved by the roof membrane Manufacturer for use in conjunction with the roof membrane materials. Acceptable types are as follows:
 - a. Siplast PS-304 Elastometric Sealant by Silplast, Irving, TX.
5. Ceramic Granules: No. 11 grade specification ceramic granules of color scheme matching the granule surfacing of the finish ply.
6. Metallic Powder: A finely graded metal dust as supplied or approved by the membrane manufacturer, used for covering of bitumen overruns over the foil surfaced membrane.
7. Perlite Cant Strips: A cant strip composed of expanded volcanic minerals combined with waterproofing binders. The top surface shall be pre-treated with an asphalt based coating. The face of the cant shall have a nominal 4" dimension.
8. Fasteners
 - a. Insulation Fasteners and Densdeck Sheathing Panel Fasteners for Wood/Plywood Flashing Surfaces: Insulation fasteners and plates shall be FM Approved, and/or approved by the manufacturer of the primary roofing products. The insulation fasteners shall provide attachment required to meet the specified uplift performance and to restrain the insulation panels against the potential for ridging. The fastening pattern for each insulation panel to be used shall be as recommended by the insulation manufacturer and approved by the manufacturer of the primary roofing products. Acceptable insulation fastener manufacturers for specific deck types are listed below.
 - 1). Metal Decks and Wood/Plywood Flashing Surfaces: Insulation mechanical fasteners for metal decks shall be factory coated for corrosion resistance. The fastener shall conform to meet or exceed Factory Mutual Standard 4470 and when subjected to 30 Kesternich cycles shall show less than 15% red rust. Acceptable insulation fastener types for metal decks are listed below.
 - a). A fluorocarbon coated screw type roofing fastener having a minimum 0.220" thread diameter. Plates used in conjunction with the fastener shall be a metal type having a minimum 3" diameter, as supplied by the fastener manufacturer.

- Parafast Fastener by Siplast; Irving, TX
 - Roofgrip with Buildex Metal Plates by ITW Buildex; Itasca, IL
 - Dekfast #12 with Dekfast Steel Hexagonal Plates by Construction Fasteners, Inc. Wyomissing, PA.
 - Standard Roofing Fastener by Olympic Manufacturing Group; Agawam, MA.
- b. Fire Resistant Slipsheet Fasteners: Slipsheet fasteners shall be approved by the manufacturer of the primary roofing products. Acceptable fasteners for specific substrate types are listed below.
- 1). Wood/Plywood Flashing Substrates
- b). A 12 gauge, spiral or annular threaded shank, zinc coated steel roofing fastener having a minimum 1" head.
- Square Cap by W. H. Maze Co.; Peru, IL
 - 12 Gauge Simplex Nail by the Simplex Nail and Manufacturing Co., Americus, GA.
9. Walktread: A prefabricated, puncture resistant polyester core reinforced, polymer modified bitumen sheet material topped with a ceramic-coated granule wearing surface.
- a. Thickness 0.217" (5.5 mm)
- b. Weight: 1.8 lb/ft² (8.8 kg/m²)
- c. Width: 30" (76.2 cm)
- Paratread Roof Protection Material by Siplast; Irving, TX

PART 3 - EXECUTION

3.1 PREPARATION

- A. General: Sweep or vacuum all surfaces, removing all loose aggregate and foreign substances prior to commencement of roofing.
- B. Preparation of Densdeck Substrates to Receive Flashing Materials: Lay the coated fiberglass slipsheet over the Densdeck surface to receive flashing materials, lapping sides and ends a minimum of 2 inches. Nail the sheets sufficiently to hold in place until the Densdeck sheathing panels can be applied mechanically.

3.2 SUBSTRATE PREPARATION

- A. Insulation: Install insulation panels with end joints offset; edges of the panels shall be in moderate contact without forcing applied in strict accordance with the insulation manufacturer's requirements and the following instructions. Stagger joints between layers where insulation is installed in two or more layers. Maintain a maximum panel size of 4' by 4' for insulation applied in hot asphalt.
1. Insulation – double layer. Mechanically attach the bottom layer, using the specified fasteners, at a rate of 1 fastener per 2 square feet of panel area (16 per 4' x 8' panel). Increase the fastening frequency at the corners/perimeter in accordance with the recommendations set forth in solid mopping of hot asphalt; laying each panel directly behind the asphalt applicator. Stagger the panel joints between insulation layers.

3.3 ROOF MEMBRANE INSTALLATION

- A. Membrane Application: Apply roofing in accordance with roofing system manufacturer's instructions and the following requirements. Application of roofing membrane components shall immediately follow application of base sheet and/or insulation as a continuous operation.
- B. Aesthetic Considerations: An aesthetically pleasing overall appearance of the finished roof application is a standard requirement for this project. Make necessary preparations, utilize

recommended application techniques. Apply the specified materials including granules and metallic powder, and exercise care in ensuring that the finished application is acceptable to the Owner.

- C. Priming: Prime metal and concrete and masonry surfaces with a uniform coating of the specified asphalt primer.
- D. Kettles and Tankers: Kettles and tankers shall be equipped with accurate, fully readable thermometers. Do not heat asphalt to or above its flash point. Avoid heating at or above the FBT. Should conditions make this impractical, heating must be no more than 25 °F below the EVT and no more than 25 °F above EVT.
- E. Asphalt Temperatures: If the EVT information is not provided, the following asphalt temperature shall be observed. Maximum heating temperature shall be 525 °F (274 °C). Minimum application temperature shall be 400 °F (204 °C).
- F. Asphalt Moppings: Ensure that all moppings do not exceed a maximum of 25 lb/sq. Mopping shall be total in coverage, leaving no breaks or voids.
- G. Bitumen Consistency: Cutting or alterations of bitumen, primer, and sealants will not be permitted.
- H. Roofing Application: Apply all layers of roofing free of wrinkles, creases or fishmouths. Exert sufficient pressure on the roll during application to ensure prevention of air pockets.
 - 1. Apply all layers of roofing perpendicular to the slope of the deck.
 - 2. Fully bond the base ply to the prepared substrate, utilizing minimum 3" side and end laps. Apply each sheet directly behind the asphalt applicator. Cut a dog ear angle at the end laps on overlapping selvage edges. Using a clean trowel, apply top pressure to top seal T-laps immediately following sheet application. Stagger end laps a minimum of 3'.
 - 3. Fully bond the finish ply to the base ply, utilizing minimum 3" side and end laps. Apply each sheet directly behind the cold adhesive applicator. Stagger end laps of the finish ply a minimum 3'. Cut a dog ear angle at the end laps on overlapping selvage edges. Using a clean trowel, apply top pressure to top seal T-laps immediately following sheet application. Stagger side laps of the finish ply a minimum 12" from side laps in the underlying base ply. Stagger end laps of the finish ply a minimum 3' from end laps in the underlying base ply.
 - 4. Maximum sheet lengths and special fastening of the specified roof membrane system may be required at various slope increments where the roof deck slope exceeds 1/2" per foot. The manufacturer shall provide acceptable sheet lengths and the required fastening schedule for all roofing sheet applications to applicable roof slopes.
- I. Granule Embedment: Broadcast mineral granules over all bitumen overruns on the finish ply surface, while the bitumen is still hot or the adhesive is soft, to ensure a monolithic surface color.
- J. Flashing Application – masonry surfaces: Flash masonry parapet wall and curbs using the reinforcing sheet and the metal foil flashing membrane. After the base ply has been applied to the top of the cant, fully adhere the reinforcing sheet, utilizing minimum 3" side laps and extend a minimum of 3" onto the base ply surface and 3" up the parapet wall above the cant. After the final roofing ply has been applied to the top of the cant, prepare the surface area that is to receive flashing coverage by torch heating granular surfaces or by application of asphalt primer; allowing primer to dry thoroughly. Torch apply the metal foil-faced flashing into place using three foot widths (cut off the end of roll) always lapping the factory selvage edge. Stagger the laps of the metal foil flashing layer from lap seams in the reinforcing layer. Extend the flashing sheet a minimum of 4" beyond the toe of the cant onto the prepared surface of the finished roof and up the wall to the desired flashing height. Exert pressure on the flashing sheet during

application to ensure complete contact with the wall/roof surfaces, preventing air pockets; this can be accomplished by using a damp sponge or shop rag. Check and seal all loose laps and edges. Nail the top edge of the flashing on 9" centers. (See manufacturer's schematic for visual interpretation.)

- K. Flashing Application – surfaces sheathed with gypsum sheathing panels Flash parapet walls and curbs sheathed with the specified gypsum sheathing panel using the reinforcing sheet and the metal foil flashing membrane. After the base ply has been applied to the top of the cant, fully adhere the reinforcing sheet, utilizing minimum 3" side laps and extend a minimum of 3" onto the base ply surface and up the gypsum sheathing panel surface above the cant. After the final roofing ply has been applied to the top of the cant, prepare the surface area that is to receive flashing coverage by torch heating granular surfaces or by application of asphalt primer; allowing primer to dry thoroughly. Torch apply the metal foil-faced flashing into place using three foot widths (cut of the end of roll) always lapping the factory selvage edge. Stagger the laps of the metal foil flashing layer from lap seams in the reinforcing layer. Extend the flashing sheet a minimum of 4" beyond the toe of the cant onto the prepared surface of the finished roof and up the wall to the desired flashing height. Exert pressure on the flashing sheet during application to ensure complete contact with the wall/roof surfaces, preventing air pockets; this can be accomplished by using a damp sponge or shop rag. Check and seal all loose laps and edges. Nail the top edge of the flashing on 9" centers. (See manufacturer's schematic for visual interpretation).
- L. Catalyzed Acrylic Resin Flashing System: Install the liquid-applied primer and flashing system in accordance with the membrane system manufacturer's printed installer's guidelines and other applicable written recommendations as provided by the manufacturer.
- M. Use of Metallic Powder: Broadcast metallic powder over all bitumen overruns on the metal foil membrane surface while the bitumen is still hot to ensure a monolithic surface color.
- N. Water Cut-Off: At end of day's work, or when precipitation is imminent, construct a water cut-off at all the open edges. Cut-offs can be built using asphalt or plastic cement and roofing felts, constructed to withstand protracted periods of service. Cut-offs must be completely removed prior to the resumption of roofing.

3.4 ROOF SYSTEM INTERFACE WITH RELATED COMPONENTS

- A. Walktread: Cut the walktread into maximum 5 foot lengths and allow it to relax until flat. Adhere to the sheet using the specified plastic cement. Apply the specified cement in a 3/8" thickness to the back of the product in" by 5" spots in accordance with the pattern as supplied by the walktread manufacturer, then walk-in each sheet after application, to ensure proper adhesion. Use a minimum spacing of 2" between sheets to allow for proper drainage.
- B. Sealant: Apply a smooth continuous bead of the specified sealant at the exposed finish ply edge transition to metal flashings incorporated into the roof system.

3.5 FIELD QUALITY CONTROL AND INSPECTIONS

- A. Site Condition: Leave all areas around job site free of debris, roofing materials, equipment and related items after completion of job.
- B. Notification of Completion: Notify the manufacturer by means of manufacturer's printed Notification of Completion form of job completion in order to schedule a final inspection date.
- C. Final Inspection

1. Post-Installation Meeting: Hold a meeting at the completion of the project, attended by all parties that were present at the pre-job conference. A punch list of items required for completion shall be compiled by the Contractor and the manufacturer's representative. Complete, sign, and mail the punch list form to the manufacturer's headquarters.
- D. Issuance of the Guarantee: Complete all post installation procedures and meet the manufacturer's final endorsement for issuance of the specified guarantee.

END OF SECTION

SECTION 07 71 00 – MANUFACTURED ROOF SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Copings.
 - 2. Roof-edge flashings.
 - 3. Roof-edge drainage systems.
 - 4. Reglets and counterflashings.

- B. Related Sections:
 - 1. Section 06 10 00 Rough Carpentry for wood nailers, curbs, and blocking.
 - 2. Section 07 41 13 Metal Roof and Wall Panels for roof-edge drainage-system components provided by metal-roof-panel manufacturer.
 - 3. Section 07 92 00 Joint Sealants for field-applied sealants between roof specialties and adjacent materials.

1.2 PERFORMANCE REQUIREMENTS

- A. General Performance: Roof specialties shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

- B. SPRI Wind Design Standard: Manufacture and install components tested according to SPRI ES-1 and capable of resisting the following design pressures:
 - 1. Design Pressure: 20 PSF.

- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of thermal movements.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

- B. Shop Drawings: For roof specialties. Include plans, elevations, expansion-joint locations, keyed details, and attachments to other work. Distinguish between plant- and field-assembled work. Include the following:
 - 1. Pattern of seams and layout of fasteners, cleats, clips, and other attachments.
 - 2. Details of special conditions.

- C. Samples for Initial Selection: For each type of roof specialty indicated with factory-applied color finishes.

- D. Product Test Reports: Verifying compliance of copings with performance requirements.

- E. Warranty: Sample of special warranty.

1.4 QUALITY ASSURANCE

- A. Preinstallation Conference: Conduct conference at Project site.

1. Meet with Owner or Owner's representative, Engineer, Installer, and installers whose work interfaces with or affects roof specialties including installers of roofing materials and accessories.
2. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
3. Review special roof details, roof drainage, and condition of other construction that will affect roof specialties.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Do not store roof specialties in contact with other materials that might cause staining, denting, or other surface damage. Store roof specialties away from uncured concrete and masonry.
- B. Protect strippable protective covering on roof specialties from exposure to sunlight and high humidity, except to extent necessary for the period of roof specialties installation.

PART 2 - PRODUCTS

2.1 EXPOSED METALS

- A. Aluminum Sheet: ASTM B 209, alloy as standard with manufacturer for finish required, with temper to suit forming operations and performance required.
 1. Surface: Smooth, flat finish.
 2. Mill Finish: As manufactured.
 3. Exposed Coil-Coated Finishes: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Two-Coat Fluoropolymer: AAMA 620. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight.
- B. Aluminum Extrusions: ASTM B 221, alloy and temper recommended by manufacturer for type of use and finish indicated, finished as follows:
 1. Exposed High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Two-Coat Fluoropolymer: AAMA 2604. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight.
- C. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304.
- D. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation.
 1. Surface: Smooth, flat finish.
 2. Mill-Phosphatized Finish: Manufacturer's standard for field painting.
 3. Exposed Coil-Coated Finishes: Prepainted by the coil-coating process to comply with ASTM A 755/A 755M. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Two-Coat Fluoropolymer: AAMA 621. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight.

2.2 CONCEALED METALS

- A. Aluminum Sheet: ASTM B 209, alloy and temper recommended by manufacturer for type of use and structural performance indicated, mill finished.

- B. Aluminum Extrusions: ASTM B 221, alloy and temper recommended by manufacturer for type of use and structural performance indicated, mill finished.
- C. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304.
- D. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation.

2.3 UNDERLAYMENT MATERIALS

- A. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Carlisle Coatings & Waterproofing; CCW WIP 300HT.
 - b. Grace Construction Products, a unit of W. R. Grace & Co.; Ultra.
 - c. Henry Company; Blueskin PE200 HT.
 - d. Metal-Fab Manufacturing, LLC; MetShield.
 - e. Owens Corning; WeatherLock Metal High Temperature Underlayment.
- B. Polyethylene Sheet: 6-mil-thick polyethylene sheet complying with ASTM D 4397.
- C. Slip Sheet: Building paper, 3-lb/100 sq. ft. (0.16-kg/sq. m) minimum, rosin sized.

2.4 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.
- B. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to meet performance requirements. Furnish the following unless otherwise indicated:
 - 1. Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.
 - 2. Fasteners for Copper Sheet: Copper, hardware bronze, or passivated Series 300 stainless steel.
 - 3. Fasteners for Aluminum: Aluminum or Series 300 stainless steel.
 - 4. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.
 - 5. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A 153/A 153M or ASTM F 2329.
- C. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane polymer sealant of type, grade, class, and use classifications required by roofing-specialty manufacturer for each application.
- D. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

2.5 COPINGS

- A. Copings: Manufactured coping system consisting of formed-metal coping cap in section lengths not exceeding 12 feet, concealed anchorage; corner units, end cap units, and concealed splice plates with same finish as coping caps.
 - 1. Basis-of-Design Product: Southern Aluminum Finishing Company, Inc., Perimeter Systems Division, Profile CP-3, or a comparable product by one of the following:

- a. Architectural Products Company.
- b. ATAS International, Inc.
- c. Castle Metal Products.
- d. Cheney Flashing Company.
- e. Hickman Company, W. P.
- f. Johns Manville.
- g. Merchant & Evans, Inc.
- h. Metal-Era, Inc.
- i. Metal-Fab Manufacturing, LLC.
- j. MM Systems Corporation.
- k. National Sheet Metal Systems, Inc.
- l. Perimeter Systems; a division of Southern Aluminum Finishing Company, Inc.
- m. Petersen Aluminum Corporation.

2.6 ROOF-EDGE FLASHINGS

- A. Roof-Edge Aluminum Fascia: Manufactured, two-piece, roof-edge fascia consisting of snap-on metal fascia cover in section lengths not exceeding 12 feet and a continuous formed- or extruded-aluminum anchor bar with integral drip-edge cleat to engage fascia cover. Provide matching corner units.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Hickman Company, W. P.
 - b. Johns Manville.
 - c. Metal-Era, Inc.
 - d. Metal-Fab Manufacturing, LLC.
 - e. National Sheet Metal Systems, Inc.
 - f. Perimeter Systems; a division of Southern Aluminum Finishing Company, Inc.
 - 2. Fascia Cover: Fabricated from the following exposed metal:
 - a. Formed Aluminum: Thickness as required to meet performance requirements.
 - 3. Corners: Factory mitered and continuously welded.
 - 4. Splice Plates: Concealed, of same material, finish, and shape as fascia cover.
 - 5. Special Fabrications: As required.
- B. Aluminum Flashing Finish: Two-coat fluoropolymer.

2.7 ROOF-EDGE DRAINAGE SYSTEMS

- A. Gutters: Manufactured in uniform section lengths not exceeding 12 feet, with matching corner units, ends, outlet tubes, and other accessories. Elevate back edge at least 1/2-inch above front edge. Furnish flat-stock gutter straps, gutter brackets, expansion joints, and expansion-joint covers fabricated from same metal as gutters.
 - 1. Fabricate from the following exposed metal:
 - a. Formed Aluminum: 0.050 inch thick.
 - b. Zinc-Coated Steel: Nominal 0.034-inch thickness.
 - 2. Gutter Profile: 6" deep.
 - 3. Corners: Factory mitered and mechanically clinched and sealed watertight.
 - 4. Gutter Supports: Manufacturer's standard supports with finish matching the gutters.
- B. Downspouts: Corrugated rectangular complete with machine-crimped elbows, manufactured from the following exposed metal. Furnish with metal hangers, from same material as downspouts, and anchors.
 - 1. Formed Aluminum: 0.050 inch thick.
 - 2. Extruded Aluminum: 0.125 inch thick.
 - 3. Zinc-Coated Steel: Nominal 0.034-inch thickness.

- C. Parapet Scuppers: Manufactured with closure flange trim to exterior, 4-inch wide wall flanges to interior, and base extending 4 inches beyond cant or tapered strip into field of roof.

2.8 REGLETS AND COUNTERFLASHINGS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Castle Metal Products.
 - 2. Cheney Flashing Company.
 - 3. Fry Reglet Corporation.
 - 4. Heckmann Building Products Inc.
 - 5. Hickman Company, W. P.
 - 6. Keystone Flashing Company, Inc.
 - 7. Metal-Era, Inc.
 - 8. Metal-Fab Manufacturing, LLC.
 - 9. MM Systems Corporation.
 - 10. National Sheet Metal Systems, Inc.
- B. Reglets: Manufactured units formed to provide secure interlocking of separate reglet and counterflashing pieces, from the following exposed metal:
 - 1. Formed Aluminum: 0.024 inch thick.
 - 2. Stainless Steel: 0.019 inch thick.
 - 3. Zinc-Coated Steel: Nominal 0.022-inch thickness.
 - 4. Corners: Factory mitered and mechanically clinched and sealed watertight.
 - 5. Surface-Mounted Type: Provide reglets with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
 - 6. Concrete Type, Embedded: Provide temporary closure tape to keep reglet free of concrete materials, special fasteners for attaching reglet to concrete forms, and guides to ensure alignment of reglet section ends.
 - 7. Masonry Type, Embedded: Provide reglets with offset top flange for embedment in masonry mortar joint.
 - 8. Multiuse Type, Embedded: For multiuse embedment in cast-in-place concrete and masonry mortar joints.
- C. Counterflashings: Manufactured units of heights to overlap top edges of base flashings by 4 inches and in lengths not exceeding 12 feet designed to snap into reglets or through-wall-flashing receiver and compress against base flashings with joints lapped, from the following exposed metal:
 - 1. Formed Aluminum: 0.024 inch thick.
 - 2. Stainless Steel: 0.019 inch thick.
 - 3. Zinc-Coated Steel: Nominal 0.022-inch thickness.

2.9 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.
- B. Examine walls, roof edges, and parapets for suitable conditions for roof specialties.
- C. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 UNDERLAYMENT INSTALLATION

- A. Self-Adhering Sheet Underlayment: Install wrinkle free. Apply primer if required by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer rather than nails for installing underlayment at low temperatures. Apply in shingle fashion to shed water. Overlap edges not less than 3-1/2 inches. Roll laps with roller. Cover underlayment within 14 days.
- B. Polyethylene Sheet: Install with adhesive for temporary anchorage to minimize use of mechanical fasteners under roof specialties. Apply in shingle fashion to shed water, with lapped and taped joints of not less than 2 inches.
- C. Slip Sheet: Install with tape or adhesive for temporary anchorage to minimize use of mechanical fasteners under roof specialties. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches.

3.3 INSTALLATION, GENERAL

- A. General: Install roof specialties according to manufacturer's written instructions. Anchor roof specialties securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete roof-specialty systems.
 - 1. Install roof specialties level, plumb, true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
 - 2. Provide uniform, neat seams with minimum exposure of solder and sealant.
 - 3. Install roof specialties to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.
 - 4. Torch cutting of roof specialties is not permitted.
 - 5. Do not use graphite pencils to mark metal surfaces.
- B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
 - 1. Coat concealed side of uncoated aluminum and stainless-steel roof specialties with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
 - 2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of self-adhering, high-temperature sheet underlayment or polyethylene sheet.
- C. Expansion Provisions: Allow for thermal expansion of exposed roof specialties.

- D. Fastener Sizes: Use fasteners of sizes that will penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.
- E. Seal joints with elastomeric sealant as required by roofing-specialty manufacturer.
- F. Seal joints as required for watertight construction. Place sealant to be completely concealed in joint. Do not install sealants at temperatures below 40 deg F.

3.4 COPING INSTALLATION

- A. Install cleats, anchor plates, and other anchoring and attachment accessories and devices with concealed fasteners.
- B. Anchor copings to meet performance requirements.

3.5 ROOF-EDGE FLASHING INSTALLATION

- A. Install cleats, cants, and other anchoring and attachment accessories and devices with concealed fasteners.
- B. Anchor roof edgings with manufacturer's required devices, fasteners, and fastener spacing to meet performance requirements.

3.6 ROOF-EDGE DRAINAGE-SYSTEM INSTALLATION

- A. General: Install components to produce a complete roof-edge drainage system according to manufacturer's written instructions. Coordinate installation of roof perimeter flashing with installation of roof-edge drainage system.
- B. Gutters: Join and seal gutter lengths. Allow for thermal expansion. Attach gutters to firmly anchored gutter supports spaced not more than 30 inches apart. Attach ends with rivets and seal with sealant to make watertight. Slope to downspouts.
- C. Downspouts: Join sections with manufacturer's standard telescoping joints. Provide hangers with fasteners designed to hold downspouts securely to walls and 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c.
 - 1. Provide elbows at base of downspout to direct water away from building.
- D. Parapet Scuppers: Install scuppers through parapet where indicated. Continuously support scupper, set to correct elevation, and seal flanges to interior wall face, over cants or tapered edge strips, and under roofing membrane.
 - 1. Anchor scupper closure trim flange to exterior wall and seal or solder to scupper.
 - 2. Loosely lock front edge of scupper with conductor head.
 - 3. Seal or solder exterior wall scupper flanges into back of conductor head.

3.7 REGLET AND COUNTERFLASHING INSTALLATION

- A. General: Coordinate installation of reglets and counterflashings with installation of base flashings.
- B. Surface-Mounted Reglets: Install reglets to receive flashings where flashing without embedded reglets is indicated on Drawings. Install at height so that inserted counterflashings overlap 4 inches over top edge of base flashings.

- C. Counterflashings: Insert counterflashings into reglets or other indicated receivers; ensure that counterflashings overlap 4 inches over top edge of base flashings. Lap counterflashing joints a minimum of 4 inches and bed with elastomeric sealant. Fit counterflashings tightly to base flashings.

3.8 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder and sealants.
- C. Remove temporary protective coverings and strippable films as roof specialties are installed. On completion of installation, clean finished surfaces including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain roof specialties in a clean condition during construction.
- D. Replace roof specialties that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 07 72 00 - ROOF ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Roof curbs.
 - 2. Equipment supports.

1.2 SUBMITTALS

- A. Product Data: For each type of roof accessory indicated.
- B. Shop Drawings: For roof accessories.
- C. Samples: For each exposed product and for each color and texture specified.
- D. Coordination Drawings: Roof plans, drawn to scale, and coordinating penetrations and roof-mounted items.
- E. Operation and maintenance data.
- F. Warranty: Sample of special warranty.

PART 2 - PRODUCTS

2.1 METAL MATERIALS

- A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation.
 - 1. Mill-Phosphatized Finish: Manufacturer's standard for field painting.
 - 2. Factory Prime Coating: Where field painting is indicated, apply pretreatment and white or light-colored, factory-applied, baked-on epoxy primer coat, with a minimum dry film thickness of 0.2 mil (0.005 mm).
 - 3. Exposed Coil-Coated Finish: Two-coat fluoropolymer finish; AAMA 621; system consisting of primer and fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight.
 - 4. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat, with a minimum dry film thickness of 1 mil (0.025 mm) for topcoat.
- B. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, AZ50 (AZM150) coated.
 - 1. Factory Prime Coating: Where field painting is indicated, apply pretreatment and white or light-colored, factory-applied, baked-on epoxy primer coat, with a minimum dry film thickness of 0.2 mil (0.005 mm).
 - 2. Exposed Coil-Coated Finish: Two-coat fluoropolymer finish; AAMA 621; system consisting of primer and fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight
 - 3. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat, with a minimum dry film thickness of 1 mil (0.025 mm) for topcoat.
- C. Aluminum Sheet: ASTM B 209 (ASTM B 209M), manufacturer's standard alloy for finish required, with temper to suit forming operations and performance required.
 - 1. Mill Finish: As manufactured.

2. Factory Prime Coating: Where field painting is indicated, apply pretreatment and white or light-colored, factory-applied, baked-on epoxy primer coat, with a minimum dry film thickness of 0.2 mil (0.005 mm).
 3. Clear Anodic Finish: AAMA 611, Class II, 0.010 mm or thicker.
 4. Color Anodic Finish: AAMA 611, Class II, 0.010 mm or thicker.
 5. Exposed Coil-Coated Finish: Two-coat fluoropolymer finish; AAMA 620; system consisting of primer and fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight.
 6. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0.04 mm).
- D. Aluminum Extrusions and Tubes: ASTM B 221 (ASTM B 221M), manufacturer's standard alloy and temper for type of use, finished to match assembly where used, otherwise mill finished.
- E. Stainless-Steel Sheet and Shapes: ASTM A 240/A 240M or ASTM A 666, Type 304.
- F. Steel Shapes: ASTM A 36/A 36M, hot-dip galvanized according to ASTM A 123/A 123M unless otherwise indicated.

2.2 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.
- B. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, acceptable to authorities having jurisdiction, containing no arsenic or chromium, and complying with AWPA C2; not less than 1-1/2 inches (38 mm) thick.
- C. Fasteners: Roof accessory manufacturer's recommended fasteners suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide non-removable fastener heads to exterior exposed fasteners.
- D. Sealants: As recommended by roof accessory manufacturer for installation indicated.

2.3 ROOF CURBS

- A. Roof Curbs: Internally reinforced roof-curb units capable of supporting superimposed live and dead loads, including equipment loads and other construction indicated on Drawings; with welded or mechanically fastened and sealed corner joints, and integrally formed deck-mounting flange at perimeter bottom.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Vent Products Model 8130 roof curb or comparable product by one of the following:
 - a. AES Industries, Inc.
 - b. Curbs Plus, Inc.
 - c. Custom Solution Roof and Metal Products.
 - d. Greenheck Fan Corporation.
 - e. LM Curbs.
 - f. Metallic Products Corp.
 - g. Milcor Inc.; Commercial Products Group of Hart & Cooley, Inc.
 - h. Pate Company (The).
 - i. Roof Products, Inc.
 - j. Safe Air of Illinois.
 - k. Thybar Corporation.
 - l. Vent Products Co., Inc.

- B. Material: Zinc-coated (galvanized) 18 gauge steel sheet.
 - 1. Finish: Mill phosphatized.
 - 2. Insulation: Factory insulated with 1-1/2-inch- (38-mm-) thick glass-fiber board insulation.
 - 3. Liner: 0.63" aluminum liner.
 - 4. Factory-installed wood nailer at top of curb, continuous around curb perimeter.
 - 5. Fabricate curbs to minimum height of 12 inches (300 mm) unless otherwise indicated.
 - 6. Top Surface: Level around perimeter with roof slope accommodated by sloping the deck-mounting flange.
 - 7. Sloping Roofs: Where roof slope exceeds 1:48, fabricate curb with perimeter curb height tapered to accommodate roof slope so that top surface of perimeter curb is level. Equip unit with water diverter or cricket on side that obstructs water flow.

2.4 EQUIPMENT SUPPORTS

- A. Equipment Supports: Internally reinforced metal equipment supports capable of supporting superimposed live and dead loads, including equipment loads and other construction indicated on Drawings; with welded or mechanically fastened and sealed corner joints and integrally formed deck-mounting flange at perimeter bottom.
 - 1. Manufacturers: Subject to compliance with requirements available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. AES Industries, Inc.
 - b. Curbs Plus, Inc.
 - c. Custom Solution Roof and Metal Products.
 - d. Greenheck Fan Corporation.
 - e. LM Curbs.
 - f. Milcor Inc.; Commercial Products Group of Hart & Cooley, Inc.
 - g. Pate Company (The).
 - h. Roof Products, Inc.
 - i. Thybar Corporation.
 - j. Vent Products Co., Inc.
- B. Material: Zinc-coated (galvanized) 18 gauge steel sheet.
 - 1. Finish: Mill phosphatized.
- C. Construction:
 - 1. Fabricate equipment supports to minimum height of 12 inches (300 mm) unless otherwise indicated.
 - 2. Sloping Roofs: Where roof slope exceeds 1:48, fabricate each support with height to accommodate roof slope so that tops of supports are level with each other. Equip supports with water diverters or crickets on sides that obstruct water flow.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Verify dimensions of roof openings for roof accessories. Install roof accessories according to manufacturer's written instructions.
 - 1. Install roof accessories level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil canning, buckling, or tool marks.
 - 2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.
 - 3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
 - 4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.

- B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
- C. Roofing Protection:
 - 1. Protect roofing using details approved by the roofing manufacturer.
 - 2. Roofing materials shall be continuous under equipment supports or terminate vertically not less than 8 inches above the roof surface.
 - 3. If mechanical units are of a size or weight that they will crush the insulation, then the insulation below the sleeper must be replaced by wood blocking.
- D. Seal joints with sealant as required by roof accessory manufacturer.

3.2 REPAIR AND CLEANING

- A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing according to ASTM A 780.
- B. Touch up factory-primed surfaces with compatible primer ready for field painting according to Division 9 painting Sections.
- C. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 07 92 00 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Silicone joint sealants.
 - 2. Urethane joint sealants.
 - 3. Preformed joint sealants.
- B. Related Sections:
 - 1. Section 04 22 00 - Unit Masonry Assemblies, for masonry control and expansion joint fillers and gaskets.

1.2 PRECONSTRUCTION TESTING

- A. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.
 - 1. Use ASTM C 1087 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
 - 2. Submit not fewer than three pieces of each kind of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
 - 3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
 - 4. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.
 - 5. Testing will not be required if joint-sealant manufacturers submit joint preparation data that are based on previous testing, not older than 24 months, of sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.

1.3 SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- C. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2 inch-wide joints formed between two 6 inch- long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- D. Joint-Sealant Schedule: Include the following information:
 - 1. Joint-sealant application, joint location, and designation.
 - 2. Joint-sealant manufacturer and product name.
 - 3. Joint-sealant formulation.
 - 4. Joint-sealant color.
- E. Qualification Data: For qualified Installer and testing agency.
- F. Product Certificates: For each kind of joint sealant and accessory, from manufacturer.
- G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that sealants comply with requirements.

- H. Preconstruction Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:
 - 1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
 - 2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.
- I. Warranties: Sample of special warranties.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Source Limitations: Obtain each kind of joint sealant from single source from single manufacturer.
- C. Product Testing: Test joint sealants using a qualified testing agency.
 - 1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.
 - 2. Test according to SWRI's Sealant Validation Program for compliance with requirements specified by reference to ASTM C 920 for adhesion and cohesion under cyclic movement, adhesion-in-peel, and indentation hardness.
- D. Pre-installation Conference: Conduct conference at Project site.

1.5 PROJECT 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.
 - 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.

1.6 WARRANTY

- A. Special Installer's Warranty: Manufacturer's standard form in which 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's standard form in which joint-sealant manufacturer agrees to furnish joint sealants to repair or replace those 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.
- C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
 - 1. Movement of the structure caused by structural settlement or errors attributable to design or construction resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
 - 2. Disintegration of joint substrates from natural 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 MATERIALS, 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. Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
 1. Suitability for Immersion in Liquids. Where sealants are indicated for Use I for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C 1247. Liquid used for testing sealants is de-ionized water, unless otherwise indicated.
- C. Colors of Exposed Joint Sealants: As indicated by manufacturer's designations

2.2 SILICONE JOINT SEALANTS

- A. One-Part Silicones: ASTM C920, Type S, Grade NS, Class 25.
 1. 795 Silicone Structural Glazing, Glazing, and Weatherproofing Sealant, by Dow Corning. (colors only)
 2. Construction 1200 Sealant, General Electric Company.
 3. 999-A, Dow Corning.
 4. 864 Architectural Silicone, by Pecora Corporation. (colors only)

2.3 URETHANE JOINT SEALANTS

- A. Two-Part Urethane: Self-Leveling, ASTM C920, Type M, Grade P, Class 25.
 1. Chem-Calk CC-550, by Bostik.
 2. Vulkem 245, by Mameco.
 3. Vulkem 255, Wide-Joint, by Mameco.
 4. NR-200 Urexpan, by Pecora Corporation.
 5. Sikaflex-2c NS/SL, by Sika Corporation.
- B. Two-Part Urethane: Non-Sag, ASTM C920, Type M, Grade NS, Class 25.
 1. Chem-Calk 500, by Bostik.
 2. Vulkem 227, by Mameco.
 3. Dynatrol II, by Pecora Corporation.
 4. Sikaflex-2c NS/SL, by Sika Corporation.
 5. Sonolastic NP 2, by Sonneborn Building Products, ChemRex Inc.
- C. One-Part Urethane: Self-Leveling, ASTM C920, Type S, Grade P, Class 25.
 1. Vulkem 45, by Mameco.
 2. Urexpan NR-201, by Pecora Corporation.
 3. Sonolastic SL1, by Sonneborn Building Products, ChemRex Inc.
 4. Sikaflex 1C-SL by Sika.
- D. One-Part Urethane: Non-Sag, ASTM C920, Type S, Grade NS, Class 25.
 1. Chem-Calk 900, by Bostik.

2. Vulkem 116, by Mameco.
3. Sonolastic NP I, by Sonneborn Building Products, ChemRex Inc.
4. Sikaflex 1A by Sika.

2.4 PREFORMED JOINT SEALANTS

- A. Preformed Silicone Joint Sealants: Manufacturer's standard sealant consisting of precured low-modulus silicone extrusion, in sizes to fit joint widths indicated, combined with a neutral-curing silicone sealant for bonding extrusions to substrates.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Corning Corporation; 123 Silicone Seal.
 - b. GE Advanced Materials - Silicones; UltraSpan US1100.
 - c. Pecora Corporation; Sil-Span.

2.5 JOINT SEALANT BACKING

- A. General: Provide sealant backings of material that are non-staining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin) OR Type O (open-cell material), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

2.6 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.

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 joint-sealant performance.
- 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.
 - b. Masonry.
 - c. Exterior insulation and finish systems.
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. 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.

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 C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of kind 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 per Figure 8A in ASTM C 1193, unless otherwise indicated.
 4. Provide flush joint profile where indicated per Figure 8B in ASTM C 1193.
 5. Provide recessed joint configuration of recess depth and at locations indicated per Figure 8C in ASTM C 1193.

- G. Installation of Preformed Silicone-Sealant System: Comply with the following requirements:
1. Apply silicone sealant to each side of joint to produce a bead of size complying with preformed silicone-sealant system manufacturer's written instructions and covering a bonding area of not less than 3/8 inch. Hold edge of sealant bead 1/4 inch inside masking tape.
 2. Within 10 minutes of sealant application, press silicone extrusion into sealant to wet extrusion and substrate. Use a roller to apply consistent pressure and ensure uniform contact between sealant and both extrusion and substrate.
 3. Complete installation of sealant system in horizontal joints before installing in vertical joints. Lap vertical joints over horizontal joints. At ends of joints, cut silicone extrusion with a razor knife.

3.4 FIELD QUALITY CONTROL

- A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
1. Extent of Testing: Test completed and cured sealant joints as follows:
 - a. Perform 10 tests for the first 1000 feet of joint length for each kind of sealant and joint substrate.
 - b. Perform 1 test for each 1000 feet of joint length thereafter or 1 test per each floor per elevation.
 2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
 - a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
 3. Inspect tested joints and report on the following:
 - a. Whether sealants filled joint cavities and are free of voids.
 - b. Whether sealant dimensions and configurations comply with specified requirements.
 - c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.
 4. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.
 5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.
- B. Evaluation of Field-Adhesion Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.5 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.6 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION

DIVISION 8
OPENINGS

SECTION 08 16 13 – FIBERGLASS REINFORCED PLASTIC DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Fiberglass reinforced plastic (FRP) doors and frames.
 - a. Standard doors and frames.
 - b. Fire-rated doors and frames.
- B. Related Sections:
 - 1. Section 07 92 00 – Joint Sealants.
 - 2. Section 08 71 00 - Door Hardware.

1.2 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, core descriptions, label compliance, fire-resistance and temperature-rise ratings, and finishes for each type of FRP door and frame specified.
 - 1. Manufacturers' printed installation instructions for doors and frames.
- B. Shop Drawings: In addition to requirements below, provide a schedule of FRP doors and frames showing size and thickness, and using same reference numbers for details and openings as those on Drawings:
 - 1. Elevations of each door design.
 - 2. Details of doors, including vertical and horizontal edge details.
 - 3. Frame details for each frame type, including dimensioned profiles.
 - 4. Details and locations of reinforcement and preparations for hardware.
 - 5. Details of each different wall opening condition.
 - 6. Details of anchorages, accessories, joints, and connections.
 - 7. Details of glazing, glazing frames and stops showing glazing.
- C. Samples for Initial Selection: Complete set of actual materials in small sections for the following:
 - 1. FRP Door Faces: Show the full range of finish colors, textures, and patterns available.
- D. Samples for Verification: Actual door face materials, approximately 4x4 inches square for each sample selected. Provide samples showing color and texture to be expected in the finished work.
- E. Qualification Data: For manufacturer and for Installer.
- F. Product Test Reports: Based on evaluation of comprehensive fire tests performed by a qualified testing agency, for each type of FRP door and frame.
 - 1. Certification: Test report/certification of self-extinguishing capabilities of gel-coat finish.
- G. Reinforcement Certification: Test report/certification of anchor holding value of door and frame reinforcement material.
 - 1. Documentation of anchor holding valves for composite design of doors and frames.
- H. Other Action Submittals:
 - 1. Schedule: Provide a schedule of fiberglass reinforced plastic work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with door hardware schedule.

1.3 QUALITY ASSURANCE

- A. Source Limitations: Obtain FRP doors and frames through one source from a single manufacturer (for both standard and fire-rated doors).
- B. Manufacturer's Qualifications: A company specializing in the manufacture of FRP doors and frames (standard and fire-rated) with a minimum of five years documented production experience.
- C. Installer Qualifications: An experienced installer trained and approved by manufacturer or the supplier, with a minimum of three years experience.
- D. Standard FRP Door and Frame Assemblies: Doors and frames shall have a flame-spread rating of 25 or less in accordance with ASTM E 84.
 - 1. Component Rating: All FRP components, including the gel-coat finish, shall be self-extinguishing per ASTM D 635.
- E. Fire-Rated FRP Door and Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated.
 - 1. All doors and frames shall be certified to meet UL 10B/UL 10C and ASTM E 152.
- F. Core Material Rating: Foam plastic core material for all non-rated insulated doors must be a Class A rated foam.
 - 1. Frame Spread Index: 75 or less.
 - 2. Smoke Developed Index: Not more than 450.
- G. Pre-installation Conference: Conduct conference at project site.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Delivery doors and frames cardboard wrapped, or crated in wood to provide protection during transit and on-site storage.
 - 1. Provide foam or corrugated separation between individual units.
- B. Store doors and frames under cover (out of the weather) at Project site. Place units in a vertical position with heads up, spaced by blocking, on minimum 4-inch high wood blocking. Avoid using non-vented plastic or canvas shelters that could create a humidity chamber.
 - 1. If wrappers on doors become wet, remove cartons immediately. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

1.5 PROJECT CONDITIONS

- A. Field Measurements: Verify openings in poured concrete and CMU walls by field measurements before fabrication and indicate measurements on Shop Drawings.

1.6 COORDINATION

- A. Coordinate installation of anchorages for frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.7 WARRANTY

- A. Warranty: Manufacturer's standard form, signed by manufacturer, Installer, and Contractor, in which manufacturer agrees to repair or replace doors that are defective in materials or workmanship, or which have damage or have failed due to corrosion.
 - 1. Ten (10) year for defects in materials and/or workmanship.
 - 2. Twenty-five (25) years for de-lamination, and/or degradation or failure due to corrosion.

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:
 - 1. Chem-Pruf Door Co. Ltd.
 - 2. Tiger Door, LLC.
 - 3. Or Approved Equal.

2.2 MATERIALS

- A. Fiberglass Mat: Random glass fiber mat, minimum 4.5 ounces per square foot weight of glass material.
- B. Polyurethane Foam: Minimum density 4 pounds per cubic foot, maximum flame spread 25 in accordance with ASTM E 84.
 - 1. Class "A" rated to comply with International Building Code requirements.
- C. Kraft Honeycomb Material: Phenolic resin impregnated, maximum flame spread 25 in accordance with ASTM E 84.
- D. Mineral Core: Manufacturer's standard fire-resistant mineral core materials.
- E. Roving: Unidirectional glass fiber mat, minimum 16 ounces per square yard weight.
- F. Resins: Formulated for specified environment, maximum flame spread 25 in accordance with ASTM E 84, self-extinguishing in accordance with ASTM D 635.
- G. Anchors: Manufacturer's standard stainless steel anchors.
- H. Bonding Materials: Manufacturer's standard frame-to-opening bonding system.
- I. Joint Sealer: Silicone sealant, specified in Section 07 92 00.
- J. Glazing:
 - 1. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacturer, fabrication or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
 - 2. Delegated Design: Design glass, including comprehensive engineering analysis according to ICC's 2006 International building code by a qualified professional engineer.
 - 3. Thermal movements: Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
 - a. Temperature Change: 120 deg F (67 deg C), ambient; material surfaces.
 - 4. Sealants and accessories shall be manufacturer's standards.

2.3 FRP DOORS

- A. General: Provide FRP doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces, unless otherwise indicated.
1. Design: Flush panel – seamless design with smooth face.
 2. Finish: Manufacturer's standard gel-coat finish, self-extinguishing type.
 - a. Flame Spread Rating: 25 or less.
 3. Size: Width and height as scheduled on Drawings.
 - a. Height of doors shall not be altered on-site, unless manufacturer agrees, in writing, to honor the specified warranty(s) after modifications.
 4. Thickness: Nominal 1-3/4 inches.
 5. Foam Core Material: Foam plastic core materials shall conform to the requirements of the International Building Code.
 6. Hardware Provisions: Provide surface recessed areas, cutouts, or hinge pockets, and internal reinforcement for mortised hardware and hinges.
- B. Door Construction: Manufacturer's standard construction FRP process, subject to compliance with the following requirements:
1. Stiles and Rails: Pultruded rectangular (or square) fiberglass tubes, or a molded one-piece U-shaped frame.
 - a. Minimum Tube Size: 1-1/2 x 1-1/2 inches.
 2. Standard Core Materials: As indicated below – no wood allowed.
 - a. Exterior Doors
 - 1) Urethane/Polyurethane Core: Class A rated.
 - a) R-Value: R-10 to R-12 minimum.
 - b. Interior Doors
 - 1) Honeycomb Core: Phenolic resin impregnated Kraft paper.
 - a) Maximum Flame Spread Rating: 25.
 - b) R-Value: R-5 to R-8.
 3. Fire-Rated Core Material
 - a. Mineral Core: Fire-rated (as scheduled).
 - 1) Full thickness of door cavity.
 4. Internal Reinforcement: Manufacturer's standard FRP or high-density polymer.
 - a. Minimum Screw-Holding Capacity: 650 pounds.
 - b. Thru-Bolting: Embed compression members or reinforcement during fabrication where thru-bolting of hardware is required.
 5. Face Sheets: Fiberglass reinforced mats or sheets, saturated with resins.
 - a. Fire-Rated Doors: FRP mats or panels made with fire-retardant resins, or with intumescent molded into the door structure.
 6. Finish: Gel-coat finish with integral color.
 - a. Minimum Thickness: 25 mil gel-coat.
 - b. Surface: Smooth.
 - 1) Sheen: Gloss or semi-gloss.
 7. Color: Provide custom color. Owner shall select final color.

2.4 DOOR ACCESSORIES

- A. Glazed Openings: Cutouts/openings for fixed view panels shall be provided by the FRP door manufacturer at the time the door is fabricated. Openings cut into the door shall be completely sealed by FRP frame members provided as an integral part of the door fabrication.
1. Glazing Stops/Retainers: Solid FRP or molded resin stops, with a sloped profile that drains away from the glazing.
 - a. Type: Removable type, with anchors which do not affect the sealed integrity of the door panel itself.
 - b. Finish: Match the color and finish of the door.

2. Louvers: Where required/indicated, louvers shall be fabricated of FRP material of an inverted "v" design, and shall be subject to the same performance requirements and warranty as the door panel. The louver opening will be fabricated into the door in the same method as for glazed openings above.
 - a. Finish and Color: To match door and frame.
3. Fasteners: Provide stainless steel fasteners, as required by manufacturer, for installation of stops at glazing openings and louvers.
4. Astragals: Astragals (for pairs of doors) shall be fabricated of FRP material to match door.
 - a. Profile: Angle or "z" style astragal.
 - b. Finish and Color: To match door.
5. Thresholds: Pultruded or molded FRP with gel-coat finish.
 - a. Type and Size: 5 inch wide saddle-type threshold.
 - b. Finish and Color: To match door and frame.

2.5 FRP FRAMES

- A. General: Provide FRP frames of design indicated herein, and as shown on the Drawings. FRP faced hollow metal or stainless steel frames are not acceptable.
 1. Profile: One-piece frame with integral stop - no joints or screws.
 2. Finish: Gel-coat finish shall match finish for doors.
 - a. Gel-coat shall be self-extinguishing.
 - b. Flame Spread Rating: 25 or less.
 3. Color: Provide custom color.
- B. Frame Construction: Manufacturer's standard FRP pultrusion or one-piece molded frames.
 1. Opening Size: As scheduled on the Drawings.
 2. Frame Size: As follows unless otherwise shown or noted on the Drawings.
 - a. Jamb Depth: 5-3/4 inches standard.
 - b. Face Dimensions: Jambs 2 inches standard; head 2 inch or 4 inch as scheduled.
 - c. Stop Depth: 5/8 inch minimum.
 3. Standard Core Materials: Full depth FRP or Class A rated plastic foam fill.
 4. Fire-Rated Core Materials: Fire-stop and mineral core, or other fire-resistant composite core formulation, used by manufacturer to achieve UL and ASTM certifications.
 5. Internal reinforcement: Provide solid polymer or FRP reinforcement materials as an integral part of the frame design, for the attachment of mortise and surface-mounted hardware.
 6. Anchors: Manufacturer shall provide the type, number and spacing for anchors as required for adjacent construction.
 - a. CMU Walls: "T" strap or heavy gauge wire anchors.
 - b. Concrete Walls: Existing opening anchors.
 - c. Metal Framing: As recommended by manufacturer.

2.6 HARDWARE/HARDWARE PREPARATIONS

- A. General: Hardware for FRP doors and frames is specified in Section 08 71 00 Finish Hardware unless otherwise noted.
 1. Hardware Specified in this Section: Provide hardware items as follows:
 - a. FRP astragals.
 - b. FRP thresholds.
 2. Hardware by Others: FRP door/frame manufacturer shall coordinate the fabrications of the doors and frames to accommodate hardware specified or indicated elsewhere in the contract documents, and as provided by an approved Hardware Schedule.

- B. Hardware Preparations: FRP door/frame manufacturer shall provide internal reinforcement blocking for all surface-mounted hardware, and to provide the blocking and cutouts for all mortise hardware.
 - 1. Surface-Mounted Hardware Items
 - a. Closers
 - b. Kick plates.
 - 2. Mortise Hardware items: All doors and frames shall be mortised and reinforced to allow on-site installation of hinges and locks, in accordance with the approved Hardware Schedule and the hardware manufacturer's templates.
 - a. Full mortise hinges.
 - b. Mortise locksets.
 - c. Mortise exit devices.

2.7 FASTENERS

- A. General: All fasteners shall be Type 304 CRSS (18-8 series corrosion-resistant stainless steel) - no carbon steel or aluminum components.

2.8 FABRICATION

- A. General: Fabricate FRP doors and frames as shown on the Drawings and in accordance with industry practices as required to achieve highest quality of workmanship.
 - 1. Frames shall be rigid, neat in appearance and free from defects.
 - 2. Field measurements shall be taken as required for coordination with adjoining work.
- B. Quality Standards: Form exposed surfaces free from warp, wave and buckle, with all corners square.
 - 1. Set each member in proper alignment and relationship to other members with all surfaces straight and in a true plane.
- C. Reinforcement: Reinforce members, accessories and joints with plates, tubes or angles for rigidity and strength.
- D. Hardware Preparation: Doors and frames shall be mortised and reinforced for hardware in accordance with the hardware manufacturer's instructions and templates. The reinforcing shall be designed to receive hinges, locks, strikes, closures, etc.
 - 1. Reinforcing for hardware shall be designed by the FRP manufacturer to withstand all imposed loads and repetitions of use for each respective item of hardware.
- E. Furnish at least one floor anchor and three jamb anchors in each jamb of frames up to 84 inches high and one additional anchor for each 12 inches in height above 84 inches, in shapes, sizes and spacing shown or as required by manufacturer for anchorage into adjoining wall construction.
 - 1. Fabricate joint anchor of stainless steel.
 - 2. Terminate bottom of frames at the indicated finished floor level.
- F. Door/Frame Tolerances: Provide clearance for doors of 1/8 inch at jambs and heads; 1/4 inch clearance above threshold.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of FRP doors and frames.
 - 1. Examine roughing-in for embedded and built-in anchors to verify actual locations of FRP frame connections before frame installation.
 - 2. Do not proceed with installation until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

3.2 INSTALLATION

- A. General: Provide FRP doors and frames of sizes, thicknesses, and designs indicated. Install doors and frames plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings, approved shop drawings, and manufacturer's written instructions and recommendations.
 - 1. Field Modifications: On-site alteration or modification of FRP doors and frames to accommodate field conditions is not permitted.
 - 2. Fire labeled doors and frames must be installed in strict accordance with manufacturer's instructions and the latest revision of NFPA 80.
- B. FRP Frames: Install frames for doors (sidelights, transoms and borrowed lights, where applicable) and other openings, of size and profile indicated.
 - 1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces or spreaders, leaving frame surfaces smooth of undamaged.
 - a. Install view or light-opening frames with removable glazing stops located on secure side of opening.
 - b. Remove temporary braces necessary for installation only after frames have been properly set and secured.
 - c. Check plumb, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
 - d. Provide floor anchors for each jamb (and/or mullion) that extends to floor and secure with post-installed expansion anchors.
- C. FRP Doors: Fit doors accurately in frames, within clearances specified below.
 - 1. Non-Fire-Rated Doors:
 - a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
 - b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
 - c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
 - d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.
 - 2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
- D. Glazing: Comply with installation requirements and with FRP door and frame manufacturer's written instructions.
 - 1. Secure stops with countersunk stainless steel flat-head screws/anchors spaced uniformly not more than 9 inches o.c., and not more than 2 inches o.c. from each corner.

3.3 ADJUSTING AND CLEANING

- A. Final Adjustments: Leave work in complete and proper operating condition. Remove and replace damaged or defective work, including doors or frames that are warped, bowed, or otherwise unacceptable.
 - 1. Adjust doors in accordance with door manufacturer's maintenance instructions to swing open and shut without binding and to fit accurately in the frames within the clearances/tolerances specified.
 - 2. Check and readjust operating hardware items immediately before final inspection.
- B. Cleaning: Clean FRP doors and frames immediately after installation using cleaning materials and procedures as recommended by the manufacturer.
 - 1. Clean with mild, non-abrasive cleaner and water, using soft, non-abrasive cleaning aids.

3.4 PROTECTION

- A. General: Protect door/frame opening assemblies and hardware from damage by subsequent construction until time for Substantial Completion.

3.5 SCHEDULE

- A. DOOR SCHEDULE- See individual facility plans.

END OF SECTION

SECTION 08 33 23 - OVERHEAD COILING DOORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Insulated service doors.
- B. Related Sections:
 - 1. Section 05 50 00 - Metal Fabrications, for miscellaneous steel supports.
 - 2. Section 09 90 00 - Painting and Protection Coatings, for finish painting of factory-primed doors.

1.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design overhead coiling doors, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance, Exterior Doors: Exterior overhead coiling doors shall withstand the wind loads, the effects of gravity loads, and loads and stresses within limits and under conditions indicated according to SEI/ASCE 7.
 - 1. Wind Loads:
 - a. Uniform pressure (velocity pressure) of 25 lbf/sq. ft., acting inward and outward.
 - b. For additional wind design criteria required for analysis, refer to the plans and spec section 01 81 04.
 - 2. Deflection Limits: Design overhead coiling doors to withstand design wind load without evidencing permanent deformation or disengagement of door components.
- C. Operability under Wind Load: Design overhead coiling doors to remain operable under design wind load, acting inward and outward.
- D. Seismic Performance: Overhead coiling doors shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.
 - 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
 - 2. For additional seismic design criteria required for analysis, refer to the plans and spec section 01 81 02.
- E. Operation Cycles: Provide overhead coiling door components and operators capable of operating for not less than number of cycles indicated for each door. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.

1.3 SUBMITTALS

- A. Product Data: For each type and size of overhead coiling door and accessory. Include the following:
 - 1. Construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.
 - 2. Rated capacities, operating characteristics, electrical characteristics, and furnished accessories.

- B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data. 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.
 - 2. Show locations of replaceable fusible links.
 - 3. Wiring Diagrams: For power, signal, and control wiring.
- C. Samples for Initial Selection: Manufacturer's finish charts showing full range of colors and textures available for units with factory-applied finishes.
 - 1. Include similar Samples of accessories involving color selection.
- D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
 - 1. Bottom Bar: 6 inches long.
 - 2. Guides: 6 inches long.
 - 3. Brackets: 6 inches square.
 - 4. Hood: 6 inches square.
 - 5. Laminate-Clad Counter Panel Product: 6 inches square; for each type, color, pattern, and surface finish; laminated to core.
- E. Delegated-Design Submittal: For overhead coiling doors indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - 1. Detail fabrication and assembly of seismic restraints.
 - 2. Summary of forces and loads on walls and jambs.
- F. Qualification Data: For qualified Installer.
- G. Seismic Qualification Certificates: For overhead coiling doors, accessories, and components, from manufacturer.
- H. Maintenance Data: For overhead coiling doors to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for both installation and maintenance of units required for this Project.
- B. Source Limitations: Obtain overhead coiling doors from single source from single manufacturer.
 - 1. Obtain operators and controls from overhead coiling door manufacturer.

PART 2 - PRODUCTS

2.1 DOOR CURTAIN MATERIALS AND CONSTRUCTION

- A. Door Curtains: Fabricate overhead coiling-door curtain of interlocking metal slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:
 - 1. Steel Door Curtain Slats: Zinc-coated (galvanized), cold-rolled structural steel sheet; complying with ASTM A 653/A 653M, with G90 zinc coating; nominal sheet thickness (coated) of 0.028 inch and as required to meet requirements.

2. Insulation: Fill slats for insulated doors with manufacturer's standard thermal insulation complying with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E 84. Enclose insulation completely within slat faces.
 3. Metal Interior Curtain-Slat Facing: Match metal of exterior curtain-slat face.
 4. Gasket Seal: Provide insulated slats with manufacturer's standard interior-to-exterior thermal break or with continuous gaskets between slats.
- B. Endlocks and Windlocks for Service Doors: Malleable-iron casings galvanized after fabrication, secured to curtain slats with galvanized rivets or high-strength nylon. Provide locks on not less than alternate curtain slats for curtain alignment and resistance against lateral movement.
- C. Bottom Bar for Service Doors: Consisting of two angles, each not less than 1-1/2 by 1-1/2 by 1/8 inch thick; fabricated from manufacturer's standard hot-dip galvanized steel, stainless steel, or aluminum extrusions to match curtain slats and finish.
- D. Curtain Jamb Guides: Manufacturer's standard angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent over travel of curtain, and a continuous bar for holding windlocks.
1. Removable Posts and Jamb Guides for Counter Doors: Manufacturer's standard.

2.2 HOOD

- A. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.
1. Galvanized Steel: Nominal 0.028-inch- thick, hot-dip galvanized steel sheet with G90 zinc coating, complying with ASTM A 653/A 653M.

2.3 LOCKING DEVICES

- A. Slide Bolt: Fabricate with side-locking bolts to engage through slots in tracks for locking by padlock, located on both left and right jamb sides, operable from coil side.
- B. Locking Device Assembly: Fabricate with cylinder lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.
1. Lock Cylinders: Provide cylinders standard with manufacturer and keyed to building keying system.
 2. Keys: Provide five for each cylinder.
- C. Chain Lock Keeper: Suitable for padlock.

2.4 CURTAIN ACCESSORIES

- A. Weatherseals: Equip each exterior door with weather-stripping gaskets fitted to entire perimeter of door for a weathertight installation, unless otherwise indicated.
1. At door head, use 1/8-inch- thick, replaceable, continuous sheet secured to inside of hood.
 2. At door jambs, use replaceable, adjustable, continuous, flexible, 1/8-inch- thick seals of flexible vinyl, rubber, or neoprene.

2.5 COUNTERBALANCING MECHANISM

- A. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.
- B. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, welded or seamless carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in./ft. of span under full load.
- C. Spring Balance: One or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.
- D. Torsion Rod for Counterbalance Shaft: Fabricate of manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.
- E. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

2.6 MANUAL DOOR OPERATORS

- A. Equip door with manufacturer's recommended manual door operator unless another type of door operator is indicated.
- B. Chain-Hoist Operator: Consisting of endless steel hand chain, chain-pocket wheel and guard, and gear-reduction unit with a maximum 25 lbf force for door operation. Provide alloy-steel hand chain with chain holder secured to operator guide.

2.7 DOOR ASSEMBLY

- A. Insulated Service Door: Overhead coiling door formed with curtain of interlocking metal slats.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ACME Rolling Doors.
 - b. Alpine Overhead Doors, Inc.
 - c. AlumaTek, Inc.
 - d. C.H.I. Overhead Doors.
 - e. City-Gates.
 - f. Cookson Company.
 - g. Cornell Iron Works, Inc.
 - h. Dynamic Closures Corp.
 - i. Lawrence Roll-Up Doors, Inc.
 - j. Mahon Door Corporation.
 - k. McKeon Rolling Steel Door Company, Inc.
 - l. Metro Door.
 - m. Overhead Door Corporation.
 - n. QMI Security Solutions.
 - o. Raynor.
 - p. Southwestern Steel Rolling Door Co.
 - q. Wayne-Dalton Corp.
 - r. Windsor Door.

- B. Operation Cycles: Not less than 50,000.
 - 1. Include tamperproof cycle counter.
- C. Curtain R-Value: 6.0 deg F x h x sq. ft./Btu.
- D. Door Curtain Material: Galvanized steel.
- E. Door Curtain Slats: Flat profile slats of 1-7/8 inch to 3-1/4 inch center-to-center height.
- F. Curtain Jamb Guides: Galvanized steel with exposed finish matching curtain slats. Provide continuous integral wear strips to prevent metal-to-metal contact and to minimize operational noise.
- G. Hood: Galvanized steel.
 - 1. Shape: Round.
 - 2. Mounting: Face of wall.
- H. Locking Devices: Equip door with locking device assembly and chain lock keeper.
 - 1. Locking Device Assembly: Single-jamb side locking bars, operable from outside with cylinder.
- I. Manual Door Operator: Chain-hoist operator.
- J. Door Finish:
 - 1. Baked-Enamel or Powder-Coated Finish: Color as selected by Owner or Engineer from manufacturer's full range.

2.8 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- 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.

2.9 STEEL AND GALVANIZED-STEEL FINISHES

- A. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates areas and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.
- B. Examine locations of electrical connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install overhead coiling doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.
- B. Install overhead coiling doors, hoods, and operators at the mounting locations indicated for each door.
- C. Accessibility: Install overhead coiling doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.

3.3 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
 - 1. Perform installation and startup checks according to manufacturer's written instructions.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - 3. Test door closing when activated by detector or alarm-connected fire-release system. Reset door-closing mechanism after successful test.

3.4 ADJUSTING

- A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.
- B. Lubricate bearings and sliding parts as recommended by manufacturer.
- C. Adjust seals to provide weathertight fit around entire perimeter.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling doors.

END OF SECTION

SECTION 08 71 00 - DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Commercial door hardware for the following:
 - a. Swinging doors.
 - b. Hinged transom.
- B. Related Sections:
 - 1. Section 08 11 13 – Steel Doors and Frames.
- C. Products furnished, but not installed, under this Section include the following. Coordinating, purchasing, delivering, and scheduling remain requirements of this Section.
 - 1. Thresholds and weather stripping for locks specified in other Sections.

1.2 SUBMITTALS

- A. Product Data: Include construction and installation details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Samples for Initial Selection: For each finish, color, and texture required for each type of door hardware indicated.
- C. Samples for Verification: Submit minimum 2-by-4-inch plate Samples of each type of finish required, except primed finish.
- D. Maintenance Data: For each type of door hardware to include in maintenance manuals. Include final hardware and keying schedule.
- E. Warranty: Special warranty specified in this Section.
- F. Other Action Submittals:
 - 1. Door Hardware Sets: Prepared by or under the supervision of Architectural Hardware Consultant, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final door hardware sets with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
 - a. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule." Double space entries, and number and date each page.
 - b. Format: Use same scheduling sequence and format and use same door numbers as in the Contract Documents.
 - c. Content: Include the following information:
 - 1) Identification number, location, hand, fire rating and material of each door and frame.
 - 2) Type, style, function, size, quantity, and finish of each door hardware item. Include description and function of each lockset and exit device.
 - 3) Complete designations of every item required for each door or opening including name and manufacturer.
 - 4) Fastenings and other pertinent information.
 - 5) Location of each door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
 - 6) Explanation of abbreviations, symbols, and codes contained in schedule.

- 7) Mounting locations for door hardware.
- 8) Door and frame sizes and materials.
- 9) List of related door devices specified in other Sections for each door and frame.
- d. Submittal Sequence: Submit the final door hardware sets at earliest possible date, particularly where approval of the door hardware sets must precede fabrication of other work that is critical in Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the door hardware sets.
- 2. Keying Schedule: Prepared by or under the supervision of Architectural Hardware Consultant, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations.

1.3 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by lock manufacturer.
 - 1. Installer's responsibilities include supplying and installing door hardware and providing a qualified Architectural Hardware Consultant available during the course of the Work to consult with Contractor, Engineer, and Owner about door hardware and keying.
 - 2. Installer shall have warehousing facilities in Project's vicinity.
 - 3. Scheduling Responsibility: Preparation of door hardware and keying schedules.
- B. Architectural Hardware Consultant Qualifications: A person who is currently certified by DHI as an Architectural Hardware Consultant and who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project.
- C. Source Limitations: Obtain each type and variety of door hardware from a single manufacturer, unless otherwise indicated.
- D. Pre-installation Conference: Conduct conference at Project site.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.
- B. Tag each item or package separately with identification related to the final door hardware sets, and include basic installation instructions, templates, and necessary fasteners with each item or package.
- C. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

1.5 COORDINATION

- A. Templates: Distribute door hardware templates for doors, frames, and other work specified to be factory prepared for installing door hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware don't that fails in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:

- a. Structural failures including excessive deflection, cracking, or breakage.
 - b. Faulty operation of operators and door hardware.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
2. Warranty Period: Three years from date of Substantial Completion, except as follows:
- a. Exit Devices: Two years from date of Substantial Completion.
 - b. Manual Closers: 10 years from date of Substantial Completion.

1.7 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

- A. General: Provide door hardware for each door to comply with requirements in this Section and door hardware sets indicated in Part 3 "Door Hardware Sets" Article.
 - 1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and products equivalent in function and comparable in quality to named products.
 - 2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.
- B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in Part 3 "Door Hardware Sets" Article. Products are identified by using door hardware designations, as follows:
 - 1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in Part 3 "Door Hardware Sets" Article.
- C. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified unless noted otherwise in the hardware schedules.

2.2 HINGES, GENERAL

- A. Quantity: Provide the following, unless otherwise indicated:
 - 1. Two Hinges: For doors with heights up to 60 inches.
 - 2. Three Hinges: For doors with heights 61 to 90 inches.
 - 3. Four Hinges: For doors with heights 91 to 120 inches.
 - 4. For doors with heights more than 120 inches provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.
- B. Template Requirements: Provide only template-produced units.
- C. Hinge Weight: Unless otherwise indicated, provide the following:
 - 1. Exterior Doors and interior metal or FRP doors: Heavy-weight hinges.
 - 2. Interior Wood Doors: Standard-weight hinges.
 - 3. Doors with Closers and/or exit devices: Antifriction-bearing hinges – ball bearing.
- D. Hinge Base Metal: Unless otherwise indicated, provide the following:

1. Exterior Hinges: Stainless steel, with stainless-steel pin (630/US32D).
 2. Interior Hinges: Stainless steel, with stainless-steel pin (630/US32D).
 3. Hinges for Fire-Rated Assemblies: Stainless steel, with stainless-steel pin.
- E. Hinge Size: 4-1/2-inch x 4-1/2-inch, unless otherwise noted.
1. Nonremovable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for outswinging exterior doors.
 2. Corners: Square.
- F. Fasteners: Comply with the following:
1. Machine Screws: For metal doors and frames. Install into drilled and tapped holes.
 2. Wood Screws: For wood doors.
 3. Threaded-to-the-Head Wood Screws: For fire-rated wood doors.
 4. Screws: Phillips flat-head. Finish screw heads to match surface of hinges.
 - a. Fasteners for FRP doors and frame hardware are specified in Division 8, "FRP Doors and Frames."

2.3 HINGES

- A. Butts and Hinges: BHMA A156.1. Listed under Category A in BHMA's "Certified Product Directory."
- B. Template Hinge Dimensions: BHMA A156.7.
- C. Available Manufacturers:
1. Hager Companies (HAG).
 2. Lawrence Brothers, Inc. (LB).
 3. Stanley Commercial Hardware; Div. of The Stanley Works (STH).

2.4 PIVOTS AND PIVOT HINGES

- A. Pivots: BHMA A156.4. Listed under Category C in BHMA's "Certified Product Directory.:
- B. Available Manufacturers:
1. DORMA Architectural Hardware; Member of The DORMA Group North America.
 2. IVES Hardware; an Ingersoll-Rand Company.
 3. Rixson Specialty Door Controls; an ASSA ABLOY Group company.

2.5 LOCKS AND LATCHES, GENERAL

- A. Accessibility Requirements: Where indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)" and ANSI A117.1.
1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf (22 N).
- B. Latches and Locks for Means of Egress Doors: Comply with NFPA 101. Latches shall not require more than 15 lbf (67 N) to release the latch. Locks shall not require use of a key, tool, or special knowledge for operation.
- C. Lock Trim
1. Levers: Cast.
 2. Escutcheons: Forged or Cast.
 3. Dummy Trim: Match lever lock trim and escutcheons.

4. Lockset Designs: Provide lockset design(s) indicated by hardware sets or, if locksets are provided by another manufacturer, provide designs that match those designated.
- D. Lock Throw: Comply with testing requirements for lengths of bolts required for labeled fire doors, and as follows:
 1. Mortise Locks: Minimum 3/4-inch latchbolt throw.
 2. Deadbolts: Minimum 1-inch bolt throw.
 - a. Bored Locks: Minimum 1/2-inch latchbolt throw.
 - E. Backset: 2-3/4 inches, unless otherwise indicated.
 - F. Strikes: Manufacturer's standard strike with strike box for each latchbolt or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, and as follows:

2.6 MECHANICAL LOCKS AND LATCHES

- A. Lock Functions: Function numbers and descriptions indicated in door hardware sets comply with the following:
 1. Mortise Locks: BHMA A156.13.
 2. Bored (Cylindrical) Locks: BHMA A156.2.
- B. Mortise Locks: Stamped steel case with steel parts; BHMA A156.13, Grade 1; Series 1000.
 1. Available Manufacturers:
 - a. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group Company (CR).
 - b. Sargent Manufacturing Company; an ASSA ABLOY Group company.
 - c. Yale Commercial Locks and Hardware: an ASSA ABLOY Group Company.
 2. Product Reference Standard: CR ML2000 Series with Citation CSB (630) Trim.
- C. Bored (Cylindrical) Locks: BHMA A156.2, Grade 1, Series 4000.
 1. Available Manufacturers:
 - a. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group Company (CR).
 - b. SARGENT Manufacturing Company; an ASSA ABLOY Group company.
 - c. Yale Commercial Locks and Hardware: an ASSA ABLOY Group Company.
 2. Product Reference Standard: CR CL3100 Series with Armstrong (626) Trim.

2.7 AUXILIARY LOCKS AND LATCHES

- A. Auxiliary Locks: BHMA A156.5, Grade 1.
 1. Available Manufacturers:
 - a. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company.
 - b. SARGENT Manufacturing Company; an ASSA ABLOY Group company.
 - c. Yale Commercial Locks and Hardware: an ASSA ABLOY Group Company.
 2. Finish: 626/US26D

2.8 DOOR BOLTS

- A. Bolt Throws: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:
 1. Mortise Flush Bolts: Minimum 3/4-inch (19 mm) throw.
 2. Surface Bolts: Minimum 7/8-inch (22 mm) throw.
 3. Fire-Rated Surface Bolts: Minimum 1-inch (25 mm) throw.
- B. Dustproof Strikes: BHMA A156.16, Grade 1.
- C. Surface Bolts: BHMA A156.16, Grade 1.

1. Flush Bolt Heads: Minimum of 1/2-inch (13 mm) diameter rods of stainless steel with minimum 12-inch heads (305 mm) long rods for doors up to 84 inches (2134 mm) in height. Provide longer rods as necessary for doors exceeding 84 inches (2134 mm).
 2. Available Manufacturers:
 - a. Ives Hardware, an Ingersoll-Rand Company.
 - b. Other approved equal.
- D. Manual Flush Bolts: BHMA A156.16, Grade 1, designed for mortising into door edge.
1. Available Manufacturers:
 - a. Ives Hardware; an Ingersoll-Rand Company.
 - b. Stanley Commercial Hardware; Div. of The Stanley Works.
 - c. Trimco.
 2. Product Reference Standard: Ives No. 457-1/2 x 12 inches with top and bottom plates for rod retention.

2.9 EXIT DEVICES

- A. Exit Devices: BHMA A156.3, Grade 1.
- B. Accessibility Requirements: Where handles, pulls, latches, locks, and other operating devices are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)" and ANSI A117.1.
1. Provide operating devices that do not require tight grasping, pinching or twisting of the wrist and that operate with a force of not more than 5 lbf.
- C. Exit Devices for Means of Egress Doors: Comply with NFPA 101. Exit devices shall not require more than 15 lbf to release the latch. Locks shall not require use of a key, tool, or special knowledge for operation.
- D. Panic Exit Devices: Listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305.
- E. Fire Exit Devices: Devices complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire and panic protection, based on testing according to UL 305 and NFPA 252.
- F. Exit Device Design: Push Bar type equal to Corbin Russwin ED 5000 Series.
1. Panic-Listed Mortise Exit Devices: Corbin Russwin ED 5600L Series, with Citation C9M lever trim. Function as indicated on the door and/or hardware schedules.
 2. Rim Exit Devices: Corbin Russwin ED 5200 Series with Citation C9 lever trim. Function as indicated on the door and/or hardware schedules.
- G. Outside Trim: Lever with Mortise cylinder and Exit device; material and finish to match locksets, unless otherwise indicated.
- H. Dogging: One point dogging with 1/4-turn maximum to activate.

2.10 LOCK CYLINDERS

- A. Standard Lock Cylinders: BHMA A156.5, Grade 1.
1. Key Control Level: Category A.
 2. Destructive Test Level: Category A.
 3. Surreptitious Entry Resistance Level: Category A.
 4. Finish: 626/US26D

- B. Cylinders: Manufacturer's standard tumbler type, constructed from stainless steel, or nickel silver, and complying with the following:
 - 1. Number of Pins: Six.
 - 2. Mortise Type: Threaded cylinders with rings and straight- or clover-type cam.
 - 3. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
 - 4. Bored-Lock Type: Cylinders with tailpieces to suit locks.
- C. Permanent Cores: Manufacturer's standard; finish face to match lockset; complying with the following:
 - 1. Interchangeable Cores: Core insert, removable by use of a special key; usable with other manufacturers' cylinders.
- D. Construction Keying: Comply with the following:
 - 1. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.
 - a. Replace construction cores with permanent cores upon completion of construction.
- E. Manufacturer: Same manufacturer as for locks and latches.
- F. Available Manufacturers
 - 1. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group Company.
 - 2. Or Approved Equal.

2.11 CLOSERS

- A. Accessibility Requirements: Where handles, pulls, latches, locks, and other operating devices are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)" and ANSI A117.1.
 - 1. Comply with the following maximum opening-force requirements:
 - a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf (22.2 N) applied perpendicular to door.
 - b. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
- B. Door Closers for Means of Egress Doors: Comply with NFPA 101. Door closers shall not require more than 30 lbf (133 N) to set door in motion and not more than 15 lbf (67 N) to open door to minimum required width.
- C. Overhead Closers: Closers shall have high-strength cast-iron body with rectangular covers, adjustable spring power and back-check, and full rack and pinion action. All closers shall have adjustable back-check intensity valves and separate adjustment screws for closing and latching speeds.
 - 1. Closers for doors over 7-feet in height, or more than 3-feet wide, shall have heavy duty arms.
 - 2. Closers at exterior doors shall include hold open arms unless otherwise indicated.
 - 3. Door closer covers and arms shall be primed and painted to match door hardware.
 - 4. Closers shall be provided with sex bolts for fastening through doors, frames and transoms.
- D. Size of Units: Unless otherwise indicated, comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

- E. Surface Closers: BHMA A156.4, Grade 1. Listed under Category C in BHMA's "Certified Product Directory." Provide type of arm required for closer to be located on non-public side of door, unless otherwise indicated.
- F. Closer Design/Type: Closer type as follows:
 1. Regular Arm: Corbin Russwin DC3200 Series
 2. Parallel Arm: Corbin Russwin DC3210 Series
 3. Parallel Arm with Hold Open: Corbin Russwin DC3210

2.12 PROTECTIVE DOOR PLATES

- A. Size: 1-1/2 inches (38 mm) less than door width on push side and 1/2 inch (13 mm) less than door width on pull side, by height specified below.
- B. Fasteners: Manufacturer's standard machine or self-tapping screws.
- C. Metal Protective Kick Plates: BHMA A156.6; beveled top and 2 sides; fabricated from the following material:
 1. Material: 0.050-inch- (1.3 mm) thick stainless steel.
 2. Product References Standard: Rockwood No. 1050; 16 inches high.
- D. Metal Protective Armor Plates: Beveled top and two sides.
 1. Material: 0.062 inch thick stainless steel.
 2. Product Reference Standard: Rockwood No. 1050; 30 inches high.

2.13 STOPS AND HOLDERS

- A. Stops and Bumpers: General: BHMA A156.16, Grade 1.
 1. Provide wall stops for doors unless other type stops are scheduled or indicated. Do not mount floor stops where they will impede pedestrian or vehicular traffic. Where floor or wall stops are not appropriate, provide overhead holders.
- B. Door Stops: Door stops shall be of the type specified in the hardware sets or in this schedule, and shall be provided with the proper fasteners.
 1. Door Stop Schedule

	Floor Stop <u>w/ Keeper</u>	Floor <u>Stop</u>	Wall Stop <u>w/ Keeper</u>	<u>Wall Stop</u>	Kick Stop <u>(4" Arm)</u>
Rockwood	472	471	476	406	461L
 2. Fasteners/Anchors: Stops shall be provided with machine screws and anchors at concrete and masonry conditions, and toggle bolts at plaster, gypsum board, and wood conditions.
- C. Overhead Holders: Overhead type door holders shall be concealed type of correct size for door, 90 degrees openable, unless 120 degree opening shown, and allowing for checkmating. Interior doors shall be provided with overhead stops if wall type stops cannot be used and floor stops create a tripping hazard. Finish shall be chrome plated bronze with satin finish, US 26D, unless otherwise specified.
 1. Holders Design: Door holders shall be Russwin Corbin, DH 5000 Series, Holder No. DH5400, or equal.
- D. Silencers for Metal Door Frames: BHMA A156.16, Grade 1; neoprene or rubber, minimum diameter 1/2 inch (13 mm); fabricated for drilled-in application to frame.

2.14 THRESHOLDS

- A. Standard: BHMA A156.21. Listed under Category J in BHMA's "Certified Product Directory."

- B. Accessibility Requirements: Where thresholds are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)" and ANSI A117.1.
 - 1. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2-inch.
- C. Thresholds for Means of Egress Doors: Comply with NFPA 101. Maximum 1/2-inch (13 mm) high.
- D. Threshold Design: All exterior doors shall receive a panic style (offset) aluminum threshold unless otherwise indicated:
 - 1. Accessible Entry: National Guard No. 896N (neoprene gasket).
 - 2. Non-Accessible Entry: National Guard No. 884N (neoprene gasket).
 - 3. Receiving Entry: National Guard No. 513, Saddle/flat style threshold.

2.15 MISCELLANEOUS DOOR HARDWARE/ACCESSORIES

- A. Push Plates and Pulls: 4-inch by 16-inch by 0.050 thick, stainless steel: Rockwood #70 or equal. Pulls shall be 3/4" diameter thru-bolted with 4-inch x 16-inch stainless steel plate, Rockwood No. 105 x 70 with 630 finish, or equal.
- B. Astragal: "T" Astragal No. 158NA, National Guard Products or FRP astragal by door manufacturer; furnish with neoprene weatherstrip seal.
- C. Coordinator: Frame mounted, non-handed coordinator and filler piece; Rockwood No. 1600 Series with 630 finish.
Provide Rockwood No. 1100 carry bars at openings with astragals.
- D. Drip Strip: National Guard No. 16A x door width plus 2 inches. Mount head to door frame.
- E. Bottom Sweep: National Guard No. 201NA x door width.
- F. Weatherstrip: National Guard No. 135N; install at each jamb and at head.
- G. Door Bolts: As specified in Section 2.8.
- H. Closers: As specified in Section 2.11.
- I. Kick/Armor Plates: As specified in Section 2.12.
- J. Threshold: As specified in Section 2.14.
- K. Panic Exit Devices: Devices complying with NFPA 80 and as further specified in Section 2.9.

2.16 KEYING

- A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, Appendix A.
 - 1. Existing System: Master key locks to Owner's existing system.
- B. Keys: Nickel silver.
 - 1. Quantity: In addition to one extra key blank for each lock, provide the following:
 - a. Master Keys: Five.

2.17 FABRICATION

- A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location.
 - 1. Manufacturer's identification is permitted on rim of lock cylinders only.
- B. Base Metals: Produce door hardware units of base metal, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18. Do not furnish manufacturer's standard materials or forming methods if different from specified standard.
- C. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.
 - 1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
 - 2. Steel Machine or Wood Screws: For the following fire-rated applications:
 - a. Mortise hinges to doors.
 - b. Strike plates to frames.
 - c. Closers to doors and frames.
 - 3. Steel Through Bolts: For the following fire-rated applications unless door blocking is provided:
 - a. Surface hinges to doors.
 - b. Closers to doors and frames.
 - c. Surface-mounted exit devices.
 - 4. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
 - 5. Fasteners for Wood Doors: Comply with requirements in DHI WDHS.2, "Recommended Fasteners for Wood Doors."

2.18 FINISHES

- A. Standard: BHMA A156.18, as indicated in door hardware sets.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable temporary protective cover before shipping.
- C. 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 the 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.

2.19 MANUFACTURERS

- A. Product numbers listed in the following specifications are taken from catalogs of manufacturers listed as follows:
 - 1. ST Stanley Hardware
 - 2. S Sargent & Company
 - 3. NG National Guard Products

4. R Russwin
5. Mc McKinney
6. N Norton
7. H Hager
8. RO Rockwood Mfg.
9. I Ives
10. GJ Glynn Johnson
11. Sch Schlage
12. VD Von Duprin
13. C Cal Royal
14. D Dorma
15. DE Detex
16. Y Yale

- B. Products of the following manufacturers will be considered acceptable provided products are of equivalent weight, function, materials and design:
1. Hinges: Hager, Mc Kinney
 2. Locks: Russwin, Sargent, Schlage
 3. Closers: Russwin, Norton, Sargent
 4. Holders and Stops: Sargent
 5. Door Trim: Glynn Johnson, Ives
 6. Thresholds & Weather stripping National Guard, Hager

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, wall and floor construction, and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Steel Doors and Frames: Comply with DHI A115 Series.
 1. Surface-Applied Door Hardware: Drill and tap doors and frames according to ANSI A250.6.

3.3 INSTALLATION

- A. Mounting Heights: Mount door hardware units at heights indicated as follows unless otherwise indicated or required to comply with governing regulations.
 1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
 2. Custom Steel Doors and Frames: DHI's "Recommended Locations for Builders' Hardware for Custom Steel Doors and Frames."
- B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
 1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.

2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- C. Thresholds: Set thresholds for exterior doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

3.4 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
1. Door Closers: Unless otherwise required by authorities having jurisdiction, adjust sweep period so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the leading edge of the door.

3.5 CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by door hardware installation.
- B. Clean operating items as necessary to restore proper function and finish.
- C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

3.6 DOOR HARDWARE SETS

- A. In addition to miscellaneous hardware per Section 2.15 provide:

HARDWARE SET 1 (HW-1)		
Each to Have		
Mfr.	Description	Model Number
H	Butt Hinges	(3) BB1191 4.5 x 4.5 x US32D
H	Flush Bolts	(2) 282D x 12" x US26D (Face Mount) Transom
Y	Exit Device	7100 x AU626F x US32D
Y	Exit Device	7100 x US32D (Exit Only)
Sch	Cylinder Locks	(2) As Required
DE	Removable Keyed Mullion	KR90 x DH
D	Closer	(2) 8916 RWPA x SNB x Transom Brackets as Required
H	Kickplates	(2) 194S x 10" x 2" LDW x 0.05" US32D
H	Threshold	412 x DW x AL
H	Door Sweeps	(2) 770SV x DW x AL
H	Interlock Seals	(2) 718S x DW x AL

H	Brush Seals	(4) 801S x DH x AL

HARDWARE SET 2 (HW-2)		
Each to Have		
Mfr.	Description	Model Number
H	Butt Hinges	(3) BB1191 4.5 x 4.5 x US32D
Sch	Office Lock	ND50PD RHO x US26D
H	Wall Stop	236W x US32D
H	Silencers	(3) 307D
H	Kickplate	194S x 10" x 2" LDW x 0.05" US32D

HARDWARE SET 8 (HW-3)		
Each to Have		
Mfr.	Description	Model Number
H	Butt Hinges	(3) BB1191 4.5 x 4.5 x US32D
Sch	Occupancy Indicator Lock	B571 x US26D
Sch	Passage	ND10S RHO x US26D
H	Wall Stop	236W x US32D
H	Silencers	(3) 307D
H	Kickplate	194S x 10" x 2" LDW x 0.05" US32D
D	Closer	8916 RWPA x SNB x 689

HARDWARE SET 4 (HW-4)		
Each to Have		
Mfr.	Description	Model Number
H	Butt Hinges	(3) BB1191 4.5 x 4.5 x US32D
Y	Exit Device	7100 x AU626F x US32D
Sch	Cylinder Lock	As Required
D	Closer	8916 RWPA x SNB x 689
H	Kickplate	194S x 10" x 2" LDW x 0.05" US32D
H	Threshold	412 x DW x AL
H	Door Sweep	770SV x DW x AL
H	Seals	726S x Size Required

H	Drip Cap	810S x DW + 4" x AL

END OF SECTION

SECTION 08 80 00 - GLAZING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
 - a. Storefront framing.

1.2 PERFORMANCE REQUIREMENTS

- A. General: Provide glazing systems that are produced, fabricated, and installed to withstand normal thermal movement, wind loading, and impact loading (where applicable), without failure including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; and other defects in construction.
- B. Glass Design: Glass thickness indicated on the drawings are for detailing only. Confirm glass thickness by analyzing project loads and in-service conditions. Provide glass lites for the various size openings in the thicknesses and strengths (annealed or heat-treated) to meet or exceed The International Building Code – 2006. Safety Glazing shall be installed at all locations as required by the International Building Code – 2006
- C. Normal thermal movement results from the maximum change (range) in 120°F ambient and 180°F surface temperatures acting on glass-framing members and glazing components. Base engineering calculations on materials actual surface temperatures due to both solar heat gain and nighttime sky heat loss.

1.3 PRECONSTRUCTION TESTING

- A. Preconstruction Adhesion and Compatibility Testing: Test each glazing material type, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants.
 - 1. Testing will not be required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted.

1.4 SUBMITTALS

- A. Product Data: For each glass product and glazing material indicated.
- B. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches (300 mm) square.
- C. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.
- D. Preconstruction adhesion and compatibility test report.

1.5 QUALITY ASSURANCE

- A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. GANA Publications: "GANA's "Glazing Manual."
 2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
- B. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.
- 1.6 WARRANTY
- A. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form in which insulating-glass manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.
1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 INSULATING GLASS UNITS

- A. Sealed Insulating Glass Unit Surfaces & Coating Orientation:
1. Surface 1 – Exterior surface of outer pane (surface facing outdoors of outboard lite).
 2. Surface 2 – Interior surface of outer pane (surface facing indoors of outboard lite).
 3. Surface 3 – Exterior surface of inner pane (surface facing outdoors of inboard lite).
 4. Surface 4 – Room side surface of inner pane (surfacing facing indoors of inboard lite).
- B. Performance Characteristics: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
1. Center-of-Glass – Performance values that take only the center portion of a glass makeup into account and not the framing members
 2. Glass Thermal and Optical Performance Properties shall be based on data and calculations from the current LBNL WINDOW 5.2 computer program.
 - a. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F (W/sq. m x K).
 - b. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
 3. Fenestration Performance – Performance values that take into account the total fenestration (center-of-glass and framing members). Normally identified with building energy codes such as ASHRAE-IESNA 90.1 and the IECC. These values can also be tested and certified by the National Fenestration Rating Council (NFRC).
 4. Provide glazing systems capable of withstanding normal thermal movements, wind loads and impact loads, without failure, including loss due to defective manufacture, fabrication and installation; deterioration of glazing materials; and other defects in construction.
 5. Provide glass products in the thicknesses and strengths (annealed or heat-treated) required to meet or exceed the following criteria based on project loads and in-service conditions per ASTM E1300.
 - a. Minimum thickness of annealed or heat-treated glass products is selected, so the worst-case probability of failure does not exceed the following:
 - 1) 8 breaks per 1000 for glass installed vertically or not over 15 degrees from the vertical plane and under wind action.

- 2) 1 break per 1000 for glass installed 15 degrees or more from the vertical plane and under action of wind and/or snow.

2.2 MANUFACTURERS

- A. Manufacturer is used in this section to refer to a firm that produces primary glass or fabricated glass as defined in the referenced standards.
 1. Oldcastle Glass
 2. Guardian Industries
 3. Pilkington
 4. PPG Industries

2.3 MATERIALS

- A. Sealed Insulating Glass (IG) Units
 1. Insulating Glass Unit Makeup
 - a. Outboard Lite
 - 1) 1/4" Clear PPG Solarban 80 on Clear Radiant Low-E#2 on Surface 2
 - 2) 1/4" Clear Oldcastle Sunglass Low-E #2 on Surface 2
 - 3) Product having equal performance, if approved by Architect.
 - b. Spacer
 - 1) Nominal Thickness: 1/2"
 - 2) Gas Fill: 90% Argon
 - c. Inboard Lite
 - 1) 1/4" clear glass
 - d. Performance Characteristics (Center of Glass)
 - e. Visible Light Transmittance: 64% or more
 - f. Winter U-factor (U-value): 0.29 or less
 - g. Solar Heat Gain Coefficient (SHGC): 25% or less
 2. Provide hermetically sealed IG units with dehydrated airspace, dual sealed with a primary seal of polyisobutylene (PIB), or thermo plastic spacer (TPS) and a secondary seal of silicone or an organic sealant depending on the application.
 3. Insulating glass units are certified through the Insulating Glass Certification Council (IGCC) to either ASTM E774, or to ASTM E2190, or both.
 4. Annealed float glass shall comply with ASTM C1036, Type I, Class 1 (clear), Class 2 (tinted), Quality-Q3.
 5. Heat-Strengthened float glass shall comply with ASTM C1048, Type I, Class 1 (clear), Class 2 (tinted), Quality Q3, Kind HS.
 6. Tempered float glass shall comply with ASTM C1048, Type I, Class 1 (clear), Class 2 (tinted), Quality Q3, Kind FT.
 7. Glass shall be annealed, heat-strengthened or tempered as required by codes, or as required to meet thermal stress and wind loads.
 8. Glass heat-treated by horizontal (roller hearth) process with inherent roller wave distortion parallel to the bottom edge of the glass as installed when specified.
- B. Glazing Products
 1. Select appropriate glazing sealants, tapes, gaskets and other glazing materials of proven compatibility with other materials that they contact. These include glass products, insulating glass unit seals and glazing channel substrates under installation and service conditions, as demonstrated by testing and field experience.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Site Verification and Conditions

1. Verify that site conditions are acceptable for installation of the glass.
2. Verify openings for glazing are correctly sized and within tolerance.
3. Verify that a functioning weep system is present.
4. Verify that the minimum required face and edge clearances are being followed.
5. Do not proceed with glazing until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Protection
 1. Handle and store product according to manufacturers' recommendations.
- B. Surface Preparation
 1. Clean and prepare glazing channels and other framing members to receive glass.
 2. Remove coatings and other harmful materials that will prevent glass and glazing installation required to comply with performance criteria specified.

3.3 INSTALLATION

- A. Install products using the recommendations of manufacturers of glass, sealants, gaskets and other glazing materials, except where more stringent requirements are indicated, including those in the "GANA Glazing Manual".
- B. Verify that Insulating Glass (IG) Unit secondary seal is compatible with glazing sealants.
- C. Install glass in prepared glazing channels and other framing members.
- D. Install setting blocks in rabbets as recommended by referenced glazing standards in GANA Glazing Manual and IGMA Glazing Guidelines.
- E. Provide bite on glass, minimum edge and face clearances and glazing material tolerances recommended by GANA Glazing Manual.
- F. Provide weep system as recommended by GANA Glazing Manual.
- G. Set glass lites in each series with uniform pattern, draw, bow and similar characteristics.
- H. Distribute the weight of the glass unit along the edge rather than at the corner.
- I. Comply with manufacturer's and referenced industry recommendations on expansion joints and anchors, accommodating thermal movement, glass openings, use of setting blocks, edge, face and bite clearances, use of glass spacers, edge blocks and installation of weep systems.
- J. Protect glass from edge damage during handling and installation.
- K. Prevent glass from contact with contaminating substances that result from construction operations, such as weld spatter, fireproofing or plaster
- L. Remove and replace glass that is broken, chipped, cracked or damaged in any way.

3.4 CLEANING

- A. Clean excess sealant or compound from glass and framing members immediately after application, using solvents or cleaners recommended by manufacturers.
- B. Glass to be cleaned according to:

1. GANA Glass Informational Bulletin GANA 01-0300 - Proper Procedures for Cleaning Architectural Glass Products.
2. GANA Glass Information Bulletin GANA TD-02-0402 – Heat-Treated Glass Surfaces Are Different.

C. Do not use scrapers or other metal tools to clean glass.

END OF SECTION

SECTION 08 90 00 - LOUVERS AND VENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Combination, Drainable extruded-aluminum louvers.
 - 2. Stationary, Drainable extruded-aluminum louvers.
- A. Related Sections:
 - 1. Section 07 92 00 – Joint Sealants.

1.2 DEFINITIONS

- A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.
- B. Horizontal Louver: Louver with horizontal blades; i.e., the axes of the blades are horizontal.
- C. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.

1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Louvers shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.
 - 1. Wind Loads: Determine loads based on a uniform pressure of 20 lbf/sq. ft. acting inward or outward.
- B. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.

1.4 SUBMITTALS

- A. Product Data: For each type of louver indicated.
- B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain louvers and vents from single source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.
- B. Welding: Qualify procedures and personnel according to the following:
 - 1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
 - 2. AWS D1.3, "Structural Welding Code - Sheet Steel."
 - 3. AWS D1.6, "Structural Welding Code - Stainless Steel."

- C. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.
- D. UL and NEMA Compliance: Provide motors and related components for motor-operated louvers that are listed and labeled by UL and comply with applicable NEMA standards.

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T5, T-52, or T6.
- B. Fasteners: Use types and sizes to suit unit installation conditions.
 - 1. Use screws for exposed fasteners unless otherwise indicated.
 - 2. For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.
 - 3. For fastening stainless steel, use 300 series stainless-steel fasteners.
 - 4. For color-finished louvers, use fasteners with heads that match color of louvers.
- C. Post-installed Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, made from stainless-steel components, with capability to sustain, without failure, a load equal to 4 times the loads imposed, for concrete, or 6 times the load imposed, for masonry, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
- D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.2 FABRICATION, GENERAL

- A. Assemble louvers in factory to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- B. Vertical Assemblies: Where height of louver units exceeds fabrication and handling limitations, fabricate units to permit field-bolted assembly with close-fitting joints in jambs and mullions, reinforced with splice plates.
 - 1. Continuous Vertical Assemblies: Fabricate units without interrupting blade-spacing pattern.
 - 2. Horizontal Mullions: Provide horizontal mullions at joints.
- C. Maintain equal louver blade spacing to produce uniform appearance.
- D. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.
- E. Include supports, anchorages, and accessories required for complete assembly.
- F. Provide vertical mullions of type and at spacings indicated, but not more than recommended by manufacturer, or 72 inches (1830 mm) o.c., whichever is less.
- G. Provide subsills made of same material as louvers or extended for recessed louvers.

- H. Join frame members to each other and to fixed louver blades with fillet welds, threaded fasteners, or both, as standard with louver manufacturer unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.3 COMBINATION, DRAINABLE EXTRUDED-ALUMINUM LOUVERS

- A. Louver Construction and Operation: Provide operable louvers with extruded-aluminum frames and blades not less than 0.080-inch (2.03-mm) nominal thickness, and with operating mechanisms to suit louver sizes.
 - 1. Motor operation with 2-position, spring-return application (with power on, motor opens louver; with power off, spring closes louver); 110-V, 60-Hz motor and limit switch.
- B. Dual-Blade, Drainable-Blade, combination Louver: Fixed drainable blades and adjustable plain blades combined in single frame.
 - 1. Louver Depth 6 inches overall.
 - 2. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

2.4 STATIONARY, DRAINABLE EXTRUDED-ALUMINUM LOUVER

- A. Louver Construction: Provide stationary louver with extruded-aluminum frame and blades not less than 0.080 inch (2.0-mm) nominal thickness. Frame shall be integral flange type.
 - 1. Hinged frame: Continuous piano hinge
 - 2. Louver Depth: 4 inches (100 mm)

2.5 LOUVER SCREENS

- A. General: Provide screen at each exterior louver
 - 1. Screening Type: Insect screening.

2.6 EXTENDED SILLS

- A. General: Provide extended sills at each louver
 - 1. Extended Sills: Extruded aluminum, Alloy 6063-T5. Minimum nominal wall thickness 0.060 inch (1.5 mm).

2.7 INSTALLATION ANGLES

- A. General: Provide manufacturer's installation angles and fasteners for each louver.

2.8 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

2.9 ALUMINUM FINISHES

- A. Finish louvers after assembly.
- B. Kynar 500 Fluoropolymer Coating:
 - 1. Conform to AAMA 605.2.
 - 2. Apply coating following cleaning and pretreatment.
 - 3. Cleaning: AA-C12C42R1X.
 - 4. Dry louvers before final finish application.
 - 5. Total Dry Film Thickness: Approximately 1.2 mils (0.03 mm), when baked at 450 degrees F (232 degrees C) for 10 minutes.

6. Color and Gloss: Match Architect's sample building color.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and openings, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.3 INSTALLATION

- A. Locate and place louvers and vents level, plumb, and at indicated alignment with adjacent work.
- B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.
- C. Form closely fitted joints with exposed connections accurately located and secured.
- D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
- E. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.
- F. Protect unpainted galvanized and nonferrous-metal surfaces that will be in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.
- G. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Section 07 92 00, JOINT SEALANTS for sealants applied during louver installation.

3.4 ADJUSTING AND CLEANING

- A. Test operation of adjustable louvers and adjust as needed to produce fully functioning units that comply with requirements.
- B. Clean exposed surfaces of louvers and vents that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.
- C. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.
- D. Restore louvers and vents damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.

1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION

DIVISION 09
FINISHES

SECTION 09 29 00 – GYPSUM DRYWALL AND METAL SUPPORT SYSTEMS

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. Types of work included in this Section:
 1. Gypsum drywall including non-load bearing interior metal stud wall framing. (For load bearing metal stud wall framing, see Division 5.)
 2. Gypsum drywall including non-load bearing exterior metal stud wall framing.
 3. Gypsum drywall applied to wood and metal support framing and furring.
 4. Gypsum backing boards for application of other finishes.
 5. Lead-lined gypsum board.
 6. Drywall finishing (drywall trim and joint tape-and-compound treatment).
- B. Related Sections, specified elsewhere:
 1. Cold-formed Metal Framing (Exterior and Interior Load-Bearing Walls), Division 5.
 2. Wood Framing and Furring, Division 6.
 3. Building Insulation, Division 7.
 4. Joint Sealants and Caulking, Division 7.
 5. Hollow Metal Doors and Frames, Division 8.
 6. Windows, Division 8.
 7. Finishes, Division 9.

1.3 QUALITY ASSURANCE

- A. Gypsum Board Terminology Standard: GA-505 by Gypsum Association.
- B. Single Source Responsibility: Obtain gypsum board products from a single manufacturer, or from manufacturers recommended by the prime manufacturer of gypsum boards.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's product specifications and installation instructions appropriately marked to indicate each gypsum drywall component, including other data as may be required to show compliance with these specifications.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials in original packages, containers or bundles bearing brand name and identification of manufacturer or supplier.
- B. Store materials inside under cover and in manner to keep them dry, protected from weather, direct sunlight, surface contamination, corrosion and damage from construction traffic and other causes. Neatly stack gypsum boards flat to prevent sagging.
- C. Handle gypsum boards to prevent damage to edges, ends or surfaces. Protect metal corner beads and trim from being bent or damaged.

1.6 PROJECT CONDITIONS

- A. Environmental Requirements, General: Comply with requirements of referenced gypsum board application standards and recommendations of gypsum board manufacturer, for environmental conditions before, during and after application of gypsum board.
- B. Cold Weather Protection: When ambient outdoor temperatures are below 55°F maintain continuous, uniform, comfortable building working temperatures of not less than 55°F for a minimum period of 48 hours prior to, during and following application of gypsum board and joint treatment materials or bonding of adhesives.
- C. Ventilation: Ventilate building spaces as required to remove water in excess of that required for drying of joint treatment material immediately after its application. Avoid drafts during dry, hot weather to prevent too rapid drying.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Metal Support Materials
 1. Alabama Metal Industries Corp.
 2. Dale/Incor Industries
 3. Gold Bond Building Products Div., National Gypsum Co.
 4. Marino/Ware Div., Ware Industries, Inc.
 5. United States Gypsum Co.
- B. Gypsum Board and Related Products:
 1. Georgia-Pacific Corp.
 2. Gold Bond Building Products Div., National Gypsum Co.
 3. United States Gypsum Co.

2.2 METAL SUPPORT MATERIALS

- A. Recycled Content of Steel Products: Provide products with average recycled content of steel products such that postconsumer recycled content plus one-half of pre-consumer recycled content is not less than 25 percent.
- B. Interior Non-Load Bearing Wall/Partition Support Materials:
 1. Studs: ASTM C 645; 25 gage, 0.0179 inches thickness of base metal.
 - a. Depth of Section: As indicated on Drawings.
 - b. Runners: Match studs; type recommended by stud manufacturer for floor and ceiling support of studs, and for vertical abutment of drywall work at other work.

2.3 RECYCLED CONTENT OF GYPSUM PANELS

- A. Provide gypsum panel products with recycled content such that postconsumer recycled content plus one-half of pre-consumer recycled content constitutes a minimum of 25 percent by weight.

2.4 GYPSUM BOARD

- A. Gypsum Wallboard: ASTM C 36, of types, edge configuration and thickness indicated below; in maximum lengths available to minimize end-to-end butt joints.
 1. Type: Regular, unless otherwise indicated.
 2. Edges: Tapered.

3. Thickness: As indicated on drawings.
- B. Water Resistant Backing Board: ASTM C 630, with tapered edges and of type and thickness indicated below; in maximum lengths available to minimize end-to-end butt joints.
 1. Type: Regular, unless otherwise indicated.
 2. Thickness: As indicated on drawings.
- C. Exterior-Grade, Moisture resistant Gypsum Wall Sheathing: ASTM C 79/C 79M or ASTM C 1396/C 1396/M, gypsum sheathing; with water-resistant-treated core.

2.5 TRIM ACCESSORIES

- A. Provide manufacturer's standard trim accessories of types indicated for drywall work, formed of galvanized steel or PVC with either knurled and perforated or expanded flanges for nailing or stapling, and beaded for concealment of flanges in joint compound. Provide J-type semi-finishing edge trim at 90 degrees vertical intersection of dissimilar wall. Provide inside corner trim and one-piece control joint beads. (Exposed trim such as L or J trim not acceptable except as indicated above.)

2.6 JOINT TREATMENT MATERIALS

- A. General: ASTM C 475; type recommended by the manufacturer for the application indicated, except as otherwise indicated.
- B. Joint Tape: Paper reinforcing tape and fiberglass drywall tape.
- C. Joint Compound: Ready-mixed vinyl-type for interior use, two (2) separate grades; one specifically for bedding tapes, coating over fasteners, and filling depressions, and one for second and third topping and sanding coat.
- D. Water-Resistant Joint Compound: Special water-resistant type for treatment of joints, fastener heads and cut edges of water-resistant backing board.

2.7 MISCELLANEOUS MATERIALS

- A. General: Provide auxiliary materials for gypsum drywall work of the type and grade recommended by the manufacturer of the gypsum board.
- B. Laminating Adhesive: Special adhesive or joint compound specifically recommended for laminating gypsum boards.
- C. Gypsum Board Screws: Comply with ASTM C 646.
- D. Gypsum Board Nails: Comply with ASTM C 514.

PART 3 - EXECUTION

3.1 PREPARATION FOR METAL SUPPORT SYSTEMS

- A. Ceiling Anchorages: Coordinate work with structural ceiling work and fire protection to ensure that inserts and other structural anchorage provisions have been installed to receive ceiling hangers.

3.2 INSTALLATION OF METAL SUPPORT SYSTEMS

- A. General:
 - 1. Metal Support Installation Standard: Comply with ASTM C 754.
 - 2. Nail or screw furring members to wood and/or metal framing as indicated or as may be required.

- B. Wall/Partition Support Systems:
 - 1. Install supplementary framing, blocking and bracing at terminations in the work and for support of fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, and similar work to comply with details indicated or if not otherwise indicated, to comply with applicable published recommendations of gypsum board manufacturer, or if not available, of "Gypsum Construction Handbook" published by United States Gypsum Co.
 - 2. Isolate stud systems from transfer of structural loading to system, both horizontally and vertically. Provide slip or cushioned type joints to attain lateral support and avoid axial loading.
 - 3. Install runner tracks at floors, ceilings and structural walls and columns where gypsum drywall stud system abuts other work.
 - 4. Extend partition stud system through acoustical ceilings minimum 1'-0" and brace to structure above.
 - 5. Space studs 16" o.c., unless otherwise indicated.
 - 6. Frame door openings to comply with applicable published recommendations of gypsum board manufacturer, or if not available, of "Gypsum Construction Handbook" published by United States Gypsum Co. Attach vertical studs at jambs with screws to jamb anchor clips on door frames; install runner track section (for jack studs) at head and secure to jamb studs. Extend vertical jamb studs and attach to underside of floor or roof structure above.
 - 7. Frame openings other than door openings in same manner as required for door openings; and install framing below sills of openings to match framing required above door heads.
 - 8. Space wall furring members 16" o.c., unless otherwise indicated.

3.3 GENERAL GYPSUM BOARD INSTALLATION REQUIREMENTS

- A. Gypsum Board Application and Finishing Standards: ASTM C 840 and GA 216.
- B. Install sound attenuation blankets and thermal insulation as indicated, prior to gypsum board.
- C. Locate exposed end-butt joints as far from center of walls and ceilings as possible, and stagger not less than 1'-0" in alternate courses of board.
- D. Install wall/partition boards vertically to avoid end-butt joints wherever possible. At high walls, install boards horizontally with end joints staggered over studs.
- E. Install exposed gypsum board with face side out. Do not install imperfect, damaged or damp boards. Butt boards together for a light contact at edges and ends with not more than 1/16" open space between boards. Do not force into place.
- F. Locate either edge or end joints over supports, except in horizontal applications or where intermediate supports or gypsum board back-blocking is provided behind end joints. Position boards so that like edges abut, tapered edges against tapered edges and mill-cut or field-cut ends against mill-cut or field-cut ends. Do not place tapered edges against cut edges or ends. Stagger vertical joints over different studs on opposite sides of partitions.

- G. Attach gypsum board to supplementary framing and blocking provided for additional support at openings and cutouts.
- H. Form control joints and expansion joints with space between edges of boards, prepared to receive trim accessories.
- I. Cover both faces of steel stud partition framing with gypsum board in concealed spaces (above ceilings, etc.)
- J. Isolate perimeter of non-load-bearing drywall partitions at structural abutments. Provide 1/4" to 1/2" space and trim edge with J-type semi-finishing edge trim. Seal joints with acoustical sealant.
- K. Space fasteners in gypsum boards in accordance with referenced standards and manufacturer's recommendations, except as otherwise indicated.

3.4 METHODS OF GYPSUM DRYWALL APPLICATION

- A. Single-Layer Application: Install gypsum wallboard as follows:
 1. On partitions/walls apply gypsum board vertically (parallel), unless otherwise indicated, and provide sheet lengths which will minimize end joints. Fasten with screws.
 2. Install exterior-grade moisture resistant gypsum sheathing horizontally so that joints shingle water.
- B. Wall Tile Base:
 1. At thin-set ceramic base and wall tile and similar rigid applied wall finishes, install gypsum water-resistant backing board. Apply with uncut long edge at bottom of work. Seal ends, cut-edges and penetrations of each piece with water-resistant adhesive. Provide tape-and-compound treatment of joints (2 coats un-sanded, but bladed smooth).

3.5 INSTALLATION OF DRYWALL TRIM ACCESSORIES

- A. General: Where feasible, use the same fasteners to anchor trim accessory flanges as required to fasten gypsum board to the supports. Otherwise, fasten flanges by nailing or stapling in accordance with manufacturer's instructions and recommendations.
- B. Install edge trim whenever edge of gypsum board would otherwise be exposed or semi-exposed. Provide type with face flange to receive joint compound except where semi-finishing type is indicated.
- C. Install metal control joint (beaded type) vertically not over 30'-0" o.c. on walls where horizontal dimension exceeds 30'-0". Coordinate locations with Engineer.

3.6 FINISHING OF DRYWALL

- A. General: Apply treatment at gypsum board joints (both directions), flanges of trim accessories, penetrations, fastener heads, surface defects and elsewhere as required to prepare work for decoration. Pre-fill open joints at rounded or beveled edges, if any, using type of compound recommended by manufacturer.
 1. Apply joint tape at joints between gypsum boards, except where trim accessories are indicated.
 2. Apply joint compound in three (3) coats (not including pre-fill of openings in base), and sand between last two (2) coats and after last coat.

- B. Water Resistant Gypsum Board Base for Ceramic Tile: Treat joints and fasteners to comply with directions of water-resistant joint compound manufacturer.

END OF SECTION

SECTION 09 90 00 - PAINTING AND PROTECTIVE COATINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes: Exposed, buried, and submerged metal, exposed PVC and CPVC, exposed FRP, and aluminum and dissimilar metals, to be protective painted, whether specifically mentioned or not, except as specified otherwise. Prime coat structural steel surfaces. Exterior concrete surfaces will not be protective painted unless specifically indicated. Interior concrete surfaces will be protective painted as specified herein.

1.2 REFERENCES

- A. The following is a list of standards which may be referenced in this section:
1. ASTM International (ASTM):
 - a. D 16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications.
 - b. D 4541 - Standard Test Method for Pull-off Strength of Coatings Using Portable Adhesion Testers.
 2. NACE International (NACE):
 - a. SP0178 - Design, Fabrication, and Surface Finish Practices for Tanks and Vessels to Be Lined for Immersion Service.
 - b. SP0188-06 - Discontinuity (Holiday) Testing of Protective Coatings.
 3. National Association of Pipe Fabricators (NAPF):
 - a. 500-03 - Surface Preparation Standard for Ductile Iron Pipe and Fittings Receiving Special External Coatings and/or Special Internal Linings.
 4. NSF International (NSF):
 - a. 61 - Drinking Water System Components - Health Effects.
 5. Society for Protective Coatings (SSPC):
 - a. QP1, Standard Procedure for Evaluating Qualifications of Painting Contractors.
 - b. QP2, Standard Procedure for Evaluating the Qualifications of Painting Contractors to Remove Hazardous Paint.
 - c. SP COM - Surface Preparation Commentary for Steel and Concrete Substrates.
 - d. SP-1 - Solvent Cleaning.
 - e. SP-2 - Hand Tool Cleaning.
 - f. SP-3 - Power Tool Cleaning.
 - g. SP-5 - White Metal Blast Cleaning.
 - h. SP-6 - Commercial Blast Cleaning.
 - i. SP-7 - Brush-Off Blast Cleaning.
 - j. SP 8, Pickling.
 - k. SP-10 - Near-White Blast Cleaning.
 - l. SP 11-T, Power Tool Cleaning to Bare Metal.
 - m. SP 13, Surface Preparation of Concrete.
 - n. Guide No. 3, PA, Guide to Safety in Painting Applications.
 6. U.S. Environment Protection Agency (EPA):
 - a. Method 24 - Surface Coatings.
 7. NACE International (NACE):
 - a. SP0178 - Design, Fabrication, and Surface Finish Practices for Tanks and Vessels to Be Lined for Immersion Service.
 - b. SP0188-06 - Discontinuity (Holiday) Testing of Protective Coatings.
 8. National Association of Pipe Fabricators (NAPF):
 - a. 500-03 - Surface Preparation Standard for Ductile Iron Pipe and Fittings Receiving Special External Coatings and/or Special Internal Linings.
 9. NSF International (NSF):
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 - a. QP1, Standard Procedure for Evaluating Qualifications of Painting Contractors.
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 - h. SP-6 - Commercial Blast Cleaning.
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 - j. SP 8, Pickling.
 - k. SP-10 – Near-White Blast Cleaning.
 - l. SP 11-T, Power Tool Cleaning to Bare Metal.
 - m. SP 13, Surface Preparation of Concrete.
 - n. Guide No. 3, PA, Guide to Safety in Painting Applications.
11. U.S. Environment Protection Agency (EPA):
 - a. Method 24 - Surface Coatings.

1.3 DEFINITIONS

- A. Terms used in this section:
 1. Submerged metal: Steel or iron surfaces below tops of channel or structure walls which will contain water even when above expected water level.
 2. Submerged concrete and masonry surfaces: Surfaces which are or will be:
 3. Underwater.
 4. In structures which normally contain water.
 5. Below tops of walls of water containing structures.
 6. Exposed surface: Any metal or concrete surface, indoors or outdoors that is exposed to view.
 7. Dry film thickness (DFT): Thickness of fully cured coating, measured in mils.
 8. Volatile organic compound (VOC): Content of air polluting hydrocarbons in uncured coating product measured in units of grams per liter or pounds per gallon, as determined by EPA Method 24.
 9. Ferrous: Cast iron, ductile iron, wrought iron, and all steel alloys except stainless steel.
 10. Where SSPC surface preparation standards are specified or implied for ductile iron pipe or fittings, the equivalent NAPF surface preparation standard shall be substituted for the SSPC standard.
 11. Coverage: Total minimum dry film thickness in mils, or square feet per gallon.
 12. FRP: Fiberglass Reinforced Plastic.
 13. HCl: Hydrochloric Acid.
 14. MDFT: Minimum Dry Film Thickness.
 15. MDFTPC: Minimum Dry Film Thickness per Coat.
 16. Mil: Thousandth of an inch.
 17. Military Specification-Paint.
 18. PSDS: Paint System Data Sheet.
 19. SFPG: Square Feet per Gallon.
 20. SFPGPC: Square Feet per Gallon per Coat.
 21. SP: Surface Preparation.

1.4 PERFORMANCE REQUIREMENTS

- A. Coating materials shall be especially adapted for use in water treatment plants.
- B. Coating materials used in contact with potable water supply systems shall be certified to NSF 61.

1.5 SUBMITTALS

- A. General: Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES.
- B. Shop Drawings:
 - 1. Schedule of proposed coating materials.
 - 2. Schedule of surfaces to be coated with each coating material.
- C. Product Data: Include description of physical properties of coatings including solids content and ingredient analysis, VOC content, temperature resistance, typical exposures and limitations, and manufacturer's standard color chips:
 - 1. Data Sheets:
 - a. For each paint system, furnish a Paint System Data Sheet (PSDS), the Manufacturer's Technical Data Sheets, and paint colors available (where applicable) for each product used in the paint system. The PSDS form is appended to the end of this section.
 - b. Submit required information on a system-by-system basis.
 - c. Furnish copies of paint system submittals to the coating applicator.
 - d. Indiscriminate submittal of Manufacturer's literature only is not acceptable.
 - e. Regulatory requirements: Submit data concerning the following:
 - f. Volatile organic compound limitations.
 - g. Coatings containing lead compounds and PCBs.
 - h. Abrasives and abrasive blast cleaning techniques, and disposal.
 - i. NSF certification of coatings for use in potable water supply systems.
- D. Samples: Include 8-inch square drawdowns or brush-outs of topcoat finish when requested. Identify each sample as to finish, formula, color name and number and sheen name and gloss units.
- E. Certificates: Submit in accordance with requirements for Product Data.
- F. Manufacturer's Instructions: Include the following:
 - 1. Special requirements for transportation and storage.
 - 2. Mixing instructions.
 - 3. Shelf life.
 - 4. Pot life of material.
 - 5. Precautions for applications free of defects.
 - 6. Surface preparation.
 - 7. Method of application.
 - 8. Recommended number of coats.
 - 9. Recommended dry film thickness (DFT) of each coat.
 - 10. Recommended total dry film thickness (DFT).
 - 11. Drying time of each coat, including prime coat.
 - 12. Required prime coat.
 - 13. Compatible and non-compatible prime coats.
 - 14. Recommended thinners, when recommended.
 - 15. Limits of ambient conditions during and after application.
 - 16. Time allowed between coats (minimum and maximum).
 - 17. Required protection from sun, wind, and other conditions.
 - 18. Touch-up requirements and limitations.
 - 19. Minimum adhesion of each system submitted in accordance with ASTM D 4541.
- G. Manufacturer's Representative's Field Reports.
- H. Operations and Maintenance Data: Submit as specified in Section 01 77 00 CLOSEOUT PROCEDURES.

1. Reports on visits to project site to view and approve surface preparation of structures to be coated.
2. Reports on visits to project site to observe and approve coating application procedures.
3. Reports on visits to coating plants to observe and approve surface preparation and coating application on items that are "shop coated."

1.6 QUALITY ASSURANCE

- A. Quality Assurance Submittals:
1. Quality Assurance plan.
 2. Qualifications of coating applicator including List of Similar Projects and List of References substantiating experience.
 3. Factory Applied Coatings: Manufacturer's certification stating factory applied coating system meets or exceeds requirements specified.
 4. If the Manufacturer of finish coating differs from that of shop primer, provide both Manufacturers' written confirmation that materials are compatible.
 5. Manufacturer's written instructions and special details for applying each type of paint.
 6. Manufacturers' Certification of Proper Installation.
- B. Certifications: All paints and coatings to be used on this project comply with current federal, state, and local VOC regulations
- C. Applicator qualifications:
1. Minimum of 5 years' experience applying specified type or types of coatings under conditions similar to those of the Work:
 2. Provide qualifications of applicator and references listing 5 similar projects completed in the past 2 years.
 3. Manufacturer approved applicator when manufacturer has approved applicator program.
 4. Approved and licensed by polymorphic polyester resin manufacturer to apply polymorphic polyester resin coating system.
 5. Approved and licensed by elastomeric polyurethane (100 percent solids) manufacturer to apply 100 percent solids elastomeric polyurethane system.
 6. Applicator of off-site application of coal tar epoxy shall have successfully applied coal tar epoxy on similar surfaces in material, size, and complexity as on the Project.
- D. Regulatory requirements: Comply with governing agencies regulations by using coatings that do not exceed permissible volatile organic compound limits and do not contain lead:
1. Do not use coal tar epoxy in contact with drinking water or exposed to ultraviolet radiation.
 2. Perform surface preparation and painting in accordance with recommendations of the following:
 3. Paint Manufacturer's instructions.
 4. SSPC-PA Guide No. 3, Guide to Safety in Paint Applications.
 5. Federal, state, and local agencies having jurisdiction.
- E. Samples:
1. Reference Panel:
 - a. Prior to start of surface preparation, furnish a 4" by 4" steel panel for each grade of sandblast specified herein, prepared to specified requirements.
 - b. Provide panel representative of the steel used; prevent deterioration of surface quality.
 - c. Upon approval of Engineer, panel to be reference source for inspection.
 - d. Unless otherwise specified, before painting work is started, prepare minimum 8" by 10" samples with type of paint and application specified on similar substrate to which paint is to be applied.
 - e. Furnish additional samples as required until colors, finishes, and textures are approved.

- f. Approved samples to be the quality standard for final finishes.
- g. Field samples:
- h. Prepare and coat a minimum 100 square foot area between corners or limits such as control or construction joints of each system.
- i. Approved field sample may be part of Work.
- j. Obtain approval before painting other surfaces.

F. Pre-installation conference: Conduct as specified in Section 01 31 19 PROJECT MEETINGS.

G. Compatibility of coatings: Use products by same manufacturer for prime coats, intermediate coats, and finish coats on same surface, unless specified otherwise.

H. Services of coating manufacturer's representative: Arrange for coating manufacturer's representative to attend pre-installation conferences. Make periodic visits to the project site to provide consultation and inspection services during surface preparation and application of coatings, and to make visits to coating plants to observe and approve surface preparation procedures and coating application of items to be "shop primed and coated".

I. Contract Closeout Submittals: Special guarantee.

1.7 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver, store, and handle products as specified in Section 01 60 00 PRODUCT REQUIREMENTS.

B. Remove unspecified and unapproved paints from Project site immediately.

C. Deliver new unopened containers with labels identifying the manufacturer's name, brand name, product type, batch number, date of manufacturer, expiration date or shelf life, color, and mixing and reducing instructions.

- 1. Do not deliver materials aged more than 12 months from manufacturing date.

D. Store coatings in well-ventilated facility that provides protection from the sun, weather, and fire hazards. Maintain ambient storage temperature between 45 and 90 degrees Fahrenheit, unless otherwise recommended by the manufacturer.

E. Take precautions to prevent fire and spontaneous combustion.

F. Shipping:

- 1. Where pre-coated items are to be shipped to the site, protect coating from damage. Batten coated items to prevent abrasion.
- 2. Use nonmetallic or padded slings and straps in handling.

1.8 PROJECT CONDITIONS

A. Surface moisture contents: Do not coat surfaces that exceed manufacturer specified moisture contents, or when not specified by the manufacturer, the following moisture contents:

- 1. Plaster and gypsum wallboard: 12 percent.
- 2. Masonry, concrete, and concrete block: 12 percent.
- 3. Interior located wood: 15 percent.
- 4. Concrete floors: 7 percent.

B. Do not apply coatings:

- 1. Under dusty conditions or adverse environmental conditions, unless tenting, covers, or other such protection is provided for structures to be coated.

2. When light on surfaces measures less than 15 foot-candles.
 3. When ambient or surface temperature is less than 55 degrees Fahrenheit unless manufacturer allows a lower temperature.
 4. When relative humidity is higher than 85 percent.
 5. When surface temperature is less than 5 degrees Fahrenheit above dew point.
 6. When surface temperature exceeds the manufacturer's recommendation.
 7. When ambient temperature exceeds 90 degrees Fahrenheit, unless manufacturer allows a higher temperature.
 8. Apply clear finishes at minimum 65 degrees Fahrenheit.
- C. Provide fans, heating devices, dehumidifiers, or other means recommended by coating manufacturer to prevent formation of condensate or dew on surface of substrate, coating between coats and within curing time following application of last coat.
- D. Provide adequate continuous ventilation and sufficient heating facilities to maintain minimum 55 degrees Fahrenheit for 24 hours before, during and 48 hours after application of finishes.
- E. Dehumidification and heating for coating of digester interiors, wet wells, and high humidity enclosed spaces:
1. Provide dehumidification and heating of digester interior spaces in which surface preparation, coating application, or curing is in progress according to the following schedule:
 - a. October 1 to April 30: Provide continuous dehumidification and heating as required to maintain the tanks within environmental ranges as specified in this Section and as recommended by the coating material manufacturer. For the purposes of this Section, "continuous" is defined as 24 hours per day and 7 days per week.
 - b. May 1 to September 30: Provide temporary dehumidification and heating as may be required to maintain the tanks within the specified environmental ranges in the event of adverse weather or other temporary condition. At CONTRACTOR's option and at his sole expense, CONTRACTOR may suspend work until such time as acceptable environmental conditions are restored, in lieu of temporary dehumidification and heating. Repair or replace any coating or surface preparation damaged by suspension of work, at CONTRACTOR's sole expense.
 2. Equipment requirements:
 - a. Capacity: Provide dehumidification, heating, and air circulation equipment with minimum capacity to perform the following:
 - 1) Maintain the dew point of the air in the tanks at a temperature at least 5 degrees Fahrenheit less than the temperature of the coldest part of the structure where work is underway.
 - 2) Reduce dew point temperature of the air in the tanks by at least 10 degrees Fahrenheit in 20 minutes.
 - 3) Maintain air temperature in the tanks at 60 degrees minimum.
 - b. Systems:
 - 1) Internal combustion engine generators: May be used; CONTRACTOR shall obtain all required permits and provide air pollution and noise control devices on equipment as required by permitting agencies.]
 - 2) Dehumidification: Provide desiccant or refrigeration drying. Desiccant types shall have a rotary desiccant wheel capable of continuous operation. No Liquid, granular, or loose lithium chloride drying systems will be allowed.
 - 3) Heating: Electric, indirect combustion, or steam coil methods may be used. Direct fired combustion heaters will not be allowed during abrasive blasting, coating application, or coating cure time.
 3. Design and submittals:
 - a. CONTRACTOR shall prepare dehumidification and heating plan for this project, including all equipment and operating procedures.

- b. Suppliers of services and equipment shall have not less than 3 years' experience in similar applications.
 - c. Supplier: The following or equal:
 - 1) Cargocaire Corporation (Munters) or equal.
 - d. Submit dehumidification and heating plan for ENGINEER's review.
4. Monitoring and performance:
- a. Measure and record relative humidity and temperature of air, and structure temperature twice daily (beginning and end of work shifts) to verify that proper humidity and temperature levels are achieved inside the work area after the dehumidification equipment is installed and operational. Test results shall be made available to the ENGINEER upon request.
 - b. Interior space of the working area and tank(s) shall be sealed and a slight positive pressure maintained as recommended by the supplier of the dehumidification equipment.
 - c. The filtration system used to remove dust from the air shall be designed so that it does not interfere with the dehumidification equipment's ability to control the dew point and relative humidity inside the reservoir.
 - 1) The air from the tank, working area, or dust filtration equipment shall not be recirculated through the dehumidifier during coating application or when solvent vapors are present.

1.9 SEQUENCING AND SCHEDULING

- A. Sequence and Schedule: As specified in Section 01 14 00 WORK RESTRICTIONS.

1.10 SPECIAL GUARANTEE

- A. Furnish Manufacturer's extended guarantee or warranty, with OWNER named as beneficiary, in writing, as special guarantee. Special guarantee shall provide for correction, or at the option of the OWNER, removal and replacement of work specified in this Specification section found *defective* during a period of 1 year after the date of Substantial Completion.
- B. Contractor and paint Manufacturer shall jointly and severally furnish guarantee.

1.11 MAINTENANCE

- A. Extra materials: Deliver as specified in Section 01_77_00. Include minimum 1 gallon of each type and color of coating applied:
 - 1. When manufacturer packages material in gallon cans, deliver unopened labeled cans as comes from factory.
 - 2. When manufacturer does not package material in gallon cans, deliver material in new gallon containers, properly sealed and identified with typed labels indicating brand, type, and color.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Special coatings: One of the following or equal:
 - 1. Carboline: Carboline, St. Louis, MO.
 - 2. Ceilcote: International Protective Coatings, Berea, OH.
 - 3. Dampney: The Dampney Company, Everett, MA.
 - 4. Devoe: International Protective Coatings, Louisville, KY.
 - 5. Dudick: Dudick, Inc., Streetsboro, OH.
 - 6. GET: Global Eco Technologies, Pittsburg, CA.

7. Henkel: Henkel North America, Madison Heights MI.
8. IET: Integrated Environmental Technologies, Santa Barbara, CA.
9. Induron Protective Coatings, Birmingham, AL.
10. PPG Amercoat: PPG Protective & Marine Coatings, Brea, CA.
11. Raven Lining Systems, Broken Arrow, OK.
12. Rustoluem : Rustoleum Corp., Sommerset, NJ.
13. Sanchem: Sanchem, Chicago, IL.
14. Superior: Superior Environmental Products, Inc., Addison, TX.
15. S-W: Sherwin-Williams Co., Cleveland, OH.
16. Tnemec: Tnemec Co., Kansas City, MO.
17. Wasser: Wasser High Tech Coatings, Kent, WA.
18. ZRC: ZRC Worldwide Innovative Zinc Technologies, Marshfield, MA.

2.2 PREPARATION AND PRETREATMENT MATERIALS

- A. Metal pretreatment: As manufactured by one of the following or equal:
 1. Henkel: Galvaprep 5.
 2. International: AWLGrip Alumiprep 33.
- B. Surface cleaner and degreaser: As manufactured by one of the following or equal:
 1. Carboline Surface Cleaner No.3.
 2. Devoe: Devprep 88.
 3. S-W: Clean and Etch.

2.3 COATING MATERIALS

- A. Wax coating: As manufactured by the following or equal:
 1. Sanchem: No-Ox-Ild A special.
- B. High solids epoxy (self-priming) not less than 72 percent solids by volume: As manufactured by one of the following or equal:
 1. Carboline: Carboguard 891.
 2. Devoe: Bar Rust 233H.
 3. Induron: PE-70
 4. PPG Amercoat: Amerlock 2.
 5. S-W: Macropoxy 646.
- C. Aliphatic or aliphatic-acrylic polyurethane: As manufactured by one of the following or equal:
 1. Carboline: Carbothane 134 VOC.
 2. Devoe: Devthane 379.
 3. PPG Amercoat: Amershield VOC.
 4. S-W: High Solids Polyurethane [CA].
 5. Tnemec: Endura-Shield II Series 1075 (U).
- D. Epoxy Novolac: Multi-component aggregate-filled epoxy system specifically designed for exposure to municipal wastewater. As manufactured by one of the following or equal:
 1. Sauereisen: Sewergard No. 210, 210S, or 210GL
 2. Carboline: Plasite 4550 S
 3. Devoe: Devmat 100
 4. Raven 410
- E. High temperature coating 150 to 350 degrees Fahrenheit: As manufactured by one of the following or equal:
 1. Carboline: Thermaline 4900.
 2. Dampney: Thermalox 245 Silicone - Zinc Dust.

3. PPG Amercoat: Amerlock 2/400 GFK.
- F. High temperature coating 400 to 1,000 degrees Fahrenheit (dry): As manufactured by one of the following or equal:
 1. Carboline: Thermaline 4700.
 2. Dampney: Thermolox 230C Series Silicone.
 3. Devoe: HT-12, High Heat Silicone.
 - G. High temperature coating up to 1,400 degrees Fahrenheit: As manufactured by the following or equal:
 1. Dampney: Thermalox 240 Silicone Ceramix.
 - H. Asphalt varnish: AWWA C 500.
 - I. Vinyl ester: Glass mat reinforced, total system 125 mils DFT. As manufactured by one of the following or equal:
 1. Carboline: Semstone 870.
 2. Ceilcote: 6640 Ceilcrete.
 3. Dudick: Protecto-Flex 800.
 4. Tnemec: Chembloc Series 239SC.
 - J. Elastomeric polyurethane, 100 percent solids, ASTM D 16, Type V, (Urethane P): As manufactured by the following or equal:
 1. GET: Endura-Flex EF-1988.
 - K. Concrete floor coatings: As manufactured by one of the following or equal:
 1. Carboline: Semstone 140SL.
 2. Devoe: Devran 124.
 3. Dudick: Polymer Alloy 1000.
 4. Tnemec: Tneme-Glaze Series 282.
 - L. Waterborne acrylic emulsion: As manufactured by one of the following or equal:
 1. S-W: DTM Acrylic B66W1.
 2. Tnemec: Tneme-Cryl Series 6.
 - M. Galvanizing Zinc Compound: As manufactured by one of the following or equal:
 1. ZRC: Cold Galvanizing Compound.

2.4 MIXES

- A. Mix in accordance with manufacturer's instructions.

PART 3 - EXECUTION

3.1 GENERAL PROTECTION

- A. Protect adjacent surfaces from coatings and damage. Repair damage resulting from inadequate or unsuitable protection:
- B. Protect adjacent surfaces not to be coated from spatter and droppings with drop cloths and other coverings:
 1. Mask off surfaces of items not to be coated or remove items from area.

- C. Furnish sufficient drop cloths, shields, and protective equipment to prevent spray or droppings from fouling surfaces not being coated and in particular, surfaces within storage and preparation area.
- D. Place cotton waste, cloths, and material which may constitute fire hazard in closed metal containers and remove daily from site.
- E. Remove electrical plates, surface hardware, fittings, and fastenings, prior to application of coating operations. Carefully store, clean, and replace on completion of coating in each area. Do not use solvent or degreasers to clean hardware that may remove permanent lacquer finish.

3.2 GENERAL PREPARATION

- A. Prepare surfaces in accordance with coating manufacturer's instructions, unless more stringent requirements are specified in this Section.
- B. Protect following surfaces from abrasive blasting by masking, or other means:
 1. Threaded portions of valve and gate stems, grease fittings, and identification plates.
 2. Machined surfaces for sliding contact.
 3. Surfaces to be assembled against gaskets.
 4. Surfaces of shafting on which sprockets are to fit.
 5. Surfaces of shafting on which bearings are to fit.
 6. Machined surfaces of bronze trim, including those slide gates.
 7. Cadmium-plated items, except cadmium-plated, zinc-plated, or sherardized fasteners used in assembly of equipment requiring abrasive blasting.
 8. Galvanized items, unless scheduled to be coated.
- C. Protect installed equipment, mechanical drives, and adjacent coated equipment from abrasive blasting to prevent damage caused by entering sand or dust.
- D. Concrete:
 1. Allow new concrete to cure for minimum of 28 days before coating.
 2. Clean concrete surfaces of dust, mortar, fins, loose concrete particles, form release materials, oil, and grease. Fill voids so that surface is smooth. Etch or brush off-blast clean in accordance with SSPC SP-7 to provide surface profile equal to 40 to 60-grit sandpaper, or as recommended by coating manufacturer. All concrete surfaces shall be vacuumed clean prior to coating application.
- E. Ferrous metal surfaces:
 1. Remove grease and oil in accordance with SSPC SP-1.
 2. Remove rust, scale, and welding slag and spatter, and prepare surfaces in accordance with appropriate SSPC standard as specified.
 3. Abrasive blast surfaces prior to coating.
 - a. When abrasive blasted surfaces rust or discolor before coating, abrasive blast surfaces again to remove rust and discoloration.
 - b. When metal surfaces are exposed because of coating damage, abrasive blast surfaces and feather in to a smooth transition before touching-up.
 - c. Ferrous metal surfaces not to be submerged: Abrasive blast in accordance with SSPC SP-10, unless blasting may damage adjacent surfaces, prohibited or specified otherwise. Where not possible to abrasive blast, power tool clean surfaces in accordance with SSPC SP-3.
 - d. Ferrous metal surfaces to be submerged: Unless specified otherwise, abrasive blast in accordance with SSPC SP-5 to clean and provide roughened surface profile of not less than 2 mils and not more than 4 mils in depth when measured with Elcometer 123, or as recommended by the coating manufacturer.

4. All abrasive blast cleaned surfaces shall be blown down with clean dry air and or vacuumed.
- F. Ductile iron pipe and fittings to be lined or coated: Abrasive blast clean in accordance with NAPF 500-03.
- G. Sherardized, aluminum, copper, and bronze surfaces: Prepare in accordance with coating manufacturer's instructions.
- H. Galvanized surface:
1. Degrease or solvent clean (SSPC SP-1) to remove oily residue.
 2. Power tool or hand tool clean or whip abrasive blast.
 3. Test surface for contaminants using copper sulfate solution.
 4. Apply metal pretreatment within 24 hours before coating galvanized surfaces that cannot be thoroughly abraded physically, such as bolts, nuts, or preformed channels.
- I. Shop primed metal:
1. Certify that primers applied to metal surfaces in the shop are compatible with coatings to be applied over such primers in the field.
 2. Remove shop primer from metal to be submerged by abrasive blasting in accordance with SSPC SP-10, unless greater degree of surface preparation is required by coating manufacturer's representative.
 3. Correct abraded, scratched, or otherwise damaged areas of prime coat by sanding or abrasive blasting to bare metal in accordance with SSPC SP-2, SP 3, or SP-6, as directed by the ENGINEER.
 4. When entire shop priming fails or has weathered excessively (more than 25 percent of the item), or when recommended by coating manufacturer's representative, abrasive blast shop prime coat to remove entire coat and prepare surface in accordance with SSPC SP-10.
 5. When incorrect prime coat is applied, remove incorrect prime coat by abrasive blasting in accordance with SSPC SP-10.
 6. When prime coat not authorized by ENGINEER is applied, remove unauthorized prime coat by abrasive blasting in accordance with SSPC SP-10.
 7. Shop applied bituminous paint or asphalt varnish: Abrasive blast clean shop applied bituminous paint or asphalt varnish from surfaces scheduled to receive non-bituminous coatings.
- J. Cadmium-plated, zinc-plated, or sherardized fasteners:
1. Abrasive blast in same manner as unprotected metal when used in assembly of equipment designated for abrasive blasting.
- K. Abrasive blast components to be attached to surfaces which cannot be abrasive blasted before components are attached.
- L. Grind sharp edges to approximately 1/16-inch radius before abrasive blast cleaning.
- M. Remove and grind smooth all excessive weld material and weld spatter before blast cleaning in accordance with NACE SP0178.
- N. PVC and FRP Surfaces:
1. Prepare surfaces to be coated by light sanding (de-gloss) and wipe-down with clean cloths, or by solvent cleaning in strict accordance with coating manufacturer's instructions.
- O. Cleaning of previously coated surfaces:

1. Utilize cleaning agent to remove soluble salts such as chlorides and sulfates from concrete and metal surfaces:
 - a. Cleaning agent: Biodegradable non-flammable and containing no volatile organic compounds.
 - b. Manufacturer: The following or equal:
 - 1) Chlor-Rid International, Inc.
2. Cleaning of surfaces utilizing the decontamination cleaning agent may be accomplished in conjunction with abrasive blast cleaning, steam cleaning, high-pressure washing, or hand washing as approved by the coating manufacturer's representative and the ENGINEER.
3. Test cleaned surfaces in accordance with the cleaning agent manufacturer's instructions to ensure all soluble salts have been removed. Additional cleaning shall be carried out as necessary.
4. Final surface preparation prior to application of new coating system shall be made in strict accordance with coating manufacturer's printed instructions.

3.3 MECHANICAL AND ELECTRICAL EQUIPMENT PREPARATION

- A. Identify equipment, ducting, piping, and conduit as specified in Section 22 05 53 – MECHANICAL IDENTIFICATION and Section 26 05 53 – IDENTIFICATION FOR ELECTRICAL SYSTEMS.
- B. Remove grilles, covers, and access panels for mechanical and electrical system from location and coat separately.
- C. Prepare and finish coat-primed equipment with color selected by the ENGINEER.
- D. Prepare and prime and coat insulated and bare pipes, conduits, boxes, insulated and bare ducts, hangers, brackets, collars, and supports, except where items are covered with prefinished coating.
- E. Replace identification markings on mechanical or electrical equipment when coated over or spattered.
- F. Prepare and coat interior surfaces of air ducts, convactor and baseboard heating cabinets that are visible through grilles and louvers with 1 coat of flat black paint, to limit of sight line.
- G. Prepare and coat dampers exposed immediately behind louvers, grilles, convactor and baseboard cabinets to match face panels.
- H. Prepare and coat exposed conduit and electrical equipment occurring in finished areas with color and texture to match adjacent surfaces.
- I. Prepare and coat both sides and edges of plywood backboards for electrical equipment before installing backboards and mounting equipment on them.
- J. Color code equipment, piping, conduit, and exposed ductwork and apply color banding and identification, such as flow arrows, naming and numbering, in accordance with Contract Documents.

3.4 GENERAL APPLICATION REQUIREMENTS

- A. Apply coatings in accordance with manufacturer's instructions.
- B. Coat metal unless specified otherwise:
 1. Aboveground piping to be coated shall be empty of contents during application of coatings.

- C. Verify metal surface preparation immediately before applying coating in accordance with SSPC SP COM.
- D. Allow surfaces to dry, except where coating manufacturer requires surface wetting before coating.
- E. Wash coat and prime sherardized, aluminum, copper, and bronze surfaces, or prime with manufacture's recommended special primer.
- F. Prime shop primed metal surfaces. Spot prime exposed metal of shop primed surfaces before applying primer over entire surface.
- G. Multiple coats:
 - 1. Apply minimum number of specified coats.
 - 2. Apply additional coats when necessary to achieve specified thicknesses.
 - 3. Apply coats to thicknesses specified, especially at edges and corners.
 - 4. When multiple coats of same material are specified, tint prime coat and intermediate coats with suitable pigment to distinguish each coat.
 - 5. Lightly sand and dust surfaces to receive high gloss finishes, unless instructed otherwise by coating manufacturer.
 - 6. Dust coatings between coats.
- H. Coat surfaces without drops, overspray, dry spray, runs, ridges, waves, holidays, laps, or brush marks.
- I. Remove spatter and droppings after completion of coating.
- J. Apply coating by brush, roller, trowel, or spray, unless particular method of application is required by coating manufacturer's instructions or these Specifications.
- K. Plural component application: Drums shall be premixed each day. All gauges shall be working order prior to the start of application. Ratio checks shall be completed prior to each application. A spray sample shall be sprayed on plastic sheeting to insure set time is complete prior to each application. Hardness testing shall be performed after each application.
- L. Spray application:
 - 1. Stripe coat edges, welds, nuts, bolts, difficult to reach areas by brush before beginning spray application, as necessary, to ensure specified coating thickness along edges.
 - 2. When using spray application, apply coating to thickness not greater than that recommended in coating manufacturer's instructions for spray application.
 - 3. Use airless spray method, unless air spray method is required by coating manufacturer's instruction or these Specifications.
 - 4. Conduct spray coating under controlled conditions. Protect adjacent construction and property from coating mist, fumes, or overspray.
- M. Drying and recoating:
 - 1. Provide fans, heating devices, or other means recommended by coating manufacturer to prevent formation of condensate or dew on surface of substrate, coating between coats and within curing time following application of last coat.
 - 2. For submerged service the CONTRACTOR shall provide a letter to the ENGINEER that the lining system is fully cured and ready to be placed into service.
 - 3. Limit drying time to that required by these Specifications or coating manufacturer's instructions.
 - 4. Do not allow excessive drying time or exposure which may impair bond between coats.
 - 5. Recoat epoxies within time limits recommended by coating manufacturer.

6. When time limits are exceeded, abrasive blast clean and de-gloss clean prior to applying another coat.
7. When limitation on time between abrasive blasting and coating cannot be met before attachment of components to surfaces which cannot be abrasive blasted, coat components before attachment.
8. Ensure primer and intermediate coats of coating are unscarred and completely integral at time of application of each succeeding coat.
9. Touch up suction spots between coats and apply additional coats where required to produce finished surface of solid, even color, free of defects.
10. Leave no holidays.
11. Sand and feather in to a smooth transition and recoat and recoat scratched, contaminated, or otherwise damaged coating surfaces so damages are invisible to naked eye.

N. Concrete:

1. Apply first coat (primer) only when surface temperature of concrete is decreasing in order to eliminate effects of off-gassing on coating.

3.5 WAX COATING

A. Preparation:

1. Prepare surfaces in accordance with general preparation requirements.

B. Application:

1. Apply in accordance with general application requirements and as follows:
 - a. Apply at least 1/32-inch thick coat with 2-inch or shorter bristle brush.
 - b. Thoroughly rub coating into metal surface with canvas covered wood block or canvas glove.

3.6 HIGH SOLIDS EPOXY SYSTEM

A. Preparation:

1. Prepare surfaces in accordance with general preparation requirements and as follows:
 - a. Abrasive blast ferrous metal surfaces to be submerged at jobsite in accordance with SSPC SP-5 prior to coating. When cleaned surfaces rust or discolor, abrasive blast surfaces in accordance with SSPC SP-10.
 - b. Abrasive blast non-submerged ferrous metal surfaces at jobsite in accordance with SSPC SP-10, prior to coating. When cleaned surfaces rust or discolor, abrasive blast surfaces in accordance with SSPC SP 6.
 - c. Abrasive blast clean ductile iron surfaces at jobsite in accordance with SSPC SP-7.

B. Application:

1. Apply coatings in accordance with general application requirements and as follows:
 - a. Apply minimum 2-coat system with minimum total dry film thickness (DFT) of 12 mils.
 - b. Recoat or apply succeeding epoxy coats within time limits recommended by manufacturer. Prepare surfaces for recoating in accordance with manufacturer's instructions.
 - c. Coat metal to be submerged before installation when necessary, to obtain acceptable finish, and to prevent damage to other surfaces.
 - d. Coat entire surface of support brackets, stem guides, pipe clips, fasteners, and other metal devices bolted to concrete.
 - e. Coat surface of items to be exposed and adjacent 1 inch to be concealed when embedded in concrete or masonry.

3.7 HIGH SOLIDS EPOXY AND POLYURETHANE COATING SYSTEM

A. Preparation:

1. Prepare surfaces in accordance with general preparation requirements and as follows:
 - a. Prepare concrete surfaces in accordance with general preparation requirements.
 - b. Touch up shop primed steel and miscellaneous iron.
 - c. Abrasive blast ferrous metal surfaces at jobsite prior to coating. Abrasive blast clean rust and discoloration from surfaces.
 - d. Degrease or solvent clean, whip abrasive blast, power tool, or hand tool clean galvanized metal surfaces.
 - e. Lightly sand (de-gloss) fiberglass and poly vinyl chloride (PVC) pipe to be coated and wipe clean with dry cloths, or solvent clean in accordance with coating manufacturer's instructions.
 - f. Abrasive blast clean ductile iron surfaces.

B. Application:

1. Apply coatings in accordance with general application requirements and as follows:
 - a. Apply 3 coat system consisting of:
 - 1) Primer: 4 to 5 mils dry film thickness high solids epoxy.
 - 2) Intermediate coat: 4 to 5 mils dry film thickness high solids epoxy.
 - 3) Topcoat: 2.5 to 3.5 mils dry film thickness aliphatic or aliphatic-acrylic polyurethane topcoat.
2. Recoat or apply succeeding epoxy coats within 30 days or within time limits recommended by manufacturer, whichever is shorter. Prepare surfaces for recoating in accordance with manufacturer's instructions.

3.8 EPOXY NOVOLAC SYSTEM

A. Preparation:

1. Prepare surfaces in accordance with general preparation requirements and as follows:
2. Prepare concrete to obtain clean, open pore with exposed aggregate in accordance with manufacturer's instructions.
3. Prepare ferrous metal surfaces in accordance with SSPC SP-5, with coating manufacturer's recommended anchor pattern.
4. Complete application of prime coat within 6 hours of abrasive blast cleaning. When cleaned surfaces rust or discolor, abrasive blast surfaces in accordance with SSPC SP-5.
5. When handling steel, wear gloves to prevent hand printing.
6. Adjust pH of concrete to within 7 to 11 before applying prime coat.

B. Application:

1. Apply coatings in accordance with general application requirements and in accordance with manufacturer's instructions.
2. Continue to monitor dew point. Dew point shall remain 5 degrees above ambient temperature for a minimum of 8 hours after application of coating.

3.9 HIGH TEMPERATURE COATING

A. Preparation:

1. Prepare surfaces in accordance with general preparation requirements and as follows:
 - a. Abrasive blast surface in accordance with SSPC SP-10.

B. Application:

1. Apply coatings in accordance with general application requirements and as follows:
 - a. Apply number of coats in accordance with manufacturer's instructions.

3.10 ASPHALT VARNISH

A. Preparation:

1. Prepare surfaces in accordance with general preparation requirements.

B. Application:

1. Apply coatings in accordance with general application requirements and as follows:
 - a. Apply minimum 2 coats.

3.11 VINYL ESTER

A. Preparation:

1. Prepare surfaces in accordance with coating manufacturer's recommendations and as directed and approved by coating manufacturer's representative.

B. Application:

1. Apply prime coat, as required by coating manufacturer, base coat, glass mat, and topcoat to total dry film thickness of 125 mils minimum:
 - a. Final topcoat on floors shall include non-skid surface, applied in accordance with manufacturer's instructions.
2. Perform high voltage holiday detection test in accordance with SP0188-06, over 100 percent of coated surface areas to ensure pinhole free finished coating system.
3. All work shall be accomplished in strict accordance with coating manufacturer's instructions and under direction of coating manufacturer's representative.

3.12 ELASTOMERIC POLYURETHANE (100 PERCENT SOLIDS)

A. Preparation:

1. Prepare surfaces in strict accordance with coating manufacturer's instructions and as directed and approved by coating manufacturer's representative.

B. Application:

1. Apply epoxy primer at DFT of 1 to 2 mils, in strict accordance with manufacturer's instructions.
2. Apply polyurethane coating at minimum total DFT as follows:
 - a. Steel: 60 mils DFT.
 - b. Ductile iron and ductile iron pipe coating and lining: 30 mils DFT.
 - c. Concrete: 120 mils DFT.
 - d. Or as recommended by the coating manufacturer and accepted by the ENGINEER.

C. For concrete application, provide saw cutting for coating terminations in strict accordance with manufacturer's instructions:

D. For application to damaged concrete, refer to Section 03_01_03.

E. Perform high voltage holiday detection test in accordance with SP0188-06, over 100 percent of coated surface areas to ensure pinhole free finished coating system.

3.13 CONCRETE FLOOR COATINGS

A. Preparation:

1. Prepare surfaces in accordance with general application requirements and in strict accordance with coating manufacturer's instructions.

B. Application:

1. Apply primer if required by coating manufacturer.
 2. Apply 1 or more coats as recommended by coating manufacturer to receive a minimum total dry film thickness of 25 mils, color as selected by OWNER.
- C. Final topcoat shall include non-skid surface, applied in strict accordance with coating manufacturer's instructions.

3.14 WATERBORNE ACRYLIC EMULSION

- A. Preparation:
1. Remove all oil, grease, dirt, and other foreign material by Solvent Cleaning in accordance with SSPC SP-1.
 2. Lightly sand all surfaces and wipe thoroughly with clean cotton cloths before applying coating.
- B. Application:
1. Apply 2 or more coats to obtain a minimum dry film thickness (DFT) of 5.0 mils.

3.15 FIELD QUALITY CONTROL

- A. Each coat will be inspected. Strip and remove defective coats, prepare surfaces and recoat. When approved, apply next coat.
- B. Control and check dry film thicknesses and integrity of coatings.
- C. Measure dry film thickness with calibrated thickness gauge.
- D. Dry film thicknesses on ferrous-based substrates may be checked with Elcometer Type 1 Magnetic Pull-Off Gage or Positector 6000.
- E. Verify coat integrity with low-voltage sponge or high-voltage spark holiday detector, in accordance with SP0188 06. Allow ENGINEER to use detector for additional checking.
- F. Check wet film thickness before coal tar epoxy coating cures on concrete or non-ferrous metal substrates.
- G. Arrange for services of coating manufacturer's field representative to provide periodic field consultation and inspection services to ensure proper surface preparation of facilities and items to be coated, and to ensure proper application and curing:
1. Notify ENGINEER 24 hours in advance of each visit by coating manufacturer's representative.
 2. Provide ENGINEER with a written report by coating manufacturer's representative within 48 hours following each visit.

3.16 PROTECTIVE COATINGS SYSTEMS

- A. System No. 1: Not Used
- B. System No. 2: Submerged Metal – Potable General:

Surface Prep.	Paint Material	Min. Coats, Cover
Abrasive Blast, or Centrifugal Wheel Blast (SP 5)	Primer – High Solids Epoxy (Self Priming)	1 coat, 6 MDFT

	Top Coat – High Solids Epoxy	3 coats, 3 MDFTPC
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C. System No. 2B: Not Used

D. System No. 3: Exposed Metal - Highly Corrosive:

Surface Prep.	Paint Material	Min. Coats, Cover
Abrasive Blast (SP 10)	Primer – Per Manufacturer's Recommendations	1 coat, 2.5 MDFT
	Intermediate Coat – High Solids Epoxy	1 coat, 4 MDFT
	Top Coat – Aliphatic Polyurethane	1 coat, 3 MDFT

E. System No. 4: Exposed Metal – Mildly Corrosive:

Surface Prep.	Paint Material	Min. Coats, Cover
Abrasive Blast (SP 10)	Primer – Per Manufacturer's Recommendations	1 coat, 2.5 MDFT
	Top Coat – Aliphatic Polyurethane	1 coat, 3 MDFT

F. System No. 5: Buried Metal - General:

Surface Prep.	Paint Material	Min. Coats, Cover
Abrasive Blast or Centrifugal Wheel Blast (SP 10)	Standard Hot Coal-Tar Enamel	AWWA C203
	-OR- Coal-Tar Epoxy	AWWA C210
	-OR- Tape Coat System	AWWA C214
	For Acidic Soil, Brackish Water High Bacteria - Hot Coal-Tar, Double Felt	AWWA C203, App. A, Sec. A1.5
	For Highly Abrasive Soil, Brackish Water - Hot Coal-Tar, Fibrous Glass -OR- Tape Coat System	AWWA C203, App. A, Sec. A1.5 AWWA C214 with Double Outer Wrap

G. System No. 6 High Temperature (150° - 350°):

Surface Prep.	Paint Material	Min. Coats, Cover
Abrasive Blast (SP 10)	Primer – Per Manufacturer's Recommendations	1 coat, 2 MDFT
	Top Coat – High Temperature Coating 150° - 350°	1 coat, 2 MDFT

H. System No. 7 High Temperature (400° - 1000°):

Surface Prep.	Paint Material	Min. Coats, Cover
Abrasive Blast (SP 10)	Primer – Per Manufacturer's Recommendations	1 coat, 2 MDFT
	Top Coat – High Temperature Coating 400° - 1000°	1 coat, 2 MDFT 1 coat, 1.5 MDFT

I. System No. 8 High Temperature (1000° - 1400°):

Surface Prep.	Paint Material	Min. Coats, Cover
Abrasive Blast (SP 10)	Primer – Per Manufacturer's Recommendations	1 coat, 2 MDFT
	Top Coat – High Temperature Coating up to 1400°	1 coat, 1.5 MDFT

J. System No. 10 Galvanized Metal Conditioning:

Surface Prep.	Paint Material	Min. Coats, Cover
Solvent Clean (SP 1), followed by Hand Tool (SP 2), or Power Tool (SP 3),	Wash Primer or Coating Manufacturer's Recommendation.	1 coat, 0.4 MDFT
		Remaining coats as required by exposure

K. System No. 11 Galvanized Metal Conditioning:

Surface Prep.	Paint Material	Min. Coats, Cover
Solvent Clean (SP 1), followed by Hand Tool (SP 2), Power Tool (SP 3), or Brush-off Blast (SP 7)	Primer – Organic Zinc Rich	1 coat, 3 MDFT Additional coats as required by exposure.

L. System No. 12 Skid-Resistant Aluminum and FRP:

Surface Prep.	Paint Material	Min. Coats, Cover
Brush-off Blast (SP 7) or Plastic Surface Preparation	High Solids Epoxy (aggregated)	1 coat, 16 MDFT

M. System No. 13 Sliding Metal:

Surface Prep.	Paint Material	Min. Coats, Cover
Solvent Clean (SP 1), followed by Hand Tool (SP 2), Power Tool (SP 3), or Brush-off Blast (SP 7)	Wax Coating	1 coat, 31 MDFT

N. System No. 14 Exposed PVC:

Surface Prep.	Paint Material	Min. Coats, Cover
Plastic Surface Preparation	Primer – Per Manufacturer's Recommendations	1 coat, 2 MDFT
	Waterborne Acrylic Emulsion	1 coat, 3 MDFT

O. System No. 15 Aluminum and Dissimilar Metal Insulation:

Surface Prep.	Paint Material	Min. Coats, Cover
SP 1	Alkali Resistant Bitumastic or Coal-Tar Epoxy Substitute	1 coat, 18 MDFT

P. System No. 16 Existing Concrete/CMU Repair:

Surface Prep.	Paint Material	Min. Coats, Cover
SP 13	Filler – Per Manufacturer's Recommendations	1 coat, 10 MDFT
	Primer – Per Manufacturer's Recommendations	1 coat, 5 MDFT
	Top Coat – High Solids Epoxy	1 coat, 4 MDFT

Q. System No. 17 New Concrete/CMU Exterior (as required by application schedule):

Surface Prep.	Paint Material	Min. Coats, Cover
SP 13	Filler – Per Manufacturer's Recommendations	1 coat, 10 MDFT
	Intermediate Coat – High Solids Epoxy	1 coat, 4 MDFT
	Top Coat – Aliphatic Polyurethane	1 coat, 3 MDFT

R. System No. 18 Concrete/CMU – Interior or Immersion Mildly Corrosive:

Surface Prep.	Paint Material	Min. Coats, Cover
SP 13	Filler – Per Manufacturer's Recommendations	1 coat, 10 MDFT
	Intermediate Coat – High Solids Epoxy	1 coat, 6 MDFT
	Top Coat – Aliphatic Polyurethane	1 coat, 6 MDFT

S. System No. 19 Concrete/CMU – Immersion Highly Corrosive:

Surface Prep.	Paint Material	Min. Coats, Cover
SP 13	Per Manufacturer's Recommendations	As required by conditions
	Epoxy Novolac	2 coat, 40 MDFT Minimum or as called for on the Project Drawings.

3.17 SCHEDULE OF ITEMS NOT REQUIRING COATING

1. General: Unless specified otherwise, the following items do not require coating:
2. Items that have received final coat at factory and not listed to receive coating in field.
3. Aluminum, brass, bronze, copper, plastic (except PVC pipe), rubber, stainless steel, chrome, Everdur, or lead.
4. Buried or encased piping or conduit.
5. Exterior concrete.
6. Galvanized steel wall framing, galvanized roof decking, galvanized electrical conduits, galvanized pipe trays, galvanized cable trays, and other galvanized items:
 - a. Areas on galvanized items or parts where galvanizing has been damaged during handling or construction shall be repaired as follows:
 - 1) Clean damaged areas by SSPC SP-1, SP-2, SP-3, or SP-7 as required.
 - 2) Apply 2 coats of a Galvanizing Zinc Compound in strict accordance with manufacturer's instructions.
7. Grease fittings.
8. Fiberglass ducting or tanks in concealed locations.
9. Steel to be encased in concrete or masonry.

3.18 SCHEDULE OF SURFACES TO BE COATED IN THE FIELD

- A. In general, apply coatings to steel, iron, galvanized surfaces, and wood surfaces unless specified or otherwise indicated on the Drawings. Coat concrete surfaces and anodized aluminum only when specified or indicated on the Drawings. Color coat all piping as specified in Section 40 23 39.
- B. Following schedule is incomplete. Coat unlisted surfaces with same coating system as similar listed surfaces. Verify questionable surfaces.
- C. Metal:
 - 1. System 1 – Submerged Metal – General
 - a. Not used.
 - 2. System 2 – Submerged Metal – Potable
 - a. Above grade piping, wall pipes, and pipe sleeves.
 - b. Slide gate guides.
 - c. Structural Steel.
 - d.
 - e.
 - 3. System 2B – Submerged Metal – Domestic Sewage
 - a. Not used.
 - 4. System 3 - Exposed Metal – Highly Corrosive
 - a. Structural steel
 - b. Process piping, wall pipes
 - c.
 - 5. System 4 – Exposed Metal – Mildly Corrosive
 - a.
 - b.
 - c.
 - 6. System 5 – Buried Metal – General
 - 7. Buried, below-grade portions of steel items, except buried stainless steel or ductile iron.
 - a.
 - b.
 - 8. System 6 - High Temperature (150° - 350°)
 - a.
 - b.
 - c.
 - 9. System 7 - High Temperature (400° - 1000°)
 - a.
 - b.
 - c.
 - 10. System 8 - High Temperature (1000° - 1400°)
 - a.
 - b.
 - c.
 - 11. System 10 – Galvanized Metal Conditioning
 - a.
 - b.
 - c.
 - 12. System 11 – Galvanized Metal Conditioning
 - a.
 - b.
 - c.
 - 13. System 12 - Skid-Resistant Aluminum and FRP
 - a. Aluminum checker plate in all exterior locations, and in wet interior locations.
 - b.

- c.
- 14. System 13 - Sliding Metal
 - a. Sliding contact surfaces of slide gates and sluice gates.
 - b.
 - c.
- 15. System 15 - Aluminum and Dissimilar Metal Insulation
 - a. Aluminum surfaces embedded or in contact with concrete, masonry, and other metals.
 - b. Stainless steel embedded in concrete.
 - c. Dissimilar metals for electrical insulation.
 - d.
 - e.
- D. Other Materials
 - 1. System 14 - Exposed PVC
 - a. All exterior exposed-to-view PVC and CPVC surfaces, and FRP surfaces without integral UV resistant gel coat.
 - b.
 - c.
- E. Concrete:
 - 1. System 17 – New Concrete/CMU Exterior
 - a. Safety markings
 - b.
 - c.
 - 2. System 18 – Concrete/CMU Interior or Immersion Mildly Corrosive
 - a. Interior face of walls
 - b.
 - c.
 - 3. System 19 – Concrete/CMU Immersion Highly Corrosive
 - a.
 - b.
 - c.

END OF SECTION

SECTION 09 91 23 – INTERIOR PAINTING

PART 1 - GENERAL

1.1 SCOPE

- A. The work to be performed under this section of the Specifications shall consist of furnishing all labor, materials, and equipment necessary for painting and finishing exposed interior items and surfaces.
- B. Surface preparation, priming, and finish coats specified in this section are in addition to shop priming and surface treatment specified under other sections.
- C. All painting at the site of the work is hereby defined as field painting and shall be under the observation of the Engineer to the extent that he shall determine where and when painting meets specification. All surfaces to be painted shall have their readiness for painting approved by the Engineer before work is started.
- D. Certain items which will be subjected to immersion in water or sewage in the finished work as described and as set out hereinafter shall not receive a shop coat of primer or paint but shall receive in the field the specified surface preparation, primer, and finish paint coats as specified herein. Items so specified for painting entirely in the field, but delivered to the job site already primed, shall be sandblasted to remove any coatings applied in the shop and then receive the coatings specified.
- E. Items specified for shop priming shall receive one (1) shop coat of the primer specified. In all cases, shop primer shall be compatible with the field coat specified and be from the same manufacturer. If not, it shall be field blasted and re-primed. Contractor shall provide written confirmation that the shop primer is from the same manufacturer as the subsequent coatings. The Contractor shall have sole responsibility of ensuring that all coatings are coordinated and that coatings and surfaces do not conflict with one another
- F. Paint exposed surfaces whether or not colors are designated in "schedules," except where a surface or material is specifically indicated not to be painted or is to remain natural. Where an item or surface is not specifically mentioned, paint the same as similar adjacent materials or surfaces. If color or finish is not designated, the Owner will select from standard colors or finishes available.
- G. Painting includes surface preparation and field painting exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron work, primed metal surfaces of mechanical and electrical equipment and other interior items as determined by the Engineer.
- H. All metal surfaces to be painted shall be sound, clean and free of harmful scale, rust, dirt, oil, grease, moisture, or any other foreign matter that might, in any way, lessen the life or usefulness of the coating.
- I. All metal shall be smooth and free from blisters, rough corners, pits, dents, or other imperfections before painting. Pits and dents shall be filled and the metal ground smooth where required.
- J. Shop coated surfaces shall be thoroughly cleaned before the application of subsequent paint coats in the field.
- K. Paints and similar materials shall be mixed in vessels of adequate capacity. All paints shall be thoroughly stirred before being taken from the containers, shall be kept stirred while using, and

all ready-mixed paints shall be applied exactly as received from the manufacturer without addition of any kind of a drier or thinner except as permitted or directed by the Engineer.

- L. In all cases, paints and coatings shall be applied according to manufacturer's recommendations.
- M. Surfaces of exposed members inaccessible after erection shall be cleaned and painted before erection.
- N. No painting shall be done when the temperature is below 50°F or until moisture on the surfaces to be painted has completely disappeared.
- O. Painting found defective shall be removed and the surface repainted as directed by the Engineer.
- P. Painting is not required on prefinished items, finished metal surfaces, concealed surfaces, operating parts, and labels.
 - 1. Prefinished items not to be painted include the following factory-finished components:
 - a. Pre-finished building components.
 - b. Finished mechanical and electrical equipment.
 - c. Light fixtures.
 - d. Switchgear.
 - e. Distribution cabinets.
 - 2. Concealed surfaces not to be painted include wall or ceiling surfaces in the following generally inaccessible areas:
 - a. Foundation spaces.
 - b. Furred areas.
 - c. Utility tunnels.
 - d. Pipe spaces.
 - e. Duct shafts.
 - 3. Finished metal surfaces not to be painted include:
 - a. Anodized aluminum.
 - b. Stainless steel.
 - c. Chromium plate.
 - d. Copper.
 - e. Bronze.
 - f. Brass.
 - g. Cast iron grates and pipes.
 - 4. Operating parts not to be painted include moving parts of operating equipment such as the following:
 - a. Valve and damper operators.
 - b. Linkages.
 - c. Sensing devices.
 - d. Motor and fan shafts.
 - 5. Labels: Do not paint over Underwriter's Laboratories, Factory Mutual or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.
 - 6. Aluminum and galvanized members shall not be painted except where specifically noted on drawings and specifications.
- Q. This section shall apply to all interior or submerged equipment and components contained in these specifications or otherwise shown on the drawings that may be subject to coatings as directed by the Engineer:

1.2 DEFINITIONS

- A. "Paint" includes coating systems materials, primers, emulsions, enamels, stains, sealers and fillers, and other applied materials whether used as prime, intermediate, or finish coats.

1.3 SUBMITTALS

- A. All submittals shall be in accordance with the section "Submittals" of these specifications.
- B. Submit copies of manufacturer's specifications, including paint label analysis and application instructions for each material specified. Submit Color Charts (minimum of 3 originals) for each material type specified for color selection by Engineer. Do not work until colors are selected and final approval is given.
- C. After colors have been selected and submittals have been approved submit to Engineer written verification that a copy of each manufacturer's instructions has been distributed to the paint applicator responsible for this portion of the work prior to applicator beginning work.

1.4 JOB SAMPLE AND FINAL COLOR SELECTION

- A. Job samples if required by the Engineer shall be prepared for final color approval prior to beginning this portion of the work.
- B. If color(s) are unacceptable, Contractor shall prepare additional sample(s) based upon new selection(s).

1.5 QUALITY ASSURANCE

- A. Single-Source Responsibility: Provide primers and undercoat paint produced by the same manufacturer as the finish coats.
- B. Coordination of Work: Review other sections in which primers are provided to ensure compatibility of the total systems for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.
- C. Notify the Engineer of problems anticipated using the materials specified.
- D. Material Quality: Provide the manufacturer's best quality trade sale paint material of the various coating types specified. Paint material containers not displaying manufacturer's product identification will not be acceptable.
- E. Proprietary names used to designate colors or materials are not intended to imply that products named are required or to exclude equal products of other manufacturers.
- F. Comply with governing codes and regulations. Provide products of acceptable manufacturers which have been in satisfactory use in similar service for three years. Use experienced installers. Comply with VOC and environmental regulations.

1.6 JOB CONDITIONS

- A. Apply water-based and solvent-thinned paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 50 deg F (10 deg C) and 100 deg F (32 deg C).

- B. Do not apply paint in when the relative humidity exceeds 85 percent, at temperatures less than 5 deg F (3 deg C) above the dew point, or to damp or wet surfaces.
- C. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by the manufacturer during application and drying periods.
- D. Apply epoxy Coatings in accordance with manufacturer's instructions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Tnemec Company, Inc. or approved equal. Manufacturers: Devoe & Raynolds, Glidden Co., Benjamin Moore, Pratt and Lambert, Sherwin Williams or approved equal. First-line commercial-quality products shall be required for all coating systems.

2.2 PAINTS

- A. The paints and paint products listed below are as manufactured by Tnemec Company, Inc., and are intended to establish standards of quality, or equal products shall be reviewed by the Engineer. Paint products for this project shall be equal in all respects to the products listed. No request for substitution will be considered which decreases the film thickness designated and/or the number of coats to be applied, or which offers a change from the generic type of coating specified. Any request for substitution shall contain the full name of each product, descriptive literature, directions for use, generic type, nonvolatile content by volume, and a list of at least ten (10) applications where each of the coatings has been used on new construction and has rendered satisfactory service for at least three (3) years. Submitted paint system shall be used throughout entire project.
 - 1. 66-Color Hi-Build Epoxoline
 - 2. 90-97 Tneme Zinc
 - 3. 69-Color Hi-Build Epoxoline II
 - 4. 2H-Color Hi-Build Tneme Gloss
 - 5. 291-Color CRU Urethane
 - 6. 130 Envirofill-6602
 - 7. 51-792 PVA Sealer
 - 8. 36 Undercoater
- B. Each coat shall have the minimum dry film thickness indicated. All coats of paint for any particular surface shall be from the same manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions under which painting will be performed for compliance with requirements for application of paint. Do not begin paint application until unsatisfactory conditions have been corrected.
- B. Start of painting will be construed as the Applicator's acceptance of surfaces and conditions within a particular area.

3.2 PREPARATION

- A. General: Listing below does not necessarily imply that each and every substrate condition listed will be encountered in this Project. Perform all preparation and cleaning procedures in strict accordance with the paint manufacturer's instructions and as herein specified, for each particular substrate condition.
1. Remove all hardware, hardware accessories, machined surfaces, plates, lighting fixtures, and similar items in place and not to be finish painted, or provide surface-applied protection prior to surface preparation and painting operations. Remove, if necessary, for the complete painting of the items and adjacent surfaces. Following completion of painting of each space or area, reinstall the removed items by workmen skilled in the trades involved.
 2. Clean surfaces to be painted before applying paint or surface treatments. Remove oil and grease with clean cloths and cleaning solvents prior to mechanical cleaning. Schedule cleaning and painting so that dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.
 3. Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items in place that are not to be painted, or provide surface-applied protection prior to surface preparation and painting. Remove these items if necessary for complete painting of the items and adjacent surfaces. Following completion of painting operations in each space or area, have items reinstalled by workers skilled in the trades involved.
 4. At existing areas to be repainted, remove blistered or peeling paint to sound substrates. Remove chalk deposits and mildew and wash all surfaces with mild detergent. Perform related minor preparation including caulk and glazing compounds. Spot prime bare areas before priming and painting as specified.
- B. Surface Preparation: Clean and prepare surfaces to be painted in accordance with the manufacturer's instructions for each particular substrate condition and as specified.
1. Provide barrier coats over incompatible primers or remove and re-prime. Notify Engineer in writing of problems anticipated with using the specified finish-coat material with substrates primed by others.
- C. Cementitious Materials: Prepare concrete, concrete masonry block, cement plaster, and mineral-fiber-reinforced cement panel surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.
1. Determine the alkalinity and moisture content of the surfaces to be painted by performing appropriate tests. If the surfaces are found to be sufficiently alkaline to cause blistering and burning of the finish paint, correct this condition before application of paint.
 2. Do not paint over surfaces where the moisture content exceeds 8%, unless otherwise permitted in the manufacturer's printed directions.
- D. Concrete Floors: Acid etch or scarify all surfaces to create a surface profile similar to medium grit sandpaper (more than one application of acid may be required to obtain this degree of surface profile). Rinse all surfaces until a neutral pH is obtained. All surfaces shall be clean and dry.
- E. Structural and Miscellaneous Ferrous Metals (non process): Clean non-galvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with recommendations of the Steel Structures Painting Council.
1. Clean non-galvanized, ferrous surfaces that have not been shop-coated of all oil, grease, dirt, loose mill scale and other foreign substances by solvent or mechanical cleaning, complying with Steel Structures Painting Council (SSPC) - SP3.

2. Touch-up shop-applied prime coats which have damaged or bare areas. Wire-brush, solvent clean, and touch-up with the same primer as the shop coat.
3. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by the paint manufacturer, and touch up with the same primer as the shop coat.

- F. Surface Preparation Ferrous Metals (Process Equipment): Surface preparation of all ferrous metal to be primed in the shop shall have all rust, dust and scale, as well as all other foreign substances, removed by blasting (Black Beauty or equal) or pickling. Cleaned metal shall be primed or pre-treated immediately after cleaning to prevent new rusting. All ferrous metals not primed in the shop shall be sandblasted in the field prior to application of the primer, pretreatment or paint. Grades of sandblasting shall be as indicated for the specific application below and shall conform to the following definitions:
1. White Metal Blast - NACE No. 1 or SSPC-SP-5
 2. Near White Metal Blast - NACE No. 2 or SSPC-SP-10
 3. Commercial Blast - NACE No. 3 or SSPC-SP-6
 4. Brush Off Blast - NACE No. 4 or SSPC-SP-7

Unless otherwise specified, surface preparation shall be equivalent to NACE No. 2.

- G. Galvanized Surfaces: Clean galvanized surfaces with non-petroleum-based solvents so that the surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.
1. Clean free of oil and surface contaminants with an acceptable non-petroleum based solvent. Approximately 24 hours before application of prime coat (and immediately after cleaning), chemically treat surfaces with a phosphoric acid or copper sulphate solution, applied according to directions of manufacturer of paint being used.
- H. Materials Preparation: Carefully mix and prepare paint materials in accordance with manufacturer's directions.
1. Maintain containers used in mixing and application of paint in a clean condition, free of foreign materials and residue.
 2. Stir material before application to produce a mixture of uniform density; stir as required during application. Do not stir surface film into material. Remove film and, if necessary, strain material before using.
 3. Use only thinners approved by the paint manufacturer, and only within recommended limits.
- I. Tinting: Tint each undercoat a lighter shade to facilitate identification of each coat where multiple coats of the same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

3.3 APPLICATION

- A. Apply paint in accordance with manufacturer's directions. Use applicators and techniques best suited for substrate and type of material being applied.
- B. Apply paint with brush, roller, spray, or other acceptable practice in accordance with the manufacturer's directions. Use brushes best suited for the type of material being applied. Use rollers of carpet, velvet back, or high pile sheep wool as recommended by the paint manufacturer for material and texture required.
- C. The number of coats and paint film thickness required is the same regardless of the application method. Do not apply succeeding coats until the previous coat has completely dried. Sand between each enamel or varnish coat application with fine sandpaper.

- D. Apply additional coats when undercoats, stains, or other conditions show through the final coat of paint, until the paint film is of uniform finish, color and appearance. Give special attention to insure that all surfaces, including edges, corners, crevices, welds, and exposed fasteners receive a film thickness equivalent to that of flat surfaces.
- E. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Paint surfaces behind permanently fixed equipment or furniture with prime coat only.
- F. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, non-specular black paint, before final installation of equipment.
- G. Paint the back sides of access panels, removable or hinged covers to match the exposed surfaces.
- H. Recoat primed and sealed walls and ceilings where there is evidence of suction spots or unsealed areas in first coat, to assure a finish coat with no burn-through or other defects due to insufficient sealing.
- I. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
- J. Finish interior of wall and base cabinets and similar field-finished casework to match exterior.
- K. Omit primer on metal surfaces that have been shop-primed and touch up painted.
- L. Brush Application: Brush-out and work all brush coats onto the surfaces in an even film. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable. Neatly draw all glass and color break lines. Brush apply all primer or first coats, unless otherwise permitted to use mechanical applicators.
- M. Mechanical Applicators: Use mechanical methods for paint application only when permitted by governing ordinances and trade union regulations. If permitted, limit to only those surfaces impracticable for brush applications.
- N. Limit roller applications (generally) to interior wall and ceiling finishes for second and third coats. Apply each roller coat to provide the equivalent hiding as brush-applied coats.
- O. Confine spray application (generally) to metal framework, siding, decking, wire mesh and similar surfaces where hand brush work would be inferior and other surfaces specifically recommended by paint manufacturer.
- P. Wherever spray application is used, apply each coat to provide the equivalent hiding of brush applied coats. Do not double back with spray equipment for the purpose of building up film thickness of two coats in one pass.
- Q. Scheduling Painting: Apply first coat to surfaces that have been cleaned, retreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
- R. Allow sufficient time between successive coats to permit proper drying. Do not recoat until paint has dried to where it feels firm, and does not deform or feel sticky under moderate thumb pressure and where application of another coat of paint does not cause lifting or loss of adhesion of the undercoat.

- S. Mechanical and Electrical Work: Painting mechanical and electrical work is limited to items exposed in mechanical equipment rooms and in occupied spaces. Mechanical items to be painted include but are not limited to:
 - 1. Piping, pipe hangers, and supports.
 - 2. Heat exchangers.
 - 3. Tanks.
 - 4. Ductwork.
 - 5. Insulation.
 - 6. Supports.
 - 7. Motors and mechanical equipment.
- T. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.
- U. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not in compliance with specified requirements.

3.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to the job site in the manufacturer's original, unopened packages and containers bearing manufacturer's name and label and the following information:
 - 1. Product name or title of material.
 - 2. Product description (generic classification or binder type).
 - 3. Federal Specification number, if applicable.
 - 4. Manufacturer's stock number and date of manufacture.
 - 5. Contents by volume, for pigment and vehicle constituents.
 - 6. Thinning instructions.
 - 7. Application instructions.
 - 8. Color name and number.
- B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F (7 deg C). Maintain containers used in storage in a clean condition, free of foreign materials and residue.
- C. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

3.5 FIELD QUALITY CONTROL

- A. The Owner reserves the right to invoke test procedures at any time and as often as the Owner deems necessary during the period when paint is being applied.
- B. The Owner will engage the services of an independent testing laboratory to sample the paint material being used. Samples of material delivered to the project will be taken, identified, sealed, and certified in the presence of the Contractor.
- C. The testing laboratory will perform appropriate tests for the following characteristics as required by the Owner:
 - 1. Quantitative materials analysis.
 - 2. Abrasion resistance.
 - 3. Apparent reflectivity.
 - 4. Flexibility.
 - 5. Washability.
 - 6. Absorption.

- 7. Accelerated weathering.
- 8. Dry opacity.
- 9. Accelerated yellowness.
- 10. Recoating.
- 11. Skinning.
- 12. Color retention.
- 13. Alkali and mildew resistance.

D. If test results show material being used does not comply with specified requirements, the Contractor may be directed to stop painting, remove noncomplying paint, pay for testing, repaint surfaces coated with rejected paint, and remove rejected paint from previously painted surfaces if, upon repainting with specified paint, the two coatings are noncompatible. **The DFT shall be confirmed.**

3.6 REQUIRED CONDITION OF COMPLETED WORK

A. Must match approved samples for color, texture and coverage. Remove, refinish, or repaint work not in compliance with specified requirements.

3.7 CLEANING

- A. At the end of each work day, remove empty cans, rags, rubbish, and other discarded paint materials from the site.
- B. Upon completion of painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping, using care not to scratch or damage adjacent finished surfaces.
- C. At the completion of work of other trades, touch-up and restore all damaged or defaced painted surfaces.

3.8 PROTECTION

- A. Protect work of other trades, whether to be painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as acceptable to Engineer. Provide "wet paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others for protection of their work after completion of painting operations.
- B. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.9 PAINT SCHEDULE

A. The number of coats shall be not less than called for hereunder. Letter designations of various coats of paint refer to the same letter designation of paints given in the preceding subsection. Colors to be selected by the Owner from the standard color line of each particular paint type and manufacturer.

B. Coating Systems:

<u>Coat</u>	<u>Tnemec Product</u>	<u>Dry Film Thickness (Mils)</u>
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Steel - Tanks, Pipes, and Equipment

Note: Manufacturer's Standard Paint System if pump motor is not attached to pump. Contractor to touch up all areas damaged during shipment and installation.

1. Interior Exposure

<u>1st Coat:</u>	90 – 97 Tneme Zinc	2.0 to 3.0
<u>2nd Coat:</u>	69- Color Hi-Build Epoxoline II	6.0 to 8.0

Steel - Structural & Miscellaneous Metal, Bar Joists, Metal Doors, and Trim (Shop Primed)

1. Interior Exposure

<u>1st Coat:</u>	90 – 97 Tneme Zinc	2.0 to 3.0
<u>2nd Coat:</u>	69-Color Hi-Build Epoxoline II	6.0 to 8.0

Ductile Iron, Galvanized Steel, and Non-Ferrous Metals

1. Interior Exposure

<u>1st Coat:</u>	66-Color Hi-Build Epoxoline	4.0 to 6.0
<u>2nd Coat:</u>	66-Color Hi-Build Epoxoline	4.0 to 6.0

Concrete, Dense

1. Interior Exposure Excluding Floors

<u>Surface Prep:</u>	Brush-Off Blast Cleaning	
<u>1st Coat:</u>	69-Color Hi-Build Epoxoline II	6.0 to 8.0
<u>2nd Coat:</u>	69-Color Hi-Build Epoxoline II	6.0 to 8.0

Concrete Floors

- | | | |
|----------------------|---------------------------------------|------------|
| <u>Surface Prep:</u> | Acid etch or mechanical scarification | |
| <u>1st Coat</u> *: | 66-Color Hi-Build Epoxoline | 2.0 to 3.0 |
| <u>2nd Coat</u> **: | 66-Color Hi-Build Epoxoline | 2.0 to 3.0 |
| <u>3rd Coat:</u> | 291-Color CRU Urethane | 2.0 to 3.0 |

* Thin first coat 20% with Series 41-4 Thinner.

** Broadcast sand into second coat at a rate of 2 lbs per 100 square feet for a non-skid finish.

Porous Masonry

1. Interior Exposure

<u>Surface Prep:</u>	Surface shall be clean and dry	
<u>1st Coat:</u>	130 Envirofill-6602	75 to 100 sq.ft./gal.
<u>2nd Coat:</u>	69-Color Hi-Build Epoxoline II	6.0 to 8.0
<u>3rd Coat:</u>	69-Color Hi-Build Epoxoline II	6.0 to 8.0

Gypsum Wallboard

1. Interior Exposure

<u>Surface Prep:</u>	Surface shall be clean and dry	
<u>1st Coat:</u>	51-792 PVA Sealer	1.0 to 2.0
<u>2ndCoat:</u>	66-Color Hi-Build Epoxoline	2.0 to 3.0
<u>3rd Coat:</u>	66-Color Hi-Build Epoxoline	2.0 to 3.0

Wood

1. Interior Exposure

<u>Surface Prep:</u>	Surface shall be clean and dry	
<u>1st Coat:</u>	36 Undercoater	2.0 to 3.5
<u>2nd Coat:</u>	2H-Color Hi-Build Tneme-Gloss	1.5 to 3.5

3rd Coat: 2H-Color Hi-Build Tneme-Gloss 1.5 to 3.5

PVC Pipe

1. Interior Exposure

Surface Prep: Scarify by sanding

1st Coat: 66-Color Hi-Build Epoxoline 2.0 to 4.0

2nd Coat: 66-Color Hi-Build Epoxoline 2.0 to 4.0

3.10 MEASUREMENT AND PAYMENT

- A. All items of this section shall not be measured for separate payment but shall be considered subsidiary to the lump sum price bid for the associated item and schedule.

END OF SECTION

DIVISION 10
SPECIALTIES

SECTION 10 42 50 – SIGN LETTERS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following types of signs:
 - 1. Dimensional letters and numbers.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 01 Section "Temporary Facilities" for temporary project identification sign.
 - 2. Division 10 Section "Interior Signage".
 - 3. Division 10 Section "Exterior Post and Panel Signs" for freestanding exterior signs.

1.2 SUBMITTALS

- A. General: Submit the following according to the Conditions of the Contract and Division 01 Specification Sections.
- B. Product data for each type of sign specified, including details of construction relative to materials, dimensions of individual components, profiles, and finishes.
- C. Shop drawings showing fabrication and erection of signs. Include plans, elevations, and large-scale sections of typical members and other components. Show anchors, grounds, layout, reinforcement, accessories, and installation details.
 - 1. Provide message list for each sign required, including large-scale details of wording and lettering layout.
 - 2. For signs supported by or anchored to permanent construction, provide setting drawings, templates, and directions for installation of anchor bolts and other anchors to be installed as a unit of Work in other Sections.
 - 3. Templates: Furnish full-size spacing templates for individually mounted dimensional letters and numbers.
- D. Samples: Provide the following samples of each sign component for initial selection of color, pattern and surface texture as required and for verification of compliance with requirements indicated.
 - 1. Manufacturer's standard color sheet.
 - 2. Manufacturer's standard texture sample.

1.3 QUALITY ASSURANCE

- A. Sign Fabricator Qualifications: Firm experienced in producing signs similar to those indicated for this Project, with a record of successful in-service performance, and sufficient production capacity to produce sign units required without causing delay in the Work.
- B. Single-Source Responsibility: For each separate sign type required, obtain signs from one source of a single manufacturer.
- C. Design Concept: The Drawings indicate sizes, and dimensional requirements of signs and are based on the specific types and models indicated. Sign units by other manufacturers may be considered provided deviations in dimensions and profiles do not change the design concept as judged by the Engineer. The burden of proof of equality is on the proposer.

1.4 PROJECT CONDITIONS

- A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication to ensure proper fitting. Show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
 - 1. Manufacturers of Dimensional Letters:
 - a. Andco Industries Corp.
 - b. A.R.K. Ramos Manufacturing Company, Inc.
 - c. ASI Sign Systems, Inc.
 - d. Gemini, Inc.
 - e. Leeds Architectural Letters of Alabama, Inc.
 - f. Matthews International Corp.
 - g. Metal Arts.
 - h. Metallic Arts, Inc.
 - i. The Southwell Company.
 - j. Sign International, Inc.
 - k. Spanjer Brothers, Inc.
 - l. Vomar Products, Inc.

2.2 MATERIALS

- A. Aluminum Castings: Provide aluminum castings of alloy and temper recommended by the sign manufacturer for the casting process used and for the use and finish indicated.
- B. Fasteners: Use concealed fasteners fabricated from metals that are not corrosive to the sign material and mounting surface.
- C. Anchors and Inserts: Use nonferrous metal or hot-dipped galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

2.3 DIMENSIONAL LETTERS AND NUMBERS

- A. Cast Letters and Numbers: Form individual letters and numbers by casting. Produce characters with smooth, flat faces, sharp corners, and precisely formed lines and profiles, free

from pits, scale, sand holes, or other defects. Cast lugs into the back of characters and tap to receive threaded mounting studs. Comply with requirements indicated for finish, style, and size.

1. Metal: Aluminum.
2. Letter Style: Submit letter style for Engineer's approval

2.4 FINISHES

- A. Colors and Surface Textures: For exposed sign material that requires selection of materials with integral or applied colors, surface textures or other characteristics related to appearance, provide color matches as selected by the Engineer from the manufacturer's standards.
- B. Metal Finishes: Comply with NAAMM "Metal Finishes Manual" for finish designations and applications recommendations.
- C. Aluminum Finishes: Finish designations prefixed by "AA" conform to the system established by the Aluminum Association for designating aluminum finishes.
 1. Baked-Enamel Finish: AA-M4xC12C42R1x, Mechanical Finish: Manufacturer's standard, other non-directional textured. Apply baked enamel in compliance with paint manufacturer's specifications for cleaning, conversion coating, and painting.
 - a. Organic Coating: Thermosetting-modified acrylic enamel primer/topcoat system complying with AAMA 603.8 except with a minimum dry film thickness of 1.5 mils, medium gloss.
 - 1) Color: As selected by the Engineer from the manufacturer's standard colors.

2.5 SIGN SCHEDULE

- A. Furnish and install signs at the locations indicated.
 - a. Dewatering Building.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Locate sign units and accessories where indicated, using mounting methods of the type described and in compliance with the manufacturer's instructions.
 1. Install signs level, plumb, and at the height indicated, with sign surfaces free from distortion or other defects in appearance.
 2. Verify locations of signs with Engineer before installation.
- B. Dimensional Letters and Numbers: Mount letters and numbers using standard fastening methods recommended by the manufacturer for letter form, type of mounting, wall construction, and condition of exposure indicated. Provide heavy paper template to establish letter spacing and to locate holes for fasteners.
 1. Flush Mounting: Mount letters with backs in contact with the wall surface.

3.2 CLEANING AND PROTECTION

- A. After installation, clean soiled sign surfaces according to the manufacturer's instructions. Protect units from damage until acceptance by the Owner.

END OF SECTION

SECTION 10 43 00 – INTERIOR SIGNAGE

PART 1 - GENERAL

1.1 SCOPE

- A. Provide miscellaneous signage and accessories specified herein.

1.2 JOB CONDITIONS

- A. Protection: Maintain manufacturer's protective covering until final clean-up of installation.

1.3 SUBMITTALS

- A. Submit brochures and Shop Drawings of all items showing dimensions, materials, sizes, methods of construction and mounting techniques. Submit color charts of manufacturer's full standard color range.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Interior signage shall comply with Section 703 of ICC/ANSI A117.1-1998, including lettering size, graphic symbols and tactile and Braille copy.
- B. Signage Schedule:
 1. Operation's Manager
 2. Laboratory
 3. Janitor
 4. Operations
 5. Unisex Toilet
 6. Dressing
 7. Authorized Personnel Only (6 ea)
 8. Compressor
 9. Hypo
 10. Electrical (2 ea)
 11. Hearing Protection Required
 12. Eye Protection Required
 13. Emergency Eyewash/Shower Station (5 ea)

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine surfaces designated to receive Work for conditions adversely affecting the finished Work. Repair or replace surfaces not meeting tolerances or quality requirements imposed within specifications governing substrate construction prior to initiating this Work.
- B. Install signage at locations between 48 inches and 60 inches above finished floor. The same mounting height shall be used for all signs that have the same size. Signage shall be along side doors at the latch side, and for double doors the sign shall be located at the right of the right-hand door. If there is no wall space on the wall containing the door, mount the sign on the nearest adjacent wall. Signs containing tactile characters shall have an 18 inch by 18 inch minimum space on the floor centered on the sign, beyond the arc of any door swing, between the closed position and 45 degree open position. Installation shall be level and plumb.

Installation methods shall be as indicated in manufacturer's literature for the type of back-up encountered. All wall mounted items shall be securely fastened to solid backing or blocking. The tornado shelter sign shall be installed at 60 inches to the center of the sign.

- C. Conceal evidences of drilling, cutting and fitting to adjacent finishes.

3.2 CLEAN-UP

- A. Clean and polish exposed surfaces prior to Date of Substantial Completion.

END OF SECTION

SECTION 10 43 60 - EXTERIOR POST AND PANEL SIGNS

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 signs:
 - 1. Handicapped Parking Sign (1 each)
 - a. Standard Handicapped Parking Sign
 - b. 12" x 18"
 - c. Radius Corners
 - d. Blue Background with White Letters
 - e. Universal Handicapped Symbol
 - f. Letters to state: "HANDICAPPED PARKING"
 - g. Furnish and install one sign.
 - 2. Separate Sign (1 each)
 - a. Standard Handicapped Parking Sign
 - b. 4" x 12"
 - c. Radius Corners
 - d. Blue Background with White Letters
 - e. Letters to state: "VAN ACCESSIBLE"
 - f. Furnish and install one sign.
 - 3. Truck Entrance: Sign
 - a. Custom Truck Entrance Sign
 - b. 36" x 48"
 - c. Radius Corners
 - d. Green Background with White Letters
 - e. See Drawing 40-A-405, Detail 7 for lettering requirements
 - f. Arrow pointing _____
 - g. Furnish and install one sign.
 - 4. Main Entrance Sign
 - a. Custom Main Entrance Sign
 - b. 36" x 48"
 - c. Radius Corners
 - d. White Background with Black Letters
 - e. See Drawing 40-A-405, Detail 8 for lettering requirements
 - f. Arrow pointing _____
 - g. Furnish and install one sign.

1.3 SUBMITTALS

- A. Manufacturer's standard color sheet.
- B. Manufacturer's standard texture sample.

1.4 QUALITY ASSURANCE

- A. Single-Source Responsibility: For each separate sign type required, obtain signs from one source of a single manufacturer.

1.5 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
 - 1. Bell Co., Trussville, AL.
 - 2. Sign International, Inc.
- B. Anchors and Inserts: Use nonferrous metal or hot-dipped galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

PART 2 - EXECUTION

2.1 INSTALLATION

- A. Handicap sign to be mounted on 1" x 1" steel post, 8'-0" length, pre-painted at factory same blue as sign background. Set post in concrete.
- B. One (1) of the handicapped parking signs and one (1) of the separate (van-accessible) signs are to be mounted on one (1) post each for a total of one (1) post-sign assembly. Mounting heights shall be 4'-0" to the bottom of the separate sign and 4'-6-1/2" to the bottom of the handicapped sign.

2.2 CLEANING AND PROTECTION

- A. After installation, clean soiled sign surfaces according to the manufacturer's instructions. Protect units from damage until acceptance by the Owner.

END OF SECTION

SECTION 10 44 16 - FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.
- B. Owner-Furnished Material: Hand-carried fire extinguishers.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.
- B. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.
- C. Warranty: Sample of special warranty.

1.3 QUALITY ASSURANCE

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
 - 1. Provide fire extinguishers approved, listed, and labeled by FMG.

1.4 COORDINATION

- A. Coordinate type and capacity of fire extinguishers with fire protection cabinets to ensure fit and function.

1.5 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Failure of hydrostatic test according to NFPA 10.
 - b. Faulty operation of valves or release levers.
 - 2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

- A. Fire Extinguishers: Type, size, and capacity for each mounting bracket indicated.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Amerex Corporation.
 - b. Ansul Incorporated; Tyco International Ltd.
 - c. Badger Fire Protection; a Kidde company.

- d. Buckeye Fire Equipment Company.
 - e. Fire End & Croker Corporation.
 - f. J. L. Industries, Inc.; a division of Activar Construction Products Group.
 - g. Kidde Residential and Commercial Division; Subsidiary of Kidde plc.
 - h. Larsen's Manufacturing Company.
 - i. Moon-American.
 - j. Pem All Fire Extinguisher Corp.; a division of PEM Systems, Inc.
 - k. Potter Roemer LLC.
 - l. Pyro-Chem; Tyco Safety Products.
- 2. Basis-of-Design Product: Subject to compliance with requirements, provide Ansul Incorporated, Sentry 20, Model AA20 or comparable product by one of the manufacturer above:
 - 3. Valves: Manufacturer's standard.
 - 4. Handles and Levers: Manufacturer's standard.
 - 5. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B and bar coding for documenting fire extinguisher location, inspections, maintenance, and recharging.
- B. Multipurpose Dry-Chemical Type in Aluminum Container: UL-rated 20-A:120-B:C, 20-lb nominal capacity, with monoammonium phosphate-based dry chemical in enameled-aluminum container.

2.2 MOUNTING BRACKETS

- A. Mounting Brackets: Manufacturer's standard galvanized steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or black baked-enamel finish.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Basis-of-Design Product: Subject to compliance with requirements, of the manufacturer of the fire extinguisher or comparable product by one of the following:
 - a. Amerex Corporation.
 - b. Ansul Incorporated; Tyco International Ltd.
 - c. Badger Fire Protection; a Kidde company.
 - d. Buckeye Fire Equipment Company.
 - e. Fire End & Croker Corporation.
 - f. J. L. Industries, Inc.; a division of Activar Construction Products Group.
 - g. Larsen's Manufacturing Company.
 - h. Potter Roemer LLC.
- B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.
 - 1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.
 - a. Orientation: Vertical.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine fire extinguishers for proper charging and tagging.
 - 1. Remove and replace damaged, defective, or undercharged fire extinguishers.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.
 - 1. Mounting Brackets: 54 inches above finished floor to top of fire extinguisher.
- B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION