SECTION 13 12 20

RIGID-FRAME PRE-ENGINEERED METAL BUILDINGS

PART 1—GENERAL

1.01 DESCRIPTION

A. SCOPE:

This section specifies the Pre-Engineered Metal Building System, which includes the structural steel system primary and secondary members, metal roof system, column base plates and anchor bolts, trim and accessories, soffits, gutters and downspouts as described in this performance specification and shown on the Drawings.

B. BUILDING DESCRIPTION:

The Decant Facility Building will be a canopy type structure that covers multiple concrete slab-on-grade containment areas and channels. It will have a frame span of 42’-0” with a length of 120’-0”. There will not be any siding or wall framing included at the Decant Facility Building. Architecture of the Building is intended to match, as closely as possible, the existing plant facility buildings.

1.02 DESIGN REQUIREMENTS

A. ROOF SNOW LOADS:

The roof snow load used for designing the structure shall be determined in accordance with ASCE 7-05 “Minimum Design Loads for Buildings and Other Structures.”

Roof Snow Load, Pr:	30 psf
Importance Factor:	1.1

All roof structures and building frames shall be adequately designed for the required snow loads. Due consideration shall be given to drifting and the possible formation of ice dams resulting in ponding of water on un-insulated roofs.

When considering snow loads, roof live loads should only be reduced by the portion of the live load attributable to loads that would not occur simultaneously with snow. The live load allowance for piping, conduit, and lights will be included in the design calculations.

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1—GENERAL

1.01 DESCRIPTION

This section specifies cast-in-place concrete which consists of furnishing all material, mixing and transporting equipment, and performing all labor for the proportioning, mixing, transporting, placing, consolidating, finishing, and curing of concrete in the structure.

1.02 QUALITY ASSURANCE

A. QUALITY CONTROL BY OWNER:

Special Inspection of concrete work shall be performed by the Special Inspector under contract with the Owner and in conformance with the IBC Chapter 17. Special Inspector(s) and laboratory shall be acceptable to the Owner in their sole discretion. Special Inspection of concrete is in addition to, but not replacing, other inspections and quality control requirements herein. Where sampling and testing required herein conforms to Special Inspection standards, such sampling and testing need not be duplicated.

All structural concrete work shall receive Special Inspection in accordance with IBC Chapter 17. Structural concrete includes all elements which resist code-defined loads and whose failure would impact life safety. Non-structural site work concrete does not require Special Inspection. Anchor bolts and anchors installed in hardened concrete require Special Inspection.

Owner provided testing shall be in accordance with Section 01 45 29.

B. QUALITY CONTROL BY CONTRACTOR:

Where required to demonstrate conformance with the specified requirements for cast-in-place concrete, the Contractor shall provide the services of an independent testing laboratory which complies with the requirements of ASTM E329. The testing laboratory shall sample and test concrete materials as specified in paragraphs 03 30 00-2.01, 2.02, and 3.15. Costs of testing laboratory services shall be borne by the Contractor.

C. BASIS FOR QUALITY:

Cast-in-place concrete shall conform to the requirements of ACI 301, except as modified herein.

D. REFERENCES:

This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization, or if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued, or replaced.

Reference	Title
ACI 117	Tolerances for Concrete Construction and Materials
ACI 211.1	Selecting Proportions for Normal, Heavy Weight and Mass Concrete
ACI 301	Structural Concrete for Buildings
ACI 305.1	Specification for Hot Weather Concreting
ACI 306.1	Standard Specification for Cold Weather Concreting
ACI 214R	Guide to Evaluation of Strength Test Results of Concrete
ACI 318	Building Code Requirements for Structural Concrete
ACI 350	Code Requirements for Environmental Engineering Concrete Structures
ACI 350.1	Tightness Testing of Environmental Engineering Concrete Structures
ACI 503.7	Crack Repair by Epoxy Injection
ASTM C31	Making and Curing Concrete Test Specimens in the Field
ASTM C33	Concrete Aggregates
ASTM C39	Compressive Strength of Cylindrical Concrete Specimens
ASTM C40	Organic Impurities in Fine Aggregate for Concrete
ASTM C42	Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
ASTM C88	Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM C94	Ready-Mixed Concrete
ASTM C117	Materials Finer Than 75-μm (No. 200) Sieve in Mineral Aggregates by Washing

Reference	Title
ASTM C131	Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C136	Sieve Analysis of Fine and Coarse Aggregates
ASTM C142	Clay Lumps and Friable Particles in Aggregates
ASTM C143	Slump of Hydraulic Cement Concrete
ASTM C150	Portland Cement
ASTM C157	Length Change of Hardened Cement Mortar and Concrete
ASTM C172	Sampling Freshly Mixed Concrete
ASTM C192	Making and Curing Concrete Test Specimens in the Laboratory
ASTM C231	Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C260	Air-Entraining Admixtures for Concrete
ASTM C309	Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C494	Chemical Admixtures for Concrete
ASTM C595	Blended Hydraulic Cements
ASTM C618	Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
ASTM C881	Epoxy-Resin-Base Bonding Systems for Concrete
ASTM C989	Slag Cement for use in Concrete and Mortars
ASTM C1059	Latex Agents for Bonding Fresh to Hardened Concrete
ASTM C1260	Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)
ASTM C1567	Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregate (Accelerated Mortar Bar Method)
ASTM C1602	Mixing Water Used in the Production of Hydraulic Cement Concrete
ASTM D75	Sampling Aggregates
ASTM D2419	Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate
ASTM E329	Agencies Engaged in Construction Inspection and/or Testing
CRD-C572	U.S. Corps of Engineer’s Specifications for Polyvinylchloride Water stop
IBC	International Building Code with local amendments

E. CONCRETE CONFERENCE

A meeting shall be held to review the main specification requirements and the Contractor's proposed concrete design mixes and to determine the procedures for producing proper concrete construction. The meeting shall be held no later than 28 days after the Notice to Proceed.

All parties involved in the concrete work shall attend the conference, including the following: Contractor's representative, testing laboratory representative, concrete subcontractor, concrete supplier, and Construction Manager.

1.03 SUBMITTALS

The following information shall be provided in accordance with Section 01 33 00:

1. Each proposed mix design showing (a) the expected strength at 28 days, (b) corresponding slump before and after the introduction of high-range water-reducing admixtures, (c) water/cement ratios, (d) weights and test results of the ingredients, (e) aggregate gradation, (f) test results of mix design prepared by an independent testing laboratory, (g) shrinkage test results for liquid containing structures, and (h) other physical properties necessary to review each mix design for conformance with these specifications. Mix design proposed shall be sealed by a Professional Engineer registered in the state where the project is located.

2. Product literature and technical data for aggregates, cement, and Pozzolan.

3. Product literature, technical data and dosage of all proposed admixtures including, but not limited to, air entraining, water reducing and/or retarding admixtures and shrinkage reducing admixtures at liquid containing concrete.

4. Anticipated average delivery time from batch plant to site. If this time exceeds the limit specified in paragraph 3.02, include proposed method to extend set time without deleterious effects on final product. Construction Manager reserves the right, in their sole discretion, to accept or reject such proposed methods.

5. Curing program description in sufficient detail to demonstrate acceptable strength, finish and crack control as specified.

6. Product literature and technical data for water stops, curing and sealing compounds, bonding compounds, epoxy and chemical grout for crack injection, retardant, bearing pads and trench drains.

7. Sample panels of formed wall surfaces as specified in paragraph 3.11C and Section 03 11 00. Samples of concrete floor and slab finishes are specified in paragraph 3.12 E.

8. Concrete delivery truck tickets showing the information listed in ASTM C94, section 14.

9. Concrete cylinder compressive strength results, including 7-day strength results.

10. Product data for prefabricated trench drains. Product data shall include material properties of the trench drain, trench drain cover, geometric information, all required embedments in the concrete, and manufacturer's installation instructions.

PART 2—PRODUCTS

2.01 MATERIALS

A. CEMENT:

Portland cement shall be ASTM C150, Type II or Type V, low alkali, containing less than 0.60 percent alkalis. In addition to standard requirements, cement shall satisfy optional chemical and physical requirements of ASTM C150, Tables 2 and 4, respectively.

If low alkali cement is not available, aggregates shall show an expansion of less than 0.1% when tested in accordance with ASTM C1260 or ASTM C1567 concrete mix test results shall be submitted verifying that the aggregates are not reactive per the criteria in this standard. ASTM C1260 and ASTM C1567 results shall be no older than 1 year.

Portland-Pozzolan cement shall be ASTM C595, Type IP (MS), inter-ground, low alkali.

Use cementitious materials that are of the same brand and type and from the same plant of manufacture as the cementitious materials used in the concrete represented by the submitted field test records or used in the trial mixtures. See Section 2.01G.

B. GROUND GRANULATED BLAST-FURNACE SLAG:

Ground granulated blast-furnace slag (GGBFS), if used in conjunction with Portland cement, shall be per ASTM C989.

C. AGGREGATES:

1. GENERAL: Except as modified herein, fine and coarse aggregates shall conform to ASTM C33. Fine and coarse aggregates shall be regarded as separate ingredients. Aggregates shall be non-reactive and shall be washed before use.

Aggregates shall be checked for alkali-silica reactive constituents per ASTM C1260. Aggregate shall have less than 0.1% expansion when tested in accordance with ASTM C1260. Aggregates having 0.1% or greater expansion when tested in accordance with ASTM C1260 may still be satisfactory provided ASTM C1567 concrete mix test results are submitted and show an expansion of less than 0.1% at 16 days. ASTM C1260 and ASTM C1567 test results shall be no older than 1 year.

Tests for size and grading of fine and coarse aggregates shall be in accordance with ASTM C136. Combined aggregates shall be well and uniformly graded from coarse to fine sizes

to produce a concrete that has optimum workability and consolidation characteristics. The final combined aggregate gradation shall be established during the design mix.

Aggregates used in the concrete shall be obtained from the same sources and have the same size ranges as the aggregates used in the concrete represented by the submitted historical data or trial mixtures. See Section 2.01G.

2. FINE AGGREGATE: Fine aggregate shall be hard, dense, durable particles of either sand or crushed stone regularly graded from coarse to fine. Gradation shall conform to ASTM C33. For classes of concrete which will be used in liquid retaining structures, fine aggregate shall not exceed 40 percent by weight of combined aggregate total, except for concrete with coarse aggregate of less than maximum size 1/2 inch.

Variations from the specified gradations in individual tests will be acceptable if the average of three consecutive tests is within the specified limits and the variation is within the permissible variation listed below:

U.S. standard sieve size	Permissible variation in individual tests, percent
30 and coarser	2
50 and finer	0.5

Other tests shall be in accordance with the following specifications:

Test	Test method	Requirements
Amount of material	ASTM C117	3 percent passing No. 200 sieve maximum by weight
Sand equivalent	ASTM D2419	Minimum 70

3. COARSE AGGREGATE: Coarse aggregate shall be hard, dense and durable gravel or crushed rock free from injurious amounts of soft and friable particles, alkali, and organic matter. Other deleterious substances shall not exceed the limits listed in ASTM C33, Table 3 for Class Designation 5S. Gradation of each coarse aggregate size specified in paragraph 03 30 00-2.02 A shall conform to ASTM C33, Table 2.

Variations from the specified gradations will be acceptable in individual tests if the average of three consecutive tests is within the specified limits.

D. POZZOLAN:

Pozzolan shall be Class F fly ash conforming to ASTM C618. Class C fly ash is not allowed. Pozzolan supplied during the life of the project shall have been formed at the same single source. See Section 2.01G.

The Pozzolan color shall not substantially alter the resulting concrete from the normal gray color and appearance.

Use Pozzolan materials that are of the same brand and type and from the same plant of manufacture as the materials used in the concrete represented by the submitted field test records or used in the trial mixtures.

E. ADMIXTURES:

1. GENERAL: Admixtures shall be compatible with the concrete and with each other. Calcium chloride or admixtures containing calcium chloride are not acceptable. Admixtures shall be used in accordance with the manufacturer's recommendations and shall be added separately to the concrete mix. The water reducing retarders and admixtures shall reduce the water required by at least 11 percent for a given concrete consistency and shall comply with the water/cement ratio standards of ACI 211.1. Retarder dosage shall result in set time consistent with paragraph 3.02.

2. WATER REDUCING ADMIXTURES: Water reducing admixtures shall conform to ASTM C494, Type A. Acceptable products include: BASF “Pozzolith 322N”; SIKA Chemical Corp. “Plastocrete 161”; Euclid Chemical Co. “Eucon WR91”; or equal.

3. WATER REDUCING AND RETARDING ADMIXTURES: Water reducing and retarding admixtures shall conform to ASTM C494, Type D. Acceptable products include: BASF “Pozzolith 300R”; Sika Chemical Corp. “Plastiment”; Euclid Chemical Co. “Eucon Retarder 75”; or equal.

4. HIGH RANGE WATER REDUCING ADMIXTURES: High range water reducing (superplasticizing) admixtures shall conform to ASTM C494, Type F. Acceptable products include: BASF “Glenium 3000NS”; Sika Chemical Corp. “Sikament FF or 686”; Euclid Chemical Co. “Eucon 37”; W.R. Grace “ADVA 195”; or equal.

5. HIGH RANGE WATER REDUCING AND RETARDING ADMIXTURES: High range water reducing and retarding admixtures shall conform to ASTM C494, Type G. Acceptable products include: W.R. Grace “Daracem 100”; Euclid Chemical Co. “Eucon 537”; or equal.

6. AIR ENTRAINING AGENT: Air entraining agent shall conform to ASTM C260. Acceptable products include: BASF “MB-AE 90”; Sika Chemical Corp. “AEA-15”; Euclid Chemical Co. “AEA-92”; or equal. The air entraining agent added shall produce, in accordance with ASTM C260, an entrained air content specified in paragraph 03 30 00-2.02 A for each class of concrete.

7. SHRINKAGE REDUCING ADMIXTURE: Select shrinkage reducing admixture for compatibility with air entrainment admixture and other ingredients of the concrete mix. Acceptable products include: BASF “Tetraguard AS20” and Grace “Eclipse 4500”.

F. WATER:

Water for washing aggregate, for mixing and for curing shall be free from oil and deleterious amounts of acids, alkalis, and organic materials; and shall comply with the requirements of ASTM C1602. Additionally, water used for curing shall not contain an amount of impurities sufficient to discolor the concrete.

G. CHANGE OF MATERIALS:

After each concrete mix design is approved by the Construction Manager, no changes of any sort or source will be allowed without prior written approval from the Construction Manager. When brand, type, size, or source of cementitious materials, aggregates, water, ice, or admixtures are proposed to be changed, new field data, data from new trial mixtures, or evidence that indicates that the change will not affect adversely the relevant properties of the concrete shall be submitted for approval by the Construction Manager before use in concrete.

2.02 CONCRETE CHARACTERISTICS

A. MIX PROPORTIONING:

Concrete shall be normal weight concrete composed of specified cement, Pozzolan, admixtures, aggregates and water proportioned and mixed to produce a workable, strong, dense, and impermeable concrete. The Contractor may substitute inter-ground Portland-Pozzolan cement conforming to ASTM C595, containing the specified amount of Pozzolan in lieu of Portland cement and Pozzolan. Water-cementitious material (w/cm) ratio is based on the combined contents of cement and Pozzolan in a given mix proportion.

Concrete shall be provided in accordance with the following:

Concrete class	ASTM coarse aggregate size	Maximum water-cementitious materials (w/cm) ratio	Minimum Cementitious Materials Content (pounds/CY)	Pozzolan, percent by weight of cementitious materials	Air content (percent)	Minimum[a] 28 -day compressive strength, psi	Slump Range[f] (inches)
A	467	0.42	515	20-35	4-6	4000[b]	3-5
B	57 or 67	0.45	560	15-20[d]	4-6	3000	3-5
C-1	57 or 67	0.40	560	15-20	4-6	4500	3-5
C-2	57 or 67	0.42	560	15-20[d]	4-6	5000	3-5
D-1	8	0.42	600	15-20[d]	4-6	4000	3-5
D-2	8	0.40	600	15-20	4-6	4500	3-5
E[c]	57	--	-	15-20[d]	Not Required	2000	4-8

[a] Compressive strength shall be determined at the end of 28 days based on test cylinders made and tested in accordance with ASTM C39.

[b] Compressive strength of Class A concrete may be determined at 56 days.
[c] Concrete encasement for electrical conduit shall contain 3 pounds of red oxide per sack of cement.
[d] Pozzolan use optional for this class of concrete.
[e] Minimum 28-day compressive strength shall be 500 psi and maximum 28-day compressive strength shall be 1,000 psi.
[f] Slump before addition of high range water reducing admixture (superplasticizer). Maximum slump after addition of high range water reducing admixture shall be 8".

B. USE:

Concrete shall be provided by class for the corresponding use listed as follows:

Type of use	Class of concrete
Concrete greater than 36 inches thick	A
Non-structural concrete (sidewalks, curbs, pavers, etc.)	B
Typical cast-in-place structural concrete	C-1
Precast concrete	C-2
Topping concrete (Precast Concrete Topping)	D-1
Wall starter course	D-2
Pipe bedding and encasement, electrical conduit encasement (duct banks) and concrete fill	E

C. CONTROL TESTS:

1. GENERAL: Before beginning concrete work, the Contractor shall determine the proper proportions of materials for each class of concrete. The mix shall consist of specified cement, Pozzolan, admixtures, aggregate and water. Methods for selecting and adjusting proportions of the ingredients shall be in accordance with ACI 211.1. Verification of mix characteristics for submittal may be achieved using either the Trial Mix Design method or Field Experience method. Concrete shall not be placed in the field prior to review and acceptance of mix proposed.

2. TRIAL MIX DESIGN: Each class of concrete and/or mix verified by this method shall be manufactured at the batch plant which will supply concrete to the project using materials proposed for the Work and material combinations listed in paragraphs 2.01 and 202. Testing, data and reporting shall conform to ACI 318 Section 5.3 and the following:

(a) Required compressive strength used as the basis for selecting concrete proportions (f'cr) shall be the specified concrete strength (f'c) + 1,000 psi for specified concrete strengths less than 3,000 psi

and f'c + 1,200 psi for specified concrete strengths between 3,000 and 5,000 psi.

(b) Make at least three trial different mixtures for each class of concrete qualified by the Trial Mix Design. Each trial mixture shall have a different w/cm ratio or different cementitious materials content that will produce a range of compressive strengths encompassing f'cr.

(c) Trial mixtures shall be designed to produce a slump within 3/4 inch of the maximum specified and for air-entrained concrete, an air content within 0.5% of the maximum allowable air content.

(d) For each w/cm ratio or cementitious materials content, at least twelve standard test cylinders shall be cast and cured in accordance with ASTM C192. Four cylinders from each batch shall be tested at age 7 days, 14 days, and 28 days or as required to comply with ACI 318 Section 5.3.

(e) From results of the cylinder tests, plot a curve showing the relationship between w/cm ratio and compressive strength.

(f) From the curve of w/cm ratio versus compressive strength, select the w/cm ratio that will produce f'cr. This is the maximum w/cm ratio that shall be used unless a lower w/cm ratio is specified in paragraph 2.02A.

3. FIELD EXPERIENCE DATA: When sufficient test data for a particular mix design is available which is identical or substantially similar to that proposed for use, Contractor may substitute use of this data in lieu of a trial mix design. Field data, reports, and analysis shall conform to ACI 318 Section 5.3, except as modified herein. Historical mix design proportions for which data are submitted may vary from the specified mix within the following limits: (a) f'c as specified or up to 500 psi above; (b) w/cm ratio as specified or lower; (c) Pozzolan content within 5 percent of that specified; (d) maximum coarse aggregate size may not vary smaller, but gradation of coarse aggregate may vary; (e) fine aggregate fraction within +0/ 5 percent of that specified; and (f) slump after introduction of admixtures +0/-1 inch. Use of historical mix design data does not allow modification of the project mix specifications herein without the express review and acceptance of the Construction Manager.

4. SHRINKAGE: Liquid containing structures using Class C-1 concrete are intended to be watertight. When used for liquid containing structures, the Contractor shall provide test results for the Class C-1 concrete mix meeting the following requirement: drying shrinkage limit of 0.032 percent in the laboratory at 35 days (7 days moist cure and 28 days drying) as tested by ASTM C157 with the following modifications.

(a) Wet cure specimens for a period of 7 days (including the period of time the specimens are in the mold). Wet cure may be achieved either through storage in a moist cabinet or room in accordance with ASTM C 511, or through storage in lime saturated water.

(b) Slump of concrete for testing shall match job requirements and need not be limited to restrictions as stated in ASTM C 157 section 8.4.

(c) Report results in accordance with ASTM C 157 at 0, 7, 14 & 28 days of drying.

Concrete shall not be placed in the field prior to acceptance of the concrete mix. It is recommended that a shrinkage reducing admixture (see 03 30 00-2.01 E.7) be considered for use in concrete for liquid containing structures using the Class C-1 concrete mix to meet the drying shrinkage limit.

2.03 WATERSTOPS

A. POLYVINYL CHLORIDE (PVC):

PVC water stops shall be manufactured from virgin polyvinyl chloride conforming to the Corps of Engineers Specification No. CRD-C572. Unless otherwise specified or noted on the drawings, water stops in construction joints shall be 6-inch flat center/ribbed sides/0.375 inch thick. Acceptable products include: Greenstreak Group, Inc. “Model 679”; Vinylex Water stops and Accessories “Model R638”; or equal. Water stops in expansion joints shall be 9 inch center-bulb/ribbed sides/0.375 inch thick. Acceptable products include: Greenstreak Group, Inc. “Model 696”; Vinylex Water stops and Accessories Model “RLB938”; or equal.

Crosses, tees, and other shapes used for changes of direction, intersections, and transitions shall be molded pieces as recommended by the manufacturer.

B. EXPANDING (HYDROPHILIC) WATERSTOPS:

Expanding water stops shall be bentonite-free and made from unvulcanized rubber. Acceptable products include: SIKA "SikaSwell P-2010"; Adeka Corporation "Ultra Seal MC-2010MN"; Greenstreak Group, Inc. "Hydrotite CJ-1020-2K"; or equal. These are allowable for use only where indicated on the drawings or accepted in writing by the Construction Manager. Provide adhesive approved by the water stop manufacturer where required due to geometry, irregular surface conditions, or as recommended by the manufacturer. The water stop MUST be placed between two mats or curtains of steel reinforcement. For limited cover applications or where only one mat or curtain of reinforcement is present, use Adeka Corporation "Ultra Seal KBA-1510FP".

C. INJECTED TUBE WATERSTOPS:

Chemical grout injection tube system, if shown on the Drawings, shall be "Injecto System" by De Neef Construction Chemicals or equal. Equivalent systems shall be submitted to the Construction Manager for review.

2.04 SEALANTS AND JOINT FILLERS

Sealants and preformed joint fillers shall be as specified in Sections 07900 and 07905.

2.05 BONDING COMPOUNDS

Epoxy resin bonding compounds to be used for wet areas shall conform to ASTM C881 Types IV or V, Class A, B, or C depending on temperature at use, and Grade to suit geometry and installation circumstances. Acceptable products include: BASF "Concresive Paste SPL" or "Concresive 1490", as applicable; Sika Chemical Corporation "Sikadur 35" or Sikadur 32", as applicable; or equal.

Non-epoxy bonding compounds may be used in dry areas for non-structural bonding or as specifically noted on the drawings only and shall conform to ASTM C1059 Type II. Acceptable products include: Edoco "Burke Acrylic Bondcrete," ChemMasters "Cretelox," or equal.

Bonding compounds shall be applied in accordance with the manufacturer's instructions.

2.06 EPOXY FOR CRACK INJECTION

Epoxy for crack injection shall be a two-component, moisture insensitive, high modulus, injection grade, 100 percent solids, blend of epoxy-resin compounds. The consistency shall be as required to achieve complete penetration in hairline cracks and larger. Material shall conform to ASTM C881 Type 1 Grade 1. Acceptable products include Sika Corporation "Sikadur 52"; Adhesives Technology Corporation "Crackbond SLV302"; or equal. Epoxy grout shall be used for all crack repairs except as noted below for non-structural cracks in liquid-containing concrete. The Construction Manager shall determine whether a crack is classified as structural or non-structural. Structural cracks must be repaired with epoxy.

2.07 CHEMICAL GROUT FOR CRACK INJECTION

Chemical (hydrophobic polyurethane) grout shall be used at the Construction Manager's discretion as an alternative to the injection of the epoxy grout for sealing non-structural cracks in structures intended to be watertight. Acceptable products include "Hydro Active Cut" by De Neef Construction Chemicals or SikaFix HH by Sika Corporation, or equal approved by the Construction Manager.

2.08 RETARDANT

Retardant for exposing aggregates for unformed surfaces in construction joints shall be Sika "Rugasol-S"; W.R. Grace "Top-Cast"; or equal. Retardant shall be applied in accordance with manufacturer's instructions sufficient to assure a minimum penetration of 1/4 inch.

2.09 NOT USED

2.10 CURING AND SEALING COMPOUNDS

Curing and sealing compound shall be BASF Sonneborn "Kure-N-Seal 25LV"; Edoco, "Spartan-Cote VOC"; or equal, conforming to ASTM C309.

Curing compound shall be clear and shall be applied in accordance with the manufacturer's instructions, except as otherwise specified. Curing and sealing compound shall be certified compliant with final finish systems.

2.11 TRENCH DRAINS

Trench drains may be either field formed and cast, with compatible grate as specified below, or utilize a manufactured trench drain system. Trench drain systems shall be pre-engineered, manufactured systems that conform to the design loading requirements of AASHTO H-20 in traffic areas or 300 pounds per square foot elsewhere and with the following minimum requirements:

A. A method of forming a round or V-bottom channel pre-sloped to a minimum of 0.5 percent (1/16-inch per foot) installed in sections. See drawings for channel cross section or size. If not shown, assume 12 inches wide and deep (nominal) and confirm with Construction Manager.

B. An aluminum frame with stainless steel anchors at 45 degrees into the surrounding concrete. Aluminum shall be coated to prevent direct concrete contact as specified elsewhere.

C. An aluminum grate conforming to Federal Specification RR-F-621C.

D. A locking device which directly connects the grate to the frame.

Candidate manufacturers include: MultiDrain Systems, Atlanta, Georgia, (800) 433-1119; ABT, Inc., Troutman, North Carolina, (800) 438-6057; or approved equal.

PART 3—EXECUTION

3.01 GENERAL

This section covers the production of cast-in-place concrete. Included are methods and procedures for obtaining quality concrete through proper handling, placing, finishing, curing, and repair of surface defects.

3.02 CONCRETE

Concrete shall be truck-mixed, ready-mixed concrete conforming to the applicable portions of ASTM C94. Materials shall be proportioned by weighing. Pozzolan shall be introduced into the mixer with cement and other components of the concrete mix; Pozzolan shall not be introduced into a wet mixer ahead of other materials or with mixing water. Water shall be introduced at the time of charging the mixer; additional water may be introduced within 45 minutes from charging the mixer, provided the specified slump is not exceeded and the maximum total water per the approved mix design is not exceeded. Contractor shall arrange with the testing laboratory for inspection as required to comply with these specifications.

Concrete shall be delivered to the site and discharge shall be completed within 90 minutes after introduction of water to the mixture. Extension of allowable time beyond this limit requires a Contractor proposed remedial action plan to be reviewed and accepted by the Construction Manager.

3.03 CONVEYING AND PLACING CONCRETE

A. CONVEYING CONCRETE:

Concrete shall be conveyed from the mixer to the forms in accordance with ACI 301. Concrete which has segregated in conveying shall be removed from the site of the work.

B. PLACING CONCRETE:

1. GENERAL: Concrete shall be placed in accordance with ACI 301. Do not permit concrete to drop freely more than 4 feet.

2. PLACING CONCRETE BY PUMPING: Concrete may be placed by pumping at Contractor’s discretion. Use of pumping shall not, however, be the cause to change or relax specified mix design characteristics. Concrete shall possess the specified characteristics at the point of placement.

Slump shall be measured at the hose discharge, except as follows. Initial slump testing in each pour shall occur at both the pumping unit inlet hopper and hose discharge. Slump loss in pumping, measured between the inlet hopper and the hose discharge, shall not exceed 1 inch. After these criteria have been satisfied, slump may be measured at the inlet hopper with allowable slump increased by the earlier measured difference, not to exceed 1 inch.

Air content shall be measured at the hose discharge, except as follows. Initial air content testing shall occur at both the pumping unit inlet hopper and the hose discharge. Loss of air content shall be measured between the inlet hopper and the hose discharge. The air content of the delivered concrete at the inlet hopper shall be increased to provide the specified air content at the hose discharge. After these criteria have been satisfied, air content may be measured at the inlet hopper.

Before starting each pumping operation, the pump and line shall be primed with a cement slurry to lubricate the system. Cement slurry shall be wasted outside the forms. Hose tip shall be equipped with a safety chain for recovery in case of hose blowout during pumping, and in no case shall hose or accessories remain in the freshly placed concrete.

Proper tremie placing techniques and equipment shall be used for all pump placed concrete. Pump discharge system shall remain full of concrete from pump to discharge point at all times. Concrete pumping shall not occur until Construction Manager has verified that the proper equipment is available, in particular, the tremie plug. Should the discharge line become open, with significant zones empty of concrete, then the pumping shall cease and the line re-primed with tremie plug installed before continuing the pour.

3. PLACING CONCRETE IN HOT WEATHER: In hot weather (above 80 degrees F), concrete shall be placed in accordance with ACI 305.1.

4. PLACING CONCRETE IN COLD WEATHER: In cold weather (below 45 degrees F), concrete shall be placed in accordance with ACI 306.1.

5. STARTER COURSE AT WATERSTOPS: When placing concrete in wall forms for water retaining structures over eight (8) feet in height and without form windows, a starter course of Class D-2 concrete shall be placed to a minimum depth of two (2) inches and maximum depth of six (6) inches and thoroughly consolidated. Subsequent lift(s) of concrete shall be placed onto this starter course within ten (10) minutes of the starter course placement, and the two lifts shall be thoroughly consolidated together to result in a dense, continuous, watertight structure with no cold joint. Contractor shall provide adequate pumping and consolidating equipment and personnel to achieve the time limit specified herein.

C. CONSOLIDATING CONCRETE:

Concrete shall be consolidated in accordance with ACI 301. If proper consolidation is not occurring, then concrete placing shall be suspended until proper consolidation can be achieved.

3.04 CURING AND SEALING

A. GENERAL:

Concrete curing shall be completed by water curing or by using a clear membrane curing compound or by a combination of both methods. Repairs or treatment of concrete surfaces shall be coordinated so that interruption of the curing will not be necessary.

Concrete surface temperature shall be maintained between 50 degrees F and 80 degrees F for at least 5 days. Curing concrete in hot weather (above 80 degrees F) shall be in accordance with ACI 305.1. Curing concrete in cold weather (below 45 degrees F) shall be in accordance with ACI 306.1.

B. WATER CURING:

When water curing is used, concrete shall be kept wet continuously for a minimum of 10 days after placement. Absorptive mats or fabric may be used to retain moisture during the curing period.

Unless otherwise specified, water curing shall be used in hot weather for water containment structures. Forms shall be covered and kept moist. The forms shall be loosened as soon as possible without damage to the concrete, and provisions made for curing water to run down inside them. During form removal, care shall be taken to provide wet cover to newly exposed surfaces.

C. CURING COMPOUND:

When curing compound is used, it shall be applied as soon as the concrete has set sufficiently so as not to be marred by the application or immediately following form removal for vertical and other formed surfaces. Preparation of surfaces, application procedures, and installation precautions shall be followed in strict compliance with the manufacturer's instructions. Curing compound shall be applied at twice the manufacturer's recommended dosage rate in two coats applied perpendicular to each other. Use of curing compound for other than liquid containing structures shall be in accordance with the manufacturer's recommendations.

Curing compound shall not be used on concrete surfaces to be coated, waterproofed, moisture-proofed, tiled, roofed, or where other coverings are to be bonded, unless the curing compound is compatible with the final finish covering or it is removed prior to covering.

3.05 PROTECTION

Concrete shall be protected from injurious action by sun, rain, flowing water, frost and mechanical injury.

Loading green concrete will not be permitted. Green concrete is defined as concrete with less than 100 percent of the specified strength.

Unless otherwise shown on the Drawings, no backfill shall be placed against concrete walls until the concrete has reached the specified strength and the connecting slabs and beams have been cast and have reached the specified strength.

Arrangements for covering, insulating, and protecting concrete in cold weather shall be in accordance with ACI 306.1.

3.06 CONSTRUCTION JOINTS

A. GENERAL:

Concrete in each unit of construction shall be placed continuously. Before new concrete is placed on or against concrete which has set, forms shall be retightened and the surface of the set concrete shall be cleaned of foreign matter. Watertight joints shall be provided as specified in paragraph 03 30 00-3.09.

B. CONSTRUCTION:

Construction joints shall be formed as specified. A rough surface of exposed concrete aggregates shall be produced using a surface retardant at construction joints, including joints between the slab and topping concrete. The limit of the treated surfaces shall be 1 inch away from the joint edges. Within 24 hours after placing, retarded surface mortar shall be removed either by high pressure water jetting or stiff brushing or combination of both so as to expose coarse aggregates. A rough surface of exposed aggregate may also be produced by sandblasting followed by high pressure water jetting. Sandblasting, if used, shall remove 1/4 inch of laitance film and shall expose coarse aggregate to ensure adequate bond and water tightness at the construction joints.

C. LOCATIONS:

Construction joint locations shall be as follows:

1. Walls exceeding 50 feet in length shall be cast in panels not to exceed 30 feet in length. Where the number of panels is three or more, the panels shall be cast in an alternating pattern, unless 5 days have elapsed between casting of adjoining panels. Joints are not allowed within the lesser of 10 feet or 25 percent of the wall length from any corner unless specifically detailed thus on the drawings.

2. Joints in beams or girders shall be located at or near the quarter point between supports.

3. Joints in the members of a floor system shall be made at or near the quarter point of the span.

4. Joints in walls and columns shall be at the underside of floors, slabs, beams or girders and at the tops of footings or floor slabs. Joints in columns shall be perpendicular to the axis.

5. Slabs panels shall be cast in checkerboard patterns not to exceed 40 feet in length and not to exceed 900 square feet in area, with maximum 1 ½ to 1 ratio of side lengths. Minimum lapsed time between placing adjacent panels shall be 72 hours. The requirements for size of slab panel may be waived if joints are specifically located on the drawings.

Vertical construction joints shall be grooved at faces exposed to view including interior faces of basins and tanks. Grooves subjected to wetting or weather shall be caulked with joint sealer as specified.

Reinforcing steel and welded wire fabric shall be continued across construction joints. Girders and floor slabs shall not be constructed over columns or walls until at least one day has elapsed to allow for shrinkage in the column or wall. No joint will be allowed between a slab and a beam or girder unless otherwise specified. Joints shall be perpendicular to the main reinforcement. Water stops shall be provided in construction joints at locations as specified in paragraph 03 30 00-3.09.

3.07 INSERTS AND EMBEDMENTS

A. INSERTS:

Where pipes, castings or conduits are to pass through structures, the Contractor shall place such pipes or castings in the forms before placing the concrete, or he may provide openings in the concrete for subsequent insertion of such pipes, castings or conduits. Such openings shall be provided with water stops and V-shaped construction joint as shown and shall have a slight flare to facilitate grouting and permit the escape of entrained air during grouting.

Additional reinforcement shall be provided around openings as shown. Grout fill around inserts shall be non-shrink grout as specified in Section 03 60 00.

Horizontal conduits and pipes, where shown in structural slabs and beams, shall be placed between the top and bottom layers of reinforcement. Spacing and size limitations shall conform to ACI 318 Section 6.3 unless specifically approved otherwise by the Construction Manager. Such conduits and pipes shall not run directly beneath a column or, if used, its steel base plate. Pipe, conduit, dowels, and other ferrous items required to be embedded in concrete construction shall be so positioned and supported prior to placement of concrete that there will be a minimum of 2-inches clearance between said items and any part of the concrete reinforcement. The outside diameter of such conduits should not exceed one-fourth the slab or beam thickness. Securing such items in position by welding them to the reinforcement will not be permitted.

B. EMBEDMENTS:

Gate frames, gate thimbles, special castings, channels or other miscellaneous metal parts that are to be embedded in the concrete shall be set and secured in the forms prior to concrete placement. Unless otherwise specified, anchor bolts and inserts shall be embedded in concrete as shown. The Contractor shall provide inserts, anchors or other bolts necessary for the attachment of piping, valves, metal parts and equipment. Nailing blocks, plugs, strips, and the like necessary for the attachment of trim, finish, and similar work shall be provided. Voids in sleeves, inserts and anchor slots shall be filled temporarily with readily removable material to prevent the entry of concrete into the voids. Operators or sleeves for gate or valve stems shall be positioned to clear reinforcing steel, conduit and other embedments, and to align accurately with equipment.

3.08 EXPANSION JOINTS

Expansion joints shall be as shown. Reinforcement or other embedded metal items bonded to the concrete shall not extend through expansion joints. Water stops shall be provided in expansion joints as specified in paragraph 03 30 00-3.09.

3.09 WATER STOPS

Water stops shall conform to ACI 301. Water stops shall be securely held in position during placing of concrete. If, after placing concrete, water stops are materially out of position or shape, the surrounding concrete shall be removed, the water stop reset, and concrete replaced in accordance with paragraph 03 30 00-3.10.

Water stops shall be provided at the following joints:

1. Expansion joints in structures.

2. Joints in parts of structures exposed to ground or water on one side and occupied by non-submerged equipment or by personnel on the other.

3. Wall and slab joints of tanks and channels subject to water pressure. Water stops shall be provided for the full height of the wall, or as otherwise noted on the drawings.

Field splices shall be heat fused welded butt splices only and shall be acceptable only in straight sections. Lapping of splices or joining by any means other than heat fused welding shall not be allowed.

Hydrophilic water stops shall be installed according to manufacturer’s recommendations. Surfaces of concrete shall be prepared to required level/plumb and smoothness as required by manufacturer. Form and finish concrete placed first with contact surface requirements in mind, or grind surface if necessary. Provide bonding adhesive if required for the particular product, or if surface conditions warrant. Note restrictions on use described in paragraph 03 30 00-2.03 B.

3.10 MODIFICATION OF EXISTING CONCRETE

A. GENERAL:

Structural dimensions related to or controlled by previously constructed or existing structures shall be verified in the field by the Contractor prior to concrete work.

B. CUTTING OR CORING CONCRETE:

Surfaces exposed to view shall be neatly saw cut to a depth of 1 inch prior to removing the existing concrete. Where existing reinforcement is exposed due to saw cutting or core drilling and no new material is to be placed on the saw cut surface, a coating or surface treatment of epoxy shall be applied to the entire cut surface. Areas that require an oversize opening shall be as shown on the Drawings. The exposed surface of the oversized opening shall be coated with an epoxy bonding compound and re-finished with profiling mortar to the required opening size.

Existing joint edge shall be ground to create a chamfer matching those used adjacent, where occurs. Grind existing to imitate tooled edge.

Unless specifically notified otherwise, Contractor shall investigate concrete to be drilled, cored or saw cut to determine location of existing reinforcing steel. Penetrations shall be located so as to clear existing reinforcing steel if possible. Unless otherwise detailed on the drawings, or where not possible to avoid reinforcing steel, consult the Construction Manager as to acceptability of cutting reinforcing steel and provide new reinforcing systems as directed. Locating methods include chipping to expose reinforcing steel, ground penetrating radar, X-ray, or magnetic flux devices. Locates of existing reinforcing shall be paid for by the Contractor.

C. JOINING NEW CONCRETE TO EXISTING:

Existing concrete surfaces to be joined with new concrete shall be thoroughly cleaned and roughened by abrasive blasting, bush hammering or other method to achieve ¼-inch amplitude surface. Existing metalwork, embeds or other interfering items shall be removed. Coat existing surface with epoxy bonding compound just prior to placement of new concrete.

D. DOWELS:

Dowels to be installed in existing concrete shall utilize holes drilled with a hammer drill and carbide bit (core drilled holes not allowed), properly brushed and air-cleaned with oil-free compressed air, and an injectable two-component epoxy adhesive, as per Section 03 60 00. Installation shall conform to manufacturer's recommendations and to ICC Evaluation Reports.

E. DRILLING HOLES IN EXISTING CONCRETE FOR POST-INSTALLED ANCHORS

Non-destructive methods shall be used for locating reinforcement prior to drilling operations. For anchor locations that interfere with reinforcement, the Contractor shall first attempt to relocate anchors to avoid drilling through the reinforcement.

For situations that do not allow relocation of the anchor, cutting of reinforcement for anchor installation subject to the following will be acceptable:

1. Prior to drilling through reinforcement, the Contractor shall have an experienced individual evaluate the condition. For situations that appear questionable, the Construction Manager shall be consulted.

2. Holes drilled through reinforcement must be in compliance with adhesive anchor assumptions for roughened hole surface typical of a hammer drill and carbide bit. No smooth hole surfaces are allowed.

3. No slab rebar shall be cut within 24-inches of the supporting wall, column or an opening in the slab.

4. No cutting of rebar is allowed in the middle third of slab spans for anchors with diameters equal to or greater than 3/4".

5. Maximum of two rebar may be cut in any 10-foot width of slab.
6. Maximum of two rebar may be cut within any 10-foot width of concrete wall.

7. Maximum of one rebar may be cut within any 8-foot width of CMU wall.

8. No wall or slab rebar shall be cut within 24-inches of an opening.

For anchors that cannot be moved and that conflict with the above requirements, the Construction Manager shall be consulted for direction. Under no circumstances will it be acceptable to cut through reinforcement in beams, columns, precast members, and stairs.

F. WATERSTOPS:

Where a water stop between new and existing concrete is required, Contractor shall install a hydrophilic water stop unless otherwise noted on the Drawings.

3.11 FORMED SURFACE FINISHES

A. REPAIR OF SURFACE DEFECTS:

Surface defects, including tie holes, minor honeycombing or otherwise defective concrete shall be repaired in accordance with ACI 301. Areas to be patched shall be cleaned. Minor honeycombed or otherwise defective areas shall be cut out to solid concrete to a depth of at least 1 inch. The edges of the cut shall be perpendicular to the surface of the concrete. Patches on exposed surfaces shall be finished to match the adjoining surfaces after they have set. Patches shall be cured as specified for the concrete. Finished surfaces shall be protected from stains and abrasions. Finishes shall be equal in workmanship, texture, and general appearance to that of the adjacent concrete. Concrete with honeycombing which exposes the reinforcing steel or with

defects which affect structural strength shall be corrected by removing concrete a minimum of one inch beyond the reinforcing.

B. FORMED SURFACE FINISHING:

Formed surfaces shall be finished as soon as practicable after form removal and repair of surface defects. Finishes shall be as follows.

1. FINISH A: Finish A shall be a grout-cleaned rubbed finish in accordance with ACI 301 except that ALL FORM FINS AND OTHER PROTRUSIONS SHALL BE COMPLETELY REMOVED TO THE FINAL SURFACE. Surfaces shall be lightly sandblasted prior to sacking. Sandblasting shall occur after the specified curing period. For interior areas not exposed to moisture or weather, water used in the sacking mortar shall be mixed with a PVA bonding compound as recommended by the manufacturer. Finish A shall be provided for uncoated surfaces at surfaces of stair wells; interior surfaces of equipment rooms, galleries and tunnels; operations areas; exposed channels and tanks from 1 foot below minimum water surfaces and up; and permanently exposed vertical and sloped surfaces, such as pipe chases. Finish A shall not be provided at concrete surfaces receiving a coating.

2. FINISH B: Finish B shall be a smooth surface with all form fins and other protrusions completely removed to the final surface. Finish B shall be provided for coated surfaces. See specification 09900 for concrete surface coatings and surface preparation, including filling bug holes before coating.

3. FINISH C: Finish C shall be a finish which has surface imperfections less than 3/8 inch in any dimension. Surface imperfections greater than 3/8 inch shall be repaired or removed and the affected areas shall be neatly patched. Finish C or smoother shall be provided for interior surfaces of wet wells, tanks and channels from 1 foot below minimum water surfaces and down and otherwise unfinished interior surfaces.

4. FINISH D: Finish D shall be the finish for surfaces which may be left as they come from the forms, except that tie holes shall be plugged and defects greater than 1/2 inch in any dimension shall be repaired.

C. SAMPLES OF FORMED SURFACE FINISH:

A sample concrete panel, 2 feet by 2 feet, representative of formed surface Finish A shall be provided to the Construction Manager. The panel shall be representative of the workmanship and finish required, including filling of tie holes. The sample shall be deemed acceptable by the Construction Manager prior to the start of such work. The sample shall be on display at the job site, and finished surfaces shall match sample.

3.12 SLAB FINISHES

A. GENERAL:

The finishes specified herein include surface finishes, treatments and toppings for floors and slabs. Dry cement shall not be used on new concrete surfaces to absorb excess moisture. Edges shall be rounded to a radius of 1/2 inch. Joints shall be grooved to a radius and depth of 1/4 inch each. Finishes shall match the sample panels provided under paragraph 03 30 00-3.12E.

Floors shall be sloped to drain uniformly within a room or space. Unless otherwise specified, slope shall be a minimum of 1/8 inch per foot toward nearest drain. Where finish is not specified, floor slabs shall receive steel troweling. Use of floor drains with only locally depressed slabs shall be coordinated with Construction Manager if detailed on the drawings, and restricted to locations specifically noted.

B. FLOAT FINISH:

Floating shall be performed with a hand or power-driven float in accordance with ACI 301. Begin floating when the bleed water sheen has disappeared and the surface has stiffened sufficiently to permit operation of the specific float apparatus. Floating of any one area shall be the minimum necessary to produce a finish that will meet tolerance requirements of ACI 117 for a conventional surface. Refloat the slab immediately to a uniform texture. Floating shall compact and smooth the surface and close any cracks and checking of surfaces. Float finish shall be applied to surfaces of channel, tank bottom slabs, tops of footings, and steps and surfaces to receive roofing and insulation.

C. STEEL TROWEL FINISH:

Float the concrete surface and then trowel in accordance with ACI 301. Immediately after final troweling, the surface shall be cured and protected as specified in paragraphs 03 30 00-3.04 and 03 30 00-3.05. Steel trowel finish shall be provided on floors unless specified otherwise.

D. BROOMED FINISH:

Immediately after concrete has received a floated finish, give the concrete surface a coarse transverse scored texture by drawing a broom or burlap belt across the surface in accordance with ACI 301. Broomed finish shall be provided for walks, tops of tanks, slabs-on-grade exposed to atmosphere, and where otherwise indicated or specified.

E. SAMPLES OF CONCRETE FLOOR FINISHES:

A sample concrete panel, 2 feet by 2 feet, representative of each specified finish, shall be provided to the Construction Manager. The panels shall be representative of the workmanship and finishes required. Samples shall be approved in field prior to the start of such work.

3.13 TOPPING CONCRETE

A. SUBFLOOR FINISH:

Slabs to receive topping, tile or grout as shown shall be float finished to required elevations. Immediately following the final finishing, the slab shall be treated with a retardant.

B. TOPPING CONCRETE:

These requirements shall apply to the placement of normal concrete topping, with or without surface hardener, on a cured concrete substrate.

Slabs to receive topping concrete shall have an exposed aggregate subfloor finish as specified in paragraph 03 30 00-3.13 A, or have a 1/4-inch amplitude roughened surface using abrasive blast or raked finish after floating. Dirt, laitance and loose aggregate shall be removed. The cleaned base shall be kept wet for a period of 24 hours prior to the application of topping. Excess water shall be removed, and a neat cement grout shall be applied and brushed into the surface of the base. The cement grout shall not be allowed to dry and shall be spread within 15 minutes of the topping placement. The topping shall then be placed, compacted, and floated. The surface shall be tested with a straightedge to detect high and low spots of over 1/8 inch in 10 feet, which shall be eliminated.

Surface hardener shall be incorporated where specified. When the floor has hardened sufficiently, it shall receive a steel trowel finish. Structural, non-exposed topping may be float finished only.

3.14 RELATED SURFACES

A. STAIR TREAD:

Stair tread shall be constructed with nonskid nosing as specified in Section 05 53 00. Tread shall have a steel trowel finish and shall have a slope of 1/8 inch per foot toward the front. Ends of treads shall have a 1/16 to 1/8 inch cut between concrete and metal tread to allow for expansion.

B. FINISHING OF UNFORMED SURFACES:

1. RELATED UNFORMED SURFACES: Tops of walls or buttresses, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces shall be struck smooth after concrete is placed and shall be floated to a texture reasonably consistent with that of the adjacent formed surfaces. Final treatment of formed surfaces shall continue uniformly across the unformed surfaces.

2. PAVEMENTS AND SIDEWALKS: The surfaces of the concrete shall be screeded to grade and sloped to drain. After screeding, the surface shall receive a broomed finish

as specified in paragraph 03 30 00-3.12 D. Edges and expansion joints shall be rounded to a radius of 1/2 inch. Joints shall be grooved to a radius and depth of 1/4 inch each.

3.15 FIELD SAMPLING AND TESTS

A. GENERAL:

Field sampling and testing shall be performed by the independent testing laboratory. Samples of aggregates and concrete shall be taken at such times to represent the quality of the materials and work throughout the project. The laboratory shall provide the necessary labor, materials and facilities for sampling the aggregate and for casting, handling and initially storing the concrete samples at the site of work. Aggregates shall be sampled in accordance with paragraph 03 30 00-3.15 B not less than 30 days prior to the use of such aggregates in the work. The minimum number of samples and tests are specified in paragraph 03 30 00-3.15 C.

B. SAMPLING:

1. AGGREGATES:

a. GENERAL: Fine and coarse aggregates shall be sampled in accordance with ASTM D75. Samples shall be taken at the discharge gates of the bins feeding the weigh hopper. The Contractor shall provide safe and suitable facilities for obtaining samples. Samples shall be obtained at the concrete batch plant at the frequency specified in paragraph 03 30 00-3.15 C. Sampling shall be repeated when the source of material is changed or when unacceptable deficiencies or variations from the specified requirements of materials are found in testing. Aggregate samples shall be tagged and their sources identified.

b. COARSE AGGREGATE: A sample weighing between 50 and 60 pounds shall be taken after the batch plant is brought up to full operation. The samples shall be taken so that a uniform cross section, accurately representing the materials on the belt or in the bins, is obtained.

c. FINE AGGREGATE: Samples shall be taken as specified for coarse aggregate. The samples shall be taken for sieve analysis of fine aggregate and specific gravity tests. Samples of sand shall be taken when the sand is moist.

2. CONCRETE: Samples of plastic concrete shall be obtained in accordance with ASTM C172. Samples shall be taken at the hopper of concreting equipment or transit mix truck, except as noted in 03 30 00-3.03B.2

C. TESTING:

1. AGGREGATE: A minimum of one test of coarse aggregate per 400 cubic yards of concrete and a minimum of one test of fine aggregate per 200 cubic yards of concrete used shall be made to confirm continuing conformance with specifications for gradation, cleanliness and sand equivalent. A maximum of one test per day of each aggregate is required. The full test program is required before source changes will be accepted.

2. CONCRETE:

a. STRENGTH TESTS: The strengths specified for the design mix shall be verified by the independent testing laboratory during placement of the concrete. Verification shall be accomplished by testing standard cylinders of concrete samples taken at the job site. Cylinders shall be 4 by 8 inch or 6 x 12 inch.

Standard cylinders shall represent the concrete placed in the forms. One set of six standard 6 x 12 inch (or nine 4 x 8 inch) cylinders shall be cast of each class of concrete for each 100 cubic yards or less or for each 5,000 square feet of surface area placed per day. Casting, handling and curing of cylinders shall be in accordance with ASTM C31. Additional cylinders shall be provided when an error in batching is suspected. For the first 24 hours after casting, the cylinders shall be kept moist in a storage box constructed and located so that its interior air temperature will be between 60 and 80 degrees F. At the end of 24 hours, the cylinders shall be transported to the testing laboratory.

Testing of specimens for compressive strength shall be in accordance with ASTM C39. Tests shall be made at 7 and 28 days from time of casting. Two 6 x 12 inch (or three 4 x 8 inch) test cylinders from each group of six (or nine) shall be tested at the end of 7 days and two 6 x 12 inch (or three 4 x 8 inch) shall be tested at the end of 28 days. The two remaining 6 x 12 inch (or three 4 x 8 inch) cylinders shall be tested at the end of 56 days if the 28-day strength reports below specification. A strength test shall consist of the average strength of two 6 x 12 inch (or three 4 x 8) cylinders cast from material taken from a single load of concrete. If one cylinder shows evidence of low strength due to improper sampling, casting, handling or curing, the result of the remaining cylinders may be used if approved by the Construction Manager.

The average of any three consecutive 28-day strength test results of the cylinders representing each class of concrete for each structure shall be equal to or greater than the specified strength and not more than 10 percent of the strength test results shall have values less than the specified 28-day strength for the total job concrete. No individual strength test result shall be less than the specified strength by more than 500 pounds per square inch.

Certified reports of the test results shall be provided directly to the Construction Manager and the Engineer. Test reports shall include sufficient information to identify the mix used, the stationing or location of the concrete placement, and the quantity placed. Slump, air content, temperature of concrete, and ambient temperature shall be noted. The 28-day strength test results shall be evaluated in accordance with ACI 214R. Quality control charts showing field test results shall be included with the test results for each class of concrete in each major structure. Charts shall be prepared in accordance with ACI 214R. Quality control charts shall be maintained throughout the entire job and shall be available for the Construction Manager's inspection at any time.

If the 28-day test results fall below the specified compressive strength for the class of concrete required for any portion of the work, adjustment in the proportions, water content, or both, shall be made as necessary at the Contractor's expense. Changes and adjustments shall be reported in writing to the Construction Manager.

If compressive test results indicate concrete in place may not meet structural requirements, tests shall be made to determine if the structure or portion thereof is structurally sound. Tests may include, but not be limited to, cores in accordance with ASTM C42 and any other analyses or load tests acceptable to the Construction Manager. Costs of such tests shall be borne by the Contractor.

b. TESTS FOR CONSISTENCY OF CONCRETE. The slump shall be as specified when measured in accordance with ASTM C143. Samples for slump determination shall be taken from the concrete during placement. Tests shall be made at the beginning of concrete placement operation and at subsequent intervals to ensure that the specification requirements are met. Slump tests shall also be performed whenever standard cylinders are cast. For pumped concrete, slump shall be measured in accordance with paragraph 3.03B.2.

When high range water reducers are added at the site, slump tests shall be taken before and after addition of high range water reducing admixtures.

c. TESTS FOR TEMPERATURE AND AIR CONTENT: Temperature tests shall be made at frequent intervals during hot or cold weather conditions until satisfactory temperature control is established. Whenever standard cylinders are cast, temperature tests shall be performed.

Air content shall be as specified when measured in accordance with ASTM C231. Air content shall be measured whenever standard cylinders are cast. For pumped concrete, air content shall be measured in accordance with paragraph 3.03B.2.

D. FINAL LABORATORY REPORT:

A final report, prepared by the testing laboratory, shall be provided at the completion of all concreting. This report shall summarize the findings concerning concrete used in the project and provide totals of concrete used by class and structure. Final quality control charts for compressive strength tests for classes of concrete specified in each major structure shall be included. The report shall also include the concrete batch plant's coefficient of variation and standard deviation results for each class of concrete.

3.16 REPAIR OF DAMAGED CONCRETE, CRACKING:

A. ACCEPTANCE OF CONCRETE:

Completed cast-in-place concrete work shall conform to the applicable requirements of ACI 301 and the Contract Documents. Concrete work that fails to meet the requirements of ACI 301 or the Contract Documents shall be repaired as approved by the Construction Manager to bring the concrete into compliance. Concrete that cannot be brought into compliance by approved repair methods will be rejected. Rejected concrete work shall be removed and replaced. Repair methods shall be in accordance with ACI standards, including ACI 503.7, and are subject to the approval of the Construction Manager. The cost of repairs and replacement of defective concrete shall be borne by the Contractor.

B. REPAIR METHODS:

Damaged concrete or concrete with crack widths exceeding 0.004 inches at liquid-containing and conveying structures or crack widths exceeding 0.006 inches for other structures unless noted otherwise shall be repaired by one of the following methods as approved by the Construction Manager. Where crack widths exceed the maximum allowable widths listed above, the Construction Manager in their sole discretion may determine that the crack does not require repair. For liquid-containing and conveying structures, meeting the crack width criteria defined above does not relieve the Contractor from meeting the leakage criteria in this specification and performing crack injection repairs as needed to meet the leakage criteria.

1. Repair Method 1: Fill the joint or crack by drilling holes to the affected area, install injection ports and force epoxy or chemical grout (expanding urethane) into the joint under pressure. The material type, whether epoxy or chemical grout shall be approved by the Construction Manager. After injection and curing, ports, sealing mix and surface generally shall be cleaned and worked to match the specified finish.

2. Repair Method 2: Fill cracks with low viscosity epoxy, applied by pouring/flooding crack zone until cracks are filled. Prepare surface, install, and cure according to manufacturer's recommendations. At a minimum, prepare surface to result in a clean, dry surface and with no visible detrimental material in cracks to be filled. Conform to temperature limitations for epoxy to be used. Finish to match adjacent areas.

3. Repair Method 3: Cut a bevel groove 3/8 to 1/2 inch in width and depth, and caulk with sealant in accordance with manufacturer's instructions. This repair method is only to be used where expressly allowed by the Construction Manager. Groove and caulk shall be applied on wet or hydrostatic pressure side of surface where occurs.

C. REPAIR METHOD USE:

1. Repair Method 1 shall be used for all cracks in walls, surfaces sloped 1:1 or greater, beams, columns, slabs, overhead surfaces and generally for liquid retaining surfaces. Need for repair depends upon crack width, location, and surface conditions under service conditions. Epoxy grout shall be used for repair of structural cracks and chemical grout (expanding urethane) shall be used for repair of non-structural cracks at liquid-containing structures. The Construction Manager shall determine whether a crack is classified as structural or non-structural.

2. Repair Method 2 may be utilized in lieu of Method 1 for slabs which receive a raked finish. Method 2 may also be used with Construction Manager's approval for exposed troweled and broomed finishes after review of

conditions, degree of exposure to public, and proposed repair product and installation. Finish shall substantially match adjacent surfaces.

3. Repair Method 3 shall be limited to dry-surface slabs, walls subject to less than three feet of liquid pressure, or as specifically directed by the Construction Manager. Method 3 is not an equivalent repair method to Methods 1 or 2, which shall be considered the standards.

3.18 WATERTIGHTNESS TESTING AND REPAIR

A. WATER RETAINING CONCRETE TANKS AND CHANNELS:

Concrete tanks, basins, reservoirs and channels which have walls or slabs subjected to hydrostatic pressure shall be tested for water tightness. The tests shall be made after the structure is complete and the concrete has achieved its specified 28-day strength, but prior to application of waterproofing coating or backfilling. Filling of the tank for the water tightness test shall not exceed a rate of 4 feet/hour. Filling with water at this maximum rate shall continue to the maximum operating water surface. The water shall be kept at this level for at least 72 hours and then the dry sides of all walls and the base perimeter of the slab shall be visually inspected for evidence of leakage. Damp spots, leakage, or seepage revealed by the test, including those caused by shrinkage of concrete, honeycombed areas, construction joints, or other sources shall be repaired by Method 1, paragraph 03 30 00-3.16-B.1. Damp spots are defined as spots from which water that can be picked up on dry hand.

The Contractor shall re-test tanks or channels which have been repaired to check the suitability of repairs. Water required for testing and re-testing shall be pumped from Lagoon 1 using a temporary pump and piping system provided by and operated by the Contractor. At the conclusion of the watertightness test, water shall be pumped from the tank or basin to Lagoon 1.

All liquid retaining or conveying concrete structures must also meet maximum leakage criteria set forth in ACI 350.1 as follows:

Structure Type	ACI 350.1 Designation	Tightness Criterion
Cylindrical water and wastewater storage tanks and reservoirs other than digesters	HST-025	0.025% per day
Rectangular basins and tanks	HST-050	0.050% per day

Note: All damp spots on or leakage through walls or wall-to-slab joints shall be repaired as described above. Leakage equal to or less than the values shown in the table above is permitted only through the base slab or mat foundation.

Volume loss shall be measured by measuring the vertical distance from the water surface to a fixed point on the tank above the water surface taking into account evaporation from open surfaces. If the drop in water surface in the 24-hour period exceeds the values given in the table above, exclusive of evaporation, the leakage shall be considered excessive and shall be remedied.

3.19 CLEANUP

Upon completion of the work and prior to final inspection, the Contractor shall clean all concrete surfaces. The cleaning procedures shall be as follows: After sweeping with an ordinary broom to remove the loose dirt, the surface shall be flushed with clean water. Final scrubbing by hand or machine shall follow.

Floors that have curing and sealing compound shall be cleaned of loose dirt and debris by sweeping with ordinary brooms. They shall then be washed and mopped with clean water. Finally, one additional coat of the same clear curing and sealing compound shall be applied in the same manner as specified.

END OF SECTION

SECTION 13 12 20

RIGID-FRAME PRE-ENGINEERED METAL BUILDINGS

PART 1—GENERAL

1.01 DESCRIPTION

A. SCOPE:

This section specifies the Pre-Engineered Metal Building System, which includes the structural steel system primary and secondary members, metal roof system, column base plates and anchor bolts, trim and accessories, soffits, gutters and downspouts as described in this performance specification and shown on the Drawings.

B. BUILDING DESCRIPTION:

The Decant Facility Building will be a canopy type structure that covers multiple concrete slab-on-grade containment areas and channels. It will have a frame span of 42’-0” with a length of 120’-0”. There will not be any siding or wall framing included at the Decant Facility Building. Architecture of the Building is intended to match, as closely as possible, the existing plant facility buildings.

1.02 DESIGN REQUIREMENTS

A. ROOF SNOW LOADS:

The roof snow load used for designing the structure shall be determined in accordance with ASCE 7-05 “Minimum Design Loads for Buildings and Other Structures.”

Roof Snow Load, Pr:	30 psf
Importance Factor:	1.1

All roof structures and building frames shall be adequately designed for the required snow loads. Due consideration shall be given to drifting and the possible formation of ice dams resulting in ponding of water on un-insulated roofs.

When considering snow loads, roof live loads should only be reduced by the portion of the live load attributable to loads that would not occur simultaneously with snow. The live load allowance for piping, conduit, and lights will be included in the design calculations.

B. WIND LOAD:

The wind loads used for designing the structure shall be determined in accordance with ASCE 7-05. Design factors shall be as follows:

Basic Wind Speed:	105 mph (3-sec. gust)
Exposure:	C
Importance Factor:	1.0

B. SEISMIC LOAD:

The seismic loads used for designing the structure shall be determined in accordance with Section 1613 of International Building Code. Design factors shall be as follows:

Code:	IBC 2012 and ASCE 7-10
0.2 sec. Spectral Response, S_s:	0.796 g
1.0 sec. Spectral Response, S_1:	0.345 g
Site Class:	D
0.2 Sec. Design Spectral Response, S_{DS}:	0.627 g
1.0 Sec. Design Spectral Response, S_{D1}:	0.393 g
Importance Factor:	1.25
Component Importance Factor (I_p):	1.0, except I_p=1.5 for fire protection sprinkler systems
Risk Category	III
Seismic Design Category:	D

C. DEAD LOAD:

Dead loads used in the calculations shall be the weight of building system construction, such as framing, roofing, purlins, accessories, and covering materials. An additional allowance will also be added for collateral loads listed below.

D. COLLATERAL LOAD:

Additional imposed loads required by the contract documents other than the weight of the building system. These added loads include such items as mechanical and electrical systems. Collateral loads shall be:

Roof: Mechanical system and lighting = 10 psf

Circulator Fans: Per Section 23 24 23 and as shown on the Drawings = 500 lb.

E. LIVE LOAD:

Roof live load:	20 psf
Columns:	No column live load reduction allowed

F. NOT USED

G. NOT USED

H. LOAD COMBINATIONS:

All buildings and structures shall be designed to withstand the load combinations as specified in the 2012 International Building Code.

I. DEFLECTIONS:

Maximum moment frame drift = H/80, not to exceed 2-1/2-inch drift, where H = Building Eave Height and wind loads are calculated per ASCE 7-10.

Calculations for building deflections shall be performed using only the bare frame method. Reductions based on engineering judgment using the assumed composite stiffness of the building envelope shall not be allowed.

J. PRIMARY FRAMING AND ANCHOR BOLTS:

The column bases shall be designed as pinned connections. No moments shall be assumed to be transferred to the foundations.

Anchor bolt design, size and arrangements shall be coordinated between the Pre-Engineered Building Manufacturer and the foundation design as shown on the Drawings. Anchor bolt arrangements shall meet the minimum bolt spacing requirements per the AISC. Anchor bolt design shall meet the requirements as per ACI 318-11, Appendix D.

K. SECONDARY FRAMING:

Purlins at the standing seam roofs shall be braced in accordance with FMRC standards when a standing seam roof is used. Where an accepted FMRC design does not exist, the design of the roof purlins and associated bracing shall meet or exceed requirements in the latest version

of the American Iron and Steel Institute (AISI) "North American Specification for the Design of Cold-Formed Steel Structural Members."

L. METAL PANELS

Paneling system shall be designed to support design snow load, wind loads, and live loads. Panels shall be designed to support a 200 pound load over a 2 foot square area centered between purlins without exceeding a panel deflection to span ratio of 1/180.

1.03 QUALITY ASSURANCE

A. REFERENCE STANDARDS

This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were not Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date discontinued or replaced.

REFERENCE	TITLE
IBC 2012	International Building Code (IBC) with Washington State Building Code amendments.
ASCE 7-10	Minimum Design Loads for Buildings and Other Structures
ACI 318-11	Building Code Requirements for Structural Concrete and Commentary
Current edition	AISI "North American Specification for the Design of Cold-Formed Steel Structural Members"
AISC, 14th edition	American Institute of Steel Construction Manual of Steel Construction

REFERENCE	TITLE
AISI	American Iron and Steel Institute
MBMA	Metal Building Manufacturer's Association
OSHA	Occupational Safety Health Association
AWS D1.1	American Welding Society
ASTM A36/A572	Carbon Structural Steel
ASTM A123	Zinc (Hot-Dip Galvanized) Coating on Iron and Steel Products
ASTM A307	Carbon Steel Bolts and Studs, 60 ksi Tensile
ASTM A325	Structural Bolts, Steel, Heat-Treated, 120/105 ksi Tensile
ASTM A490	Structural Bolts, Alloy Steel, Heat-Treated, 150 ksi
ASTM A500	Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A525	Steel Sheet, Zinc-coated (Galvanized) by the Hot-Dip Process, General Requirements
ASTM A529	High-Strength Carbon Manganese Steel of Structural Quality
ASTM A572	High-Strength Low-Alloy Columbium-Vanadium Structural Steel
ASTM A792	Steel Sheet, 55% Aluminum Zinc Alloy-Coated by the Hot-Dip Process
A992	Structural Steel Shapes

REFERENCE	TITLE
ASTM A1011	Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
ASTM E936-98	Standard Practice for Roof System Assemblies Employing Steel Deck, Preformed Roof Insulation, and Bituminous Built-Up Roofing
ASTM 2201-99	Standard Practice for Preparation of Zinc-Coated and Zinc-Alloy-Coated Steel Panels for Testing Paint and Related Coating Products

All structural mill sections or welded-up plate sections shall be designed in accordance with Chapter 22 of the International Building Code (IBC).

All cold-formed steel structural members shall be designed in accordance with AISI "North American Specification for the Design of Cold-Formed Steel Structural Members."

All components of the roof paneling system shall be designed in accordance with AISI "Specification for the Design of Cold-Formed Steel Structural Members."

Workmanship, detailing of connections, fabrication and erection shall conform to American Institute of Steel Construction (AISC) Manual of Steel Construction.

B. RELATED SECTIONS:

The work of the following Sections is listed in this Section. Other Sections, not referenced below, may also be related to the proper performance of this work.

- Section 01 73 23 Bracing and Anchoring
- Section 03 30 00 Cast-in-Place Concrete
- Section 05 10 00 Structural Metals
- Section 05 05 23 Anchor Bolts
- Section 05 50 00 Miscellaneous Metalwork
- Section 05 05 14 Hot-Dip Zinc Coating

C. REFERENCE DRAWINGS

In addition to this performance specification, the following Owner provided drawings include requirements for the pre-engineered metal building.

- S-200, Stormwater Decant Facility Structural Foundation Plan
- S-220, Stormwater Decant Facility Sections
- S-221, Stormwater Decant Facility Sections and Details

D. QUALIFICATION REQUIREMENTS

1. QUALIFICATIONS OF BUILDING MANUFACTURER:

The minimum requirements for qualification shall be 5 years of experience in the design and fabrication of pre-engineered metal buildings and evidence of satisfactory completion of 5 projects comparable in scope to the work specified herein.

Manufacturer shall participate in the AISC Certification program and be designated and AISC Certified Plant, Category MB (Metal Building Systems).

Submit qualifications and experience with bid. Afterward, the Building Supplier shall not substitute a different manufacturer.

2. QUALIFICATIONS OF BUILDING ERECTOR:

The Erector shall be familiar with Manufacturer's pre-engineered metal building systems, standard and/or custom concepts and shall be required to perform all work in a manner that will best incorporate modern materials and methods.

Erection shall be performed by qualified erector using proper tools and equipment in accordance with manufacturer's recommendations.

3. QUALIFICATIONS OF WORKMAN:

The Erector shall provide at least one person who shall be present at all times during execution of work and who shall be thoroughly familiar with pre-engineered metal building concept and the requirements thereof, and who shall direct all work performed.

All workers employed by the Erector shall be skilled in performing tasks related to pre-engineered metal buildings.

All welders shall be qualified as prescribed by AWS.

E. DELIVERY, STORAGE & HANDLING

The metal building manufacturer and their installation contractor are responsible for the delivery, storage and handling of all materials.

Materials shall be delivered in a dry and undamaged condition and stored out of contact with the ground. Materials other than framing and structural members shall be covered with weather tight covering and kept dry. Storage accommodations for roof and wall covering shall provide good air circulation and protection from surface staining.

F. WARRANTY

The supplier shall provide the following additional warranties-guarantees for the pre-engineered building.

1. A one (1) year workmanship guarantee against failures caused by faulty erection.

2. A two (2) year materials and workmanship guarantee against failures.

3. Provide manufacturer's written weather tightness warranty for five (5) years against leaks in roof panels arising out of or caused by ordinary wear and tear under normal weather and atmospheric conditions.

4. Provide manufacturer's paint film written warranty for twenty (20) years against cracking, peeling, chalking, and fading of the coating on painted roof panels and soffit panels. Manufacturer warrants that coating shall not peel, crack, or chip for 20 years. For a period of 20 years chalking shall not exceed #8 per ASTM D4214 and fading shall be 5 NBS units or less per ASTM D 2244.

1.04 SUBMITTALS

Prior to release for manufacture of the building, the following items shall be submitted to the Owner for approval.

1. Pre-engineered building design and drawings:

   a. Provide 3 copies of drawings, prepared and sealed by a Structural Engineer registered in the State of Washington. Drawings shall include the following:

      - General arrangement plans and elevations
      - Primary and secondary framing systems
      - Roofing details, ventilation and roof drainage system details.

   b. Provide 3 copies of complete design calculations of the pre-engineered building, prepared and sealed by a Structural Engineer registered in the State of Washington.

   c. Product Data: Submit manufacturer's product information, specifications, and installation instructions for building components and accessories.

d. Shop Drawings: Submit complete erection drawings showing roof framing, transverse cross sections, covering and trim details, and accessory installation details to clearly indicate proper assembly of building components.

e. Submit color charts showing full range of colors, textures and patterns available.

f. Samples: Submit samples, two (2) each, of the following for review. Samples will be used as basis for evaluating quality of finished roof systems and selection of colors.

- Twelve inches long by actual width of roofing panels, with specified finishes.
- Fasteners for application of roofing and soffit panels.

2. Anchor Bolt Design and Drawings:

a. Provide 3 copies of drawings that include anchor bolt size, material, orientation and location, building column base plate details and all base attachments where required.

b. Provide 3 anchor bolt calculations stamped by a Structural Engineer registered in the State of Washington. Drawings shall include the unfactored building column loads imposed on foundations. Unfactored column loads are to be separately shown for dead load, live load, snow load, and the governing lateral load (earthquake or wind).

PART 2—PRODUCTS

2.01 MANUFACTURERS

The pre-engineered metal building shall be engineered and manufactured by Butler Metal Building Systems, Garco Building Systems, Star Building Systems, Varco-Pruden Buildings, or approved equal.

2.02 MATERIALS

All components and parts shall be clearly marked. Erection drawings shall be supplied for identification and assembly of the parts.

A. FRAMING

1. PRIMARY FRAMING:

a. Rigid Frames

Frames shall consist of welded-up plate section or hot-rolled wide flange columns and beams complete with necessary splice plates for bolted field assembly.

All bolts for field assembly of frame members shall be A-325, high strength bolts.

b. End Walls

Rigid Moment Frames shall be used at end walls that require a clear opening. Otherwise, a braced frame may be used at an end wall.

End wall frames shall consist of end wall corner posts and end wall roof beams.

c. Anchor Bolts

Contractor shall design and supply the anchor bolts. The anchor bolt design, size and arrangement shall be coordinated between the Metal Building Manufacturing Company and the foundation design as shown on the drawings.

All anchor bolts shall be galvanized, ASTM A36.

2. SECONDARY STRUCTURAL MEMBERS:

a. Roof Purlins

Purlins shall be galvanized (G-60) per ASTM A653. Purlins shall be “Z” shaped, precision roll formed.

b. Eave Struts

Eave Struts shall be 8”, 9-1/2”, or 11” deep “C” sections.

c. Bracing

Purlin braces, when required, shall be cold formed.

3. COATING OF STRUCTURAL MEMBERS:

Primary structural steel framing and secondary steel, such as purlins, shall be painted with a rust inhibitive alkyd primer and an alkyd enamel finish coat per project specification Section 09 90 00. As an alternative to painting, secondary steel may be galvanized G60, per ASTM A653. Coating system substitutions may only be used after written approval has ben received from the Owner’s representative.

Prior to galvanizing, steel shall be cleaned of loose rust, loose mill scale, dirt and other foreign material.

B. EXTERIOR METAL PANELS

1. ROOF PANELS:

a. Roof panels shall be factory roll-formed roof panels. Panel material shall be 24 gauge minimum galvanized G-90 coating per ASTM specification A653. As an alternate option, Galvalume AZ 55 coating, per ASTM specification may be used as a base metal coating. The exterior side shall be coated with a full strength, 70% Kynar 500®/Hylar 5000(TM) fluoropolymer coating (or equivalent).

b. Panels of maximum possible lengths shall be used to minimize end laps. Eave panels shall extend beyond the structural line of the sidewall.

c. Panel end splices shall be floating and allow the roof panels to expand and contract with roof panel temperature changes.

d. Ridge assembly shall be designed to allow roof panels to move lengthwise with expansion/contraction as the roof panel temperature changes. Panel closures shall be installed to seal the panel ends at the ridge.

2. NOT USED

3. COATING OF PANELS

The metal panel coating system for the exterior side of roof panels shall be a full strength, 70% Kynar 500®/Hylar 5000(TM) fluoropolymer coating, Flurothane IV system (or equivalent). Panel color to match existing panels on adjacent buildings within plant.

The interior side of the roof panels (and trim material) shall be coated with primer and a universal off-white polyester paint coat.

C. COMPONENTS

1. TRIMS AND FLASHINGS:

The system shall be complete with integrated pre-engineered trims and flashings to accommodate reasonable variances in tolerances and thermal movement. Minor flashings may be field fabricated. Trims and flashings shall be painted with the metal panel coating system listed in the previous section and shall match the color of the wall and/or roof panels.

2. GUTTERS AND DOWNSPOUTS:

Gutters shall be provided on exterior of building along perimeter. Downspouts shall be provided as shown on the Drawings. Gutters and Downspouts to be painted with metal panel coating system listed below and shall match the color of the roof panels as indicated on design drawings.

PART 3—EXECUTION

3.01 EXAMINATION

A. SURVEYS:

Check lines and elevations of concrete bearing surfaces. Confirm locations of anchor bolts and similar devices before metal building erection proceeds. Report discrepancies immediately to the Construction Manager. Do not proceed with erection until corrections have been made, or until compensating adjustments to the steelwork have been agreed upon.

3.02 ERECTION

Erect the work in accordance with Specifications, Drawings, and Manufacturer's directions.

Conform to configurations and connections indicated on reviewed and accepted Shop and Erection Drawings.

Temporary shoring and bracing: Provide members with connections of sufficient strength to bear imposed loads. Remove temporary members and connections when permanent members are in place and final connections have been made. Provide temporary guy lines to achieve proper alignment of structures as erection proceeds.

Accurately position and assemble structural framing to lines and members of framing system prior to permanent fastening.

Install metal panels, fasteners, trim, louvers, and related items in conformance with approved drawings and requirements of manufacturers. Protect installed panels and structures from abuse by other trades.

Erector shall not make any field modifications to any structural member except as authorized and/or specified by manufacturer in writing, with a copy to the Owner.

3.03 REPAIR/RESTORATION

Replace damaged panels and other components of work that cannot be repaired by finish touch-up or similar minor repair.

Touch-up coatings: Immediately after erection, clean field welds, bolted connections, and areas where coating is abraded. Apply coating to exposed areas using same material as used for shop coating.

3.04 FIELD QUALITY CONTROL

The Owner's Inspector will inspect and indicate if work is in conformance with specifications. This inspection will include products, erection, welding, grouting and similar construction. The Inspector will verify that the work has been performed in accordance with AISC and this specification.

Maximum deviations from plumb, level, and alignment are not to exceed AISC specifications, and tolerances specified in this section.

Defective Work: Promptly remove and replace materials and fabricated components that do not comply. Furnish, perform, and install to specified requirements.

3.05 CLEANING

Upon completion of the services, the metal building manufacturer and their installation contractor shall remove all excess materials, tools, scaffolds and rubbish which has accumulated on the premises and leave same in a clean and satisfactory condition.

END OF SECTION