CONTRACT DOCUMENTS

AND

SPECIFICATIONS

FOR

PROJECT NO. RMUA ES 2020-11 & BAMA HC21020 HAIKEY CREEK WWTP BIOSOLIDS IMPROVEMENTS FAP 25-005-L | FAP 24-0002-L | FAP 24-0016L

ATTENDANCE AT PRE-BID CONFERENCE IS MANDATORY

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VOLUME II

SECTION 00 01 07
SEALS PAGE

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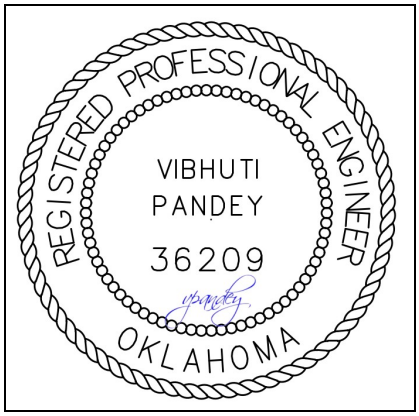
SPECIFICATIONS



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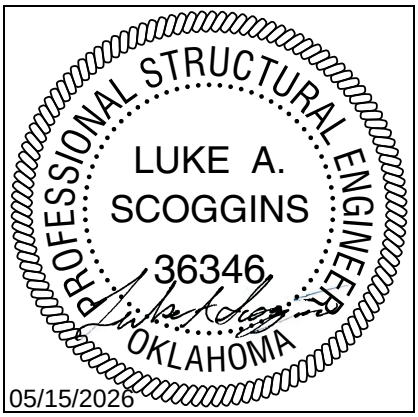

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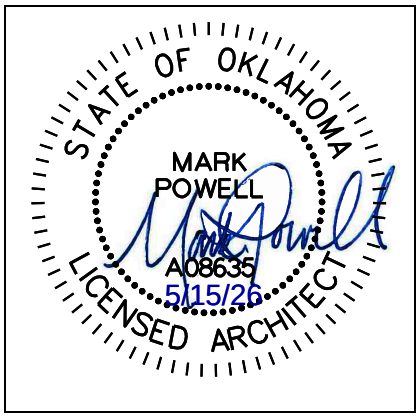

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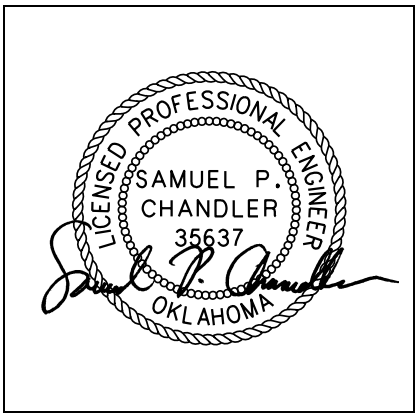

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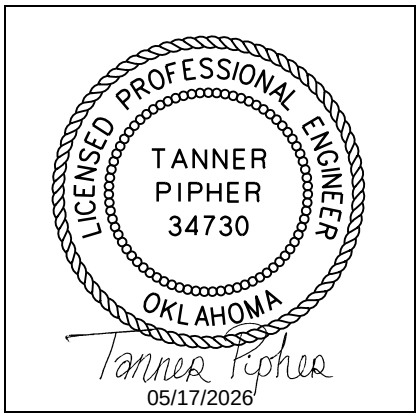

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END OF SECTION

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SECTION 01 11 00
SUMMARY OF WORK

PART 1 GENERAL

1.01 WORK COVERED BY CONTRACT DOCUMENTS

A. The completed Work will provide Owner with a new Composting Facility and related facilities at the HCWWTP that include but are not limited to:

1. Demolition of existing Belt Filter Presses and construction of new centrifuges and polymer system in the existing Dewatering Building.
2. Installation of a new Sludge Mixing Building.
3. Installation of a new sludge storage tank.
4. Demolition of an existing canopy structure, related concrete walls and slabs, and installation of a new Composting Building.
5. Installation of a new Composting Storage Building.
6. Installation of a new Composting Operations Building.
7. Various site improvements will also be completed and will include such items as earthwork, demolition, yard piping, roadway and asphalt, landscaping, site lighting, fencing and other activities.
8. All Work requires the Contractor to coordinate with the Owner to schedule their work to allow continued operations of the HCWWTP throughout construction.

B. Alternates: Only those alternates that were selected by the Owner, as evidenced in the Agreement, are made a part of this Contract.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

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SECTION 01 29 00
PAYMENT PROCEDURES

PART 1 GENERAL

1.01 SUBMITTALS

A. Informational Submittals:

1. Schedule of Values: Submit on Contractor's standard form.
2. Application for Payment.
3. Final Application for Payment.

1.02 SCHEDULE OF VALUES

A. Prepare a separate Schedule of Values for each schedule of the Work under the Agreement.

B. Upon request of Engineer, provide documentation to support the accuracy of the Schedule of Values.

C. Unit Price Work:

1. Reflect specified cash allowances and alternates, as applicable.
2. List bonds and insurance premiums, mobilization, demobilization, preliminary and detailed progress schedule preparation, equipment testing, facility startup, and contract closeout separately.
3. Break down by Division 02 through Division 49 with appropriate subdivision of each specification.

D. An unbalanced or front-end loaded schedule will not be acceptable.

E. Summation of the complete Schedule of Values representing all the Work shall equal the Contract Price.

F. Submit Schedule of Values on a CD in a spreadsheet format compatible with latest version of Excel.

1.03 APPLICATION FOR PAYMENT

A. Transmittal Summary Form: Attach one Summary Form with each detailed Application for Payment for each schedule and include Request for Payment of Materials and Equipment on Hand as applicable. Execute certification by authorized officer of Contractor.

B. Use detailed Application for Payment Form provided by Authority.

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C. Provide separate form for each schedule as applicable.

D. Include accepted Schedule of Values for each schedule or portion of lump sum Work and the unit price breakdown for the Work to be paid on a unit priced basis.

E. Include separate line item for each Change Order and Work Change Directive executed prior to date of submission. Provide further breakdown of such as requested by Engineer.

F. Preparation:

1. Round values to nearest dollar.
2. Submit Application for Payment, including a Transmittal Summary Form and detailed Application for Payment Form(s) for each schedule as applicable, a listing of materials on hand for each schedule as applicable, and such supporting data as may be requested by Engineer.

1.04 MEASUREMENT—GENERAL

A. Weighing, measuring, and metering devices used to measure quantity of materials for Work shall be suitable for purpose intended and conform to tolerances and specifications as specified in National Institute of Standards and Technology, Handbook 44.

B. Whenever pay quantities of material are determined by weight, weigh material on scales furnished by Contractor and certified accurate by state agency responsible. Obtain weight or load slip from weigher and deliver to Owner’s representative at point of delivery of material.

C. If material is shipped by rail, car weights will be accepted provided that actual weight of material only will be paid for and not minimum car weight used for assessing freight tariff, and provided further that car weights will not be acceptable for material to be passed through mixing plants.

D. Vehicles used to haul material being paid for by weight shall be weighed empty daily and at such additional times as required by Engineer. Each vehicle shall bear a plainly legible identification mark.

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E. Haul materials that are specified for measurement by the cubic yard measured in the vehicle in transport vehicles of such type and size that actual contents may be readily and accurately determined. Unless all vehicles are of uniform capacity, each vehicle must bear a plainly legible identification mark indicating its water level capacity. Load vehicles to at least their water level capacity. Loads hauled in vehicles not meeting above requirements or loads of a quantity less than the capacity of the vehicle, measured after being leveled off as above provided, will be subject to rejection, and no compensation will be allowed for such material.

F. Where measurement of quantities depends on elevation of existing ground, elevations obtained during construction will be compared with those shown on the Drawings. Variations of 1-foot or less will be ignored, and profiles shown on the Drawings will be used for determining quantities.

G. Units of measure shown on Bid Form shall be as follows, unless specified otherwise.

Item	Method of Measurement
AC	Acre—Field Measure by Engineer
CY	Cubic Yard—Field Measure by Engineer within limits specified or shown
CY-VM	Cubic Yard—Measured in Vehicle by Volume
EA	Each—Field Count by Engineer
GAL	Gallon—Field Measure by Engineer
HR	Hour
LB	Pound(s)—Weight Measure by Scale
LF	Linear Foot—Field Measure by Engineer
SF	Square Foot
SY	Square Yard
TON	Ton—Weight Measure by Scale (2,000 pounds)

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1.05 PAYMENT

A. General:

1. The following items shall be bid as shown on the Estimate of Quantities of the Bid Proposal. The description below summarizes the elements of the Work to be included in each item, but they are not intended to represent a complete list of the required Work for a completed job. Rather, the descriptions are intended to serve as guidelines for the proper distribution of the Bid price. Any items not specifically described but required by the Contract Documents shall be included in the appropriate items. The lump sum and appropriate unit price Bid items shall be broken down for the purpose of monthly progress payment as outlined below. Breakdown of the lump sum and unit quantity Bid items shall be provided by the apparent low Bidder within 48 hours after the Bid opening.
2. The Authority pays vendor invoices directly based upon written documentation submitted to and approved by the Authority.

B. Unit Price: Payment for unit price items covers all the labor, materials, and services necessary to finish and install the following items:

1. Mobilization:
   a. This item includes mobilization and demobilization. A maximum of 5 percent of the total base Bid is allowed in the Bid proposal for mobilization and shall be paid for on an each (EA) basis in the following manner:
      1) 50 percent on the first pay estimate.
      2) 35 percent on the pay estimate that shows 50 percent completion of the Work, not included allowances for stored materials.
      3) 15 percent on the final pay estimate.
2. Gravity Thickener Complete:
   a. This item includes all required Work associated with the Gravity Thickener including by not limited to:
      1) Demolition of Polymer Equipment.
      2) Demolition of Scum Piping and Line Cap.
      3) Demolition of Chlorine Solution and Pipe Cap at Source.
      4) Abandonment of Skimming Manhole.
      5) Service Water Cap at Source.
      6) Instrumentation and Controls.
      7) This item includes all Work required to make the Gravity Thickener operational. This item also includes all required Work as shown on the Drawings, Specifications, or required for the construction and not covered by another pay item.

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This item shall be paid for on a unit basis of each (EA) using a breakdown approved by the Engineer. Partial payments for this item shall be based on percentage of Work completed.

3. RAS_WAS Facility Complete:
   a. This item includes all required Work associated with the RAS WAS facility including by not limited to:
      1) Demolition.
      2) Equipment Pads.
      3) Pumps.
      4) Piping.
      5) Pipe Supports.
      6) HVAC Wall Penetration.
      7) Electrical.
      8) Instrumentation and Controls.
      9) This item includes all Work required to make the RAS WAS Facility operational. This item also includes all required Work as shown on the Drawings, Specifications, or required for the construction and not covered by another pay item. This item shall be paid for on a unit basis of each (EA) using a breakdown approved by the Engineer. Partial payments for this item shall be based on percentage of Work completed.
4. Rotary Drum Thickener (70-RDT1) Complete:
   a. This item includes all required Work associated with the Rotary Drum Thickener including by not limited to:
      1) Demolition.
      2) Piping.
      3) Pipe Supports.
      4) Connection to Existing Polymer Pipe.
      5) Wall Coring.
      6) This item includes all Work required to make the Rotary Drum Thickener operational. This item also includes all required Work as shown on the Drawings, Specifications, or required for the construction and not covered by another pay item. This item shall be paid for on a unit basis of each (EA) using a breakdown approved by the Engineer. Partial payments for this item shall be based on percentage of Work completed.
5. Sludge Mixing Building Complete (Excluding Blowers, and Pump and Mixing Assembly):
   a. This item includes all Work associated with the Sludge Mixing Building including but not limited to:
      1) Demolition.
      2) Excavation.

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3) Subgrade Preparation.
4) Concrete.
5) Pre-Engineered Metal Building.
6) Equipment Pads.
7) Piping.
8) Pipe Supports.
9) Electrical.
10) Grounding.
11) Instrumentation and Controls.
12) Drains.
13) This item includes all Work required to make the Sludge Mixing Building operational. This item also includes all required Work as shown on the Drawings, Specifications, or required for the construction and not covered by another pay item. This item shall be paid for on a unit basis of each (EA) using a breakdown approved by the Engineer. Partial payments for this item shall be based on percentage of Work completed.

6. Sludge Mixing Building, Blowers: This item includes all Work required to make the Blowers operational. This item also includes all required Work as shown on the Drawings, Specifications, or required for the construction and not covered by another pay item. This item shall be paid for on a unit basis of each (EA) basis per complete system.
7. Sludge Mixing Building, Pump and Mixing System: This item includes all Work required to make the Pump and Mixing system operational. This item also includes all required Work as shown on the Drawings, Specifications, or required for the construction and not covered by another pay item. This item shall be paid for on a unit basis of each (EA) basis per complete system.
8. Sludge Tank Sediment Removal (CY): This pay item includes the removal of all the sediment within the existing sludge holding tanks. The method of removal and disposal shall be in accordance with all the applicable regulations.
    1) Contractor shall survey the material to determine the depth, and Contractor, Engineer, and Owner shall agree on the depth of the material in the digester. Engineer will use depth provided by Contractor to determine the cubic yards (CY) of the material to be removed. Once Contractor and Owner agree on CY calculated by Engineer, that volume amount is used for payment.
    2) Base bid is approximately 400 CY of solid material removal per existing sludge holding tank.
    3) Contractor shall remove solid waste trash and haul to an approved landfill. Contractor shall coordinate directly with the landfill, properly transport, and dispose the trash at the

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landfill, and is responsible for all permits, transportation, and landfill expenses. Ultimate and final disposal is the responsibility of the Contractor.

4) In the event of improper disposal or accidental spillage, the Contractor shall immediately clean area affected to satisfaction of the Owner and all other authorities having jurisdiction.

9. Sludge Tanks Complete:
   a. This item includes all Work associated with the Sludge Tanks including but not limited to:
      1) Cleaning existing sludge tanks after sediment removal.
      2) Demolition, including existing metal stairs and elevated platform between tanks.
      3) Decommissioning East Sludge Tank.
      4) Earthwork.
      5) Subgrade Preparation.
      6) Concrete.
      7) Manways.
      8) Pumps.
      9) Piping.
      10) Pipe Supports.
      11) Coarse Bubble System.
      12) Instrumentation and Controls.
      13) This item includes all Work required to make the Sludge Tank operational. This item also includes all required Work as shown on the Drawings, Specifications, or required for the construction and not covered by another pay item. This item shall be paid for on a unit basis of each (EA) using a breakdown approved by the Engineer. Partial payments for this item shall be based on percentage of Work completed.
10. Dewatering Centrifuge Building Complete (Excluding Centrifuges and Conveyor System):
   a. This item includes all Work associated with the Dewatering Centrifuge Building including but not limited to:
      1) Demolition.
      2) Concrete.
      3) Pumps.
      4) Piping.
      5) Pipe Supports.
      6) Polymer system.
      7) Motor Control Centers.
      8) HVAC.
      9) Plumbing.
      10) This item includes all Work required to make the Dewatering Centrifuge Building operational. This item also

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includes all required Work as shown on the Drawings, Specifications, or required for the construction and not covered by another pay item. This item shall be paid for on a unit basis of each (EA) using a breakdown approved by the Engineer. Partial payments for this item shall be based on percentage of Work completed.

11. Dewatering Centrifuge Building Centrifuge No. 1 and No. 2: This item includes all Work required to make centrifuge No. 1 and centrifuge No. 2 operational. This item also includes all required Work as shown on the Drawings, Specifications, or required for the construction and not covered by another pay item. This item shall be paid for on a unit basis of each (EA) basis per complete system.
12. Dewatering Centrifuge Building Sludge Conveyor System: This item includes all Work required to make the sludge conveyor system operational. This item also includes all required Work as shown on the Drawings, Specifications, or required for the construction and not covered by another pay item. This item shall be paid for on a unit basis of each (EA) basis per complete system.
13. Existing Sludge Mixing Electrical Room Complete.
    a. This item includes all Work associated with the Existing Sludge Mixing Electrical Room including but not limited to:
        1) Demolition.
        2) Equipment Pads.
        3) Condensing Units.
        4) Variable Frequency Drives.
        5) Panel Boards.
        6) Transformer.
        7) Existing Motor Control Center Modifications.
        8) Refrigerant Piping.
        9) Drain Lines.
        10) Thermostats.
        11) All Electrical.
        12) Instrumentation and Controls.
        13) This item includes all Work required to make the Existing Sludge Mixing Electrical Room operational. This item also includes all required Work as shown on the Drawings, Specifications, or required for the construction and not covered by another pay item. This item shall be paid for on a unit basis of each (EA) using a breakdown approved by the Engineer. Partial payments for this item shall be based on percentage of Work completed.
14. Composting Building Complete.
    a. This item includes all Work associated with the Composting Building and Bulking Agent Storage including but not limited to:
        1) Demolition.

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2) Excavation.
3) Subgrade Preparation.
4) Concrete Structure.
5) Pre-Engineered Metal Building.
6) Electrical.
7) Instrumentation and Controls.
8) Lighting.
9) Exhaust Fans.
10) Mixing System.
11) Compost Conveyors.
12) Storage Conveyor.
13) Conveyor Supports.
14) Compost Fans.
15) Curing Fans.
16) Piping.
17) Pipe Supports.
18) This item includes all Work required to make the Composting Building and Bulking Agent Storage operational. This item also includes all required Work as shown on the Drawings, Specifications, or required for the construction and not covered by another pay item. This item shall be paid for on a unit basis of each (EA) using a breakdown approved by the Engineer. Partial payments for this item shall be based on percentage of Work completed.

15. Biofilter No. 1 Complete:
    a. This item includes all Work associated with Biofilter No. 1 including but not limited to:
        1) Demolition.
        2) Excavation.
        3) Subgrade Preparation.
        4) Concrete Structure.
        5) Piping.
        6) Pipe Supports.
        7) Fans.
        8) Bollards.
        9) Trench Drain.
        10) Instrumentation and Controls.
        11) This item includes all Work required to make Biofilter No. 1 operational. This item also includes all required Work as shown on the Drawings, Specifications, or required for the construction and not covered by another pay item. This item shall be paid for on a unit basis of each (EA) using a breakdown approved by the Engineer. Partial payments for this item shall be based on percentage of Work completed.

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16. Finished Composting Storage Building base bid Complete:
    a. This item includes all Work associated with the Finished Composting Storage Building Base Bid. See Drawing 95-C3CS-S-2000 for base bid layout. Pay item includes but is not limited to:
        1) Demolition.
        2) Excavation.
        3) Subgrade Preparation.
        4) Concrete Structure.
        5) Pre-Engineered Metal Building.
        6) Lighting.
        7) Instrumentation and Controls.
        8) This item includes all Work required to make the Finished Composting Storage Building operational. This item also includes all required Work as shown on the Drawings, Specifications, or required for the construction and not covered by another pay item. This item shall be paid for on a unit basis of each (EA) using a breakdown approved by the Engineer. Partial payments for this item shall be based on percentage of Work completed.
17. Composting Operations Building Complete:
    a. This item includes all Work associated with the Composting Operations Building including but not limited to:
        1) Demolition.
        2) Excavation.
        3) Subgrade Preparation.
        4) Underslab Piping.
        5) Foundation.
        6) Building Walls.
        7) Insulation.
        8) Building Roof.
        9) Prefabricated Metal Canopies.
        10) Doors.
        11) Windows.
        12) HVAC System.
        13) Plumbing.
        14) Electrical.
        15) Lighting.
        16) Grounding.
        17) Instrumentation and Controls.
        18) This item includes all Work required to make the Composting Operations Building operational. This item also includes all required Work as shown on the Drawings, Specifications, or required for the construction and not covered by another pay item. This item shall be paid for on

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a unit basis of each (EA) using a breakdown approved by the Engineer. Partial payments for this item shall be based on percentage of Work completed.

18. Packaged Sanitary Lift Station:
    a. This item includes all Work required to make the Packaged Sanitary Lift Station operational. This item also includes all required Work as shown on the Drawings, Specifications, or required for the construction and not covered by another pay item. This item shall be paid for on a unit basis of each (EA) basis per complete system.
19. Truck Wash and Fuel Station:
    a. This item includes all Work associated with the Truck Wash and Packaged Fuel Station including but not limited to:
        1) Excavation.
        2) Subgrade Preparation.
        3) Base Course.
        4) Concrete Slab.
        5) Trench Drain.
        6) Post Mounted Hose Rack.
        7) Equipment Pad.
        8) This item includes all Work required to make the Truck Wash and Packaged Fuel Station operational. This item also includes all required Work as shown on the Drawings, Specifications, or required for the construction and not covered by another pay item. This item shall be paid for on a unit basis of each (EA) using a breakdown approved by the Engineer. Partial payments for this item shall be based on percentage of Work completed.
    b. This item includes all Work required to make the Truck Wash and Fuel Station operational. This item also includes all required Work as shown on the Drawings, Specifications, or required for the construction and not covered by another pay item. This item shall be paid for on a unit basis of each (EA) basis per complete system.
20. Trommel Screen Unit: Furnish and deliver and install one Trommel Screen Unit. This item also includes all required Work as shown on the Drawings, Specifications, or required for the construction and not covered by another pay item. This item shall be paid for on a unit basis of each (EA) basis per complete system.
21. Portable Dolly-Mounted Hydrojetter Unit: Furnish and deliver one portable, gas powered, hydrojetter unit mounted on a heavy-duty, two-wheeled, or four-wheeled dolly/cart with flat-free tires for easy transport, suitable for cleaning 2 inches to 8 inches drain lines. Minimum specifications include: 3,000 pounds per square inch at 4 gpm or higher; commercial grade engine with electric start; mounted hose

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reel with 200 feet by 3/8 inches high-pressure jetting hose; pump sized for the application; and flushing nozzle accessory set. Acceptable manufacturers: (1) General JM-2900-B, (2) RIGID KJ-3100, or (3) approved equal. This item shall be paid for on a unit basis of each (EA) basis per complete system.

22. Demolition and Site Clearing: Provide all materials, labor, equipment and associated items necessary for demolition and site clearing. This item shall be paid for on a unit basis of each (EA) using a breakdown approved by the Engineer.
23. Erosion Control: Provide all materials, labor, equipment and associated items necessary to provide erosion control in accordance with the Contract Documents. This item shall be paid for on a unit basis of each (EA) using a breakdown approved by the Engineer.
24. Site Grading (Cut/Fill/Import/Export): Provide all materials, labor, equipment and associated items necessary for site grading including cut, fill, import and export. This item shall be paid for on a unit basis of each (EA) using a breakdown approved by the Engineer.
25. Geotextile: Provide all materials, labor, equipment and associated items to install new geotextile. This item shall be paid for on a square foot (SF) basis.
26. Roadway Basecourse: Provide all materials, labor, equipment and associated items to install new roadway base course. This item shall be paid for on a square foot (SF) basis.
27. Surfacing Course: Provide all materials, labor, equipment and associated items to install new surfacing course. This item shall be paid for on a square foot (SF) basis.
28. Asphalt Pavement: Provide all materials, labor, equipment and associated items to install new asphalt concrete paving. This item shall be paid for on a square foot (SF) basis.
29. Concrete Valley Gutter: Provide all materials, labor, equipment and associated items to install new concrete valley gutter. This item shall be paid for on a linear foot (LF) basis.
30. Striping: Provide all materials, labor, equipment and associated items to install new striping. This item shall be paid for on a unit basis of each (EA) using a breakdown approved by the Engineer.
31. Wheel Stops: Provide all materials, labor, equipment and associated items to install new striping. This item shall be paid for on a unit basis of each (EA).
32. Signage: Provide all materials, labor, equipment and associated items to install new signage. This item shall be paid for on a unit basis of each (EA) using a breakdown approved by the Engineer.
33. Asphalt Pavement Patches: Provide all materials, labor, equipment and associated items to install new asphalt pavement patches. This item shall be paid for on a square foot (SF) basis.

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34. Concrete Pavement: Provide all materials, labor, equipment and associated items to install new concrete pavement. This item shall be paid for on a square foot (SF) basis.
35. Sidewalks: Provide all materials, labor, equipment and associated items to install new sidewalks. This item shall be paid for on a square foot (SF) basis.
36. Curb: Provide all materials, labor, equipment and associated items to install new curb. This item shall be paid for on a linear foot (LF) basis.
37. Site Equipment Pads: Provide all materials, labor, equipment and associated items to install new site equipment pads. This item shall be paid for on a square foot (SF) basis.
38. Fencing and Gates: Provide all materials, labor, equipment and associated items to install new fencing and gates. This item shall be paid for on a linear foot (LF) basis.
39. Remove Existing Paint and Recoat Bollards Safety Yellow: Provide all materials, labor, equipment and associated items to remove existing paint and recoat bollards safety yellow. This item shall be paid for on a unit basis of each (EA).
40. Site Guard Posts: Provide all materials, labor, equipment and associated items to install new site guard posts. This item shall be paid for on a unit basis of each (EA).
41. Seeding: Provide all materials, labor, equipment and associated items to install new seeding including watering and maintenance. This item shall be paid for on a square foot (SF) basis.
42. 6-Inch HDPE Centrate, Buried with Fittings: Provide all materials, labor, equipment and associated items necessary to install 6-inch centrate including excavation, pipe, connections, backfill and compaction, and all other items for a complete system. Separate payment shall be made for surface restoration including seeding, asphalt pavement and gravel surfacing. This item shall be paid for on a linear foot (LF) basis.
43. 2-Inch PVC W1/W2, Buried with Fittings: Provide all materials, labor, equipment and associated items necessary to install 2-inch W1/W2 including excavation, pipe, connections, backfill and compaction, and all other items for a complete system. Separate payment shall be made for surface restoration including seeding, asphalt pavement and gravel surfacing. This item shall be paid for on a linear foot (LF) basis.
44. 2-1/2 Inch PVC W1, Buried with Fittings: Provide all materials, labor, equipment and associated items necessary to install 2-1/2 inch W1 including excavation, pipe, connections, backfill and compaction, and all other items for a complete system. Separate payment shall be made for surface restoration including seeding, asphalt pavement and gravel surfacing. This item shall be paid for on a linear foot (LF) basis.
45. 4-Inch PVC W1/W2, Buried with Fittings: Provide all materials, labor, equipment and associated items necessary to install 4-inch W1/W2

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including excavation, pipe, connections, backfill and compaction, and all other items for a complete system. Separate payment shall be made for surface restoration including seeding, asphalt pavement and gravel surfacing. This item shall be paid for on a linear foot (LF) basis.

46. 6-Inch PVC W1, Buried with Fittings: Provide all materials, labor, equipment and associated items necessary to install 6-inch W1 including excavation, pipe, connections, backfill and compaction, and all other items for a complete system. Separate payment shall be made for surface restoration including seeding, asphalt pavement and gravel surfacing. This item shall be paid for on a linear foot (LF) basis.
47. 10-Inch PVC W1, Buried with Fittings: Provide all materials, labor, equipment and associated items necessary to install 10-inch W1 including excavation, pipe, connections, backfill and compaction, and all other items for a complete system. Separate payment shall be made for surface restoration including seeding, asphalt pavement and gravel surfacing. This item shall be paid for on a linear foot (LF) basis.
48. 6-Inch HDPE TWAS, Buried with Fittings: Provide all materials, labor, equipment and associated items necessary to install 6-inch HDPE TWAS including excavation, pipe, connections, backfill and compaction, and all other items for a complete system. Separate payment shall be made for surface restoration including seeding, asphalt pavement and gravel surfacing. This item shall be paid for on a linear foot (LF) basis.
49. 8-Inch HDPE TWAS, Buried with Fittings: Provide all materials, labor, equipment and associated items necessary to install 8-inch HDPE TWAS including excavation, pipe, connections, backfill and compaction, and all other items for a complete system. Separate payment shall be made for surface restoration including seeding, asphalt pavement and gravel surfacing. This item shall be paid for on a linear foot (LF) basis.
50. 4-Inch HDPE SSC, Buried with Fittings: Provide all materials, labor, equipment and associated items necessary to install 4-inch HDPE SSC including excavation, pipe, connections, backfill and compaction, and all other items for a complete system. Separate payment shall be made for surface restoration including seeding, asphalt pavement and gravel surfacing. This item shall be paid for on a linear foot (LF) basis.
51. 6-Inch HDPE WAS (Left and Right), Buried with Fittings: Provide all materials, labor, equipment and associated items necessary to install 6-inch HDPE WAS (Left and Right) including excavation, pipe, connections, spacers, CLSM, backfill and compaction, and all other items for a complete system. Separate payment shall be made for surface restoration including seeding, asphalt pavement and gravel surfacing. This item shall be paid for on a linear foot (LF) basis.
52. 12-Inch PVC PD, Buried with Fittings: Provide all materials, labor, equipment and associated items necessary to install 12-inch PVC PD

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including excavation, pipe, connections, backfill and compaction, and all other items for a complete system. Separate payment shall be made for surface restoration including seeding, asphalt pavement and gravel surfacing. This item shall be paid for on a linear foot (LF) basis.

53. 8-Inch PVC PD, Buried with Fittings: Provide all materials, labor, equipment and associated items necessary to install 8-inch PVC PD including excavation, pipe, connections, backfill and compaction, and all other items for a complete system. Separate payment shall be made for surface restoration including seeding, asphalt pavement and gravel surfacing. This item shall be paid for on a linear foot (LF) basis
54. 4-Inch PVC PD, Buried with Fittings: Provide all materials, labor, equipment and associated items necessary to install 4-inch PVC PD including excavation, pipe, connections, backfill and compaction, and all other items for a complete system. Separate payment shall be made for surface restoration including seeding, asphalt pavement and gravel surfacing. This item shall be paid for on a linear foot (LF) basis.
55. 3-Inch PVC SPD, Buried with Fittings: Provide all materials, labor, equipment and associated items necessary to install 3-inch PVC SPD including excavation, pipe, connections, backfill and compaction, and all other items for a complete system. Separate payment shall be made for surface restoration including seeding, asphalt pavement and gravel surfacing. This item shall be paid for on a linear foot (LF) basis.
56. 10-Inch ALP, Buried with Fittings: Provide all materials, labor, equipment and associated items necessary to install 10-inch ALP. including excavation, pipe, connections, backfill and compaction, and all other items for a complete system. Separate payment shall be made for surface restoration including seeding, asphalt pavement and gravel surfacing. This item shall be paid for on a linear foot (LF) basis.
57. Demolish 6-Inch to 10-Inch Ductile Iron Sludge/Drain: Provide all materials, labor, equipment and associated items necessary for demolition of 6-inch to 10-inch Ductile Iron Sludge/Drain. Separate payment shall be made for surface restoration including seeding, asphalt pavement and gravel surfacing. This item shall be paid for on a linear foot (LF) basis.
58. Abandon 6-Inch PVC Sludge: Provide all materials, labor, equipment and associated items necessary for abandonment of 6-inch PVC Sludge. Separate payment shall be made for surface restoration including seeding, asphalt pavement and gravel surfacing. This item shall be paid for on a linear foot (LF) basis.
59. Abandon 36-Inch Ductile Iron Influent: Provide all materials, labor, equipment and associated items necessary for abandonment of 36-inch Ductile Iron Influent. Separate payment shall be made for surface restoration including seeding, asphalt pavement and gravel surfacing. This item shall be paid for on a linear foot (LF) basis.

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60. Abandon 48-Inch Ductile Iron Influent: Provide all materials, labor, equipment and associated items necessary for abandonment of 48-inch Ductile Iron Influent. Separate payment shall be made for surface restoration including seeding, asphalt pavement and gravel surfacing. This item shall be paid for on a linear foot (LF) basis.
61. Abandon 12-Inch Ductile Iron Filtrate: Provide all materials, labor, equipment and associated items necessary for abandonment of 12-inch Ductile Iron Filtrate. Separate payment shall be made for surface restoration including seeding, asphalt pavement and gravel surfacing. This item shall be paid for on a linear foot (LF) basis.
62. Abandon 24-Inch Ductile Iron Overflow: Provide all materials, labor, equipment and associated items necessary for abandonment of 24-inch Ductile Iron Overflow. Separate payment shall be made for surface restoration including seeding, asphalt pavement and gravel surfacing. This item shall be paid for on a linear foot (LF) basis.
63. Abandon 24-Inch Ductile Iron Mixed Liquor: Provide all materials, labor, equipment and associated items necessary for abandonment of 24-inch Ductile Mixed Liquor. Separate payment shall be made for surface restoration including seeding, asphalt pavement and gravel surfacing. This item shall be paid for on a linear foot (LF) basis.
64. Abandon 24-Inch Ductile Iron Overflow: Provide all materials, labor, equipment and associated items necessary for abandonment of 24-inch Ductile Iron Overflow. Separate payment shall be made for surface restoration including seeding, asphalt pavement and gravel surfacing. This item shall be paid for on a linear foot (LF) basis.
65. Abandon 24-Inch Ductile Iron Overflow: Provide all materials, labor, equipment and associated items necessary for abandonment of 24-inch Ductile Iron Overflow. Separate payment shall be made for surface restoration including seeding, asphalt pavement and gravel surfacing. This item shall be paid for on a linear foot (LF) basis.
66. Abandon 4-Inch Ductile Iron Scum: Provide all materials, labor, equipment and associated items necessary for abandonment of 4-inch Ductile Iron Scum. Separate payment shall be made for surface restoration including seeding, asphalt pavement and gravel surfacing. This item shall be paid for on a linear foot (LF) basis.
67. Catch Basins: Provide all materials, labor, equipment and associated items necessary to install catch basins including excavation, connections, backfill and compaction, and all other items for a complete system. Separate payment shall be made for surface restoration including seeding, asphalt pavement and gravel surfacing. This item shall be paid for on an individual/each (EA) basis.
68. Sanitary Sewer Manhole: Provide all materials, labor, equipment and associated items necessary to install sanitary sewer manholes including excavation, connections, backfill and compaction, and all other items for a complete system. Separate payment shall be made for surface

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restoration including seeding, asphalt pavement and gravel surfacing. This item shall be paid for on an individual/each (EA) basis.

69. 4-inch Backflow Preventer: Provide all materials, labor, equipment and associated items necessary to install backflow preventer including excavation, connections, backfill and compaction, and all other items for a complete system. Separate payment shall be made for surface restoration including seeding, asphalt pavement and gravel surfacing. This item shall be paid for on an individual/each (EA) basis.
70. 10-inch Meter: Provide all materials, labor, equipment and associated items necessary to install meter including excavation, connections, backfill and compaction, and all other items for a complete system. Separate payment shall be made for surface restoration including seeding, asphalt pavement and gravel surfacing. This item shall be paid for on an individual/each (EA) basis.
71. 4-inch Gate Valves: Provide all materials, labor, equipment and associated items necessary to install gate valves including excavation, connections, backfill and compaction, and all other items for a complete system. Separate payment shall be made for surface restoration including seeding, asphalt pavement and gravel surfacing. This item shall be paid for on an individual/each (EA) basis.
72. Precast Vault, RDT Bypass: Provide all materials, labor, equipment and associated items necessary to install the Precast Vault, RDT Bypass including excavation, connections, backfill and compaction, and all other items for a complete system. Separate payment shall be made for surface restoration including seeding, asphalt pavement and gravel surfacing. This item shall be paid for on an individual/each (EA) basis.
73. Electrical Ductbank 1: Provide all materials, labor, equipment and associated items necessary to install electrical conduits, encased in concrete, including excavation, backfill and all materials required for a complete system. The item shall be paid for on a linear foot (LF) basis.
74. Electrical Ductbank 2: Provide all materials, labor, equipment and associated items necessary to install electrical conduits, encased in concrete, including excavation, backfill and all materials required for a complete system. The item shall be paid for on a linear foot (LF) basis.
75. Electrical Ductbank 3: Provide all materials, labor, equipment and associated items necessary to install electrical conduits, encased in concrete, including excavation, backfill and all materials required for a complete system. The item shall be paid for on a linear foot (LF) basis.
76. Electrical Ductbank 4: Provide all materials, labor, equipment and associated items necessary to install electrical conduits, encased in concrete, including excavation, backfill and all materials required for a complete system. The item shall be paid for on a linear foot (LF) basis.
77. Electrical Ductbank 5: Provide all materials, labor, equipment and associated items necessary to install electrical conduits, encased in

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concrete, including excavation, backfill and all materials required for a complete system. The item shall be paid for on a linear foot (LF) basis.

78. Electrical Ductbank 6: Provide all materials, labor, equipment and associated items necessary to install electrical conduits, encased in concrete, including excavation, backfill and all materials required for a complete system. The item shall be paid for on a linear foot (LF) basis.
79. Electrical Ductbank 7: Provide all materials, labor, equipment and associated items necessary to install electrical conduits, encased in concrete, including excavation, backfill and all materials required for a complete system. The item shall be paid for on a linear foot (LF) basis.
80. Electrical Ductbank 8: Provide all materials, labor, equipment and associated items necessary to install electrical conduits, encased in concrete, including excavation, backfill and all materials required for a complete system. The item shall be paid for on a linear foot (LF) basis.
81. Electrical Ductbank 9: Provide all materials, labor, equipment and associated items necessary to install electrical conduits, encased in concrete, including excavation, backfill and all materials required for a complete system. The item shall be paid for on a linear foot (LF) basis.
82. Electrical Ductbank 10: Provide all materials, labor, equipment and associated items necessary to install electrical conduits, encased in concrete, including excavation, backfill and all materials required for a complete system. The item shall be paid for on a linear foot (LF) basis.
83. Electrical Ductbank 11A: Provide all materials, labor, equipment and associated items necessary to install electrical in existing conduits, including excavation, backfill and all materials required for a complete system. The item shall be paid for on a linear foot (LF) basis.
84. Electrical Ductbank 11B: Provide all materials, labor, equipment and associated items necessary to install electrical conduits, encased in concrete, including excavation, backfill and all materials required for a complete system. The item shall be paid for on a linear foot (LF) basis.
85. Electrical Ductbank 12: Provide all materials, labor, equipment and associated items necessary to install electrical conduits, encased in concrete, including excavation, backfill and all materials required for a complete system. The item shall be paid for on a linear foot (LF) basis.
86. Electrical Ductbank 13: Provide all materials, labor, equipment and associated items necessary to install electrical conduits, encased in concrete, including excavation, backfill and all materials required for a complete system. The item shall be paid for on a linear foot (LF) basis.
87. Electrical Ductbank 14: Provide all materials, labor, equipment and associated items necessary to install electrical conduits, encased in concrete, including excavation, backfill and all materials required for a complete system. The item shall be paid for on a linear foot (LF) basis.
88. Electrical Ductbank 15: Provide all materials, labor, equipment and associated items necessary to install electrical conduits, encased in

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concrete, including excavation, backfill and all materials required for a complete system. The item shall be paid for on a linear foot (LF) basis.

89. Electrical Ductbank 16: Provide all materials, labor, equipment and associated items necessary to install electrical conduits, encased in concrete, including excavation, backfill and all materials required for a complete system. The item shall be paid for on a linear foot (LF) basis.
90. Electrical Ductbank 17: Provide all materials, labor, equipment and associated items necessary to install electrical conduits, encased in concrete, including excavation, backfill and all materials required for a complete system. The item shall be paid for on a linear foot (LF) basis.
91. Electrical Ductbank 18: Provide all materials, labor, equipment and associated items necessary to install electrical conduits, encased in concrete, including excavation, backfill and all materials required for a complete system. The item shall be paid for on a linear foot (LF) basis.
92. Electrical Ductbank 19: Provide all materials, labor, equipment and associated items necessary to install electrical conduits, encased in concrete, including excavation, backfill and all materials required for a complete system. The item shall be paid for on a linear foot (LF) basis.
93. Electrical Ductbank 20: Provide all materials, labor, equipment and associated items necessary to install electrical conduits, encased in concrete, including excavation, backfill and all materials required for a complete system. The item shall be paid for on a linear foot (LF) basis.
94. Electrical Manhole: Provide all materials, labor, equipment and associated items necessary to install electrical manhole including excavation, connections, backfill and compaction, and all other items for a complete system. Separate payment shall be made for surface restoration including seeding, asphalt pavement and gravel surfacing. This item shall be paid for on an individual/each (EA) basis.
95. Electrical Handhole: Provide all materials, labor, equipment and associated items necessary to install Electrical Handhole including excavation, connections, backfill and compaction, and all other items for a complete system. Separate payment shall be made for surface restoration including seeding, asphalt pavement and gravel surfacing. This items shall be paid for on an individual/each (EA) basis.
96. Fiber Optic Ductbank: Provide all materials, labor, equipment and associated items necessary to install fiber optic ductbank, including excavation, backfill and all materials required for a complete system. The item shall be paid for on a linear foot (LF) basis.
97. Pad Mounted Switch: Provide all materials, labor, equipment and associated items to install new Pad Mounted Switch. This item shall be paid for on a unit basis of each (EA).
98. Pad Mounted Transformer: Provide all materials, labor, equipment and associated items to install new Pad Mounted Transformer. This item shall be paid for on a unit basis of each (EA).

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99. Luminaire and Pole: Provide all materials, labor, equipment and associated items to install new Luminaire and Pole. This item shall be paid for on a unit basis of each (EA).
100. Owners Allowance (MEP):
    a. Allowance for various Work not identified in the Contract Documents:
        1) Allowance 1,000,000 dollars.
        2) The allowance shall be used only at the discretion of the Owner. Any allowance balance remaining at the completion of the Project will be credited back to the Owner on the final Application for Payment submitted by the Contractor.
101. Construction As-Built: This pay item includes all Work necessary for the completion of the Construction As-Builts and provided to the Engineers as required by the Contract Documents and shall include an as-built survey, including location and elevations of equipment and structures. This item shall be paid for on a (EA) basis.

C. Allowances: An Owner's Allowance has been provided in the Contract for various civil, mechanical, electrical and plumbing and general construction work. The allowance shall be used only at the discretion of the RMUA. Any allowance balance remaining at the completion of the Project will be credited back to the Authority on the final Application for Payment submitted by the Contractor. Contractor shall proceed with the Work included in the allowance only after receiving a written order from the Authority's Representative authorizing such work. Proceeding with Work in the allowance without a written order from the Authority's Representative will be at the Contractor's cost. The allowance shall be used for the cost of materials, labor, installation, and overhead and profit in accordance with GC-26, for additional Work that tis not identified in Construction Documents/Plan, and not included in the Base Bid sum.

1. Owner's Allowance: Allowance for various mechanical /electrical / plumbing or general construction Work not included in the Contract Documents.
    a. Allowance 1,000,000 dollars.

D. Alternates:

1. Alternate 01:
    a. Dewatering Centrifuge Building Centrifuge No. 3: This item includes all Work required to make centrifuge No. 3 operational. This item also includes all required Work as shown on the Drawings, Specifications, or required for the construction and not covered by another pay item. This item shall be paid for on a unit basis of each (EA) basis per complete system.

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2. Alternate 02:
    a. Front End Loaders: Furnish and deliver two Front End Loaders. This item shall be paid for on a unit basis of each (EA) basis per complete system.
3. Alternate 03:
    a. This item includes all required Work associated with Scum Collection including by not limited to:
        1) Demolition.
        2) Excavation.
        3) Subgrade Preparation.
        4) Wetwell.
        5) Pumps.
        6) Piping.
        7) Pipe Supports.
        8) Instrumentation and Controls.
    b. This item includes all Work required to make the Scum Collection operational. This item also includes all required Work as shown on the Drawings, Specifications, or required for the construction and not covered by another pay item. This item shall be paid for on a unit basis of each (EA) using a breakdown approved by the Engineer. Partial payments for this item shall be based on percentage of Work.
4. Alternate 04:
    a. Finished Composting Storage Building Alternate Complete:
        1) This item includes all Work associated with the Finished Composting Storage Building Alternate to add two additional bays to the Base Bid (Pay Item No. 17). See Drawing 95-C3CS-S-2010. Pay item includes but is not limited to:
            a) Demolition.
            b) Excavation.
            c) Subgrade Preparation.
            d) Concrete Structure.
            e) Pre-Engineered Metal Building.
            f) Lighting.
            g) This item includes all Work required to make the Finished Composting Storage Building operational. This item also includes all required Work as shown on the Drawings, Specifications, or required for the construction and not covered by another pay item. This item shall be paid for on a unit basis of each (EA) using a breakdown approved by the Engineer. Partial payments for this item shall be based on percentage of Work completed.

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1.06 NONPAYMENT FOR REJECTED OR UNUSED PRODUCTS

A. Payment will not be made for following:

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

1.07 PARTIAL PAYMENT FOR STORED MATERIALS AND EQUIPMENT

A. Partial Payment: No partial payments will be made for materials and equipment delivered or stored unless Shop Drawings and preliminary operation and maintenance data is acceptable to Engineer.

B. Final Payment: Will be made only for products incorporated in Work; remaining products, for which partial payments have been made, shall revert to Contractor unless otherwise agreed, and partial payments made for those items will be deducted from final payment.

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

A. Notwithstanding above provisions, partial payments for undelivered (not yet delivered to Site or not stored in the vicinity of Site) products specifically manufactured for this Project, excluding off the shelf or catalog items, will be made for products listed below when all following conditions exist:

1. Partial payment request is supported by written acknowledgment from Suppliers that invoice requirements have been met.
2. Equipment is adequately insured, maintained, stored, and protected by appropriate security measures.
3. Each equipment item is clearly marked and segregated from other items to permit inventory and accountability.
4. Authorization has been provided for access to storage Site for Engineer and Owner.
5. Equipment meets applicable specifications of these Contract Documents.

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B. Payment of 15 percent of manufacturer's quoted price for undelivered, Project-specific manufactured equipment will be made following Shop Drawing approval. Thereafter, monthly payments will be made based on progress of fabrication as determined by Engineer, but in no case will total of payments prior to delivery exceed 75 percent of manufacturer's quoted price.

C. Failure of Contractor to continue compliance with above requirements shall give cause for Owner to withhold payments made for such equipment from future partial payments.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

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SECTION 01 31 13
PROJECT COORDINATION

PART 1 GENERAL

1.01 SUBMITTALS

A. Informational:

1. Statement of Qualification (SOQ) for land surveyor or civil engineer.
2. Photographs:
   a. Digital Images: Submit on compact disk each monthly progress meeting. Each image is to have a minimum file size of 1.4 Mb (1,400 Kb) so viewed resolution is high quality. The production of larger file sizes with higher resolution is encouraged.
3. Video Recordings: Submit one copy, including updated copy of project video log, within 5 days of being taken.

1.02 UTILITY NOTIFICATION AND COORDINATION

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

B. Coordinate with facility staff for any additional utility information and location.

1.03 PROJECT MILESTONES

A. General: Include the Milestones specified herein as a part of the Progress Schedule required under Section 01 32 00, Construction Progress Documentation.

B. Project Milestones:

1. Generally described in the Agreement Form. Following is a detailed description of each:
   a. Completion of Screw Pumps and RAS.
   b. Completion of WAS Pumps and Rotary Drum Thickener.
   c. Completion of Dewatering Centrifuge Building.
   d. Completion of Sludge Mixing Building.
   e. Completion of Sludge Tanks.
   f. Completion of Sludge Mixing Electrical Building.
   g. Completion of Composting Operations Building.
   h. Completion of Composting Building.

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i. Completion of Biofilter.
j. Completion of Finished Composting Storage Building.

1.04 FACILITY OPERATIONS

A. Continuous operation of Owner's facilities is of critical importance. Schedule and conduct activities to enable existing facilities to operate continuously, unless otherwise specified.

B. Perform Work continuously during critical connections and changeovers, and as required to prevent interruption of Owner's operations.

C. When necessary, plan, design, and provide various temporary services, utilities, connections, temporary piping and heating, access, and similar items to maintain continuous operations of Owner's facility.

D. Do not close lines, open or close valves, or take other action which would affect the operation of existing systems, except as specifically required by the Contract Documents and after authorization by Owner and Engineer. Such authorization will be considered within 48 hours after receipt of Contractor's written request.

E. Construct Work in the following stages to allow for Owner's continuous occupancy and for uninterrupted operation during construction.

1. Prior to Process or Facility shutdowns, the Work shown in the Contract Documents shall be complete except tie-ins to the plant as noted below. All facilities shall have been leak tested, controls shall have been field tested, facilities shall be functional and have been operated on clean water, and all facilities shall be ready to receive waste water, except for tie-in to the existing facilities as noted below.

F. Process or Facility Shutdown:

1. Provide 21 days advance written request for approval of need to shut down a process or facility to Owner and Engineer.
2. Power outages will be considered upon 48 hours written request to Owner and Engineer. Describe the reason, anticipated length of time, and areas affected by the outage. Provide temporary provisions for continuous power supply to critical facility components.

G. Install and maintain bypass facilities and temporary connections required to keep Owner's operations online. Sequences other than those specified will be considered upon written request to Owner and Engineer, provided they afford equivalent continuity of operations. The contractor shall avoid raw sewage bypasses by maintaining continuous conveyance using temporary bypass

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pumping, isolating work zones, following specified construction sequencing, providing redundant capacity, and using storage or equalization to handle peak flows.

H. Do not proceed with Work affecting a facility's operation without obtaining Owner's and Engineer's advance approval of the need for and duration of such Work.

I. Relocation of Existing Facilities:

1. During construction, it is expected that minor relocations of Work will be necessary.
2. Provide complete relocation of existing structures and Underground Facilities, including piping, utilities, equipment, structures, electrical conduit wiring, electrical duct bank, and other necessary items.
3. Use only new materials for relocated facility. Match materials of existing facility, unless otherwise shown or specified.
4. Perform relocations to minimize downtime of existing facilities.
5. Install new portions of existing facilities in their relocated position prior to removal of existing facilities, unless otherwise accepted by Engineer.

1.05 ADJACENT FACILITIES AND PROPERTIES

A. Examination:

1. After Effective Date of the Agreement and before Work at Site is started, Contractor, Engineer, and affected property owners and utility owners shall make a thorough examination of pre-existing conditions including existing buildings, structures, and other improvements in vicinity of Work, as applicable, which could be damaged by construction operations.
2. Periodic reexamination shall be jointly performed to include, but not limited to, cracks in structures, settlement, leakage, and similar conditions.

B. Documentation:

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

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1.06 CONSTRUCTION PHOTOGRAPHS

A. General:

1. Photographically document all phases of the Project including preconstruction, construction progress, and post-construction.
2. Engineer shall have right to select subject matter and vantage point from which photographs are to be taken.

B. Preconstruction and Post-Construction:

1. After Effective Date of the Agreement and before Work at Site is started, and again upon issuance of Substantial Completion, take a minimum of 100 photographs of Site and property adjacent to perimeter of Site.
2. Particular emphasis shall be directed to structures both inside and outside the Site.
3. Format: Digital, minimum resolution of 1,680 by 2,240 pixels and 24-bit, millions of color.

C. Construction Progress Photos:

1. Photographically demonstrate progress of construction, showing every aspect of Site and adjacent properties as well as interior and exterior of new or impacted structures.
2. Weekly: Take 50 photographs using digital, minimum resolution of 1,832 by 3,264 pixels and 24-bit, millions of color.
3. Photos shall be named by date (year-month-day) and brief location description.

D. Documentation:

1. Digital Images:
   a. Electronic image shall have date taken embedded into image.
   b. Archive using a commercially available photo management system that provides listing of photographs including date, keyword description, and direction of photograph.
   c. Label each disk with Project and Owner’s name, and month and year images were produced.

1.07 AUDIO-VIDEO RECORDINGS

A. Prior to beginning the Work on Site or of a particular area of the Work, and again within 10 days following date of Substantial Completion, videograph Site and property adjacent to Site.

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B. In the case of preconstruction recording, no work shall begin in the area prior to Engineer's review and approval of content and quality of video for that area.

C. Particular emphasis shall be directed to physical condition of existing vegetation, structures, and pavements.

D. Engineer shall have right to select subject matter and vantage point from which videos are to be taken.

E. Video Format and Quality:

1. DVD format, with sound.
2. Video:
   a. Produce bright, sharp, and clear images with accurate colors, free of distortion and other forms of picture imperfections.
   b. Electronically, and accurately display the month, day, year, and time of day of the recording.
3. Audio:
   a. Audio documentation shall be done clearly, precisely, and at a moderate pace.
   b. Indicate date, project name, and a brief description of the location of recording, including:
      1) Facility name.
      2) Street names or easements.
      3) Addresses of private property.
      4) Direction of coverage, including engineering stationing, if applicable.

F. Documentation:

1. DVD Label:
   a. DVD number (numbered sequentially, beginning with 001).
   b. Project name.
   c. Date and time of coverage.
2. Project Video Log: Maintain an ongoing log that incorporates above noted label information for DVDs on Project.

1.08 REFERENCE POINTS AND SURVEYS

A. Location and elevation of bench marks are shown on the Drawings.

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B. Contractor's Responsibilities:

1. Provide additional survey and layout required to layout the Work.
2. Notify Engineer at least 3 working days in advance of time when grade and line to be provided by Owner will be needed.
3. Check and establish exact location of existing facilities prior to construction of new facilities and any connections thereto.
4. In event of discrepancy in data or staking provided by Owner, request clarification before proceeding with Work.
5. Retain professional land surveyor or civil engineer registered in state of Project who shall perform or supervise engineering surveying necessary for additional construction staking and layout.
6. Maintain complete accurate log of survey work as it progresses as a Record Document.
7. On request of Engineer, submit documentation.
8. Provide competent employee(s), tools, stakes, and other equipment and materials as Engineer may require to:
    a. Establish control points, lines, and easement boundaries.
    b. Check layout, survey, and measurement work performed by others.
    c. Measure quantities for payment purposes.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 SALVAGE OF MATERIALS

A. Salvage materials for use where shown.

1. Remove material with extreme care so as not to damage for future use.

B. Meet with Engineer and Owner prior to starting to dismantle equipment or piping designated to be salvaged. Engineer will indicate locations where equipment is to be disconnected.

C. Provide new or repair damaged equipment or material specified or indicated to be salvaged. Clean and protect equipment from dust, dirt, natural elements, and store as directed.

3.02 CUTTING, FITTING, AND PATCHING

A. Cut, fit, adjust, or patch Work and work of others, including excavation and backfill as required, to make Work complete.

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B. Obtain prior written authorization of Engineer before commencing Work to cut or otherwise alter:

1. Structural or reinforcing steel, structural column or beam, elevated slab, trusses, or other structural member.
2. Weather-resistant or moisture-resistant elements.
3. Efficiency, maintenance, or safety of element.
4. Work of others.

C. Refinish surfaces to provide an even finish.

1. Refinish continuous surfaces to nearest intersection.
2. Refinish entire assemblies.
3. Finish restored surfaces to such planes, shapes, and textures that no transition between existing work and the Work is evident in finished surfaces.

D. Restore existing work, Underground Facilities, and surfaces that are to remain in completed Work including concrete-embedded piping, conduit, and other utilities as specified and as shown on the Drawings.

E. Make restorations with new materials and appropriate methods as specified for new Work of similar nature; if not specified, use recommended practice of manufacturer or appropriate trade association.

F. Fit Work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces and fill voids.

G. Remove specimens of installed Work for testing when requested by Engineer.

END OF SECTION

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SECTION 01 31 19
PROJECT MEETINGS

PART 1 GENERAL

1.01 GENERAL

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

1.02 PRECONSTRUCTION CONFERENCE

A. Contractor shall be prepared to discuss the following subjects, as a minimum:

1. Required schedules.
2. Status of Bonds and insurance.
3. Sequencing of critical path work items.
4. Progress payment procedures.
5. Project changes and clarification procedures.
6. Use of Site, access, office and storage areas, security and temporary facilities.
7. Major product delivery and priorities.
8. Contractor’s safety plan and representative.

B. Attendees will include:

1. Owner’s representatives.
2. Contractor’s office representative.
3. Contractor’s resident superintendent.
4. Contractor’s quality control representative.
5. Subcontractors’ representatives whom Contractor may desire or Engineer may request to attend.
6. Engineer’s representatives.
7. Others as appropriate.

1.03 PRELIMINARY SCHEDULES REVIEW MEETING

A. As set forth in General Conditions and Section 01 32 00, Construction Progress Documentation.

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1.04 PROGRESS MEETINGS

A. Engineer will schedule regular progress meetings at Site, conducted monthly to review the Work progress, Progress Schedule, Schedule of Submittals, Application for Payment, contract modifications, and other matters needing discussion and resolution.

B. Attendees will include:

1. Owner’s representative(s), as appropriate.
2. Contractor, Subcontractors, and Suppliers, as appropriate.
3. Engineer’s representative(s).
4. Others as appropriate.

1.05 QUALITY CONTROL MEETINGS

A. Scheduled by Engineer on regular basis and as necessary to review test and inspection reports, and other matters relating to quality control of the Work and work of other Contractors.

B. Attendees will include:

1. Contractor.
2. Contractor’s designated quality control representative.
3. Subcontractors and Suppliers, as necessary.
4. Engineer’s representatives.

1.06 PROCESS INSTRUMENTATION AND CONTROL SYSTEMS (PICS) COORDINATION MEETINGS

A. Engineer will schedule meetings at Site, conducted monthly to review specific requirements of PICS work.

B. Attendees will include:

1. Contractor.
2. Owner.
3. PICS Subcontractor/Installer.
4. Engineer’s representatives.

1.07 PREINSTALLATION MEETINGS

A. When required in individual specification sections, convene at Site prior to commencing the Work of that section.

B. Require attendance of entities directly affecting, or affected by, the Work of that section.

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C. Notify Engineer 7 days in advance of meeting date.

D. Provide suggested agenda to Engineer to include reviewing conditions of installation, preparation and installation or application procedures, and coordination with related Work and work of others.

1.08 FACILITY STARTUP MEETINGS

A. Schedule and attend a minimum of two facility startup meetings for each facility. The first of such meetings shall be held prior to submitting Facility Startup Plan, as specified in Section 01 91 14, Equipment Testing and Facility Startup, and shall include preliminary discussions regarding such plan.

B. Agenda items shall include, but not be limited to, content of Facility Startup Plan, coordination needed between various parties in attendance, and potential problems associated with startup.

C. Attendees will include:

1. Contractor.
2. Contractor’s designated quality control representative.
3. Subcontractors and equipment manufacturer’s representatives whom Contractor deems to be directly involved in facility startup.
4. Engineer’s representatives.
5. Owner’s operations personnel.
6. Others as required by Contract Documents or as deemed necessary by Contractor.

1.09 OTHER MEETINGS

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

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

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SECTION 01 32 00
CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 GENERAL

1.01 SUBMITTALS

A. Informational Submittals:

1. Preliminary Progress Schedule: Submit at least 7 days prior to preconstruction conference.
2. Detailed Progress Schedule:
   a. Submit initial Detailed Progress Schedule within 30 days after Effective Date of the Agreement.
   b. Submit an Updated Progress Schedule at each update, in accordance with Article Detailed Progress Schedule.
3. Submit with Each Progress Schedule Submission:
   a. Contractor's certification that Progress Schedule submission is actual schedule being used for execution of the Work.
   b. Electronic file compatible with latest version of Project Planner (P6) by Primavera Systems, Inc., unless otherwise approved by Engineer.
   c. Progress Schedule: Four legible copies.
   d. Narrative Progress Report: Same number of copies as specified for Progress Schedule.
4. Prior to final payment, submit a final Updated Progress Schedule.

1.02 PRELIMINARY PROGRESS SCHEDULE

A. In addition to basic requirements outlined in General Conditions, show a detailed schedule, beginning with Notice to Proceed, for minimum duration of 90 days, and a summary of balance of Project through Final Completion.

B. Show activities including, but not limited to the following:

1. Notice to Proceed.
2. Permits.
3. Submittals, with review time. Contractor may use Schedule of Submittals specified in Section 01 33 00, Submittal Procedures.
4. Early procurement activities for long lead equipment and materials.
5. Initial Site work.
6. Earthwork.
7. Specified Work sequences and construction constraints.
8. Contract Milestone and Completion Dates.
9. Owner-furnished products delivery dates or ranges of dates.

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10. Major structural, mechanical, equipment, electrical, architectural, and instrumentation and control Work.
11. System startup summary.
12. Project close-out summary.
13. Demobilization summary.

C. Update Preliminary Progress Schedule monthly as part of progress payment process. Failure to do so may result in the Owner withholding all or part of the monthly progress payment until the Preliminary Progress Schedule is updated in a manner acceptable to Engineer.

D. Format: In accordance with Article Progress Schedule Bar Chart.

1.03 DETAILED PROGRESS SCHEDULE

A. In addition to requirements of General Conditions, submit Detailed Progress Schedule beginning with Notice to Proceed and continuing through Final Completion.

B. Show the duration and sequences of activities required for complete performance of the Work reflecting means and methods chosen by Contractor.

C. When accepted by Engineer, Detailed Progress Schedule will replace Preliminary Progress Schedule and become Baseline Schedule. Subsequent revisions will be considered as Updated Progress Schedules.

D. Format: In accordance with Article Progress Schedule—Bar Chart.

E. Update monthly to reflect actual progress and occurrences to date, including weather delays.

1.04 PROGRESS SCHEDULE—BAR CHART

A. General: Comprehensive bar chart schedule, generally as outlined in Associated General Contractors of America (AGC) 580, “Construction Project Planning and Scheduling Guidelines.” If a conflict occurs between the AGC publication and this specification, this specification shall govern.

B. Format:

1. Unless otherwise approved, white paper, 11-inch by 17-inch sheet size.
2. Title Block: Show name of Project and Owner, date submitted, revision or update number, and name of scheduler.
3. Identify horizontally, across the top of the schedule, the time frame by year, month, and day.

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4. Identify each activity with a unique number and a brief description of the Work associated with that activity.
5. Legend: Describe standard and special symbols used.

C. Contents:

1. Identify, in chronological order, those activities reasonably required to complete the Work, including as applicable, but not limited to:
   a. Obtaining permits, submittals for early product procurement, and long lead time items.
   b. Mobilization and other preliminary activities.
   c. Initial Site work.
   d. Specified Work sequences, constraints, and Milestones, including Substantial Completion date(s).
   e. Subcontract Work.
   f. Major equipment design, fabrication, factory testing, and delivery dates.
   g. Sitework.
   h. Concrete Work.
   i. Structural steel Work.
   j. Architectural features Work.
   k. Conveying systems Work.
   l. Equipment Work.
   m. Mechanical Work.
   n. Electrical Work.
   o. Instrumentation and control Work.
   p. Interfaces with Owner-furnished equipment.
   q. Other important Work for each major facility.
   r. Equipment and system startup and test activities.
   s. Project closeout and cleanup.
   t. Demobilization.

1.05 PROGRESS OF THE WORK

A. Updated Progress Schedule shall reflect:

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

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B. Produce detailed subschedules during Project, upon request of Owner or Engineer, to further define critical portions of the Work such as facility shutdowns.

C. If an activity is not completed by its latest scheduled completion date and this failure is anticipated to extend Contract Times (or Milestones), submit, within 7 days of such failure, a written statement as to how nonperformance will be corrected to return Project to acceptable current Progress Schedule. Actions by Contractor to complete the Work within Contract Times (or Milestones) will not be justification for adjustment to Contract Price or Contract Times.

D. Owner may order Contractor to increase plant, equipment, labor force, or working hours if Contractor fails to:

1. Complete a Milestone activity by its completion date.
2. Satisfactorily execute Work as necessary to prevent delay to overall completion of Project, at no additional cost to Owner.

1.06 NARRATIVE PROGRESS REPORT

A. Format:

1. Organize same as Progress Schedule.
2. Identify, on a cover letter, reporting period, date submitted, and name of author of report.

B. Contents:

1. Number of days worked over the period, work force on hand, construction equipment on hand (including utility vehicles such as pickup trucks, maintenance vehicles, stake trucks).
2. General progress of Work, including a listing of activities started and completed over the reporting period, mobilization/demobilization of subcontractors, and major milestones achieved.
3. Contractor’s plan for management of Site (for example, lay down and staging areas, construction traffic), use of construction equipment, buildup of trade labor, and identification of potential Contract changes.
4. Identification of new activities and sequences as a result of executed Contract changes.
5. Documentation of weather conditions over the reporting period, and any resulting impacts to the work.
6. Description of actual or potential delays, including related causes, and the steps taken or anticipated to mitigate their impact.
7. Changes to activity logic.
8. Changes to the critical path.

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9. Identification of, and accompanying reason for, any activities added or deleted since the last report.
10. Steps taken to recover the schedule from Contractor-caused delays.

1.07 SCHEDULE ACCEPTANCE

A. Engineer's acceptance will demonstrate agreement that:

1. Proposed schedule is accepted with respect to:
   a. Contract Times, including Final Completion and all intermediate Milestones, are within the specified times.
   b. Specified Work sequences and constraints are shown as specified.
   c. Specified Owner-furnished Equipment or Material arrival dates, or range of dates, are included.
   d. Access restrictions are accurately reflected.
   e. Startup and testing times are as specified.
   f. Submittal review times are as specified.
   g. Startup testing duration is as specified and timing is acceptable.
2. In all other respects, Engineer's acceptance of Contractor's schedule indicates that, in Engineer's judgment, schedule represents reasonable plan for constructing Project in accordance with the Contract Documents. Engineer's review will not make any change in Contract requirements. Lack of comment on any aspect of schedule that is not in accordance with the Contract Documents will not thereby indicate acceptance of that change, unless Contractor has explicitly called the nonconformance to Engineer's attention in submittal. Schedule remains Contractor's responsibility and Contractor retains responsibility for performing all activities, for activity durations, and for activity sequences required to construct Project in accordance with the Contract Documents.

B. Unacceptable Preliminary Progress Schedule:

1. Make requested corrections; resubmit within 10 days.
2. Until acceptable to Engineer as Baseline Progress Schedule, continue review and revision process, including updating schedule on a monthly basis to reflect actual progress and occurrences to date.

C. Unacceptable Detailed Progress Schedule:

1. Make requested corrections; resubmit within 10 days.
2. Until acceptable to Engineer as Baseline Progress Schedule, continue review and revision process.

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D. Narrative Report: All changes to activity duration and sequences, including addition or deletion of activities subsequent to Engineer's acceptance of Baseline Progress Schedule, shall be delineated in Narrative Report current with proposed Updated Progress Schedule.

1.08 ADJUSTMENT OF CONTRACT TIMES

A. Reference General Conditions.

B. Evaluation and reconciliation of Adjustments of Contract Times shall be based on the Updated Progress Schedule at the time of proposed adjustment or claimed delay.

C. Schedule Contingency:

1. Contingency, when used in the context of the Progress Schedule, is time between Contractor's proposed Completion Time and Contract Completion Time.
2. Contingency included in Progress Schedule is a Project resource available to both Contractor and Owner to meet Contract Milestones and Contract Times. Use of Schedule contingency shall be shared to the proportionate benefit of both parties.
3. Use of schedule contingency suppression techniques such as preferential sequencing and extended activity times is prohibited.
4. Pursuant to Contingency sharing provisions of this specification, no time extensions will be granted, nor will delay damages be paid until a delay occurs which (i) consumes all available contingency time, and (ii) extends Work beyond the Contract Completion date.

D. Claims Based on Contract Times:

1. Where Engineer has not yet rendered formal decision on Contractor's Claim for adjustment of Contract Times, and parties are unable to agree as to amount of adjustment to be reflected in Progress Schedule, reflect an interim adjustment in the Progress Schedule as acceptable to Engineer.
2. It is understood and agreed that such interim acceptance will not be binding on either Contractor or Owner, and will be made only for the purpose of continuing to schedule Work until such time as formal decision has been rendered as to an adjustment, if any, of the Contract Times.
3. Revise Progress Schedule prepared thereafter in accordance with Engineer's formal decision.

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PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

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SECTION 01 33 00
SUBMITTAL PROCEDURES

PART 1 GENERAL

1.01 DEFINITIONS

A. Action Submittal: Written and graphic information submitted by Contractor that requires Engineer's approval.

B. Deferred Submittal: Information, in accordance with 2018 IBC submitted by Contractor for portions of design that are to be submitted to permitting agency for approval prior to installation of that portion of the Work, along with Engineer's review documentation that submittal has been found to be in general conformance with Project's design.

C. Informational Submittal: Information submitted by Contractor that requires Engineer's review and determination that submitted information is in accordance with the Conditions of the Contract.

1.02 PROCEDURES

A. Direct submittals to Owner and Engineer at the following, unless specified otherwise.

B. Electronic Submittals: Submittals shall, unless specifically accepted, be made in electronic format.

1. Each submittal shall be an electronic file in Adobe Acrobat Portable Document Format (PDF). Use the latest version available at time of execution of the Agreement.
2. Electronic files that contain more than 10 pages in PDF format shall contain internal bookmarking from an index page to major sections of the document.
3. PDF files shall be set to open "Bookmarks and Page" view.
4. Add general information to each PDF file, including title, subject, author, and keywords.
5. PDF files shall be set up to print legibly at 8.5-inch by 11-inch, 11-inch by 17-inch, or 22-inch by 34-inch. No other paper sizes will be accepted.
6. Submit new electronic files for each resubmittal.
7. Include a copy of the Transmittal of Contractor's Submittal form, located at end of section, with each electronic file.
8. Engineer will reject submittal that is not electronically submitted, unless specifically accepted.

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9. Provide Engineer with authorization to reproduce and distribute each file as many times as necessary for Project documentation.
10. Detailed procedures for handling electronic submittals will be discussed at the preconstruction conference.

C. Transmittal of Submittal:

1. Contractor shall:
   a. Review each submittal and check for compliance with Contract Documents.
   b. Stamp each submittal with uniform approval stamp before submitting to Engineer.
      1) Stamp to include Project name, submittal number, Specification number, Contractor's reviewer name, date of Contractor's approval, and statement certifying submittal has been reviewed, checked, and approved for compliance with Contract Documents.
      2) Engineer will not review submittals that do not bear Contractor's approval stamp and will return them without action.
2. Complete, sign, and transmit with each submittal package, one Transmittal of Contractor's Submittal form in format approved by Engineer.
3. Identify each submittal with the following:
   a. Numbering and Tracking System:
      1) Sequentially number each submittal.
      2) Resubmission of submittal shall have original number with sequential alphabetic suffix.
   b. Specification section and paragraph to which submittal applies.
   c. Project title and Engineer's project number.
   d. Date of transmittal.
   e. Names of Contractor, Subcontractor or Supplier, and manufacturer as appropriate.
4. Identify and describe each deviation or variation from Contract Documents.

D. Format:

1. Do not base Shop Drawings on reproductions of Contract Documents.
2. Package submittal information by individual specification section. Do not combine different specification sections together in submittal package, unless otherwise directed in specification.

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3. Present in a clear and thorough manner and in sufficient detail to show kind, size, arrangement, and function of components, materials, and devices, and compliance with Contract Documents.
4. Index with labeled tab dividers in orderly manner.

E. Timeliness: Schedule and submit in accordance Schedule of Submittals and requirements of individual specification sections.

F. Processing Time:

1. Time for review shall commence on Engineer's receipt of submittal.
2. Engineer will act upon Contractor's submittal and transmit response to Contractor not later than 21 calendar days after receipt, unless otherwise specified.
3. Resubmittals will be subject to same review time.
4. No adjustment of Contract Times or Price will be allowed as a result of delays in progress of Work caused by rejection and subsequent resubmittals.

G. Resubmittals: Clearly identify each correction or change made.

H. Incomplete Submittals:

1. Engineer will return entire submittal for Contractor's revision if preliminary review deems it incomplete.
2. When any of the following are missing, submittal will be deemed incomplete:
   a. Contractor's review stamp; completed and signed.
   b. Transmittal of Contractor's Submittal; completed and signed.
   c. A sufficient number of copies.

I. Submittals not required by Contract Documents:

1. Will not be reviewed and will be returned stamped "Not Subject to Review."
2. Engineer will keep one copy and return submittal to Contractor.

1.03 ACTION SUBMITTALS

A. Prepare and submit Action Submittals required by individual specification sections.

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B. Shop Drawings:

1. Identify and Indicate:
   a. Applicable Contract Drawing and Detail number, products, units and assemblies, and system or equipment identification or tag numbers.
   b. Equipment and Component Title: Identical to title shown on the Drawings.
   c. Critical field dimensions and relationships to other critical features of Work. Note dimensions established by field measurement.
   d. Project-specific information drawn accurately to scale.
2. Manufacturer's standard schematic drawings and diagrams as follows:
   a. Modify to delete information that is not applicable to the Work.
   b. Supplement standard information to provide information specifically applicable to the Work.
3. Product Data: Provide as specified in individual specifications.
4. Deferred Submittal: See the Drawings for list of deferred submittals.
   a. Contractor-design drawings and product data related to permanent construction.
      1) Written and graphic information.
      2) Drawings.
      3) Cut sheets.
      4) Data sheets.
      5) Action item submittals requested in individual specification section.
   b. Prior to installation of indicated structural or nonstructural element, equipment, distribution system, or component or its anchorage, submit required supporting data and drawings for review and acceptance by Engineer. Documentation of review and approval provided on Engineer's comment form, along with completed submittal, shall be filed with permitting agency by Contractor and approved by permitting agency prior to installation.
5. Foreign Manufacturers: When proposed, include names and addresses of at least two companies that maintain technical service representatives close to Project.

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C. Samples:

1. Copies: Two, unless otherwise specified in individual specifications.
2. Preparation:
    a. Mount, display, or package Samples in manner specified to facilitate review of quality. Attach label on unexposed side that includes the following:
        1) Manufacturer name.
        2) Model number.
        3) Material.
        4) Sample source.
3. Manufacturer's Color Chart: Units or sections of units showing full range of colors, textures, and patterns available.
4. Full-size Samples:
    a. Size as indicated in individual specification section.
    b. Prepared from same materials to be used for the Work.
    c. Cured and finished in manner specified.
    d. Physically identical with product proposed for use.

D. Action Submittal Dispositions:

1. Engineer will review, comment, stamp, and distribute as noted:
    a. Approved:
        1) Contractor may incorporate product(s) or implement Work covered by submittal.
        2) Distribution: Electronic.
    b. Approved as Noted:
        1) Contractor may incorporate product(s) or implement Work covered by submittal, in accordance with Engineer's notations.
        2) Distribution: Electronic.
    c. Partial Approval, Resubmit as Noted:
        1) Make corrections or obtain missing portions, and resubmit.
        2) Except for portions indicated, Contractor may begin to incorporate product(s) or implement Work covered by submittal, in accordance with Engineer's notations.
        3) Distribution: Electronic.
    d. Revise and Resubmit:
        1) Contractor may not incorporate product(s) or implement Work covered by submittal.
        2) Distribution: Electronic.

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1.04 INFORMATIONAL SUBMITTALS

A. General:

1. Copies: Submit electronic copies, unless otherwise indicated in individual specification section.
2. Refer to individual specification sections for specific submittal requirements.
3. Engineer will review each submittal. If submittal meets conditions of the Contract, Engineer will forward copy to appropriate parties. If Engineer determines submittal does not meet conditions of the Contract and is therefore considered unacceptable, Engineer will retain one copy and return remaining copy with review comments to Contractor, and require that submittal be corrected and resubmitted.

B. Certificates:

1. General:
   a. Provide notarized statement that includes signature of entity responsible for preparing certification.
   b. Signed by officer or other individual authorized to sign documents on behalf of that entity.
2. Welding: In accordance with individual specification sections.
3. Installer: Prepare written statements on manufacturer's letterhead certifying installer complies with requirements as specified in individual specification section.
4. Material Test: Prepared by qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements.
5. Certificates of Successful Testing or Inspection: Submit when testing or inspection is required by Laws and Regulations or governing agency or specified in individual specification sections.
6. Manufacturer's Certificate of Compliance: In accordance with Section 01 61 00, Common Product Requirements.
7. Manufacturer's Certificate of Proper Installation: In accordance with Section 01 43 33, Manufacturers' Field Services.

C. Construction Photographs and Video: In accordance with Section 01 31 13, Project Coordination, and as may otherwise be required in Contract Documents.

D. Closeout Submittals: In accordance with Section 01 77 00, Closeout Procedures.

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E. Contractor-design Data (related to temporary construction):

1. Written and graphic information.
2. List of assumptions.
3. List of performance and design criteria.
4. Summary of loads or load diagram, if applicable.
5. Calculations.
6. List of applicable codes and regulations.
7. Name and version of software.
8. Information requested in individual specification section.

F. Deferred Submittals: See the Drawings for list of deferred submittals.

1. Contractor-design data related to permanent construction:
   a. List of assumptions.
   b. List of performance and design criteria.
   c. Summary of loads or load diagram, if applicable.
   d. Calculations.
   e. List of applicable codes and regulations.
   f. Name and version of design software.
   g. Factory test results.
   h. Informational submittals requested in individual specification section.
2. Prior to installation of indicated structural or nonstructural element, equipment, distribution system, or component or its anchorage, submit calculations and test results of Contractor-designed components for review by Engineer. Documentation of review and indication of compliance with general design intent and project criteria provided on Engineer's comment form as meets conditions of the Contract, along with completed submittal, shall be filed with permitting agency by Contractor and approved by permitting agency prior to installation.

G. Manufacturer's Instructions: Written or published information that documents manufacturer's recommendations, guidelines, and procedures in accordance with individual specification section.

H. Operation and Maintenance Data: As required in Section 01 78 23, Operation and Maintenance Data.

I. Payment:

1. Application for Payment: In accordance with Section 01 29 00, Payment Procedures.
2. Schedule of Values: In accordance with Section 01 29 00, Payment Procedures.

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J. Quality Control Documentation: As required in Section 01 45 16.13, Contractor Quality Control.

K. Schedules:

1. Schedule of Submittals: Prepare separately or in combination with Progress Schedule as specified in Section 01 32 00, Construction Progress Documentation.
    a. Show for each, at a minimum, the following:
        1) Specification section number.
        2) Identification by numbering and tracking system as specified under Paragraph Transmittal of Submittal.
        3) Estimated date of submission to Engineer, including reviewing and processing time.
    b. On a monthly basis, submit updated Schedule of Submittals to Engineer if changes have occurred or resubmittals are required.
2. Progress Schedules: In accordance with Section 01 32 00, Construction Progress Documentation.

L. Special Guarantee: Supplier's written guarantee as required in individual specification sections.

M. Statement of Qualification: Evidence of qualification, certification, or registration as required in Contract Documents to verify qualifications of professional land surveyor, engineer, materials testing laboratory, specialty Subcontractor, trade, Specialist, consultant, installer, and other professionals.

N. Submittals Required by Laws, Regulations, and Governing Agencies:

1. Promptly submit promptly notifications, reports, certifications, payrolls, and otherwise as may be required, directly to the applicable federal, state, or local governing agency or their representative.
2. Transmit to Engineer for Owner's records one copy of correspondence and transmittals (to include enclosures and attachments) between Contractor and governing agency.

O. Test, Evaluation, and Inspection Reports:

1. General: Shall contain signature of person responsible for test or report.
2. Factory:
    a. Identification of product and specification section, type of inspection or test with referenced standard or code.
    b. Date of test, Project title and number, and name and signature of authorized person.
    c. Test results.

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d. If test or inspection deems material or equipment not in compliance with Contract Documents, identify corrective action necessary to bring into compliance.
e. Provide interpretation of test results, when requested by Engineer.
f. Other items as identified in individual specification sections.

3. Field:
   a. As a minimum, include the following:
      1) Project title and number.
      2) Date and time.
      3) Record of temperature and weather conditions.
      4) Identification of product and specification section.
      5) Type and location of test, Sample, or inspection, including referenced standard or code.
      6) Date issued, testing laboratory name, address, and telephone number, and name and signature of laboratory inspector.
      7) If test or inspection deems material or equipment not in compliance with Contract Documents, identify corrective action necessary to bring into compliance.
      8) Provide interpretation of test results, when requested by Engineer.
      9) Other items as identified in individual specification sections.

P. Testing and Startup Data: In accordance with Section 01 91 14, Equipment Testing and Facility Startup.

Q. Training Data: In accordance with Section 01 43 33, Manufacturers' Field Services.

1.05 SUPPLEMENT

A. The supplement listed below, following "End of Section," is a part of this specification:

1. Transmittal of Contractor's Submittal Form.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

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TRANSMITTAL OF CONTRACTOR'S SUBMITTAL

(ATTACH TO EACH SUBMITTAL)

DATE: _____

TO: _____	Submittal No.: _____
	☐ New Submittal ☐ Resubmittal
	Project: _____
	Project No.: _____
	Specification Section No.: _____ **(Cover only one section with each transmittal)**
FROM: _____ Contractor	Schedule Date of Submittal: _____

SUBMITTAL TYPE:	☐ Shop Drawing	☐ Sample	☐ Informational
	☐ Deferred		

The following items are hereby submitted:

Number of Copies	Description of Item Submitted (Type, Size, Model Number, Etc.)	Spec. and Para. No.	Drawing or Brochure Number	Contains Variation to Contract	
				No	Yes

Contractor hereby certifies that (i) Contractor has complied with the requirements of Contract Documents in preparation, review, and submission of designated Submittal and (ii) the Submittal is complete and in accordance with the Contract Documents and requirements of laws and regulations and governing agencies.

By: _____
Contractor (Authorized Signature)

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SECTION 01 42 13
ABBREVIATIONS AND ACRONYMS

PART 1 GENERAL

1.01 REFERENCE TO STANDARDS AND SPECIFICATIONS OF TECHNICAL SOCIETIES

A. Reference to standards and specifications of technical societies and reporting and resolving discrepancies associated therewith shall be as provided in Article 3 of the General Conditions, and as may otherwise be required herein and in the individual specification sections.

B. Work specified by reference to published standard or specification of government agency, technical association, trade association, professional society or institute, testing agency, or other organization shall meet requirements or surpass minimum standards of quality for materials and workmanship established by designated standard or specification.

C. Where so specified, products or workmanship shall also meet or exceed additional prescriptive or performance requirements included within Contract Documents to establish a higher or more stringent standard of quality than required by referenced standard.

D. Where two or more standards are specified to establish quality, product and workmanship shall meet or exceed requirements of most stringent.

E. Where both a standard and a brand name are specified for a product in Contract Documents, proprietary product named shall meet or exceed requirements of specified reference standard.

F. Copies of standards and specifications of technical societies:

1. Copies of applicable referenced standards have not been bound in these Contract Documents.
2. Where copies of standards are needed by Contractor, obtain a copy or copies directly from publication source and maintain in an orderly manner at the Site as Work Site records, available to Contractor’s personnel, Subcontractors, Owner, and Engineer.

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1.02 ABBREVIATIONS

A. Abbreviations for trade organizations and government agencies: Following is a list of construction industry organizations and government agencies to which references may be made in the Contract Documents, with abbreviations used.

1.	AA	Aluminum Association
2.	AABC	Associated Air Balance Council
3.	AAMA	American Architectural Manufacturers Association
4.	AASHTO	American Association of State Highway and Transportation Officials
5.	ABMA	American Bearing Manufacturers' Association
6.	ACI	American Concrete Institute
7.	AEIC	Association of Edison Illuminating Companies
8.	AGA	American Gas Association
9.	AGMA	American Gear Manufacturers' Association
10.	AI	Asphalt Institute
11.	AISC	American Institute of Steel Construction
12.	AISI	American Iron and Steel Institute
13.	AITC	American Institute of Timber Construction
14.	ALS	American Lumber Standards
15.	AMCA	Air Movement and Control Association
16.	ANSI	American National Standards Institute
17.	APA	APA – The Engineered Wood Association
18.	API	American Petroleum Institute
19.	APWA	American Public Works Association
20.	AHRI	Air-Conditioning, Heating, and Refrigeration Institute
21.	ASA	Acoustical Society of America
22.	ASABE	American Society of Agricultural and Biological Engineers
23.	ASCE	American Society of Civil Engineers
24.	ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.
25.	ASME	American Society of Mechanical Engineers
26.	ASNT	American Society for Nondestructive Testing
27.	ASSE	American Society of Sanitary Engineering
28.	ASTM	ASTM International
29.	AWI	Architectural Woodwork Institute
30.	AWPA	American Wood Preservers' Association
31.	AWPI	American Wood Preservers' Institute
32.	AWS	American Welding Society
33.	AWWA	American Water Works Association
34.	BHMA	Builders Hardware Manufacturers' Association

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35.	CBM	Certified Ballast Manufacturer
36.	CDA	Copper Development Association
37.	CGA	Compressed Gas Association
38.	CISPI	Cast Iron Soil Pipe Institute
39.	CMAA	Crane Manufacturers' Association of America
40.	CRSI	Concrete Reinforcing Steel Institute
41.	CS	Commercial Standard
42.	CSA	Canadian Standards Association
43.	CSI	Construction Specifications Institute
44.	DIN	Deutsches Institut für Normung e.V.
45.	DIPRA	Ductile Iron Pipe Research Association
46.	EIA	Electronic Industries Alliance
47.	EJCDC	Engineers Joint Contract Documents' Committee
48.	ETL	Electrical Test Laboratories
49.	FAA	Federal Aviation Administration
50.	FCC	Federal Communications Commission
51.	FDA	Food and Drug Administration
52.	FEMA	Federal Emergency Management Agency
53.	FIPS	Federal Information Processing Standards
54.	FM	FM Global
55.	Fed. Spec.	Federal Specifications (FAA Specifications)
56.	FS	Federal Specifications and Standards (Technical Specifications)
57.	GA	Gypsum Association
58.	GANA	Glass Association of North America
59.	HI	Hydraulic Institute
60.	HMI	Hoist Manufacturers' Institute
61.	IBC	International Building Code
62.	ICBO	International Conference of Building Officials
63.	ICC	International Code Council
64.	ICEA	Insulated Cable Engineers' Association
65.	IFC	International Fire Code
66.	IEEE	Institute of Electrical and Electronics Engineers, Inc.
67.	IESNA	Illuminating Engineering Society of North America
68.	IFI	Industrial Fasteners Institute
69.	IGMA	Insulating Glass Manufacturer's Alliance
70.	IMC	International Mechanical Code
71.	INDA	Association of the Nonwoven Fabrics Industry
72.	IPC	International Plumbing Code
73.	ISA	International Society of Automation
74.	ISO	International Organization for Standardization
75.	ITL	Independent Testing Laboratory

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76.	JIC	Joint Industry Conferences of Hydraulic Manufacturers
77.	MIA	Marble Institute of America
78.	MIL	Military Specifications
79.	MMA	Monorail Manufacturers' Association
80.	MSS	Manufacturer's Standardization Society
81.	NAAMM	National Association of Architectural Metal Manufacturers
82.	NACE	NACE International
83.	NBGQA	National Building Granite Quarries Association
84.	NEBB	National Environmental Balancing Bureau
85.	NEC	National Electrical Code
86.	NECA	National Electrical Contractor's Association
87.	NEMA	National Electrical Manufacturers' Association
88.	NESC	National Electrical Safety Code
89.	NETA	InterNational Electrical Testing Association
90.	NFPA	National Fire Protection Association
91.	NHLA	National Hardwood Lumber Association
92.	NICET	National Institute for Certification in Engineering Technologies
93.	NIST	National Institute of Standards and Technology
94.	NRCA	National Roofing Contractors Association
95.	NRTL	Nationally Recognized Testing Laboratories
96.	NSF	NSF International
97.	NSPE	National Society of Professional Engineers
98.	NTMA	National Terrazzo and Mosaic Association
99.	NWWDA	National Wood Window and Door Association
100.	OSHA	Occupational Safety and Health Act (both Federal and State)
101.	PCI	Precast/Prestressed Concrete Institute
102.	PEI	Porcelain Enamel Institute
103.	PPI	Plastic Pipe Institute
104.	PS	Product Standards Section-U.S. Department of Commerce
105.	RMA	Rubber Manufacturers' Association
106.	RUS	Rural Utilities Service
107.	SAE	SAE International
108.	SDI	Steel Deck Institute
109.	SDI	Steel Door Institute
110.	SJI	Steel Joist Institute
111.	SMACNA	Sheet Metal and Air Conditioning Contractors National Association
112.	SPI	Society of the Plastics Industry
113.	SSPC	The Society for Protective Coatings

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114.	STI/SPFA	Steel Tank Institute/Steel Plate Fabricators Association
115.	SWI	Steel Window Institute
116.	TEMA	Tubular Exchanger Manufacturers' Association
117.	TCA	Tile Council of North America
118.	TIA	Telecommunications Industry Association
119.	UBC	Uniform Building Code
120.	UFC	Uniform Fire Code
121.	UL	formerly Underwriters Laboratories Inc.
122.	UMC	Uniform Mechanical Code
123.	USBR	U.S. Bureau of Reclamation
124.	WCLIB	West Coast Lumber Inspection Bureau
125.	WI	Wood Institute
126.	WWPA	Western Wood Products Association

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

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SECTION 01 43 33
MANUFACTURERS' FIELD SERVICES

PART 1 GENERAL

1.01 DEFINITIONS

A. Person-Day: One person for 8 hours within regular Contractor working hours.

1.02 SUBMITTALS

A. Informational Submittals:

1. Training Schedule: Submit, in accordance with requirements of this specification, not less than 21 days prior to start of equipment installation and revise as necessary for acceptance.
2. Lesson Plan: Submit, in accordance with requirements of this specification, proposed lesson plan not less than 21 days prior to scheduled training and revise as necessary for acceptance.
3. Training Session Recordings: Furnish Owner with two complete sets of recordings fully indexed and cataloged with printed label stating session and date recorded.

1.03 QUALIFICATION OF MANUFACTURER'S REPRESENTATIVE

A. Authorized representative of the manufacturer, factory trained, and experienced in the technical applications, installation, operation, and maintenance of respective equipment, subsystem, or system, with full authority by the equipment manufacturer to issue the certifications required of the manufacturer. Additional qualifications may be specified in the individual specification section.

B. Representative subject to acceptance by Owner and Engineer. No substitute representatives will be allowed unless prior written approval by such has been given.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 FULFILLMENT OF SPECIFIED MINIMUM SERVICES

A. Furnish manufacturers' services, when required by an individual specification section, to meet the requirements of this section.

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B. Where time is necessary in excess of that stated in the Specifications for manufacturers' services, or when a minimum time is not specified, time required to perform specified services shall be considered incidental.

C. Schedule manufacturer' services to avoid conflict with other onsite testing or other manufacturers' onsite services.

D. Determine, before scheduling services, that conditions necessary to allow successful testing have been met.

E. Only those days of service approved by Engineer will be credited to fulfill specified minimum services.

F. When specified in individual specification sections, manufacturer's onsite services shall include:

1. Assistance during product (system, subsystem, or component) installation to include observation, guidance, instruction of Contractor's assembly, erection, installation or application procedures.
2. Inspection, checking, and adjustment as required for product (system, subsystem, or component) to function as warranted by manufacturer and necessary to furnish Manufacturer's Certificate of Proper Installation.
3. Providing, on a daily basis, copies of manufacturers' representatives field notes and data to Engineer and Owner.
4. Revisiting the Site as required to correct problems and until installation and operation are acceptable to Engineer.
5. Resolution of assembly or installation problems attributable to or associated with respective manufacturer's products and systems.
6. Assistance during functional and performance testing, and facility startup and evaluation.
7. Training of Owner's personnel in the operation and maintenance of respective product as required.

3.02 MANUFACTURER'S CERTIFICATE OF PROPER INSTALLATION

A. When so specified, a Manufacturer's Certificate of Proper Installation form, a copy of which is attached to this section, shall be completed and signed by equipment manufacturer's representative.

B. Such form shall certify signing party is a duly authorized representative of manufacturer, is empowered by manufacturer to inspect, approve, and operate their equipment and is authorized to make recommendations required to ensure equipment is complete and operational.

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3.03 TRAINING

A. General:

1. Furnish manufacturers' representatives for detailed classroom and hands-on training to Owner's personnel on operation and maintenance of specified product (system, subsystem, component) and as may be required in applicable Specifications.
2. Furnish trained, articulate personnel to coordinate and expedite training, to be present during training coordination meetings with Owner, and familiar with operation and maintenance manual information specified in Section 01 78 23, Operation and Maintenance Data.
3. Manufacturer's representative shall be familiar with facility operation and maintenance requirements as well as with specified equipment.
4. Furnish complete training materials, to include operation and maintenance data, to be retained by each trainee.

B. Training Schedule:

1. List specified equipment and systems that require training services and show:
   a. Respective manufacturer.
   b. Estimated dates for installation completion.
   c. Estimated training dates.
2. Allow for multiple sessions when several shifts are involved.
3. Adjust schedule to ensure training of appropriate personnel as deemed necessary by Owner, and to allow full participation by manufacturers' representatives. Adjust schedule for interruptions in operability of equipment.
4. Coordinate with Section 01 32 00, Construction Progress Documentation, and Section 01 91 14, Equipment Testing and Facility Startup.

C. Lesson Plan:

1. When manufacturer or vendor training of Owner personnel is specified, prepare a lesson plan for each required course containing the following minimum information:
   a. Title and objectives.
   b. Recommended attendees (such as, managers, engineers, operators, maintenance).
   c. Course description, outline of course content, and estimated class duration.
   d. Format (such as, lecture, self-study, demonstration, hands-on).

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e. Instruction materials and equipment requirements.
f. Resumes of instructors providing training.

D. Prestartup Training:

1. Coordinate training sessions with Owner's operating personnel and manufacturers' representatives, and with submission of operation and maintenance manuals in accordance with Contract Documents.
2. Complete at least 14 days prior to beginning of facility startup.

E. Post-startup Training: If required in Specifications, furnish and coordinate training of Owner's operating personnel by respective manufacturer's representatives.

F. Recording of Training Sessions:

1. Furnish audio and color recording of prestartup and post-startup instruction sessions, including manufacturers' representatives' hands-on equipment instruction and classroom sessions.
2. Video training materials shall be produced by a qualified, professional video production company.
3. Use DVD format suitable for playback on standard equipment available commercially in the United States. Blu-ray® DVD format is not acceptable without Engineer's prior approval.
4. DVD may contain multiple training sessions. If multiple training sessions included on a DVD, provide with on-screen menu for playback selection.

3.04 SUPPLEMENT

A. The supplement listed below, following "End of Section," is a part of this specification:

1. Manufacturer's Certificate of Proper Installation.

END OF SECTION

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MANUFACTURER'S CERTIFICATE OF PROPER INSTALLATION

OWNER _____ EQPT SERIAL NO: _____

EQPT TAG NO: _____ EQPT/SYSTEM: _____

PROJECT NO: _____ SPEC. SECTION: _____

I hereby certify that the above-referenced equipment/system has been:

(Check Applicable)

☐ Installed in accordance with Manufacturer's recommendations.

☐ Inspected, checked, and adjusted.

☐ Serviced with proper initial lubricants.

☐ Electrical and mechanical connections meet quality and safety standards.

☐ All applicable safety equipment has been properly installed.

☐ Functional tests.

☐ System has been performance tested, and meets or exceeds specified performance requirements. (When complete system of one manufacturer)

Note: Attach any performance test documentation from manufacturer.

Comments: _____

_____

_____

_____

I, the undersigned Manufacturer's Representative, hereby certify that I am (i) a duly authorized representative of the manufacturer, (ii) empowered by the manufacturer to inspect, approve, and operate their equipment and (iii) authorized to make recommendations required to ensure equipment furnished by the manufacturer is complete and operational, except as may be otherwise indicated herein. I further certify that all information contained herein is true and accurate.

Date: _____, 20___

Manufacturer: _____

By Manufacturer's Authorized Representative: _____

(Authorized Signature)

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SECTION 01 45 16.13
CONTRACTOR QUALITY CONTROL

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. ASTM International (ASTM):
   a. D3740, Evaluation of Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
   b. E329, Use in the Evaluation of Testing and Inspection Agencies as Used in Construction.

1.02 DEFINITIONS

A. Contractor Quality Control (CQC): The means by which Contractor ensures that the construction, to include that performed by subcontractors and suppliers, complies with the requirements of the Contract.

1.03 SUBMITTALS

A. Informational Submittals:

1. CQC Plan: Submit, not later than 30 days after receipt of Notice to Proceed.
2. CQC Report: Submit, weekly, an original and one copy in report form.

1.04 OWNER'S QUALITY ASSURANCE

A. All Work is subject to Owner's quality assurance inspection and testing at all locations and at all reasonable times before acceptance to ensure strict compliance with the terms of the Contract Documents.

B. Owner's quality assurance inspections and tests are for the sole benefit of Owner and do not:

1. Relieve Contractor of responsibility for providing adequate quality control measures.
2. Relieve Contractor of responsibility for damage to or loss of the material before acceptance.
3. Constitute or imply acceptance.
4. Affect the continuing rights of Owner after acceptance of the completed Work.

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C. The presence or absence of a quality assurance inspector does not relieve Contractor from any Contract requirement.

D. Promptly furnish all facilities, labor, and material reasonably needed for performing such safe and convenient inspections and tests as may be required by Engineer.

E. Owner may charge Contractor for any additional cost of inspection or test when Work is not ready at the time specified by Contractor for inspection or test, or when prior rejection makes re-inspection or retest necessary. Quality assurance inspections and tests will be performed in a manner that will not unnecessarily delay the Work.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 GENERAL

A. Maintain an adequate inspection system and perform such inspections as will ensure that the Work conforms to the Contract Documents.

B. Maintain complete inspection records and make them available at all times to Owner and Engineer.

C. The quality control system shall consist of plans, procedures, and organization necessary to produce an end product that complies with the Contract Documents. The system shall cover all construction and demolition operations, both onsite and offsite, including Work by subcontractors, fabricators, suppliers and purchasing agents, and shall be keyed to the proposed construction sequence.

3.02 COORDINATION MEETING

A. After the Preconstruction Conference, but before start of construction, and prior to acceptance of the CQC Plan, schedule a meeting with Engineer and Owner to discuss the quality control system.

B. Develop a mutual understanding of the system details, including the forms for recording the CQC operations, control activities, testing, administration of the system for both onsite and offsite Work, and the interrelationship of Contractor’s management and control with the Owner’s Quality Assurance.

C. There may be occasions when subsequent conferences may be called by either party to reconfirm mutual understandings and/or address deficiencies in the CQC system or procedures that may require corrective action by Contractor.

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3.03 QUALITY CONTROL ORGANIZATION

A. CQC System Manager:

1. Designate an individual within Contractor's organization who will be responsible for overall management of CQC and have the authority to act in CQC matters for the Contractor.
2. CQC System Manager may perform other duties on the Project.
3. CQC System Manager shall be an experienced construction person, with a minimum of 3 years construction experience on similar type Work.
4. CQC System Manager shall report to the Contractor's project manager or someone higher in the organization. Project manager in this context shall mean the individual with responsibility for the overall quality and production management of the Project.
5. CQC System Manager shall be onsite during construction; periods of absence may not exceed 2 weeks at any one time.
6. Identify an alternate for CQC System Manager to serve with full authority during the System Manager's absence. The requirements for the alternate will be the same as for designated CQC System Manager.

B. CQC Staff:

1. Designate a CQC staff, available at the Site at all times during progress, with complete authority to take any action necessary to ensure compliance with the Contract. CQC staff members shall be subject to acceptance by Engineer.
2. CQC staff shall take direction from CQC System Manager in matters pertaining to QC.
3. CQC staff must be of sufficient size to ensure adequate QC coverage of Work phases, work shifts, and work crews involved in the construction. These personnel may perform other duties, but must be fully qualified by experience and technical training to perform their assigned QC responsibilities and must be allowed sufficient time to carry out these responsibilities.
4. The actual strength of the CQC staff may vary during any specific Work period to cover the needs of the Project. Add additional staff when necessary for a proper CQC organization.

C. Organizational Changes: Obtain Engineer's acceptance before replacing any member of the CQC staff. Requests for changes shall include name, qualifications, duties, and responsibilities of the proposed replacement.

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3.04 QUALITY CONTROL PHASING

A. CQC shall include at least three phases of control to be conducted by CQC System Manager for all definable features of Work, as follows:

1. Preparatory Phase:
   a. Notify Owner at least 48 hours in advance of beginning any of the required action of the preparatory phase.
   b. This phase shall include a meeting conducted by the CQC System Manager and attended by the superintendent, other CQC personnel (as applicable), and the foreman responsible for the definable feature. The CQC System Manager shall instruct applicable CQC staff as to the acceptable level of workmanship required in order to meet Contract requirements.
   c. Document the results of the preparatory phase meeting by separate minutes prepared by the CQC System Manager and attached to the QC report.
   d. Perform prior to beginning Work on each definable feature of Work:
      1) Review applicable Contract Specifications.
      2) Review applicable Contract Drawings.
      3) Verify that all materials and/or equipment have been tested, submitted, and approved.
      4) Verify that provisions have been made to provide required control inspection and testing.
      5) Examine the Work area to verify that all required preliminary Work has been completed and is in compliance with the Contract.
      6) Perform a physical examination of required materials, equipment, and sample Work to verify that they are on hand, conform to approved Shop Drawing or submitted data, and are properly stored.
      7) Review the appropriate activity hazard analysis to verify safety requirements are met.
      8) Review procedures for constructing the Work, including repetitive deficiencies.
      9) Document construction tolerances and workmanship standards for that phase of the Work.
      10) Check to verify that the plan for the Work to be performed, if so required, has been accepted by Engineer.

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2. Initial Phase:
    a. Accomplish at the beginning of a definable feature of Work:
        1) Notify Owner at least 48 hours in advance of beginning the initial phase.
        2) Perform prior to beginning Work on each definable feature of Work:
            a) Review minutes of the preparatory meeting.
            b) Check preliminary Work to verify compliance with Contract requirements.
            c) Verify required control inspection and testing.
            d) Establish level of workmanship and verify that it meets minimum acceptable workmanship standards. Comparison with sample panels is appropriate.
            e) Resolve all differences.
            f) Check safety to include compliance with and upgrading of the safety plan and activity hazard analysis. Review the activity analysis with each worker.
        3) Separate minutes of this phase shall be prepared by the CQC System Manager and attached to the QC report. Exact location of initial phase shall be indicated for future reference and comparison with follow-up phases.
        4) The initial phase should be repeated for each new crew to work onsite, or any time acceptable specified quality standards are not being met.
3. Follow-up Phase:
    a. Perform daily checks to verify continuing compliance with Contract requirements, including control testing, until completion of the particular feature of Work.
    b. Daily checks shall be made a matter of record in the CQC documentation and shall document specific results of inspections for all features of Work for the day or shift.
    c. Conduct final follow-up checks and correct all deficiencies prior to the start of additional features of Work that will be affected by the deficient Work. Constructing upon or concealing nonconforming Work will not be allowed.
4. Additional Preparatory and Initial Phases: Additional preparatory and initial phases may be conducted on the same definable features of Work as determined by Owner if the quality of ongoing Work is unacceptable; or if there are changes in the applicable QC staff or in the onsite production supervision or work crew; or if work on a definable feature is resumed after a substantial period of inactivity, or if other problems develop.

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3.05 CONTRACTOR QUALITY CONTROL PLAN

A. General:

1. Plan shall identify personnel, procedures, control, instructions, test, records, and forms to be used.
2. An interim plan for the first 30 days of operation will be considered.
3. Construction will be permitted to begin only after acceptance of the CQC Plan or acceptance of an interim plan applicable to the particular feature of Work to be started.
4. Work outside of the features of Work included in an accepted interim plan will not be permitted to begin until acceptance of a CQC Plan or another interim plan containing the additional features of Work to be started.

B. Content:

1. Plan shall cover the intended CQC organization for the entire Contract and shall include the following, as a minimum:
    a. Organization: Description of the quality control organization, including a chart showing lines of authority and acknowledgment that the CQC staff will implement the three-phase control system (see Paragraph Quality Control Phasing) for all aspects of the Work specified.
    b. CQC Staff: The name, qualifications (in resume format), duties, responsibilities, and authorities of each person assigned a QC function.
    c. Letters of Authority: A copy of a letter to the CQC System Manager signed by an authorized official of the firm, describing the responsibilities and delegating sufficient authorities to adequately perform the functions of the CQC System Manager, including authority to stop Work which is not in compliance with the Contract. The CQC System Manager shall issue letters of direction to all other various quality control representatives outlining duties, authorities and responsibilities. Copies of these letters will also be furnished to Owner.
    d. Submittals: Procedures for scheduling, reviewing, certifying, and managing submittals, including those of subcontractors, offsite fabricators, suppliers and purchasing agents.
    e. Testing: Control, verification and acceptance testing procedures for each specific test to include the test name, frequency, specification paragraph containing the test requirements, the personnel and laboratory responsible for each type of test, and an estimate of the number of tests required.

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f. Procedures for tracking preparatory, initial, and follow-up control phases and control, verification, and acceptance tests, including documentation.
g. Procedures for tracking deficiencies from identification through acceptable corrective action. These procedures will establish verification that identified deficiencies have been corrected.
h. Reporting procedures, including proposed reporting formats; include a copy of the CQC report form.

C. Acceptance of Plans: Acceptance of the Contractor's basic and addendum CQC plans is required prior to the start of construction. Acceptance is conditional and will be predicated on satisfactory performance during the construction. Owner reserves the right to require Contractor to make changes in the CQC plan and operations including removal of personnel, as necessary, to obtain the quality specified.

D. Notification of Changes: After acceptance of the CQC plan, Contractor shall notify Engineer, in writing, a minimum of 7 calendar days prior to any proposed change. Proposed changes are subject to acceptance by Engineer.

3.06 CONTRACTOR QUALITY CONTROL REPORT

A. As a minimum, prepare a CQC report for every 7 calendar days. Account for all days throughout the life of the Contract. Reports shall be signed and dated by CQC System Manager. Include copies of test reports and copies of reports prepared by QC staff.

B. Maintain current records of quality control operations, activities, and tests performed, including the Work of subcontractors and suppliers.

C. Records shall be on an acceptable form and shall be a complete description of inspections, the results of inspections, daily activities, tests, and other items, including but not limited to the following:

1. Contractor/subcontractor and their areas of responsibility.
2. Operating plant/equipment with hours worked, idle, or down for repair.
3. Work performed today, giving location, description, and by whom. When a network schedule is used, identify each phase of Work performed each day by activity number.
4. Test and/or control activities performed with results and references to specifications/plan requirements. The control phase should be identified (Preparatory, Initial, Follow-up). List deficiencies noted along with corrective action.
5. Material received with statement as to its acceptability and storage.
6. Identify submittals reviewed, with Contract reference, by whom, and action taken.

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7. Offsite surveillance activities, including actions taken.
8. Job safety evaluations stating what was checked, results, and instructions or corrective actions.
9. List instructions given/received and conflicts on the Drawings and/or in the Specifications.
10. Contractor's verification statement.
11. Indicate a description of trades working on the Project; the number of personnel working; weather conditions encountered; and any delays encountered.
12. These records shall cover both conforming and deficient features and shall include a statement that equipment and materials incorporated in file work and workmanship comply with the Contract.

3.07 SUBMITTAL QUALITY CONTROL

A. Submittals shall be as specified in Section 01 33 00, Submittal Procedures. The CQC organization shall be responsible for certifying that all submittals are in compliance with the Contract requirements. Owner will furnish copies of test report forms upon request by Contractor. Contractor may use other forms as approved.

3.08 TESTING QUALITY CONTROL

A. Testing Procedure:

1. Perform tests specified or required to verify that control measures are adequate to provide a product which conforms to Contract requirements. Procure services of a licensed testing laboratory. Perform the following activities and record the following data:
    a. Verify testing procedures comply with contract requirements.
    b. Verify facilities and testing equipment are available and comply with testing standards.
    c. Check test instrument calibration data against certified standards.
    d. Verify recording forms and test identification control number system, including all of the test documentation requirements, have been prepared.
    e. Documentation:
        1) Record results of all tests taken, both passing and failing, on the CQC report for the date taken.
        2) Include specification paragraph reference, location where tests were taken, and the sequential control number identifying the test.
        3) Actual test reports may be submitted later, if approved by Engineer, with a reference to the test number and date taken.

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4) Provide directly to Engineer an information copy of tests performed by an offsite or commercial test facility. Test results shall be signed by an engineer registered in the state where the tests are performed.
5) Failure to submit timely test reports, as stated, may result in nonpayment for related Work performed and disapproval of the test facility for this Contract.

B. Testing Laboratories: Laboratory facilities, including personnel and equipment, utilized for testing soils, concrete, asphalt and steel shall meet criteria detailed in ASTM D3740 and ASTM E329, and be accredited by the American Association of Laboratory Accreditation (AALA), National Institute of Standards and Technology (NIST), National Voluntary Laboratory Accreditation Program (NVLAP), the American Association of State Highway and Transportation Officials (AASHTO), or other approved national accreditation authority. Personnel performing concrete testing shall be certified by the American Concrete Institute (ACI).

3.09 COMPLETION INSPECTION

A. CQC System Manager shall conduct an inspection of the Work at the completion of all Work or any milestone established by a completion time stated in the Contract.

B. Punchlist:

1. CQC System Manager shall develop a punchlist of items which do not conform to the Contract requirements.
2. Include punchlist in the CQC report, indicating the estimated date by which the deficiencies will be corrected.
3. CQC System Manager or staff shall make a second inspection to ascertain that all deficiencies have been corrected and so notify the Owner.
4. These inspections and any deficiency corrections required will be accomplished within the time stated for completion of the entire Work or any particular increment thereof if the Project is divided into increments by separate completion dates.

END OF SECTION

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SECTION 01 45 33
SPECIAL INSPECTION, OBSERVATION, AND TESTING

PART 1 GENERAL

1.01 SUMMARY

A. This section covers requirements for Special Inspection, Observation, and Testing required in accordance with Chapter 17 of the 2018 IBC and is in addition to and supplements requirements included in Statement of Special Inspections shown on the Drawings.

1.02 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Society of Civil Engineers (ASCE): 7, Minimum Design Loads for Buildings and Other Structures.
2. International Code Council (ICC):
   a. International Building Code (IBC).
   b. Evaluation Service (ICC-ES) Reports and Legacy Reports.

1.03 DEFINITIONS

A. Agencies and Personnel:

1. Authority Having Jurisdiction (AHJ): Permitting building agency; may be a federal, state, local, or other regional department, or individual including building official, fire chief, fire marshal, chief of a fire prevention bureau, labor department, or health department, electrical inspector; or others having statutory authority. AHJ may be Owner when authorized to be self-permitting by governmental permitting agency or when no governmental agency has authority.
2. Approved Agency: An established and recognized agency regularly engaged in conducting tests or furnishing inspection services, when such agency has been approved.
3. Registered Design Professional in Responsible Charge: An individual who is registered or licensed to practice their respective design profession as defined by statutory requirements of professional registration laws of state or jurisdiction in which Project is to be constructed.
4. Special Inspector: Qualified person employed by Owner who will demonstrate competence to the satisfaction of AHJ for inspection of a particular type of construction or operation requiring Special Inspection.

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B. Statement of Special Inspections: Detailed written procedure contained on the Drawings establishing systems and components subject to Special Inspection, Observation, and Testing during construction, type and frequency of testing, extent and duration of Special Inspection, and reports to be completed and distributed by Special Inspector.

C. Special Inspection:

1. Special Inspection: Inspection required of materials, installation, fabrication, erection, or placement of components and connections requiring special expertise to ensure compliance with approved Contract Documents and referenced standards.
2. Special Inspection, Continuous: Full-time observation of work requiring Special Inspection by an approved Special Inspector who is present in area where the Work is being performed.
3. Special Inspection, Periodic: Part-time or intermittent observation of the Work requiring Special Inspection by an approved Special Inspector who is present in area where the Work has been or is being performed, and at completion of the Work.

D. Structural Systems and Components:

1. Diaphragm: Component of structural lateral load resisting system consisting of roof, floor, or other membrane or bracing system acting to transfer lateral forces to vertical resisting elements of structure.
2. Drag Strut or Collector: Component of structural lateral load resisting system consisting of diaphragm or shear wall element that collects and transfers diaphragm shear forces to vertical force-resisting elements or distributes forces within diaphragm or shear wall.
3. Seismic-Force-Resisting System: That part of structural lateral load resisting system that has been considered in the design to provide required resistance to seismic forces identified on the Drawings.
4. Shear Wall: Component of structural lateral load resisting system consisting of a wall designed to resist lateral forces parallel to plane of the wall. Unless noted otherwise on the Drawings, load-bearing walls with direct in-plane connections to roof and floors shall be considered to be shear walls.
5. Wind Force Resisting System: That part of the structural system that has been considered in the design to provide required resistance to wind forces identified on the Drawings.

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E. Nonstructural Components:

1. Architectural Component Supports: Structural members or assemblies of members which transmit loads and forces from architectural systems or components to structure, including braces, frames, struts, and attachments.
2. Electrical Component Supports: Structural members or assemblies which transmit loads and forces from electrical equipment to structure, including braces, frames, legs, pedestals, and tethers, as well as elements forged or cast as part of component for anchorage.
3. Mechanical Component Supports: Structural members or assemblies which transmit loads and forces from mechanical equipment to structure, including braces, frames, skirts, legs, saddles, pedestals, snubbers, and tethers, as well as elements forged or cast as part of component for anchorage.

F. Professional Observation:

1. Does not include or waive responsibility for required Special Inspection or inspections by building official.
2. Requirements are indicated on Statement of Special Inspections provided on the Drawings.
3. Geotechnical Observation: Visual observation of selected subgrade bearing surfaces and installation of deep foundation elements by a registered design professional for general conformance to Contract Documents.
4. Structural Observation: Visual observation of structural system(s) by a registered design professional for general conformance to Contract Documents.

1.04 STATEMENT OF SPECIAL INSPECTIONS REQUIREMENTS

A. Designated Systems for Inspection:

1. Seismic-force-resisting systems designated under IBC Section 1705 and subject to Special Inspection under IBC Section 1705: None required.
2. Wind-force-resisting systems designated under IBC Section 1705: None required.
3. Architectural, Mechanical, and Electrical Components subject to Special Inspection under IBC Section 1705.13.5 and IBC Section 1705.13.6 for Seismic Resistance: None required.

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B. Statement of Special Inspections:

1. As included on the Drawings and in support of building permit application, Project-specific requirements were prepared by Registered Design Professional in Responsible Charge. The following identifies elements of inspection, observation, and testing program to be followed in construction of the Work:
   a. Special Inspection and testing required by IBC Section 1705 and other applicable sections and referenced standards therein.
   b. Type and frequency of Special Inspection required.
   c. Type and frequency of testing required.
   d. Required frequency and distribution of testing and Special Inspection reports to be distributed by Special Inspector to Engineer, Contractor, building official, and Owner.
   e. Geotechnical Observation to be Performed: Required frequency and distribution of Geotechnical Observation reports by registered design professional to Contractor, building official, and Owner.
   f. Structural Observations to be Performed: Required frequency and distribution of Structural Observation reports by registered design professional to Contractor, building official, and Owner.

C. Special Inspection and associated testing of shop fabrication and field construction will be performed by an approved accredited independent agency or by Authority Having Jurisdiction's (AHJ) approved, qualified inspection staff. Owner will secure and pay for services of agency to perform Special Inspection and associated testing.

D. Code required Special Inspection with associated testing and Professional Observation, as provided in Statement of Special Inspections on the Drawings and further provided in this section, is for benefit of Owner and does not:

1. Relieve Contractor of responsibility for providing adequate quality control measures.
2. Relieve Contractor of responsibility for damage to or loss of material before acceptance.
3. Constitute or imply acceptance.
4. Affect continuing rights of Owner after acceptance of completed Work.

E. The presence or absence of code required Special Inspector and Professional Observer does not relieve Contractor from Contract requirements.

F. Contractor is responsible for additional costs associated with Special Inspection and Testing and Observation when Work is not ready at time identified by Contractor and Special Inspectors and Professional Observer are onsite, but not able to provide contracted services.

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G. Contractor is responsible for associated costs for additional Special Inspection and Testing and Professional Observation by Special Inspectors and Professional Observers required because of rejection of materials of in place Work that cannot be made compliant to Contract Document without additional inspections and observation and testing.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 GENERAL

A. Requirements of the Statement of Special Inspections are provided by the Owner. All other testing and inspections, unless noted otherwise, are provided by Contractor.

B. Provide access to shop or Site for Special Inspection and Testing and Professional Observation requirements.

C. Notify Engineer in advance of required Special Inspection and Professional Observation no later than 48 hours prior to date of Special Inspection and Professional Observation.

D. Provide access for Special Inspector to construction documents.

E. Retain special inspection records on-site to be readily available for review.

F. Cooperate with Special Inspector and provide safe access to the Work to be inspected.

G. Submit Fabricator’s Certificates of Compliance for approved fabricators.

H. Provide reasonable auxiliary services as requested by the Special Inspector. Auxiliary services required include, but not limited to:

1. Providing access to the Work and furnishing incidental labor and facilities necessary to facilitate inspections and tests to assist the Special Inspector in performing test/inspections.
2. Providing storage space for the Special Inspector’s exclusive use, such as for storing and curing concrete test samples and delivery of samples to testing laboratories.
3. Providing the Special Inspector with access to all approved submittals.
4. Providing security and protection of samples and test equipment at the Project Site.
5. Provide samples of materials to be tested in required quantities.

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I. Materials and systems shall be inspected during placement where Continuous Special Inspection is required.

J. Where Periodic Special Inspection is indicated in the Statement of Special Inspections:

1. Schedule inspections for either during or at completion of their placement or a combination or both.
2. Schedule periodically inspected Work (either inspected during or after its placement) so that corrections can be completed and re-inspected before Work is inaccessible.
3. Sampling a portion of the Work is not allowed. Schedules shall provide for inspection of all Work requiring periodic inspection.

END OF SECTION

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SECTION 01 50 00
TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Association of Nurserymen (AAN): American Standards for Nursery Stock.
2. Federal Emergency Management Agency (FEMA).
3. National Fire Prevention Association (NFPA): 241, Standard for Safeguarding Construction, Alteration, and Demolition Operations.
4. Telecommunications Industry Association (TIA); Electronic Industries Alliance (EIA): 568B, Commercial Building Telecommunications Cabling Standard.
5. U.S. Department of Agriculture (USDA): Urban Hydrology for Small Watersheds.
6. U.S. Weather Bureau: Rainfall-Frequency Atlas of the U.S. for Durations from 30 Minutes to 24 Hours and Return Periods from 1-Year to 100 Years.

1.02 SUBMITTALS

A. Informational Submittals:

1. Copies of permits and approvals for construction as required by Laws and Regulations and governing agencies.
2. Temporary Utility Submittals:
   a. Electric power supply and distribution plans.
   b. Water supply and distribution plans.
   c. Dewatering well locations.
   d. Sanitary.
3. Temporary Construction Submittals:
   a. Access Roads: Routes, cross-sections, and drainage facilities.
   b. Parking area plans.
   c. Contractor’s field office, storage yard, and storage building plans, including gravel surfaced area.
   d. Fencing and protective barrier locations and details.
   e. Engineer’s field office plans.
   f. Staging area location plan.
   g. Traffic Routing Plan
   h. Plan for maintenance of existing plant operations.
   i. Project sign.

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4. Temporary Control Submittals:
    a. Noise control plan.
    b. Dust control plan.

1.03 MOBILIZATION

A. Mobilization includes, but is not limited to, these principal items:

1. Obtaining required permits.
2. Moving Contractor's field office and equipment required for first month operations onto Site.
3. Installing temporary construction power, wiring, and lighting facilities.
4. Providing onsite Internet service and telephones.
5. Providing onsite sanitary facilities and potable water facilities as specified and as required by Laws and Regulations, and governing agencies.
6. Arranging for and erection of Contractor's work and storage yard.
7. Posting OSHA required notices and establishing safety programs and procedures.
8. Having Contractor's superintendent at Site full time.
9. Providing Engineer's facilities.

B. Use area designated for Contractor's temporary facilities as shown on the Drawings.

1.04 PROTECTION OF WORK AND PROPERTY

A. Comply with Owner's safety rules while on Owner's property.

B. Keep Owner informed of serious onsite accidents and related claims.

C. Use of Explosives: No blasting or use of explosives will be allowed onsite.

1.05 VEHICULAR TRAFFIC

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

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PART 2 PRODUCTS

2.01 CONSTRUCTION MANAGER'S AND ENGINEER'S FIELD OFFICE

A. Furnish equipment specified for exclusive use of Construction Manager, Engineer and its representatives.

B. Ownership of equipment furnished under this article will remain, unless otherwise specified, that of Contractor.

C. Equipment furnished shall be new or like new in appearance and function.

D. Minimum Features:

1. 110-volt lighting and wall plugs.
2. Fluorescent ceiling lights.
3. Electric heating and self-contained air conditioning unit, properly sized for Project locale and conditions. Provide ample electric power to operate installed systems.
4. Provide railed stairways, and landings, and exterior lighting at entrances.
5. Sign on entrance door reading JACOBS, letter height 4 inches minimum.
6. Exterior Door(s):
   a. Number: Two.
   b. Type: Solid core.
   c. Lock(s): Cylindrical; keyed alike.
7. Number of Windows: Two.
8. Minimum Interior Height: 8 feet.

E. Floor Space: Minimum 225 square feet.

F. Rooms: Three, with minimum private office floor space of 80 square feet, a bathroom, and remainder configured for open meeting or storage space.

G. Plan table; plan rack; two double desk(s) with desk surface located 29 inches from floor; two 2-drawer, steel file cabinets; and overhead shelf(s).

H. All-metal frame; all-metal exterior, sides, and roof; and insulated double walls, floor, and roof.

I. Security guard screens on windows.

J. Bathroom shall include toilet and wash basin with hot and cold water and drains, and a paper towel dispenser.

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K. Blinds or drapes on windows.

L. Work Surface: One, 30 inches by 10 feet at desk height of 29 inches from floor.

M. Office Equipment—General:

1. Desk: One, steel, 30 inches by 60 inches with desk surface located 29 inches from floor.
2. Desk Chair:
   a. Two, with the following characteristics:
      1) Five castor base.
      2) Adjustable height.
      3) Swivels.
      4) Locking Back.
      5) Adjustable seat back for height and angle.
      6) Adjustable arms.
3. Bookcase: Two, one per room, 36 inches wide by 84 inches high.
4. Wastepaper Basket: Two, one per room.
5. First-Aid Kit: One.
6. Tri-Class (ABC), Dry Chemical Fire Extinguisher, 10 pound: One.
7. Wi-Fi access.

2.02 PROJECT SIGN

A. Provide and maintain one project sign as detailed in Supplement Project Sign of this specification and as described below:

1. Lettering shall be applied by an experienced sign painter.
2. Include Owner’s and agency’s logos in full color.
3. Provide exterior type enamel paint.

PART 3 EXECUTION

3.01 ENGINEER’S FIELD OFFICE

A. Make available for Construction Manager’s and Engineer’s use prior to start of the Work at Site and to remain on Site for minimum of 30 days after final acceptance of the Work.

B. Locate where directed by Engineer; level, block, tie down, skirt, provide stairways, and relocate when necessary and approved. Construct on proper foundations, and provide proper surface drainage and connections for utility services.

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C. Provide minimum 100 square feet of gravel or crushed rock base, minimum depth of 4 inches, at each entrance.

D. Raise grade under field office, as necessary, to elevation adequate to avoid flooding.

E. Provide sanitary facilities in compliance with state and local health authorities.

F. Exterior Door Keys: Furnish two set(s) of keys.

G. Maintain in good repair and appearance, and provide weekly cleaning service and replenishment, as required, of paper towels, paper cups, hand soap, toilet paper, first-aid kit supplies, and bottled water.

H. Replenish, as needed, copy paper and toner.

3.02 TEMPORARY UTILITIES

A. Power:

1. Electric power will be available at or near Site. Determine type and amount available and make arrangements for obtaining temporary electric power service, metering equipment, and pay costs for electric power used during Contract period, except for portions of the Work designated in writing by Engineer as substantially complete.
2. Cost of electric power will be borne by Owner.

B. Lighting: Provide temporary lighting to meet applicable safety requirements to allow erection, application, or installation of materials and equipment, and observation or inspection of the Work.

C. Heating, Cooling, and Ventilating:

1. Provide as required to maintain adequate environmental conditions to facilitate progress of the Work, to meet specified minimum conditions for installation of materials, and to protect materials, equipment, and finishes from damage because of temperature or humidity.
2. Provide adequate forced air ventilation of enclosed areas to cure installed materials, to dispense humidity, and to prevent hazardous accumulations of dust, fumes, vapors, or gases.
3. Pay costs of installation, maintenance, operation, removal, and fuel consumed.
4. Provide portable unit heaters, complete with controls, oil- or gas-fired, and suitably vented to outside as required for protection of health and property.

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D. Water: Owner will provide a place of temporary connection for construction and drinking water at Site. Provide temporary facilities and piping required to bring water to point of use and remove when no longer needed. Install an acceptable metering device and pay for water used at Owner's current rate.

E. Sanitary and Personnel Facilities:

1. Provide and maintain facilities for Contractor's employees, Subcontractors, and other onsite employers' employees. Service, clean, and maintain facilities and enclosures.
2. Use of Owner's existing sanitary facilities by construction personnel will not be allowed.

F. Fire Protection: Furnish and maintain on Site adequate firefighting equipment capable of extinguishing incipient fires. Comply with applicable parts of NFPA 241.

3.03 PROTECTION OF WORK AND PROPERTY

A. General:

1. Perform Work within right-of-way and easements in a systematic manner that minimizes inconvenience to property owners and the public.
2. Maintain in continuous service existing oil and gas pipelines, underground power, telephone or communication cable, water mains, irrigation lines, sewers, poles and overhead power, and other utilities encountered along line of the Work, unless other arrangements satisfactory to owners of said utilities have been made.
3. Where completion of the Work requires temporary or permanent removal or relocation of existing utility, coordinate activities with owner of said utility and perform work to their satisfaction.
4. Protect, shore, brace, support, and maintain underground pipes, conduits, drains, and other underground utility construction uncovered or otherwise affected by construction operations.
5. Keep fire hydrants and water control valves free from obstruction and available for use at all times.
6. In areas where Contractor's operations are adjacent to or near a utility, such as gas, telephone, television, electric power, water, sewer, or irrigation system, and such operations may cause damage or inconvenience, suspend operations until arrangements necessary for protection have been made by Contractor.

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7. Notify property owners and utility offices that may be affected by construction operation at least 2 days in advance: Before exposing a utility, obtain utility owner's permission. Should service of utility be interrupted due to Contractor's operation, notify proper authority immediately. Cooperate with said authority in restoring service as promptly as possible and bear costs incurred.
8. Do not impair operation of existing sewer system. Prevent construction material, pavement, concrete, earth, volatile and corrosive wastes, and other debris from entering sewers, pump stations, or other sewer structures.
9. Maintain original Site drainage wherever possible.

B. Site Security:

1. Erect a temporary security fence for protection of existing facilities, as specified in Section 32 31 13, Chain Link Fences and Gates. Maintain fence throughout construction period. Obtain Engineer's written permission before removal of temporary security fencing.
2. Provide and maintain additional temporary security fences as necessary to protect the Work and Contractor-furnished products not yet installed.

C. Trees and Plantings:

1. Protect from damage and preserve trees, shrubs, and other plants outside limits of the Work and within limits of the Work, which are designated on the Drawings to remain undisturbed.
    a. Where practical, tunnel beneath trees when on or near line of trench.
    b. Employ hand excavation as necessary to prevent tree injury.
    c. Do not stockpile materials or permit traffic within drip lines of trees.
    d. Provide and maintain temporary barricades around trees.
    e. Water vegetation as necessary to maintain health.
    f. Cover temporarily exposed roots with wet burlap, and keep burlap moist until soil is replaced around roots.
    g. No trees, except those specifically shown on the Drawings to be removed, shall be removed without written approval of Engineer.
    h. Dispose of removed trees in a legal manner off the Site.
2. Balling and burlapping of trees indicated for replacement shall conform to recommended specifications set forth in the American Standards for Nursery Stock, published by American Association of Nurserymen. Balls shall be firm and intact and made-balls will not be accepted. Handle ball and burlap trees by ball and not by top.

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3. In event of damage to bark, trunks, limbs, or roots of plants that are not designated for removal, treat damage by corrective pruning, bark tracing, application of a heavy coating of tree paint, and other accepted horticultural and tree surgery practices.
4. Replace each plant that dies as a result of construction activities.

D. Existing Structures:

1. Where Contractor contemplates removal of small structures such as mailboxes, signposts, and culverts that interfere with Contractor's operations, obtain approval of property owner and Engineer.
2. Move mailboxes to temporary locations accessible to postal service.
3. Replace items removed in their original location and a condition equal to or better than original.

E. Finished Construction: Protect finished floors and concrete floors exposed as well as those covered with composition tile or other applied surfacing.

F. Waterways: Keep ditches, culverts, and natural drainages continuously free of construction materials and debris.

G. Dewatering: Construct, maintain, and operate cofferdams, channels, flume drains, sumps, pumps, or other temporary diversion and protection works. Furnish materials required, install, maintain, and operate necessary pumping and other equipment for the environmentally safe removal and disposal of water from the various parts of the Work. Maintain foundations and parts of the Work free from water.

H. Endangered and Threatened Species:

1. Take precautions necessary and prudent to protect native endangered and threatened flora and fauna.
2. Notify Engineer of construction activities that might threaten endangered and threatened species or their habitats.
3. Engineer will mark areas known as habitats of endangered and threatened species prior to commencement of onsite activities.
4. Additional areas will be marked by Engineer as other habitats of endangered and threatened species become known during construction.

3.04 TEMPORARY CONTROLS

A. Air Pollution Control:

1. Minimize air pollution from construction operations.
2. Burning of waste materials, rubbish, or other debris will not be permitted on or adjacent to Site.

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

B. Noise Control:

1. Provide acoustical barriers so noise emanating from tools or equipment will not exceed legal noise levels.
2. Noise Control Plan: Propose plan to mitigate construction noise and to comply with noise control ordinances, including method of construction, equipment to be used, and acoustical treatments.

C. Water Pollution Control:

1. Divert sanitary sewage and non-storm waste flow interfering with construction and requiring diversion to sanitary sewers. Do not cause or permit action to occur which would cause an overflow to existing waterway.
2. Prior to commencing excavation and construction, obtain Engineer's agreement with detailed plans showing procedures intended to handle and dispose of sewage, groundwater, and dewatering pump discharges.
3. Comply with Section 01 57 13, Temporary Erosion and Sedimentation Control, for stormwater flow and surface runoff.
4. Do not dispose of volatile wastes such as mineral spirits, oil, chemicals, or paint thinner in storm or sanitary drains. Disposal of wastes into streams or waterways is prohibited. Provide acceptable containers for collection and disposal of waste materials, debris, and rubbish.

D. Erosion, Sediment, and Flood Control: Provide, maintain, and operate temporary facilities as specified in Section 01 57 13, Temporary Erosion and Sedimentation Control, to control erosion and sediment releases, and to protect the Work and existing facilities from flooding during construction period.

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3.05 STORAGE YARDS AND BUILDINGS

A. Coordinate requirements with Section 01 61 00, Common Product Requirements.

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

C. Temporary Storage Buildings:

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

3.06 ACCESS ROADS

A. Construct access roads as shown and within easements, rights-of-way, or Project limits. Use existing roads where shown.

B. Maintain drainage ways. Install and maintain culverts to allow water to flow beneath access roads. Provide corrosion-resistant culvert pipe of adequate strength to resist construction loads.

C. Provide gravel, crushed rock, or other stabilization material to permit access by all motor vehicles at all times.

D. Maintain road grade and crown to eliminate potholes, rutting, and other irregularities that restrict access.

E. Coordinate with Engineer detours and other operations affecting traffic and access. Provide at least 72 hours' notice to Owner of operations that will alter access to Site.

F. Where access road crosses existing fences, install and maintain gates. Gates and gate posts shall conform to those as specified in Section 32 31 13, Chain Link Fences and Gates.

G. Upon completion of construction, restore ground surface disturbed by access road construction to original grade.

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3.07 PARKING AREAS

A. Control vehicular parking to preclude interference with public traffic or parking, access by emergency vehicles, Owner's operations, or construction operations.

B. Provide parking facilities for personnel working on Project. No employee or equipment parking will be permitted on Owner's existing paved areas.

3.08 VEHICULAR TRAFFIC

A. Comply with Laws and Regulations regarding closing or restricting use of public streets or highways. No public or private road shall be closed, except by written permission of proper authority. Ensure the least possible obstruction to traffic and normal commercial pursuits.

B. Conduct the Work to interfere as little as possible with public travel, whether vehicular or pedestrian.

C. Whenever it is necessary to cross, close, or obstruct roads, driveways, and walks, whether public or private, provide and maintain suitable and safe bridges, detours, or other temporary expedients for accommodation of public and private travel.

D. Road Closures: Maintain satisfactory means of exit for persons residing or having occasion to transact business along route of the Work. If it is necessary to close off roadway or alley providing sole vehicular access to property for periods greater than 2 hours, provide written notice to each owner so affected 3 days prior to such closure. In such cases, closings of up to 4 hours may be allowed. Closures of up to 10 hours may be allowed if a week's written notice is given and undue hardship does not result.

E. Maintenance of traffic is not required if Contractor obtains written permission from Owner and tenant of private property, or from authority having jurisdiction over public property involved, to obstruct traffic at designated point.

F. In making street crossings, do not block more than one-half the street at a time. Whenever possible, widen shoulder on opposite side to facilitate traffic flow. Provide temporary surfacing on shoulders as necessary.

G. Maintain top of backfilled trenches before they are paved, to allow normal vehicular traffic to pass over. Provide temporary access driveways where required. Cleanup operations shall follow immediately behind backfilling.

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H. When flaggers and guards are required by regulation or when deemed necessary for safety, furnish them with approved orange wearing apparel and other regulation traffic control devices.

I. Notify fire department and police department before closing street or portion thereof. Notify said departments when streets are again passable for emergency vehicles. Do not block off emergency vehicle access to consecutive arterial crossings or dead-end streets, in excess of 300 linear feet, without written permission from fire department. Conduct operations with the least interference to fire equipment access, and at no time prevent such access. Furnish Contractor's night emergency telephone numbers to police department.

J. Coordinate traffic routing with that of others working in same or adjacent areas.

3.09 CLEANING DURING CONSTRUCTION

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

B. Wet down exterior surfaces prior to sweeping to prevent blowing of dust and debris. At least weekly, sweep floors (basins, tunnels, platforms, walkways, roof surfaces), and pick up and dispose of debris.

C. Provide approved containers for collection and disposal of waste materials, debris, and rubbish. At least weekly, dispose of such waste materials, debris, and rubbish offsite.

D. At least weekly, brush sweep entry drive, roadways, and other streets and walkways affected by the Work and where adjacent to the Work.

END OF SECTION

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SECTION 01 57 13
TEMPORARY EROSION AND SEDIMENT CONTROL

PART 1 GENERAL

1.01 SUMMARY

A. This section covers Work to implement structural and nonstructural Best Management Practices (BMP) to control soil erosion by wind or water and keep eroded sediments and other construction-generated pollutants from moving off Project Sites. Requirements described in this specification and shown on the Drawings are part of the Project Erosion and Sediment Control Plan (ESC Plan) and are the minimum for all Project construction sites, phases and conditions. This specification covers all Project activities, including material sources, disposal sites, and offsite mitigation areas unless specific Project activities are excluded elsewhere in this specification or in other Contract Documents controlling the Work.

B. National Pollutant Discharge Elimination System: Comply with federal, state, and local laws, rules and regulations, and the National Pollutant Discharge Elimination System (NPDES) Construction Stormwater Discharge Permit or Permits applicable to the Project.

C. General Permit (OKR10): Contractor shall be responsible for and apply for permit. Permit and related documents shall comply with Oklahoma Department of Environmental Quality (ODEQ) requirements.

D. Stormwater Pollution Prevention Plan (SWP3): Comply with Oklahoma Department of Environmental Quality (ODEQ) requirements.

E. Other Regulations: A local government erosion and sediment control permit may apply and some local agency requirements may be more stringent than this specification. Adequate erosion and sediment control is essential for complying with the federal Endangered Species Act where construction runoff enters waters inhabited by protected species.

1.02 REFERENCES

A. Activities shall conform to the State of Oklahoma Erosion and Sediment Control Manual, and the Drawings. In the event of a conflict, the more stringent requirement shall apply.

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B. The following is a list of standards that may be referenced in this section:

1. American Association of State Highway and Transportation Officials (AASHTO): M252, Standard Specification for Corrugated Polyethylene Drainage Pipe.
2. ASTM International (ASTM):
   a. D638, Standard Test Method for Tensile Properties of Plastics.
   b. D2974, Standard Test Methods for Moisture, Ash, and Organic Matter of Peat and Other Organic Soils.
   c. D3776/D3776M, Standard Test Methods for Mass Per Unit Area (Weight) of Fabric.
   d. D4355, Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus.
   e. D4397, Standard Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications.
   f. D4491, Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
   g. D4533, Standard Test Method for Trapezoid Tearing Strength of Geotextiles.
   h. D4632/D4632M, Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
   i. D4751, Standard Test Method for Determining Apparent Opening Size of a Geotextile
   j. D6241, Standard Test Method for Static Puncture Strength of Geotextiles and Geotextile-Related Products Using a 50-mm Probe.
   k. D6459, Standard Test Method for Determination of Rolled Erosion Control Product (RECP) Performance in Protecting Hillslopes from Rainfall-Induced Erosion.
   l. D6460, Standard Test Method for Determination of Rolled Erosion Control Product (RECP) Performance in Protecting Earthen Channels from Stormwater-Induced Erosion.
   m. D6475, Standard Test Method for Measuring Mass Per Unit Area of Erosion Control Blankets.
   n. D7322, Standard Test Method for Determination of Rolled Erosion Control Product (RECP) Ability to Encourage Seed Germination and Plant Growth Under Bench-Scale Conditions.
   o. D7367, Standard Test Method for Determining Water Holding Capacity of Fiber Mulches for Hydraulic Planting.
3. National Weather Service:
   a. Precipitation-Frequency of the United States by State/Territory, 2012.
   b. Precipitation Frequency Data Server, 2012.
4. North American Weed Management Association (NAWMA).

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5. U.S. Department of Agriculture, Natural Resources Conservation Service: *Urban Hydrology for Small Watersheds*; 1986. Technical Release 55.
6. U.S. Environmental Protection Agency:
   a. Developing Your Stormwater Pollution Prevention Plan: A Guide for Construction Sites, 2007. EPA-833-R-06-004.
   b. National Menu of BMPs, 2012.

1.03 SYSTEM DESCRIPTION

A. Erosion and Sediment Control:

1. Provide, maintain, and operate temporary facilities to control erosion and sediment releases during construction period.
2. Design erosion and sediment controls to handle peak runoff resulting from 25-year, 24-hour storm event based on National Weather Service: Precipitation Frequency Data Server.
3. Size temporary stormwater conveyances based on procedures presented in U.S. Department of Agriculture, Natural Resources Conservation Service: Urban Hydrology for Small Watersheds, 1986. Technical Release 55.

B. Erosion and Sediment Control (ESC) Lead:

1. Identify the ESC Lead at the preconstruction discussions and in the ESC Plan. The ESC Lead shall have certification in construction site erosion and sediment control from a course approved by Owner.
2. The ESC Lead shall implement the ESC Plan, including, but not limited to:
   a. Installing and maintaining all temporary erosion and sediment control Best Management Practices (BMPs) included in the ESC Plan to assure continued performance of their intended function. Damaged or inadequate ESC BMPs shall be corrected immediately.
   b. Updating ESC Plan to reflect current field conditions.
   c. Terminating ESC Plan.
3. When an ESC Plan is included in the Contract Plans, ESC Lead shall also inspect all areas disturbed by construction activities, all onsite erosion and sediment control BMPs, all stormwater discharge points, and all temporarily stabilized inactive sites per schedule in the Construction Stormwater Discharge Permit(s) or as directed by Engineer. Complete erosion and sediment control inspection form provided by water resource agency or Owner for each inspection and submit a copy to Engineer no later than end of the next working day following inspection.

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C. Personnel Training:

1. Prior to commencement of construction, applicable personnel must have an understanding of the Construction Stormwater Discharge Permit's requirements and their specific responsibilities under the permit. At a minimum, personnel must be trained to understand the following as it relates to the scope of their job duties:
   a. The location of all stormwater controls and how to maintain them.
   b. Procedures for complying with the pollution prevention requirements.
   c. Procedures for conducting inspections, recording findings, and taking corrective action.

D. Erosion and Sediment Control Plan (Stormwater Pollution Prevention Plan):

1. An ESC Plan is furnished as part of the Drawings, which helps fulfill part of the plan requirement of the NPDES Permit. This initial ESC Plan, when adopted by Contractor, may be used as the basis of the construction ESC Plan. Additional or revised erosion and sediment control features, not shown on the initial ESC Plan, may be required depending on Contractor's methods of operation and schedule.
2. For each phase of the scheduled work, indicate on the ESC Plan all the BMPs proposed and installed for erosion and sediment control to minimize clearing, stabilize exposed soil, divert or temporarily store flows, limit runoff from exposed areas, and filter transported sediment. Include all temporary slopes, constructed for staging or other reasons, which may not have been identified in the original Contract plans. Refer to the current local jurisdiction's erosion and sediment control manual.
3. Some ESC Plan required elements typically required by NPDES permits:
   a. Narrative Site Description:
      1) Nature of construction activity planned for the Site.
      2) Estimates of total site area and the areas of the Site expected to be disturbed.
      3) Soil types found onsite and their erosion potential.
      4) The types of fill materials to be used.
      5) Timetable for sequence of major construction events.
   b. Site Map:
      1) All areas of development.
      2) Drainage patterns.
      3) Areas of soil disturbance, including pre-development and post-development elevation contours.
      4) Areas used for storage of soils or wastes.
      5) Areas where vegetative practices are to be implemented.

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6) Location of all erosion and sediment control BMP or structures.
7) Location of all impervious structures and surfaces after Project is completed.
8) All surface waters located onsite.
9) Boundaries of the 100-year floodplain.
10) Ordinary High Water line of adjacent surface waters.
11) Location of storm drainage outfalls to receiving waters.
12) Details of sediment and erosion controls.
13) Details of storm drain piping, inflow and outflow details.

c. Required BMPs and Procedures for Erosion Prevention, Runoff Control, and Sediment Control:
1) Construction entrances and parking areas.
2) Unpaved Site roads such as haul roads.
3) Hauling saturated soils from the Site.
4) Water washed from concrete trucks.
5) Correct installation of erosion and sediment control BMPs.
6) Prompt maintenance and repair of BMPs.
7) Clearing and grading practices to minimize area of exposed soil throughout life of the Project.
8) Schedule of phased clearing operations to limit soils to what can be stabilized.
9) Vegetative practices, including preservation of existing vegetation, seeding, mulching, and buffer strips.
10) Preventing erosion of exposed areas.
11) Diverting flows from exposed slopes.
12) Limiting runoff from exposed areas.
13) Limiting sediment transport within work sites and keeping it from moving off of Project areas.
14) Perimeter controls for all clearing and grubbing, both planned and installed.
15) Additional controls for wet season work and temporary work suspensions.
16) Sensitive areas such as wetlands.
17) Offsite material source and waste areas.
18) Dust.
19) Emergency materials stockpiled onsite.
20) Soil stockpiles.

4. Contractor’s construction ESC Plan and implementation schedules must be prepared by a competent individual. Furnish a signed copy of the ESC Plan with individual’s name, title, state certifications, and employing firm if different than Contractor’s firm.
5. Do not begin any Site activities that have potential to cause erosion or sediment movement until the ESC Plan and implementation schedules are approved by Engineer.

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6. Keep a copy of the approved ESC Plan with updated changes onsite during all construction activities. During inactive periods longer than 7 calendar days, keep the ESC Plan onsite or provide a copy to Engineer to retain.
7. Continually update the ESC Plan and schedules as needed for unexpected storm or other events to ensure that sediment-laden water does not leave the construction site. Add approved changes to the ESC Plan no later than 24 hours after implementation.

E. Install high visibility fence along the Site limits shown on the Drawings or as instructed by Engineer. Space posts and attach fence fabric to posts as required by the manufacturer. Do not fasten fence to trees. Throughout the life of the Project, preserve and protect delineated area, acting immediately to repair or restore any fencing damaged or removed.

F. Preventing erosion, and controlling runoff, sedimentation, and non-stormwater pollution, requires Contractor to perform temporary Work items including, but not limited to:

1. Providing ditches, berms, culverts, and other measures to control surface water.
2. Building dams, settling basins, energy dissipaters, and other measures, to control downstream flows.
3. Controlling underground water found during construction.
4. Covering or otherwise protecting slopes until permanent erosion control measures are working.

G. To the degree possible, coordinate this temporary Work with permanent drainage and erosion control work the Contract requires.

H. Engineer may require additional temporary control measures if it appears pollution or erosion may result from weather, nature of materials, or progress on the Work.

I. When natural elements rut or erode the slope, restore and repair damage with eroded material where possible, and remove and dispose of any remaining material found in ditches and culverts. When Engineer orders replacement with additional or other materials, unit Contract prices will cover quantities needed.

J. Install all sediment control devices including, but not limited to, sediment ponds, perimeter sediment fencing, or other sediment trapping BMPs prior to any ground disturbing activity. Do not expose more erodible earth than necessary during clearing, grubbing, excavation, borrow, or fill activities without written approval by Engineer. Engineer may increase or decrease the limits based on Project conditions. Erodible earth is defined as any surface

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where soils, grindings, or other materials may be capable of being displaced and transported by rain, wind, or surface water runoff. Cover inactive areas of erodible earth, whether at final grade or not, within specified time period (see NPDES General OKR10 Permit), using an approved soil covering practice. Phase clearing and grading to maximum extent practical to prevent exposed inactive areas from becoming a source of erosion.

K. Water Management:

1. Manage site water in accordance with the conditions of the waste discharge permit from a local permitting authority. If site water management is not subject to permit, manage as follows:
    a. Groundwater. When groundwater is encountered in an excavation, treat and discharge as follows:
        1) When groundwater conforms to jurisdiction Water Quality Standards, it may bypass detention and treatment facilities and be routed directly to its normal discharge point at a rate and method that will not cause erosion.
        2) When turbidity of groundwater is similar to turbidity of site runoff, groundwater may be treated using same detention and treatment facilities being used to treat the site runoff and then discharged at a rate that will not cause erosion.
        3) When groundwater turbidity is greater than turbidity of site runoff, treat ground water separately until turbidity is similar to or better than site runoff, and then it may be combined with site runoff and treated as described above.
    b. Process Water:
        1) Do not discharge high pH process water or wastewater (non-stormwater) that is generated onsite, including water generated during concrete grinding, rubblizing, washout, and hydrodemolition activities, to waters of the jurisdiction, including wetlands. Water may be infiltrated upon approval of Engineer. Offsite disposal of concrete process water is subject to approval of Engineer.
        2) Treat all water generated onsite from construction or washing activities that is more turbid than site runoff separately until turbidity is the same or less than site runoff, and then it may be combined with site runoff and treated as described above. Water may be infiltrated upon approval of Engineer.

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c. Offsite Water: Prior to disruption of normal watercourse, intercept offsite stormwater and pipe it either through or around the Project Site. This water shall not be combined with onsite stormwater. Discharge offsite water at its preconstruction outfall point preventing an increase in erosion below the Site. Submit proposed method for performing this Work for Engineer's approval.

L. Pollution Control:

1. Use BMPs to prevent or minimize stormwater exposure to pollutants from spills; vehicle and equipment fueling, maintenance, and storage; other cleaning and maintenance activities; and waste handling activities. These pollutants include fuel, hydraulic fluid, and other oils from vehicles and machinery, as well as debris, leftover paints, solvents, and glues from construction operations. Implement the following BMPs when applicable:
   a. Written spill prevention and response procedures.
   b. Employee training on spill prevention and proper disposal procedures.
   c. Spill kits in all vehicles.
   d. Regular maintenance schedule for vehicles and machinery.
   e. Material delivery and storage controls.
   f. Training and signage.
   g. Covered storage areas for waste and supplies.

M. If Engineer orders the Work suspended, continue to control erosion, pollution, and runoff during the shutdown.

N. Nothing in this section shall relieve Contractor from complying with other Contract requirements.

1.04 SUBMITTALS

A. Informational Submittals:

1. When an ESC Plan is included on the Drawings, either adopt or modify the ESC Plan. Provide a schedule for ESC Plan implementation and incorporate it into Contractor's progress schedule. Obtain Engineer's approval of the ESC Plan and schedule before any Work begins.
2. Modified ESC Plans shall meet all requirements of the applicable jurisdictions.
3. The ESC Plan shall cover all areas that may be affected inside and outside the limits of the Project (including all Owner-provided sources, disposal sites, and haul roads, and all nearby land, streams, and other bodies of water).

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4. Allow at least 5 working days for Engineer to review any original or revised ESC Plan. Failure to approve all or part of any such Plan shall not make Owner liable to Contractor for any Work delays.

PART 2 PRODUCTS

2.01 INLET PROTECTION

A. Rock Material Used for Inlet Protection Bag: Clean, open-graded, 3/4-inch rock, with no recycled materials.

B. Wood Chips Used for Inlet Protection Bags: As specified in Article Wood Chips and Wood Shavings.

2.02 HIGH VISIBILITY FENCING

A. High Visibility Fence: UV stabilized, orange, high-density polyethylene or polypropylene mesh.

B. Height: 4 feet minimum.

C. Support Posts: Wood or steel with sufficient strength and durability to support the fence through the life of the Project.

2.03 OUTLET PROTECTION

A. Size riprap or quarry spall to resist movement under design flows. Install at least 8 inches deep. Provide riprap or quarry spall material free of extraneous material.

2.04 PLASTIC COVERING

A. Clear plastic meeting requirements of ASTM D4397 for polyethylene sheeting having a minimum thickness of 6 mils.

2.05 SEEDING

A. See Section 32 92 00, Turf and Grasses.

2.06 SEDIMENT FENCE

A. Geotextile: As specified in Article Geotextile.

B. Support Posts: As recommended by manufacturer of geotextile.

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C. Fasteners: Heavy-duty wire staples at least 1-inch long, tie wires, or hog rings, as recommended by manufacturer of geotextile.

2.07 STABILIZED CONSTRUCTION ENTRANCE

A. Construct a pad from stone 3 inches to 6 inches in size, placed at least 8 inches deep and not less than 50 feet long.

B. Provide aggregate free of extraneous materials that may cause or contribute to track out.

C. Place separation geotextile under the rock to prevent fine sediment from pumping up into the rock pad. See Article Geotextile for required geotextile properties.

D. Use of constructed or constructed/manufactured steel plates with ribs (such as, shaker/rumble plates or corrugated steel plates) for entrance/exit access is allowable.

2.08 GEOTEXTILE

A. Geotextiles shall consist only of long chain polymeric fibers or yarns formed into a stable network such that the fibers or yarns retain their position relative to each other during handling, placement, and design service life. At least 95 percent by weight of the material shall be polyolefins or polyesters. The material shall be free from defects or tears. Geotextile shall also be free of any treatment or coating which might adversely alter its hydraulic or physical properties after installation. Geotextile properties shall be as specified in Section 31 32 19.16, Geotextile, or as described in Table 1 through Table 3.

Table 1
Geotextile for Permanent Erosion Control

Geotextile Property	ASTM Test Method	Geotextile Property Requirements					
		Permanent Erosion Control				Ditch Lining	
		Moderate Survivability		High Survivability			
		Woven	Nonwoven	Woven	Nonwoven	Woven	Nonwoven
AOS	D4751	See Table 2		See Table 2		U.S. No. 30 max.	
Water Permittivity	D4491	See Table 2		See Table 2		0.02 sec^{-1} min.	
Grab Tensile Strength, in machine and x-machine direction	D4632/ D4632M	250 lb min.	160 1b min.	315 lb min.	200 lb min.	250 lb min.	160 lb min.
Grab Failure Strain, in machine and x-machine direction	D4632/ D4632M	15% -50%	≥50%	15% -50%	≥50%	<50%	≥50%
Seam Breaking Strength	D4632/ D4632M	220 lb min.	140 lb min.	270 lb min.	180 lb min.	220 lb min.	140 lb min.

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Table 1
Geotextile for Permanent Erosion Control

Geotextile Property	ASTM Test Method	Geotextile Property Requirements					
		Permanent Erosion Control				Ditch Lining	
		Moderate Survivability		High Survivability			
		Woven	Nonwoven	Woven	Nonwoven	Woven	Nonwoven
Puncture Resistance	D6241	495 lb min.	310 lb min.	620 lb min.	430 lb min.	495 lb min.	310 lb min.
Tear Strength, in machine and x-machine direction	D4533	80 lb min.	50 lb min.	112 lb min.	79 lb min.	80 lb min.	50 lb min.
Ultraviolet (UV) Radiation Stability	D4355	70% strength retained min., after 500 hours in xenon arc device					

Table 2
Filtration Properties for Geotextile for Permanent Erosion Control

Geotextile Property	ASTM Test Method	Geotextile Property Requirements		
		Class A	Class B	Class C
AOS	D4751	U.S. No. 40 max.	U.S. No. 60 max.	U.S. No. 70 max.
Water Permittivity	D4491	0.7 sec^{-1} min.	0.4 sec^{-1} min.	0.2 sec^{-1} min.

Table 3
Geotextile for Temporary Silt Fence

Geotextile Property	ASTM Test Method	Geotextile Property Requirements	
		Unsupported Between Posts	Supported Between Posts with Wire or Polymeric Mesh
AOS	D4751	U.S. No. 30 max. for silt wovens, U.S. No. 50 for all other geotextile types, U.S. No. 100 min.	
Water Permittivity	D4491	0.2 sec^{-1} min.	
Grab Tensile Strength, in machine and x-machine direction	D4632/D4632M	180 lb min. in machine direction, 100 lb min. in x-machine direction	100 lb min.
Grab Failure Strain, in machine and x-machine direction	D4632/D4632M	30% max. at 180 lb or more	
Ultraviolet (UV) Radiation Stability	D4355	70% strength retained min., after 500 hours in xenon arc device	

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2.09 STREET CLEANING

A. Use self-propelled pickup street sweeper(s). Mechanical broom sweepers are not allowed where environmental concerns exist about storm water pollution or air quality.

2.10 TACKIFIERS

A. Biodegradable Hydraulically Applied Erosion Control Products (HECPs) in a dry condition, free of noxious weeds, seeds, chemical printing ink, germination inhibitors, herbicide residue, chlorine bleach, rock, metal, plastic, and other materials detrimental to plant life. Up to 5 percent by weight may be photodegradable material.

B. Suitable for spreading with a hydroseeder.

C. Furnish HECPs premixed by the manufacturer. Under no circumstances will field mixing of additives or components be acceptable.

D. Provide test results, dated within 3 years prior to the date of application, from an independent, accredited laboratory, as approved by Engineer, showing that the product meets the HECP requirements in Table 7.

Table 7
HECP Requirements

Properties	Test Method	Requirements
Acute Toxicity	EPA-821-R-02-012 Methods for Measuring Acute Toxicity of Effluents. Test leachate from recommended application rate receiving 2 inches of rainfall per hour using static test for No-Observed-Adverse-Effect-Concentration (NOEC).	Four replicates are required with no statistically significant reduction in survival in 100 percent leachate for a Daphnid at 48 hours and Oncorhynchus mykiss (rainbow trout) at 96 hours.
Solvents	EPA 8260B	Benzene: < 0.03 mg/kg Methylene chloride: < 0.02 mg/kg Naphthalene: < 5 mg/kg Tetrachloreoethylene: < 0.05 mg/kg Toluene: < 7 mg/kg Trichloroethylene: < 0.03 mg/kg Xylenes: < 9 mg/kg

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Table 7
HECP Requirements

Properties	Test Method	Requirements
Heavy Metals	EPA 6020A Total Metals	Antimony: < 4 mg/kg Arsenic: < 6 mg/kg Barium: < 80 mg/kg Boron: < 100 mg/kg Cadmium: < 2 mg/kg Chromium: < 2 mg/kg Copper: < 5 mg/kg Lead: < 5 mg/kg Mercury: < 2 mg/kg Nickel: < 2 mg/kg Selenium: < 10 mg/kg Strontium: < 30 mg/kg Zinc: < 5 mg/kg
Water Holding Capacity	ASTM D7367	900 percent minimum
Organic Matter Content	ASTM D2974	90 percent minimum
Moisture Content	ASTM D2974	15 percent
Seed Germination Enhancement	ASTM D7322	Long-Term: 420 percent minimum Moderate-Term: 400 percent minimum Short-Term: 200 percent minimum

2.11 WOOD CHIPS AND WOOD SHAVINGS

A. Wood Chips:

1. Derived from softwood species not containing resin, tannin, or other compounds in quantities that would be detrimental to plant life, and meeting the following loose volume gradation:
   a. 2-inch Sieve Size: 95 percent to 100 percent passing.
   b. No. 4 Sieve Size: 0 percent to 30 percent passing.

B. Wood Shavings: Provide shavings with 80 percent of the fibers 6 inches or longer between 0.030 inch wide and 0.50 inch wide, and between 0.017 inch thick and 0.13 inch thick.

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PART 3 EXECUTION

3.01 PREPARATION

A. Engineer's acceptance of the ESC Plan is required prior to starting earth disturbing activities.

B. Include proposed stockpile areas and installation of temporary erosion control devices, ditches, or other facilities in Work phasing plans.

C. Areas designated for Contractor's use during Project may be temporarily developed as specified to provide working, staging, and administrative areas. Include control of sediment from these areas in the ESC Plan.

D. High Visibility Fencing: Install high visibility fencing in accordance with the Drawings.

E. Inlet Protection: Install inlet protection below or above, or as a prefabricated cover at each inlet grate, as shown on the Drawings. Install inlet protection devices prior to beginning clearing, grubbing or earthwork activities. Geotextile fabric used in prefabricated inlet protection devices must meet or exceed the requirements for Moderate Survivability and minimum filtration properties. When depth of accumulated sediment and debris reaches approximately one-half the height of an internal device or one-third the height of external device (or less when so specified by the manufacturers) or as designated by Engineer, remove deposits and stabilize onsite.

1. Below Inlet Grate:
    a. Prefabricated units specifically designed for inlet protection.
    b. Must remain securely attached to drainage structure when fully loaded with sediment and debris or at the maximum level of sediment and debris specified by manufacturer.
2. Above Inlet Grate:
    a. Devices may be sediment fence, sandbags, or prefabricated units specifically designed for inlet protection.
    b. Must remain securely in place around drainage structure under all conditions.
3. Inlet Grate Cover:
    a. Prefabricated units specifically designed for inlet protection and:
        1) Be a sewn geotextile fabric unit fitted to individual grate and completely enclosing grate.
        2) Have built-in lifting devices to allow manual access of stormwater system.
        3) Use an orange monofilament geotextile fabric.
    b. Check dams or functionally equivalent devices may be used as inlet protection devices with approval of Engineer.

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F. Outlet Protection: Provide outlet protection to prevent scour at outlets of ponds, pipes, ditches, or other conveyances.

G. Plastic Covering: Use clear plastic covering to promote seed germination when seeding is performed outside of specified dates. Use black plastic covering for stockpiles or other areas where vegetative growth is unwanted. Place plastic with at least a 12-inch overlap of all seams. Install and maintain plastic cover tolon prevent water from cutting under the plastic and to prevent cover from blowing open in the wind.

H. Seeding: See Section 32 92 00, Turf and Grasses.

I. Sediment Fence:

1. Sediment fence shall be installed in accordance with the Drawings. When backup support is used, use steel wire with a maximum mesh spacing of 2 inches by 4 inches, or plastic mesh as resistant to ultraviolet radiation as the geotextile it supports. Provide wire or plastic mesh with strength equivalent to or greater than as required for unsupported geotextile (for example, 180 pounds grab tensile strength in the machine direction).
2. Attach geotextile to posts and support system using staples, wire, or in accordance with manufacturer’s recommendations. Geotextile shall be sewn together at the point of manufacture, or at a location approved by Engineer, to form geotextile lengths as required.
3. Provide wood or steel support posts at sewn seams and overlaps and as shown on the Drawings and necessary to support fence.
4. Wood Posts: Minimum dimensions of 1-1/4 inches by 1-1/4 inches by the minimum length shown on the Drawings.
5. Steel Posts: Minimum weight of 0.90 lb/ft.
6. When sediment deposits reach approximately one-third the height of the sediment fence, remove and stabilize deposits.

J. Stabilized Construction Entrance: Construct temporary stabilized construction entrance in accordance with the Drawings, prior to beginning any clearing, grubbing, earthwork, or excavation. When stabilized entrance no longer prevents track out of sediment or debris, either rehabilitate existing entrance to original condition or construct a new entrance.

K. Street Cleaning: Use self-propelled pickup street sweepers whenever required by Engineer to prevent transport of sediment and other debris off Project Site. Provide street sweepers designed and operated to meet air quality standards. Street washing with water will require approval by Engineer. Intentional washing of sediment into storm sewers or drainage ways must not occur.

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Vacuuming or dry sweeping and material pickup must be used to cleanup released sediments.

L. Wheel Wash Facility: When the Contract requires a tire wash (in conjunction with a stabilized entrance), include details for tire wash and method for containing and treating sediment-laden runoff as part of the ESC Plan. All vehicles leaving the Site shall stop and wash sediment from their tires. Keep the water level 12 inches to 14 inches deep. Change wash water a minimum of once per day. Polymers may be used to promote coagulation and flocculation in a closed-loop system. Polyacrylamide (PAM) added to the wheel wash water at a rate of 0.25 pound to 0.5 pound per 1,000 gallons of water increases effectiveness and reduces cleanup time.

M. Wood Chips and Wood Shavings: Install in accordance with the Drawings.

3.02 ADDITIONAL REQUIREMENTS

A. Natural Buffer or Equivalent:

1. Unless natural buffer between the Project Site and receiving waters has previously been eliminated by pre-existing development disturbances, comply with one of the following alternatives if stormwater from construction will discharge to surface water:
   a. Provide a 50-foot, undisturbed natural buffer between construction disturbances and surface water.
   b. Provide an undisturbed natural buffer that is less than 50 feet supplemented by additional erosion and sediment controls, which in combination, achieve a sediment load reduction that is equivalent to a 50-foot buffer.
   c. If it is infeasible to provide an undisturbed natural buffer of any size, implement erosion and sediment controls that achieve a sediment load reduction that is equivalent to a 50-foot buffer.

3.03 MAINTENANCE

A. The ESCP measures described in this specification are minimum requirements for anticipated Site conditions. During the construction period, upgrade these measures as needed to comply with all applicable local, state, and federal erosion and sediment control regulations.

B. Maintain erosion and sediment control BMPs so they properly perform their function until Engineer determines they are no longer needed.

C. Construction activities must avoid or minimize excavation and creation of bare ground during wet weather.

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D. The intentional washing of sediment into storm sewers or drainage ways must not occur. Vacuuming or dry sweeping and material pickup must be used to cleanup released sediments.

E. Inspect BMPs in accordance with the schedule in the Construction Stormwater Discharge Permit(s) or as directed by Engineer.

F. Complete an inspection report within 24 hours of an inspection. Each inspection report shall be signed and identify corrective actions. Document that corrective actions are performed within 7 days of identification. Keep a copy of all inspection reports at the Site or at an easily accessible location.

G. Unless otherwise specified, remove deposits before the depth of accumulated sediment and debris reaches approximately height of BMP. Dispose of debris or contaminated sediment at approved locations. Clean sediments may be stabilized onsite using BMPs as approved by Engineer.

H. Sediment Fence: Remove trapped sediment before it reaches one-third of the above ground fence height and before fence removal.

I. Inlet Protection: Remove sediment before it reaches 2 inches depth above ground height and before BMP removal.

J. Catch Basins: Clean before retention capacity has been reduced by 50 percent.

K. Initiate repair or replacement of damaged erosion and sediment control BMPs immediately, and work completed by end of next work day. Significant replacement or repair must be completed within 7 days, unless infeasible.

L. Within 24 hours, remediate any significant sediment that has left construction site. Investigate cause of the sediment release and implement steps to prevent a recurrence of discharge within same 24 hours.

M. At end of each work day, stabilize or cover soil stockpiles or implement other BMPs to prevent discharges to surface waters or conveyance systems leading to surface waters.

N. Temporarily stabilize soils at end of shift before holidays and weekends, if needed. Ensure soils are stable during rain events at all times of year.

O. Initiate stabilization by no later than end of next work day after construction work in an area has stopped permanently or temporarily.

P. Within 14 days of initiating stabilization or as specified in permit, either seed or plant stabilized area (see Section 32 92 00, Turf and Grasses); or apply non-vegetative measures and cover all areas of exposed soil. Seed dry areas as

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soon as Site conditions allow. Ensure that vegetation covers at least 70 percent of stabilized area. In areas where Contractor's activities have compromised erosion control functions of existing grasses, overseed existing grass. Non-vegetative measures may include blown straw and a tackifier, loose straw, or an adequate covering of compost mulch. Complete initial stabilization within 7 days if storm water discharges to surface waters impaired for sediment or nutrients, or high quality waters.

Q. Provide permanent erosion control measures on all exposed areas. Do not remove temporary sediment control practices until permanent vegetation or other cover of exposed areas is established. However, do remove all temporary erosion control measures as exposed areas become stabilized, unless doing so conflicts with local requirements. Properly dispose of construction materials and waste, including sediment retained by temporary BMPs.

3.04 EMERGENCY MATERIALS

A. Provide, stockpile, and protect the following emergency erosion and sediment control materials on the Project Site for unknown weather or erosion conditions. Emergency materials are in addition to other erosion control materials required to implement and maintain the ESC Plan. Replenish emergency materials as they are used. Remove all unused emergency materials from the Project Site at completion of the Project.

3.05 REMOVAL

A. When Engineer determines that an erosion control BMP is no longer required, remove BMP and all associated hardware from the Project limits. When materials are biodegradable, Engineer may approve leaving temporary BMP in place.

B. Permanently stabilize all bare and disturbed soil after removal of erosion and sediment control BMPs. Dress sediment deposits remaining after BMPs have been removed to conform to existing grade. Prepare and seed graded area. If installation and use of erosion control BMPs have compacted or otherwise rendered soil inhospitable to plant growth, such as construction entrances, take measures to rehabilitate soil to facilitate plant growth. This may include, but is not limited to, ripping the soil, incorporating soil amendments, or seeding with specified seed.

END OF SECTION

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SECTION 01 61 00
COMMON PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 DEFINITIONS

A. Products:

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

1.02 DESIGN REQUIREMENTS

A. Where Contractor design is specified, design of installation, systems, equipment, and components, including supports and anchorage, shall be in accordance with provisions of latest edition of International Building Code (IBC) by International Code Council. See the Drawings, Structural Notes, Drawing 01-G-0020.

1.03 ENVIRONMENTAL REQUIREMENTS

A. Altitude: Provide materials and equipment suitable for installation and operation under rated conditions at 600 feet above sea level.

B. Provide equipment and devices installed outdoors or in unheated enclosures capable of continuous operation within an ambient temperature range of 13 degrees F to 105 degrees F.

1.04 PREPARATION FOR SHIPMENT

A. When practical, factory assemble products. Mark or tag separate parts and assemblies to facilitate field assembly. Cover machined and unpainted parts that may be damaged by the elements with strippable protective coating.

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B. Package products to facilitate handling and protect from damage during shipping, handling, and storage. Mark or tag outside of each package or crate to indicate its purchase order number, bill of lading number, contents by name, name of Project and Contractor, equipment number, and approximate weight. Include complete packing list and bill of materials with each shipment.

C. Extra Materials, Special Tools, Test Equipment, and Expendables:

1. Furnish as required by individual specifications.
2. Schedule:
    a. Ensure that shipment and delivery occurs concurrent with shipment of associated equipment.
    b. Transfer to Owner shall occur immediately subsequent to Contractor's acceptance of equipment from Supplier.
3. Packaging and Shipment:
    a. Package and ship extra materials and special tools to avoid damage during long term storage in original cartons insofar as possible, or in appropriately sized, hinged-cover, wood, plastic, or metal box.
    b. Prominently displayed on each package, the following:
        1) Manufacturer's part nomenclature and number, consistent with Operation and Maintenance Manual identification system.
        2) Applicable equipment description.
        3) Quantity of parts in package.
        4) Equipment manufacturer.
4. Replace extra materials and special tools found to be damaged or otherwise inoperable at time of transfer to Owner.

D. Factory Test Results: Reviewed and accepted by Engineer before product shipment as required in individual specification sections.

1.05 DELIVERY AND INSPECTION

A. Deliver products in accordance with accepted current Progress Schedule and coordinate to avoid conflict with the Work and conditions at Site. Deliver anchor bolts and templates sufficiently early to permit setting prior to placement of structural concrete.

B. Deliver products in undamaged condition, in manufacturer's original container or packaging, with identifying labels intact and legible. Include on label, date of manufacture and shelf life, where applicable.

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C. Unload products in accordance with manufacturer's instructions for unloading or as specified. Record receipt of products at Site. Promptly inspect for completeness and evidence of damage during shipment.

D. Remove damaged products from Site and expedite delivery of identical new undamaged products, and remedy incomplete or lost products to provide that specified, so as not to delay progress of the Work.

1.06 HANDLING, STORAGE, AND PROTECTION

A. Handle and store products in accordance with manufacturer's written instructions and in a manner to prevent damage. Store in approved storage yards or sheds provided in accordance with Section 01 50 00, Temporary Facilities and Controls. Provide manufacturer's recommended maintenance during storage, installation, and until products are accepted for use by Owner.

B. Manufacturer's instructions for material requiring special handling, storage, or protection shall be provided prior to delivery of material.

C. Arrange storage in a manner to provide easy access for inspection. Make periodic inspections of stored products to ensure that products are maintained under specified conditions, and free from damage or deterioration. Keep running account of products in storage to facilitate inspection and to estimate progress payments for products delivered, but not installed in the Work.

D. Store electrical, instrumentation, and control products, and equipment with bearings in weather-tight structures maintained above 60 degrees F. Protect electrical, instrumentation, and control products, and insulate against moisture, water, and dust damage. Connect and operate continuously space heaters furnished in electrical equipment.

E. Store fabricated products above ground on blocking or skids, and prevent soiling or staining. Store loose granular materials in well-drained area on solid surface to prevent mixing with foreign matter. Cover products that are subject to deterioration with impervious sheet coverings; provide adequate ventilation to avoid condensation.

F. Store finished products that are ready for installation in dry and well-ventilated areas. Do not subject to extreme changes in temperature or humidity.

G. After installation, provide coverings to protect products from damage due to traffic and construction operations. Remove coverings when no longer needed.

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H. Hazardous Materials: Prevent contamination of personnel, storage area, and Site. Meet requirements of product specification, codes, and manufacturer's instructions.

PART 2 PRODUCTS

2.01 GENERAL

A. Provide manufacturer's standard materials suitable for service conditions, unless otherwise specified in the individual specifications.

B. Where product specifications include a named manufacturer, with or without model number, and also include performance requirements, named manufacturer's products must meet the performance specifications.

C. Like items of products furnished and installed in the Work shall be end products of one manufacturer and of the same series or family of models to achieve standardization for appearance, operation and maintenance, spare parts and replacement, manufacturer's services, and implement same or similar process instrumentation and control functions in same or similar manner.

D. Do not use materials and equipment removed from existing premises, except as specifically permitted by Contract Documents.

E. Provide interchangeable components of the same manufacturer, for similar components, unless otherwise specified.

F. Equipment, Components, Systems, and Subsystems: Design and manufacture with due regard for health and safety of operation, maintenance, and accessibility, durability of parts, and shall comply with applicable OSHA, state, and local health and safety regulations.

G. Regulatory Requirement: Coating materials shall meet federal, state, and local requirements limiting the emission of volatile organic compounds and for worker exposure.

H. Safety Guards: Provide for all belt or chain drives, fan blades, couplings, or other moving or rotary parts. Cover rotating part on all sides. Design for easy installation and removal. Use 16-gauge or heavier; galvanized steel, aluminum coated steel, or galvanized or aluminum coated 1/2-inch mesh expanded steel. Provide galvanized steel accessories and supports, including bolts. For outdoors application, prevent entrance of rain and dripping water.

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I. Authority Having Jurisdiction (AHJ):

1. Provide the Work in accordance with NFPA 70, National Electrical Code (NEC). Where required by the AHJ, material and equipment shall be labeled or listed by a nationally recognized testing laboratory or other organization acceptable to the AHJ in order to provide a basis for approval under NEC.
2. Materials and equipment manufactured within the scope of standards published by UL shall conform to those standards and shall have an applied UL listing mark.

J. Equipment Finish:

1. Provide manufacturer's standard finish and color, except where specific color is indicated.
2. If manufacturer has no standard color, provide equipment with gray finish as approved by Owner.

K. Special Tools and Accessories: Furnish to Owner, upon acceptance of equipment, all accessories required to place each item of equipment in full operation. These accessory items include, but are not limited to, adequate oil and grease (as required for first lubrication of equipment after field testing), light bulbs, fuses, hydrant wrenches, valve keys, handwheels, chain operators, special tools, and other spare parts as required for maintenance.

L. Lubricant: Provide initial lubricant recommended by equipment manufacturer in sufficient quantity to fill lubricant reservoirs and to replace consumption during testing, startup, and operation until final acceptance by Owner.

M. Components and Materials in Contact with Water for Human Consumption: Comply with the requirements of the Safe Drinking Water Act and other applicable federal, state, and local requirements. Provide certification by manufacturer or an accredited certification organization recognized by the Authority Having Jurisdiction that components and materials comply with the maximum lead content standard in accordance with NSF/ANSI 61 and NSF/ANSI 372.

1. Use or reuse of components and materials without a traceable certification is prohibited.

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2.02 FABRICATION AND MANUFACTURE

A. General:

1. Manufacture parts to U.S.A. standard sizes and gauges.
2. Two or more items of the same type shall be identical, by the same manufacturer, and interchangeable.
3. Design structural members for anticipated shock and vibratory loads.
4. Use 1/4-inch minimum thickness for steel that will be submerged, wholly or partially, during normal operation.
5. Modify standard products as necessary to meet performance specifications.

B. Lubrication System:

1. Require no more than weekly attention during continuous operation.
2. Convenient and accessible; oil drains with bronze or stainless steel valves and fill-plugs easily accessible from the normal operating area or platform. Locate drains to allow convenient collection of oil during oil changes without removing equipment from its installed position.
3. Provide constant-level oilers or oil level indicators for oil lubrication systems.
4. For grease type bearings, which are not easily accessible, provide and install stainless steel tubing; protect and extend tubing to convenient location with suitable grease fitting.

2.03 SOURCE QUALITY CONTROL

A. Where Specifications call for factory testing to be witnessed by Engineer, notify Engineer not less than 14 days prior to scheduled test date, unless otherwise specified.

B. Calibration Instruments: Bear the seal of a reputable laboratory certifying instrument has been calibrated within the previous 12 months to a standard endorsed by the National Institute of Standards and Technology (NIST).

C. Factory Tests: Perform in accordance with accepted test procedures and document successful completion.

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PART 3 EXECUTION

3.01 INSPECTION

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

3.02 MANUFACTURER'S CERTIFICATE OF COMPLIANCE

A. When so specified, a Manufacturer's Certificate of Compliance, a copy of which is attached to this section, shall be completed in full, signed by entity supplying the product, material, or service, and submitted prior to shipment of product or material or execution of the services.

B. Engineer may permit use of certain materials or assemblies prior to sampling and testing if accompanied by accepted certification of compliance.

C. Such form shall certify proposed product, material, or service complies with that specified. Attach supporting reference data, affidavits, and certifications as appropriate.

D. May reflect recent or previous test results on material or product, if acceptable to Engineer.

3.03 INSTALLATION

A. Equipment Drawings show general locations of equipment, devices, and raceway, unless specifically dimensioned.

B. No shimming between machined surfaces is allowed.

C. Install the Work in accordance with NECA Standard of Installation, unless otherwise specified.

D. Repaint painted surfaces that are damaged prior to equipment acceptance.

E. Do not cut or notch any structural member or building surface without specific approval of Engineer.

F. Handle, install, connect, clean, condition, and adjust products in accordance with manufacturer's instructions, and as may be specified. Retain a copy of manufacturers' instruction at Site, available for review at all times.

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G. For material and equipment specifically indicated or specified to be reused in the Work:

1. Use special care in removal, handling, storage, and reinstallation to assure proper function in the completed Work.
2. Arrange for transportation, storage, and handling of products that require offsite storage, restoration, or renovation. Include costs for such Work in the Contract Price.

3.04 FIELD FINISHING

A. In accordance with Section 09 90 00, Painting and Coating, and individual specification sections.

3.05 ADJUSTMENT AND CLEANING

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

3.06 LUBRICANTS

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

3.07 SUPPLEMENT

A. The supplement listed below, following “End of Section,” is a part of this specification:

1. Manufacturer’s Certificate of Compliance Form.

END OF SECTION

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MANUFACTURER'S CERTIFICATE OF COMPLIANCE

OWNER: _____

PROJECT NAME: _____

PROJECT NO: _____

PRODUCT, MATERIAL, OR SERVICE SUBMITTED: _____

Comments: _____

_____

_____

_____

_____

_____

I hereby certify that the above-referenced product, material, or service called for by the Contract for the named Project will be furnished in accordance with all applicable requirements. I further certify that the product, material, or service are of the quality specified and conform in all respects with the Contract requirements, and are in the quantity shown.

Date of Execution: _____, 20___

Manufacturer: _____

Manufacturer's Authorized Representative *(print)*: _____

_____

(Authorized Signature)

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SECTION 01 77 00
CLOSEOUT PROCEDURES

PART 1 GENERAL

1.01 SUBMITTALS

A. Informational Submittals:

1. Submit prior to application for final payment.
   a. Record Documents: As required in General Conditions.
   b. Approved Shop Drawings and Samples: As required in the General Conditions.
   c. Special bonds, Special Guarantees, and Service Agreements.
   d. Consent of Surety to Final Payment: As required in General Conditions.
   e. Releases or Waivers of Liens and Claims: As required in General Conditions.
   f. Releases from Agreements.
   g. Final Application for Payment: Submit in accordance with procedures and requirements stated in Section 01 29 00, Payment Procedures.
   h. Extra Materials: As required by individual Specification sections.

1.02 RECORD DOCUMENTS

A. Quality Assurance:

1. Furnish qualified and experienced person, whose duty and responsibility shall be to maintain record documents.
2. Accuracy of Records:
   a. Coordinate changes within record documents, making legible and accurate entries on each sheet of the Drawings and other documents where such entry is required to show change.
   b. Purpose of Project record documents is to document factual information regarding aspects of the Work, both concealed and visible, to enable future modification of the Work to proceed without lengthy and expensive Site measurement, investigation, and examination.
3. Make entries within 24 hours after receipt of information that a change in the Work has occurred.

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4. Prior to submitting each request for progress payment, request Engineer's review and approval of current status of record documents. Failure to properly maintain, update, and submit record documents may result in a deferral by Engineer to recommend whole or any part of Contractor's Application for Payment, either partial or final.

1.03 RELEASES FROM AGREEMENTS

A. Furnish Owner written releases from property owners or public agencies where side agreements or special easements have been made, or where Contractor's operations have not been kept within the Owner's construction right-of-way.

B. In the event Contractor is unable to secure written releases:

1. Inform Owner of the reasons.
2. Owner or its representatives will examine the Site, and Owner will direct Contractor to complete the Work that may be necessary to satisfy terms of the side agreement or special easement.
3. Should Contractor refuse to perform this Work, Owner reserves right to have it done by separate contract and deduct cost of same from Contract Price, or require Contractor to furnish a satisfactory bond in a sum to cover legal Claims for damages.
4. When Owner is satisfied that the Work has been completed in agreement with Contract Documents and terms of side agreement or special easement, right is reserved to waive requirement for written release if: (i) Contractor's failure to obtain such statement is due to grantor's refusal to sign, and this refusal is not based upon any legitimate Claims that Contractor has failed to fulfill terms of side agreement or special easement, or (ii) Contractor is unable to contact or has had undue hardship in contacting grantor.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 MAINTENANCE OF RECORD DOCUMENTS

A. General:

1. Promptly following commencement of Contract Times, secure from Engineer at no cost to Contractor, one complete set of Contract Documents. Drawings will be full size.
2. Label or stamp each record document with title, "RECORD DOCUMENTS," in neat large printed letters.

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3. Record information concurrently with construction progress and within 24 hours after receipt of information that change has occurred. Do not cover or conceal Work until required information is recorded.

B. Preservation:

1. Maintain documents in a clean, dry, legible condition and in good order. Do not use record documents for construction purposes.
2. Make documents and Samples available at all times for observation by Engineer.

C. Making Entries on the Drawings:

1. Using an erasable colored pencil (not ink or indelible pencil), clearly describe change by graphic line and note as required.
    a. Color Coding:
        1) Green when showing information deleted from the Drawings.
        2) Red when showing information added to the Drawings.
        3) Blue and circled in blue to show notes.
2. Date entries.
3. Call attention to entry by “cloud” drawn around area or areas affected.
4. Legibly mark to record actual changes made during construction, including, but not limited to:
    a. Depths of various elements of foundation in relation to finished first floor data if not shown or where depth differs from that shown.
    b. Horizontal and vertical locations of existing and new Underground Facilities and appurtenances, and other underground structures, equipment, or Work. Reference to at least two measurements to permanent surface improvements.
    c. Location of internal utilities and appurtenances concealed in the construction referenced to visible and accessible features of the structure.
    d. Locate existing facilities, piping, equipment, and items critical to the interface between existing physical conditions or construction and new construction.
    e. Changes made by Addenda and Field Orders, Work Change Directive, Change Order, and Engineer’s written interpretation and clarification using consistent symbols for each and showing appropriate document tracking number.

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5. Dimensions on Schematic Layouts: Show on the Record Drawings, by dimension, the centerline of each run of items such as are described in previous subparagraph above.
    a. Clearly identify the item by accurate note such as “cast iron drain,” “galv. water,” and the like.
    b. Show, by symbol or note, vertical location of item (“under slab,” “in ceiling plenum,” “exposed,” and the like).
    c. Make identification so descriptive that it may be related reliably to Specifications.

3.02 FINAL CLEANING

A. At completion of the Work or of a part thereof and immediately prior to Contractor’s request for certificate of Substantial Completion; or if no certificate is issued, immediately prior to Contractor’s notice of completion, clean entire Site or parts thereof, as applicable.

1. Leave the Work and adjacent areas affected in a cleaned condition satisfactory to Owner.
2. Remove grease, dirt, dust, paint or plaster splatter, stains, labels, fingerprints, and other foreign materials from exposed surfaces.
3. Repair, patch, and touch up marred surfaces to specified finish and match adjacent surfaces.
4. Clean all windows.
5. Clean and wax wood, vinyl, or painted floors.
6. Broom clean exterior paved driveways and parking areas.
7. Hose clean sidewalks, loading areas, and others contiguous with principal structures.
8. Rake clean all other surfaces.
9. Remove snow and ice from access to buildings.
10. Replace air-handling filters and clean ducts, blowers, and coils of ventilation units operated during construction.
11. Leave water courses, gutters, and ditches open and clean.

B. Use only cleaning materials recommended by manufacturer of surfaces to be cleaned.

END OF SECTION

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SECTION 01 78 23
OPERATION AND MAINTENANCE DATA

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Detailed information for the preparation, submission, and Engineer's review of Operations and Maintenance (O&M) Data, as required by individual specification sections.

1.02 DEFINITIONS

A. Final Data: Engineer-accepted data, submitted as specified herein.

B. Maintenance Operation: As used on Maintenance Summary Form is defined to mean any routine operation required to ensure satisfactory performance and longevity of equipment. Examples of typical maintenance operations are lubrication, belt tensioning, adjustment of pump packing glands, and routine adjustments.

C. Preliminary Data: Initial and subsequent submissions for Engineer's review.

1.03 SEQUENCING AND SCHEDULING

A. Equipment and System Data:

1. Preliminary Data:
   a. Do not submit until Shop Drawing for equipment or system has been reviewed and approved by Engineer.
   b. Submit prior to shipment date.
2. Final Data: Submit Instructional Manual Formatted data not less than 30 days prior to Submit Compilation Formatted and Electronic Media Formatted data prior to Substantial Completion of Project.

B. Materials and Finishes Data:

1. Preliminary Data: Submit at least 15 days prior to request for final inspection.
2. Final Data: Submit within 10 days after final inspection.

1.04 DATA FORMAT

A. Prepare preliminary and final data in the form of an instructional manual. Prepare final data in data compilation format and on electronic media.

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B. Instructional Manual Format:

1. Binder: Commercial quality, permanent, three-ring or three-post binders with durable plastic cover.
2. Size: 8-1/2 inches by 11 inches, minimum.
3. Cover: Identify manual with typed or printed title “OPERATION AND MAINTENANCE DATA” and list:
    a. Project title.
    b. Designate applicable system, equipment, material, or finish.
    c. Identity of separate structure as applicable.
    d. Identify volume number if more than one volume.
    e. Identity of general subject matter covered in manual. Identity of equipment number and specification section.
4. Spine:
    a. Project title.
    b. Identify volume number if more than one volume.
5. Title Page:
    a. Contractor name, address, and telephone number.
    b. Subcontractor, Supplier, installer, or maintenance contractor’s name, address, and telephone number, as appropriate.
        1) Identify area of responsibility of each.
        2) Provide name and telephone number of local source of supply for parts and replacement.
6. Table of Contents:
    a. Neatly typewritten and arranged in systematic order with consecutive page numbers.
    b. Identify each product by product name and other identifying numbers or symbols as set forth in Contract Documents.
7. Paper: 20-pound minimum, white for typed pages.
8. Text: Manufacturer’s printed data, or neatly typewritten.
9. Three-hole punch data for binding and composition; arrange printing so that punched holes do not obliterate data.
10. Material shall be suitable for reproduction, with quality equal to original. Photocopying of material will be acceptable, except for material containing photographs.

C. Data Compilation Format:

1. Compile all Engineer-accepted preliminary O&M data into a hard-copy, hard-bound set.
2. Each set shall consist of the following:
    a. Binder: Commercial quality, permanent, three-ring or three-post binders with durable plastic cover.

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b. Cover: Identify each volume with typed or printed title "OPERATION AND MAINTENANCE DATA, VOLUME NO. ___ OF ___," and list:
   1) Project title.
   2) Contractor's name, address, and telephone number.
   3) If entire volume covers equipment or system provided by one Supplier include the following:
      a) Identity of general subject matter covered in manual.
      b) Identity of equipment number and Specification section.

c. Provide each volume with title page and typed table of contents with consecutive page numbers. Place contents of entire set, identified by volume number, in each binder.

d. Table of contents neatly typewritten, arranged in a systematic order:
   1) Include list of each product, indexed to content of each volume.
   2) Designate system or equipment for which it is intended.
   3) Identify each product by product name and other identifying numbers or symbols as set forth in Contract Documents.

e. Section Dividers:
   1) Heavy, 80-pound cover weight, tabbed with numbered plastic index tabs.
   2) Fly-Leaf:
      a) For each separate product, or each piece of operating equipment, with typed description of product and major component parts of equipment.
      b) List with Each Product:
         (1) Name, address, and telephone number of Subcontractor, Supplier, installer, and maintenance contractor, as appropriate.
         (2) Identify area of responsibility of each.
         (3) Provide local source of supply for parts and replacement.
      c) Identity of separate structure as applicable.

f. Assemble and bind material, as much as possible, in same order as specified in the Contract Documents.

D. Electronic Media Format:

1. Portable Document Format (PDF):
   a. After all preliminary data has been found to be acceptable to Engineer, submit Operation and Maintenance data in PDF format on CD.

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b. Files to be exact duplicates of Engineer-accepted preliminary data. Arrange by specification number and name.
c. Files to be fully functional and viewable in most recent version of Adobe Acrobat.

1.05 SUBMITTALS

A. Informational:

1. Data Outline: Submit two copies of a detailed outline of proposed organization and contents of Final Data prior to preparation of Preliminary Data.
2. Preliminary Data:
   a. Submit three copies for Engineer's review.
   b. If data meets conditions of the Contract:
      1) One copy will be returned to Contractor.
      2) One copy will be forwarded to Resident Project Representative.
      3) One copy will be retained in Engineer's file.
   c. If data does not meet conditions of the Contract:
      1) All copies will be returned to Contractor with Engineer's comments (on separate document) for revision.
      2) Engineer's comments will be retained in Engineer's file.
      3) Resubmit two copies revised in accordance with Engineer's comments.
3. Final Data: Submit four copies in format specified herein.

1.06 DATA FOR EQUIPMENT AND SYSTEMS

A. Content For Each Unit (or Common Units) and System:

1. Product Data:
   a. Include only those sheets that are pertinent to specific product.
   b. Clearly annotate each sheet to:
      1) Identify specific product or part installed.
      2) Identify data applicable to installation.
      3) Delete references to inapplicable information.
   c. Function, normal operating characteristics, and limiting conditions.
   d. Performance curves, engineering data, nameplate data, and tests.
   e. Complete nomenclature and commercial number of replaceable parts.
   f. Original manufacturer's parts list, illustrations, detailed assembly drawings showing each part with part numbers and sequentially numbered parts list, and diagrams required for maintenance.

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g. Spare parts ordering instructions.
h. Where applicable, identify installed spares and other provisions for future work (such as, reserved panel space, unused components, wiring, terminals).

2. As-installed, color-coded piping diagrams.
3. Charts of valve tag numbers, with the location and function of each valve.
4. Drawings: Supplement product data with the Drawings as necessary to clearly illustrate:
   a. Format:
      1) Provide reinforced, punched, binder tab; bind in with text.
      2) Reduced to 8-1/2 inches by 11 inches, or 11 inches by 17 inches folded to 8-1/2 inches by 11 inches.
      3) Where reduction is impractical, fold and place in 8-1/2-inch by 11-inch envelopes bound in text.
      4) Identify specification section and product on the Drawings and envelopes.
   b. Relations of component parts of equipment and systems.
   c. Control and flow diagrams.
   d. Coordinate drawings with Project record documents to assure correct illustration of completed installation.
5. Instructions and Procedures: Within text, as required to supplement product data.
   a. Format:
      1) Organize in consistent format under separate heading for each different procedure.
      2) Provide logical sequence of instructions for each procedure.
      3) Provide information sheet for Owner's personnel, including:
         a) Proper procedures in event of failure.
         b) Instances that might affect validity of guarantee or Bond.
   b. Installation Instructions: Including alignment, adjusting, calibrating, and checking.
   c. Operating Procedures:
      1) Startup, break-in, routine, and normal operating instructions.
      2) Test procedures and results of factory tests where required.
      3) Regulation, control, stopping, and emergency instructions.
      4) Description of operation sequence by control manufacturer.
      5) Shutdown instructions for both short and extended duration.
      6) Summer and winter operating instructions, as applicable.
      7) Safety precautions.
      8) Special operating instructions.
   d. Maintenance and Overhaul Procedures:
      1) Routine maintenance.
      2) Guide to troubleshooting.

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3) Disassembly, removal, repair, reinstallation, and re-assembly.

6. Guarantee, Bond, and Service Agreement: In accordance with Section 01 77 00, Closeout Procedures.

B. Content for Each Electric or Electronic Item or System:

1. Description of Unit and Component Parts:
   a. Function, normal operating characteristics, and limiting conditions.
   b. Performance curves, engineering data, nameplate data, and tests.
   c. Complete nomenclature and commercial number of replaceable parts.
   d. Interconnection wiring diagrams, including control and lighting systems.
2. Circuit Directories of Panelboards:
   a. Electrical service.
   b. Control requirements and interfaces.
   c. Communication requirements and interfaces.
   d. List of electrical relay settings, and control and alarm contact settings.
   e. Electrical interconnection wiring diagram, including as applicable, single-line, three-line, schematic and internal wiring, and external interconnection wiring.
   f. As-installed control diagrams by control manufacturer.
3. Operating Procedures:
   a. Routine and normal operating instructions.
   b. Startup and shutdown sequences, normal and emergency.
   c. Safety precautions.
   d. Special operating instructions.
4. Maintenance Procedures:
   a. Routine maintenance.
   b. Guide to troubleshooting.
   c. Adjustment and checking.
   d. List of relay settings, control and alarm contact settings.
5. Manufacturer’s printed operating and maintenance instructions.
6. List of original manufacturer’s spare parts, manufacturer’s current prices, and recommended quantities to be maintained in storage.

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C. Maintenance Summary:

1. Compile individual Maintenance Summary for each applicable equipment item, respective unit or system, and for components or sub-units.
2. Format:
   a. Use Maintenance Summary Form bound with this section or electronic facsimile of such.
   b. Each Maintenance Summary may take as many pages as required.
   c. Use only 8-1/2-inch by 11-inch size paper.
   d. Complete using typewriter or electronic printing.
3. Include detailed lubrication instructions and diagrams showing points to be greased or oiled; recommend type, grade, and temperature range of lubricants and frequency of lubrication.
4. Recommended Spare Parts:
   a. Data to be consistent with manufacturer's Bill of Materials/Parts List furnished in O&M manuals.
   b. "Unit" is the unit of measure for ordering the part.
   c. "Quantity" is the number of units recommended.
   d. "Unit Cost" is the current purchase price.

1.07 DATA FOR MATERIALS AND FINISHES

A. Content for Architectural Products, Applied Materials, and Finishes:

1. Manufacturer's data, giving full information on products:
   a. Catalog number, size, and composition.
   b. Color and texture designations.
   c. Information required for reordering special-manufactured products.
2. Instructions for Care and Maintenance:
   a. Manufacturer's recommendation for types of cleaning agents and methods.
   b. Cautions against cleaning agents and methods that are detrimental to product.
   c. Recommended schedule for cleaning and maintenance.

B. Content for Moisture Protection and Weather Exposed Products:

1. Manufacturer's data, giving full information on products:
   a. Applicable standards.
   b. Chemical composition.
   c. Details of installation.
2. Instructions for inspection, maintenance, and repair.

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1.08 OPERATIONS AND MAINTENANCE AND WARRANTY PERIOD

A. The warranty period for all new equipment shall not commence until all the following have been successfully completed, submitted, and approved by the Owner:

1. Successful startup, functional testing, and acceptance.
2. Performance testing and acceptance of all required data.
3. All required sampling, laboratory testing, and acceptance of results.
4. Submission and approval of Operations and Maintenance (O&M) Manuals.
5. Submission of spare parts and maintenance lists.
6. Completion and acceptance of required training.
7. Submission and approval of complete Lucity asset data.

1.09 SUPPLEMENTS

A. The supplements listed below, following “End of Section,” are a part of this specification:

1. Maintenance Summary Form.
2. Lucity Tag Index.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

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MAINTENANCE SUMMARY FORM

PROJECT:_____ CONTRACT NO.:_____

1. EQUIPMENT ITEM_____

2. MANUFACTURER _____

3. EQUIPMENT/TAG NUMBER(S) _____

4. WEIGHT OF INDIVIDUAL COMPONENTS (OVER 100 POUNDS)_____

5. NAMEPLATE DATA (hp, voltage, speed, etc.) _____

6. MANUFACTURER'S LOCAL REPRESENTATIVE _____

   a. Name_____ Telephone No. _____

   b. Address _____

7. MAINTENANCE REQUIREMENTS

Maintenance Operation Comments	**Frequency**	**Lubricant (If Applicable)**
List briefly each maintenance operation required and refer to specific information in manufacturer's standard maintenance manual, if applicable. (Reference to manufacturer's catalog or sales literature is not acceptable.)	List required frequency of each maintenance operation.	Refer by symbol to lubricant required.

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8. LUBRICANT LIST

Reference Symbol	Shell	Exxon Mobile	Chevron Texaco	BP Amoco	Or Equal
List symbols used in No. 7 above.	List equivalent lubricants, as distributed by each manufacturer for the specific use recommended.				

9. RECOMMENDED SPARE PARTS FOR OWNER'S INVENTORY.

Part No.	Description	Unit	Quantity	Unit Cost
Note: Identify parts provided by this Contract with two asterisks.				

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MAINTENANCE SUMMARY FORM

PROJECT:_____ CONTRACT NO.:_____

1. EQUIPMENT ITEM_____

2. MANUFACTURER _____

3. EQUIPMENT/TAG NUMBER(S) _____

4. WEIGHT OF INDIVIDUAL COMPONENTS (OVER 100 POUNDS)_____

5. NAMEPLATE DATA (hp, voltage, speed, etc.) _____

6. MANUFACTURER'S LOCAL REPRESENTATIVE _____

   a. Name_____ Telephone No. _____

   b. Address _____

7. MAINTENANCE REQUIREMENTS

Maintenance Operation Comments	**Frequency**	**Lubricant (If Applicable)**
List briefly each maintenance operation required and refer to specific information in manufacturer's standard maintenance manual, if applicable. (Reference to manufacturer's catalog or sales literature is not acceptable.)	List required frequency of each maintenance operation.	Refer by symbol to lubricant required.

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8. LUBRICANT LIST

Reference Symbol	Shell	Exxon Mobile	Chevron Texaco	BP Amoco	Or Equal
List symbols used in No. 7 above.	List equivalent lubricants, as distributed by each manufacturer for the specific use recommended.				

9. RECOMMENDED SPARE PARTS FOR OWNER'S INVENTORY.

Part No.	Description	Unit	Quantity	Unit Cost
Note: Identify parts provided by this Contract with two asterisks.				

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LUCITY TAG INDEX: EQUIPMENT DEMOLISH

LOCATION	DESCRIPTION	STATUS	EQUIPMENT ID	PLAN DRAWING NO.	SPECIFICATION NO.
SCUM COLLECTION	EXHAUST FAN	DEMOLISH		50-FCL1-D-1000	02 41 00
SCUM COLLECTION	ELECTRICAL PANEL	DEMOLISH		50-FCL1-D-1000	02 41 00
SCUM COLLECTION	AIR PISTON VALVE	DEMOLISH		50-FCL1-D-1000	02 41 00
SCUM COLLECTION	SCUM PUMP	DEMOLISH		50-FCL1-D-1000	02 41 00
GRAVITY THICKENER	WATER HEATER	DEMOLISH		70-THK1-D-1000	02 41 00
GRAVITY THICKENER	POLYMER BLENDING UNIT	DEMOLISH		70-THK1-D-1000	02 41 00
GRAVITY THICKENER	POLYMER FEED PUMP	DEMOLISH		70-THK1-D-1000	02 41 00
GRAVITY THICKENER	POLYMER SYSTEM CONTROL PANEL	DEMOLISH		70-THK1-D-1000	02 41 00
GRAVITY THICKENER	POLYMER STOCK PUMP	DEMOLISH		70-THK1-D-1000	02 41 00
DEWATERING CENTRIFUGE BUILDING	SLUDGE FEED PUMP #1	DEMOLISH		90-D1BL-D-1000	02 41 00
DEWATERING CENTRIFUGE BUILDING	SLUDGE FEED PUMP #2	DEMOLISH		90-D1BL-D-1000	02 41 00
DEWATERING CENTRIFUGE BUILDING	SLUDGE FEED PUMP #3	DEMOLISH		90-D1BL-D-1000	02 41 00
DEWATERING CENTRIFUGE BUILDING	DEWATERING SLUDGE FILTRATE PUMP #1	DEMOLISH		90-D1BL-D-1000	02 41 00
DEWATERING CENTRIFUGE BUILDING	DEWATERING SLUDGE FILTRATE PUMP #2	DEMOLISH		90-D1BL-D-1000	02 41 00
DEWATERING CENTRIFUGE BUILDING	DEWATERING SLUDGE FILTRATE PUMP #3	DEMOLISH		90-D1BL-D-1000	02 41 00
DEWATERING CENTRIFUGE BUILDING	BELT FILTER PRESS #1	DEMOLISH		90-D1BL-D-1001	02 41 00
DEWATERING CENTRIFUGE BUILDING	BELT FILTER PRESS #2	DEMOLISH		90-D1BL-D-1001	02 41 00
DEWATERING CENTRIFUGE BUILDING	POLYMER EQUIPMENT AND SYSTEM	DEMOLISH		90-D1BL-D-1001	02 41 00
DEWATERING CENTRIFUGE BUILDING	LIME SCREW CONVEYOR	DEMOLISH		90-D1BL-D-1001	02 41 00
DEWATERING CENTRIFUGE BUILDING	LIME MIXER	DEMOLISH		90-D1BL-D-1001	02 41 00
DEWATERING CENTRIFUGE BUILDING	LIME MOTOR	DEMOLISH		90-D1BL-D-1001	02 41 00
DEWATERING CENTRIFUGE BUILDING	LIME SILO	DEMOLISH		90-D1BL-D-1001	02 41 00
DEWATERING CENTRIFUGE BUILDING	EXHAUST FAN	DEMOLISH		90-D1BL-D-1100	02 41 00
DEWATERING CENTRIFUGE BUILDING	HVAC HEATER	DEMOLISH		90-D1BL-D-1100	02 41 00
DEWATERING CENTRIFUGE BUILDING	VENTILLATION EQUIPMENT	DEMOLISH		90-D1BL-D-1100	02 41 00
DEWATERING CENTRIFUGE BUILDING	WATER HEATER	DEMOLISH		90-D1BL-P-1100	02 41 00
SLUDGE TANKS	SLUDGE HOLDING TANK #1	DEMOLISH		90-D1CT-D-1000	02 41 00
SLUDGE MANAGEMENT BUILDING	PISTON PUMP	DEMOLISH		90-D3BL-D-1000	02 41 00
SLUDGE MANAGEMENT BUILDING	SLUDGE FEED PUMP #1	DEMOLISH		90-D3BL-D-1000	02 41 00
SLUDGE MANAGEMENT BUILDING	SLUDGE FEED PUMP #2	DEMOLISH		90-D3BL-D-1000	02 41 00
SLUDGE MANAGEMENT BUILDING	SLUDGE FEED PUMP #3	DEMOLISH		90-D3BL-D-1000	02 41 00
SLUDGE MANAGEMENT BUILDING	ROTARY LOBE BLOWER #1	DEMOLISH		90-D3BL-D-1000	02 41 00
SLUDGE MANAGEMENT BUILDING	ROTARY LOBE BLOWER #2	DEMOLISH		90-D3BL-D-1000	02 41 00
WAS PUMPS	LOUVER	DEMOLISH		40-WAS1-D-1001	02 41 00

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LUCITY TAG INDEX: EQUIPMENT NEW

LOCATION	DESCRIPTION	STATUS	EQUIPMENT ID	DRAWING NO.	SPECIFICATION NO.
WAS FEED PUMPS	AIR RELIEF VALVE FOR WAS PUMP NO. 1	NEW	H040-WAS1-ARV01	09-N-0001	40 27 02
WAS FEED PUMPS	AIR RELIEF VALVE FOR WAS PUMP NO. 3	NEW	H040-WAS1-ARV02	09-N-0001	40 27 02
WAS FEED PUMPS	AIR RELIEF VALVE FOR WAS PUMP NO. 2	NEW	H040-WAS1-ARV03	09-N-0001	40 27 02
WAS FEED PUMPS	DRAIN BALL VALVE NO. 1	NEW	H040-WAS1-BLV01	09-N-0001	40 27 02
WAS FEED PUMPS	DRAIN BALL VALVE NO. 2	NEW	H040-WAS1-BLV02	09-N-0001	40 27 02
WAS FEED PUMPS	DRAIN BALL VALVE NO. 3	NEW	H040-WAS1-BLV03	09-N-0001	40 27 02
WAS FEED PUMPS	DRAIN BALL VALVE NO. 4	NEW	H040-WAS1-BLV04	09-N-0001	40 27 02
WAS FEED PUMPS	DRAIN BALL VALVE NO. 5	NEW	H040-WAS1-BLV05	09-N-0001	40 27 02
WAS FEED PUMPS	DRAIN BALL VALVE NO. 6	NEW	H040-WAS1-BLV06	09-N-0001	40 27 02
WAS FEED PUMPS	DRAIN BALL VALVE NO. 7	NEW	H040-WAS1-BLV07	09-N-0001	40 27 02
WAS FEED PUMPS	DRAIN BALL VALVE NO. 8	NEW	H040-WAS1-BLV08	09-N-0001	40 27 02
WAS FEED PUMPS	CHECK VALVE FOR WAS PUMP NO. 1	NEW	H040-WAS1-CKV01	09-N-0001	40 27 02
WAS FEED PUMPS	CHECK VALVE FOR WAS PUMP NO. 3	NEW	H040-WAS1-CKV02	09-N-0001	40 27 02
WAS FEED PUMPS	CHECK VALVE FOR WAS PUMP NO. 2	NEW	H040-WAS1-CKV03	09-N-0001	40 27 02
WAS FEED PUMPS	CONTROL PANEL FOR WAS FEED PUMPS	NEW	H040-WAS1-CPL01	09-N-0001	
WAS FEED PUMPS	WAS PUMPS INTAKE FLOW INDICATOR	NEW	H040-WAS1-FMT01	09-N-0001	40 27 02
WAS FEED PUMPS	PLUG VALVE NO. 1	NEW	H040-WAS1-PGV01	09-N-0001	40 27 02
WAS FEED PUMPS	PLUG VALVE NO. 2	NEW	H040-WAS1-PGV02	09-N-0001	40 27 02
WAS FEED PUMPS	PLUG VALVE NO. 3	NEW	H040-WAS1-PGV03	09-N-0001	40 27 02
WAS FEED PUMPS	PLUG VALVE NO. 4 WITH POSITION FEEDBACK	NEW	H040-WAS1-PGV04	09-N-0001	40 27 02
WAS FEED PUMPS	PLUG VALVE NO. 5 WITH POSITION FEEDBACK	NEW	H040-WAS1-PGV05	09-N-0001	40 27 02
WAS FEED PUMPS	PLUG VALVE NO. 6 WITH POSITION FEEDBACK	NEW	H040-WAS1-PGV06	09-N-0001	40 27 02
WAS FEED PUMPS	PLUG VALVE NO. 7 WITH POSITION FEEDBACK	NEW	H040-WAS1-PGV07	09-N-0001	40 27 02
WAS FEED PUMPS	PLUG VALVE NO. 8 WITH POSITION FEEDBACK	NEW	H040-WAS1-PGV08	09-N-0001	40 27 02
WAS FEED PUMPS	PLUG VALVE NO. 9	NEW	H040-WAS1-PGV09	09-N-0001	40 27 02
WAS FEED PUMPS	PLC FOR WAS FEED PUMPS	NEW	H040-WAS1-PLC01	09-N-0001	
WAS FEED PUMPS	WAS PUMP NO. 1 LOW SUCTION PRESSURE SWITCH	NEW	H040-WAS1-PRS01	09-N-0001	
WAS FEED PUMPS	WAS PUMP NO. 1 HIGH DISCHARGE PRESSURE SWITCH	NEW	H040-WAS1-PRS02	09-N-0001	
WAS FEED PUMPS	WAS PUMP NO. 2 LOW SUCTION PRESSURE SWITCH	NEW	H040-WAS1-PRS03	09-N-0001	
WAS FEED PUMPS	WAS PUMP NO. 2 HIGH DISCHARGE PRESSURE SWITCH	NEW	H040-WAS1-PRS04	09-N-0001	
WAS FEED PUMPS	WAS PUMP NO. 3 LOW SUCTION PRESSURE SWITCH	NEW	H040-WAS1-PRS05	09-N-0001	
WAS FEED PUMPS	WAS PUMP NO. 3 HIGH DISCHARGE PRESSURE SWITCH	NEW	H040-WAS1-PRS06	09-N-0001	
WAS FEED PUMPS	VFD FOR WAS PUMP NO. 1	NEW	H040-WAS1-VFD01	09-N-0001	26 29 23
WAS FEED PUMPS	VFD FOR WAS PUMP NO. 3	NEW	H040-WAS1-VFD02	09-N-0001	26 29 23
WAS FEED PUMPS	VFD FOR WAS PUMP NO. 2	NEW	H040-WAS1-VFD03	09-N-0001	26 29 23
WAS FEED PUMPS	WAS PUMP NO. 1	NEW	H040-WAS1-WSP01	09-N-0001	44 42 56.01
WAS FEED PUMPS	WAS PUMP NO. 2	NEW	H040-WAS1-WSP02	09-N-0001	44 42 56.01
WAS FEED PUMPS	WAS PUMP NO. 3	NEW	H040-WAS1-WSP03	09-N-0001	44 42 56.01
SCUM WET WELL	AIR RELIEF VALVE FOR SCUM PUMP NO. 1	NEW	H050-FCL1-ARV01	09-N-0002	40 27 02
SCUM WET WELL	AIR RELIEF VALVE FOR SCUM PUMP NO. 2	NEW	H050-FCL1-ARV02	09-N-0002	40 27 02
SCUM WET WELL	BACKFLOW PREVENTOR FOR WASHDOWN SPRAY BAR	NEW	H050-FCL1-BFL01	09-N-0002	40 27 02
SCUM WET WELL	BALL VALVE NO. 1	NEW	H050-FCL1-BLV01	09-N-0002	40 27 02
SCUM WET WELL	BALL VALVE NO. 2	NEW	H050-FCL1-BLV02	09-N-0002	40 27 02
SCUM WET WELL	BALL VALVE NO. 3	NEW	H050-FCL1-BLV03	09-N-0002	40 27 02
SCUM WET WELL	BALL VALVE NO. 4	NEW	H050-FCL1-BLV04	09-N-0002	40 27 02
SCUM WET WELL	BALL VALVE NO. 5	NEW	H050-FCL1-BLV05	09-N-0002	40 27 02
SCUM WET WELL	CHECK VALVE FOR SCUM PUMP NO. 1	NEW	H050-FCL1-CKV01	09-N-0002	40 27 02
SCUM WET WELL	CHECK VALVE FOR SCUM PUMP NO. 2	NEW	H050-FCL1-CKV02	09-N-0002	40 27 02

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LOCATION	DESCRIPTION	STATUS	EQUIPMENT ID	DRAWING NO.	SPECIFICATION NO.
SCUM WET WELL	SCUM WET WELL CONTROL PANEL	NEW	H050-FCL1-CPL01	09-N-0002	44 42 56.04
SCUM WET WELL	SCUM WET WELL LOCAL CONTROL PANEL	NEW	H050-FCL1-CPL02	09-N-0002	44 42 56.04
SCUM WET WELL	DUCKBILL VALVE FOR DRAIN	NEW	H050-FCL1-DBV01	09-N-0002	40 27 02
SCUM WET WELL	GATE VALVE FROM INFLUENT CHAMBER	NEW	H050-FCL1-GTV01	09-N-0002	40 27 02
SCUM WET WELL	GATE VALVE FROM SECONDARY CLARIFIER NO. 1	NEW	H050-FCL1-GTV02	09-N-0002	40 27 02
SCUM WET WELL	GATE VALVE FROM SECONDARY CLARIFIER NO. 2	NEW	H050-FCL1-GTV03	09-N-0002	40 27 02
SCUM WET WELL	GATE VALVE FROM SECONDARY CLARIFIER NO. 3	NEW	H050-FCL1-GTV04	09-N-0002	40 27 02
SCUM WET WELL	GATE VALVE FROM SECONDARY CLARIFIER NO. 4	NEW	H050-FCL1-GTV05	09-N-0002	40 27 02
SCUM WET WELL	SCUM TANK RADAR LEVEL INDICATOR	NEW	H050-FCL1-LIT01	09-N-0002	
SCUM WET WELL	PLUG VALVE NO. 1	NEW	H050-FCL1-PGV01	09-N-0002	40 27 02
SCUM WET WELL	MOTOROIZED PLUG VALVE NO. 2	NEW	H050-FCL1-PGV02	09-N-0002	40 27 02
SCUM WET WELL	PLUG VALVE NO. 3	NEW	H050-FCL1-PGV03	09-N-0002	40 27 02
SCUM WET WELL	MOTORIZED PLUG VALVE NO. 4	NEW	H050-FCL1-PGV04	09-N-0002	40 27 02
SCUM WET WELL	SCUM WET WELL PLC	NEW	H050-FCL1-PLC01	09-N-0002	
SCUM WET WELL	SECONDARY SCUM PUMP NO. 1 HIGH DISCHARGE PRESSURE SWITCH	NEW	H050-FCL1-PRS01	09-N-0002	
SCUM WET WELL	SECONDARY SCUM PUMP NO. 2 HIGH DISCHARGE PRESSURE SWITCH	NEW	H050-FCL1-PRS02	09-N-0002	
SCUM WET WELL	SECONDARY SCUM PUMP NO. 1 PRESSURE TRANSMITTER	NEW	H050-FCL1-PTM01	09-N-0002	
SCUM WET WELL	SECONDARY SCUM PUMP NO. 2 PRESSURE TRANSMITTER	NEW	H050-FCL1-PTM02	09-N-0002	
SLUDGE HOLDING TANKS	RDT BYPASS CONTROL VALVE BOX FLOW INDICATOR	NEW	H070-RDT1-FMT01	09-N-0004	40 27 02
SLUDGE HOLDING TANKS	PLUG VALVE NO. 1 WITH POSITION FEEDBACK	NEW	H070-RDT1-PGV01	09-N-0004	40 27 02
SLUDGE HOLDING TANKS	PLUG VALVE NO. 2 WITH POSITION FEEDBACK	NEW	H070-RDT1-PGV02	09-N-0004	40 27 02
SLUDGE HOLDING TANKS	PLUG VALVE NO. 3 WITH POSITION FEEDBACK	NEW	H070-RDT1-PGV03	09-N-0004	40 27 02
SLUDGE HOLDING TANKS	PLUG VALVE NO. 4 WITH POSITION FEEDBACK	NEW	H070-RDT1-PGV04	09-N-0004	40 27 02
SLUDGE HOLDING TANKS	SLUDGE HOLDING TANK NO. 1 RADAR LEVEL INDICATOR	NEW	H090-DEW1-LIT01	09-N-0004	
SLUDGE HOLDING TANKS	AIR RELIEF VALVE NO. 1	NEW	H090-DEW2-ARV01	09-N-0004	40 27 02
SLUDGE HOLDING TANKS	AIR RELIEF VALVE FOR RECIRCULATION PUMP NO. 1	NEW	H090-DEW2-ARV02	09-N-0004	40 27 02
SLUDGE HOLDING TANKS	AIR RELIEF VALVE FOR RECIRCULATION PUMP NO. 2	NEW	H090-DEW2-ARV03	09-N-0004	40 27 02
SLUDGE HOLDING TANKS	BUTTERFLY VALVE FOR BLOWER NO. 1	NEW	H090-DEW2-BFV01	09-N-0004	40 27 02
SLUDGE HOLDING TANKS	BUTTERFLY VALVE FOR BLOWER NO. 2	NEW	H090-DEW2-BFV02	09-N-0004	40 27 02
SLUDGE HOLDING TANKS	BUTTERFLY VALVE FOR BLOWER NO. 3	NEW	H090-DEW2-BFV03	09-N-0004	40 27 02
SLUDGE HOLDING TANKS	SLUDGE HOLDING TANK BLOWER NO. 1	NEW	H090-DEW2-BLO01	09-N-0004	44 42 19.04
SLUDGE HOLDING TANKS	SLUDGE HOLDING TANK BLOWER NO. 2	NEW	H090-DEW2-BLO02	09-N-0004	44 42 19.04
SLUDGE HOLDING TANKS	SLUDGE HOLDING TANK BLOWER NO. 3	NEW	H090-DEW2-BLO03	09-N-0004	44 42 19.04
SLUDGE HOLDING TANKS	DRAIN BALL VALVE NO. 1	NEW	H090-DEW2-BLV01	09-N-0004	40 27 02
SLUDGE HOLDING TANKS	DRAIN BALL VALVE NO. 2	NEW	H090-DEW2-BLV02	09-N-0004	40 27 02
SLUDGE HOLDING TANKS	DRAIN BALL VALVE NO. 3	NEW	H090-DEW2-BLV03	09-N-0004	40 27 02
SLUDGE HOLDING TANKS	DRAIN BALL VALVE NO. 4	NEW	H090-DEW2-BLV04	09-N-0004	40 27 02
SLUDGE HOLDING TANKS	DRAIN BALL VALVE NO. 5	NEW	H090-DEW2-BLV05	09-N-0004	40 27 02
SLUDGE HOLDING TANKS	DRAIN BALL VALVE NO. 6	NEW	H090-DEW2-BLV06	09-N-0004	40 27 02
SLUDGE HOLDING TANKS	DRAIN BALL VALVE NO. 7	NEW	H090-DEW2-BLV07	09-N-0004	40 27 02
SLUDGE HOLDING TANKS	DRAIN BALL VALVE NO. 8	NEW	H090-DEW2-BLV08	09-N-0004	40 27 02
SLUDGE HOLDING TANKS	PLUG VALVE NO. 1	NEW	H090-DEW2-PGV01	09-N-0004	40 27 02
SLUDGE HOLDING TANKS	PLUG VALVE NO. 2	NEW	H090-DEW2-PGV02	09-N-0004	40 27 02
SLUDGE HOLDING TANKS	PLUG VALVE NO. 3	NEW	H090-DEW2-PGV03	09-N-0004	40 27 02
SLUDGE HOLDING TANKS	PLUG VALVE NO. 4	NEW	H090-DEW2-PGV04	09-N-0004	40 27 02
SLUDGE HOLDING TANKS	PLUG VALVE NO. 5	NEW	H090-DEW2-PGV05	09-N-0004	40 27 02
SLUDGE HOLDING TANKS	PLUG VALVE NO. 6	NEW	H090-DEW2-PGV06	09-N-0004	40 27 02
SLUDGE HOLDING TANKS	PLUG VALVE NO. 7	NEW	H090-DEW2-PGV07	09-N-0004	40 27 02

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LOCATION	DESCRIPTION	STATUS	EQUIPMENT ID	DRAWING NO.	SPECIFICATION NO.
SLUDGE HOLDING TANKS	PLUG VALVE NO. 8	NEW	H090-DEW2-PGV08	09-N-0004	40 27 02
SLUDGE HOLDING TANKS	PLUG VALVE NO. 9	NEW	H090-DEW2-PGV09	09-N-0004	40 27 02
SLUDGE HOLDING TANKS	PLUG VALVE NO. 10	NEW	H090-DEW2-PGV10	09-N-0004	40 27 02
SLUDGE HOLDING TANKS	BLOWER NO. 1 HIGH DISCHARGE PRESSURE SWITCH	NEW	H090-DEW2-PRS01	09-N-0004	
SLUDGE HOLDING TANKS	BLOWER NO. 2 HIGH DISCHARGE PRESSURE SWITCH	NEW	H090-DEW2-PRS02	09-N-0004	
SLUDGE HOLDING TANKS	BLOWER NO. 3 HIGH DISCHARGE PRESSURE SWITCH	NEW	H090-DEW2-PRS03	09-N-0004	
SLUDGE HOLDING TANKS	RECIRCULATION PUMP NO. 1 LOW INTAKE PRESSURE SWITCH	NEW	H090-DEW2-PRS04	09-N-0004	
SLUDGE HOLDING TANKS	RECIRCULATION PUMP NO. 1 HIGH DISCHARGE PRESSURE SWITCH	NEW	H090-DEW2-PRS05	09-N-0004	
SLUDGE HOLDING TANKS	RECIRCULATION PUMP NO. 2 LOW INTAKE PRESSURE SWITCH	NEW	H090-DEW2-PRS06	09-N-0004	
SLUDGE HOLDING TANKS	RECIRCULATION PUMP NO. 2 HIGH DISCHARGE PRESSURE SWITCH	NEW	H090-DEW2-PRS07	09-N-0004	
SLUDGE HOLDING TANKS	SLUDGE HOLDING TANK NO. 1 PRESSURE INDICATOR	NEW	H090-DEW2-PTM01	09-N-0004	
SLUDGE HOLDING TANKS	RECIRCULATION PUMP NO. 1 INTAKE PRESSURE INDICATOR	NEW	H090-DEW2-PTM02	09-N-0004	
SLUDGE HOLDING TANKS	RECIRCULATION PUMP NO. 1 DISCHARGE PRESSURE INDICATOR	NEW	H090-DEW2-PTM03	09-N-0004	
SLUDGE HOLDING TANKS	RECIRCULATION PUMP NO. 2 INTAKE PRESSURE INDICATOR	NEW	H090-DEW2-PTM04	09-N-0004	
SLUDGE HOLDING TANKS	RECIRCULATION PUMP NO. 2 DISCHARGE PRESSURE INDICATOR	NEW	H090-DEW2-PTM05	09-N-0004	
SLUDGE HOLDING TANKS	RECIRCULATION PUMP NO. 1	NEW	H090-DEW2-RCP01	09-N-0004	44 42 56.05
SLUDGE HOLDING TANKS	RECIRCULATION PUMP NO. 2	NEW	H090-DEW2-RCP02	09-N-0004	44 42 56.05
SLUDGE HOLDING TANKS	CONTROL PANEL FOR BLOWER NO. 1	NEW	H090-DEW3-CPL01	09-N-0004	44 42 19.04
SLUDGE HOLDING TANKS	CONTROL PANEL FOR BLOWER NO. 2	NEW	H090-DEW3-CPL02	09-N-0004	44 42 19.04
SLUDGE HOLDING TANKS	CONTROL PANEL FOR BLOWER NO. 3	NEW	H090-DEW3-CPL03	09-N-0004	44 42 19.04
SLUDGE HOLDING TANKS	MAIN CONTROL PANEL FOR SLUDGE HOLDING TANKS	NEW	H090-DEW3-MCP01	09-N-0004	
SLUDGE HOLDING TANKS	PLC FOR SLUDGE HOLDING TANKS	NEW	H090-DEW3-PLC01	09-N-0004	
SLUDGE HOLDING TANKS	VFD FOR BLOWER NO. 1	NEW	H090-DEW3-VFD01	09-N-0004	26 29 23
SLUDGE HOLDING TANKS	VFD FOR BLOWER NO. 2	NEW	H090-DEW3-VFD02	09-N-0004	26 29 23
SLUDGE HOLDING TANKS	VFD FOR BLOWER NO. 3	NEW	H090-DEW3-VFD03	09-N-0004	26 29 23
SLUDGE HOLDING TANKS	VFD FOR RECIRCULATION PUMP NO. 1	NEW	H090-DEW3-VFD04	09-N-0004	26 29 23
SLUDGE HOLDING TANKS	VFD FOR RECIRCULATION PUMP NO. 2	NEW	H090-DEW3-VFD05	09-N-0004	26 29 23
SLUDGE FEED PUMPS	DRAIN BALL VALVE NO. 1	NEW	H090-DEW1-BLV01	09-N-0005	40 27 02
SLUDGE FEED PUMPS	DRAIN BALL VALVE NO. 2	NEW	H090-DEW1-BLV02	09-N-0005	40 27 02
SLUDGE FEED PUMPS	DRAIN BALL VALVE NO. 3	NEW	H090-DEW1-BLV03	09-N-0005	40 27 02
SLUDGE FEED PUMPS	POLYMER INJECTION BALL VALVE NO. 4	NEW	H090-DEW1-BLV04	09-N-0005	40 27 02
SLUDGE FEED PUMPS	DRAIN BALL VALVE NO. 5	NEW	H090-DEW1-BLV05	09-N-0005	40 27 02
SLUDGE FEED PUMPS	DRAIN BALL VALVE NO. 6	NEW	H090-DEW1-BLV06	09-N-0005	40 27 02
SLUDGE FEED PUMPS	POLYMER INJECTION VALVE NO. 7	NEW	H090-DEW1-BLV07	09-N-0005	40 27 02
SLUDGE FEED PUMPS	DRAIN BALL VALVE NO. 8	NEW	H090-DEW1-BLV08	09-N-0005	40 27 02
SLUDGE FEED PUMPS	DRAIN BALL VALVE NO. 9	NEW	H090-DEW1-BLV09	09-N-0005	40 27 02
SLUDGE FEED PUMPS	POLYMER INJECTION BALL VALVE NO. 10	NEW	H090-DEW1-BLV10	09-N-0005	40 27 02
SLUDGE FEED PUMPS	POTABLE WATER BALL VALVE NO. 11	NEW	H090-DEW1-BLV11	09-N-0005	40 27 02
SLUDGE FEED PUMPS	CHECK VALVE FOR SLUDGE FEED PUMP NO. 1	NEW	H090-DEW1-CKV01	09-N-0005	40 27 02
SLUDGE FEED PUMPS	CHECK VALVE FOR SLUDGE FEED PUMP NO. 2	NEW	H090-DEW1-CKV02	09-N-0005	40 27 02
SLUDGE FEED PUMPS	CHECK VALVE FOR SLUDGE FEED PUMP NO. 3	NEW	H090-DEW1-CKV03	09-N-0005	40 27 02
SLUDGE FEED PUMPS	CONTROL PANEL FOR GRINDER NO. 1	NEW	H090-DEW1-CPL01	09-N-0005	
SLUDGE FEED PUMPS	SUPPLEMENTAL SLUDGE/POLYMER MIXER NO. 1 FLOW INDICATOR	NEW	H090-DEW1-FMT01	09-N-0005	
SLUDGE FEED PUMPS	SUPPLEMENTAL SLUDGE/POLYMER MIXER NO. 2 FLOW INDICATOR	NEW	H090-DEW1-FMT02	09-N-0005	
SLUDGE FEED PUMPS	SUPPLEMENTAL SLUDGE/POLYMER MIXER NO. 3 FLOW INDICATOR	NEW	H090-DEW1-FMT03	09-N-0005	
SLUDGE FEED PUMPS	GRINDER NO. 1	NEW	H090-DEW1-GRD01	09-N-0005	46 24 25
SLUDGE FEED PUMPS	SUPPLEMENTAL SLUDGE/POLYMER MIXER NO. 1	NEW	H090-DEW1-MXR01	09-N-0005	44 44 63.01
SLUDGE FEED PUMPS	SUPPLEMENTAL SLUDGE/POLYMER MIXER NO. 2	NEW	H090-DEW1-MXR02	09-N-0005	44 44 63.01

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LOCATION	DESCRIPTION	STATUS	EQUIPMENT ID	DRAWING NO.	SPECIFICATION NO.
SLUDGE FEED PUMPS	SUPPLEMENTAL SLUDGE/POLYMER MIXER NO. 3	NEW	H090-DEW1-MXR03	09-N-0005	44 44 63.01
SLUDGE FEED PUMPS	PLUG VALVE NO. 1	NEW	H090-DEW1-PGV01	09-N-0005	40 27 02
SLUDGE FEED PUMPS	PLUG VALVE NO. 2	NEW	H090-DEW1-PGV02	09-N-0005	40 27 02
SLUDGE FEED PUMPS	PLUG VALVE NO. 3	NEW	H090-DEW1-PGV03	09-N-0005	40 27 02
SLUDGE FEED PUMPS	PLUG VALVE NO. 4	NEW	H090-DEW1-PGV04	09-N-0005	40 27 02
SLUDGE FEED PUMPS	PLUG VALVE NO. 5 WITH POSITION FEEDBACK	NEW	H090-DEW1-PGV05	09-N-0005	40 27 02
SLUDGE FEED PUMPS	PLUG VALVE NO. 6	NEW	H090-DEW1-PGV06	09-N-0005	40 27 02
SLUDGE FEED PUMPS	PLUG VALVE NO. 7 WITH POSITION FEEDBACK	NEW	H090-DEW1-PGV07	09-N-0005	40 27 02
SLUDGE FEED PUMPS	PLUG VALVE NO. 8	NEW	H090-DEW1-PGV08	09-N-0005	40 27 02
SLUDGE FEED PUMPS	PLUG VALVE NO. 9 WITH POSITION FEEDBACK	NEW	H090-DEW1-PGV09	09-N-0005	40 27 02
SLUDGE FEED PUMPS	PLUG VALVE NO. 10 WITH POSITION FEEDBACK	NEW	H090-DEW1-PGV10	09-N-0005	40 27 02
SLUDGE FEED PUMPS	PLUG VALVE NO. 11 WITH POSITION FEEDBACK	NEW	H090-DEW1-PGV11	09-N-0005	40 27 02
SLUDGE FEED PUMPS	PLUG VALVE NO. 12	NEW	H090-DEW1-PGV12	09-N-0005	40 27 02
SLUDGE FEED PUMPS	SLUDGE FEED PUMP NO. 1 LOW INTAKE PRESSURE SWITCH	NEW	H090-DEW1-PRS01	09-N-0005	
SLUDGE FEED PUMPS	SLUDGE FEED PUMP NO. 1 HIGH DISCHARGE PRESSURE SWITCH	NEW	H090-DEW1-PRS02	09-N-0005	
SLUDGE FEED PUMPS	SLUDGE FEED PUMP NO. 2 LOW INTAKE PRESSURE SWITCH	NEW	H090-DEW1-PRS03	09-N-0005	
SLUDGE FEED PUMPS	SLUDGE FEED PUMP NO. 2 HIGH DISCHARGE PRESSURE SWITCH	NEW	H090-DEW1-PRS04	09-N-0005	
SLUDGE FEED PUMPS	SLUDGE FEED PUMP NO. 3 LOW INTAKE PRESSURE SWITCH	NEW	H090-DEW1-PRS05	09-N-0005	
SLUDGE FEED PUMPS	SLUDGE FEED PUMP NO. 3 HIGH DISCHARGE PRESSURE SWITCH	NEW	H090-DEW1-PRS06	09-N-0005	
SLUDGE FEED PUMPS	DIFFERENTIAL PRESSURE VALVE FOR SLUDGE FEED PUMP NO. 1	NEW	H090-DEW1-PSV01	09-N-0005	40 27 02
SLUDGE FEED PUMPS	DIFFERENTIAL PRESSURE VALVE FOR SLUDGE FEED PUMP NO. 2	NEW	H090-DEW1-PSV02	09-N-0005	40 27 02
SLUDGE FEED PUMPS	DIFFERENTIAL PRESSURE VALVE FOR SLUDGE FEED PUMP NO. 3	NEW	H090-DEW1-PSV03	09-N-0005	40 27 02
SLUDGE FEED PUMPS	CENTRIFUGE SLUDGE FEED PUMP NO. 1	NEW	H090-DEW1-SFP01	09-N-0005	44 42 56.13
SLUDGE FEED PUMPS	CENTRIFUGE SLUDGE FEED PUMP NO. 2	NEW	H090-DEW1-SFP02	09-N-0005	44 42 56.13
SLUDGE FEED PUMPS	CENTRIFUGE SLUDGE FEED PUMP NO. 3	NEW	H090-DEW1-SFP03	09-N-0005	44 42 56.13
SLUDGE FEED PUMPS	POTABLE WATER STRAINER	NEW	H090-DEW1-STR01	09-N-0005	
SLUDGE FEED PUMPS	VFD FOR CENTRIFUGE SLUDGE FEED PUMP NO. 1	NEW	H090-DEW1-VFD01	09-N-0005	26 29 23
SLUDGE FEED PUMPS	VFD FOR CENTRIFUGE SLUDGE FEED PUMP NO. 2	NEW	H090-DEW1-VFD02	09-N-0005	26 29 23
SLUDGE FEED PUMPS	VFD FOR CENTRIFUGE SLUDGE FEED PUMP NO. 3	NEW	H090-DEW1-VFD03	09-N-0005	26 29 23
SLUDGE FEED PUMPS	MAIN CONTROL PANEL FOR DEWATERING BUILDING	NEW	H090-DEW1-MCP01	09-N-0005 09-N-0006 09-N-0007 09-N-0008 09-N-0009 09-N-0010	
SLUDGE FEED PUMPS	PLC FOR DEWATERING BUILDING	NEW	H090-DEW1-PLC01	09-N-0005 09-N-0006 09-N-0007 09-N-0008 09-N-0009 09-N-0010	
DEWATERING	DEWATERING MAIN CONTROL CENTER NO. 1	NEW	H090-DEW1-MCC01	09-N-0005 09-N-0006 09-N-0009 09-N-0011	
DEWATERING	DEWATERING MAIN CONTROL CENTER NO. 2	NEW	H090-DEW1-MCC02	09-N-0005 09-N-0009 09-N-0011	

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LOCATION	DESCRIPTION	STATUS	EQUIPMENT ID	DRAWING NO.	SPECIFICATION NO.
CENTRIFUGES	BALL VALVE NO. 12	NEW	H090-DEW1-BLV12	09-N-0006	40 27 02
CENTRIFUGES	BALL VALVE NO. 13	NEW	H090-DEW1-BLV13	09-N-0006	40 27 02
CENTRIFUGES	BALL VALVE NO. 14	NEW	H090-DEW1-BLV14	09-N-0006	40 27 02
CENTRIFUGES	BALL VALVE NO. 15	NEW	H090-DEW1-BLV15	09-N-0006	40 27 02
CENTRIFUGES	BALL VALVE NO. 16	NEW	H090-DEW1-BLV16	09-N-0006	40 27 02
CENTRIFUGES	BALL VALVE NO. 17	NEW	H090-DEW1-BLV17	09-N-0006	40 27 02
CENTRIFUGES	CENTRIFUGE NO. 1	NEW	H090-DEW1-CEN01	09-N-0006	43 22 23
CENTRIFUGES	OPERATOR PANEL FOR CENTRIFUGE NO. 1	NEW	H090-DEW1-CPL02	09-N-0006	43 22 23
CENTRIFUGES	DAMPER FOR ODOROUS FAN NO. 1	NEW	H090-DEW1-DMP01	09-N-0006	
CENTRIFUGES	DAMPER FOR ODOROUS FAN NO. 1	NEW	H090-DEW1-DMP02	09-N-0006	
CENTRIFUGES	FLOW CONTROL VALVE FOR LUBRICATION SYSTEM NO. 1	NEW	H090-DEW1-FCV01	09-N-0006	40 27 02
CENTRIFUGES	GLOBE BALL VALVE NO. 1	NEW	H090-DEW1-GBV01	09-N-0006	40 27 02
CENTRIFUGES	KNIFE GATE FOR CENTRIFUGE NO. 1	NEW	H090-DEW1-KGV01	09-N-0006	
CENTRIFUGES	LUBRICATION SYSTEM NO. 1	NEW	H090-DEW1-LBS01	09-N-0006	
CENTRIFUGES	STARTER PANEL FOR CENTRIFUGE NO. 1	NEW	H090-DEW1-MDP01	09-N-0006	43 22 23
CENTRIFUGES	MAIN DRIVE FOR CENTRIFUGE NO. 1	NEW	H090-DEW1-MOT01	09-N-0006	
CENTRIFUGES	BACK DRIVE FOR CENTRIFUGE NO. 1	NEW	H090-DEW1-MOT02	09-N-0006	
CENTRIFUGES	ODOROUS AIR FAN NO. 1	NEW	H090-DEW1-OFC01	09-N-0006	23 34 05
CENTRIFUGES	PLUG VALVE NO. 13	NEW	H090-DEW1-PGV13	09-N-0006	40 27 02
CENTRIFUGES	DIFFERENTIAL PRESSURE SWITCH FOR ODOROUS AIR FAN NO. 1	NEW	H090-DEW1-PRS21	09-N-0006	
CENTRIFUGES	BALL VALVE NO. 18	NEW	H090-DEW1-BLV18	09-N-0007	40 27 02
CENTRIFUGES	BALL VALVE NO. 19	NEW	H090-DEW1-BLV19	09-N-0007	40 27 02
CENTRIFUGES	BALL VALVE NO. 20	NEW	H090-DEW1-BLV20	09-N-0007	40 27 02
CENTRIFUGES	BALL VALVE NO. 21	NEW	H090-DEW1-BLV21	09-N-0007	40 27 02
CENTRIFUGES	BALL VALVE NO. 22	NEW	H090-DEW1-BLV22	09-N-0007	40 27 02
CENTRIFUGES	BALL VALVE NO. 23	NEW	H090-DEW1-BLV23	09-N-0007	40 27 02
CENTRIFUGES	CENTRIFUGE NO. 2	NEW	H090-DEW1-CEN02	09-N-0007	43 22 23
CENTRIFUGES	CENTRIFUGE NO. 3	NEW	H090-DEW1-CEN03	09-N-0007	43 22 23
CENTRIFUGES	OPERATOR PANEL FOR CENTRIFUGE NO. 2	NEW	H090-DEW1-CPL03	09-N-0007	43 22 23
CENTRIFUGES	OPERATOR PANEL FOR CENTRIFUGE NO. 3	NEW	H090-DEW1-CPL04	09-N-0007	43 22 23
CENTRIFUGES	DAMPER FOR ODOROUS FAN NO. 1	NEW	H090-DEW1-DMP03	09-N-0007	
CENTRIFUGES	DAMPER FOR ODOROUS FAN NO. 1	NEW	H090-DEW1-DMP04	09-N-0007	
CENTRIFUGES	FLOW CONTROL VALVE FOR LUBRICATION SYSTEM NO. 2	NEW	H090-DEW1-FCV02	09-N-0007	40 27 02
CENTRIFUGES	FLOW CONTROL VALVE FOR LUBRICATION SYSTEM NO. 3	NEW	H090-DEW1-FCV03	09-N-0007	40 27 02
CENTRIFUGES	GLOBE BALL VALVE NO. 2	NEW	H090-DEW1-GBV02	09-N-0007	40 27 02
CENTRIFUGES	GLOBE BALL VALVE NO. 3	NEW	H090-DEW1-GBV03	09-N-0007	40 27 02
CENTRIFUGES	KNIFE GATE FOR CENTRIFUGE NO. 2	NEW	H090-DEW1-KGV02	09-N-0007	
CENTRIFUGES	KNIFE GATE FOR CENTRIFUGE NO. 3	NEW	H090-DEW1-KGV03	09-N-0007	
CENTRIFUGES	LUBRICATION SYSTEM NO. 2	NEW	H090-DEW1-LBS02	09-N-0007	
CENTRIFUGES	LUBRICATION SYSTEM NO. 3	NEW	H090-DEW1-LBS03	09-N-0007	
CENTRIFUGES	STARTER PANEL FOR CENTRIFUGE NO. 2	NEW	H090-DEW1-MDP02	09-N-0007	43 22 23
CENTRIFUGES	STARTER PANEL FOR CENTRIFUGE NO. 3	NEW	H090-DEW1-MDP03	09-N-0007	43 22 23
CENTRIFUGES	MAIN DRIVE FOR CENTRIFUGE NO. 2	NEW	H090-DEW1-MOT03	09-N-0007	
CENTRIFUGES	BACK DRIVE FOR CENTRIFUGE NO. 2	NEW	H090-DEW1-MOT04	09-N-0007	
CENTRIFUGES	MAIN DRIVE FOR CENTRIFUGE NO. 3	NEW	H090-DEW1-MOT05	09-N-0007	
CENTRIFUGES	BACK DRIVE FOR CENTRIFUGE NO. 3	NEW	H090-DEW1-MOT06	09-N-0007	
CENTRIFUGES	PLUG VALVE NO. 15	NEW	H090-DEW1-PGV15	09-N-0007	40 27 02
CENTRIFUGES	PLUG VALVE NO. 16	NEW	H090-DEW1-PGV16	09-N-0007	40 27 02

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LOCATION	DESCRIPTION	STATUS	EQUIPMENT ID	DRAWING NO.	SPECIFICATION NO.
POLYMER FEED PUMPS	DRAIN BALL VALVE NO. 24	NEW	H090-DEW1-BLV24	09-N-0008	40 27 02
POLYMER FEED PUMPS	DRAIN BALL VALVE NO. 25	NEW	H090-DEW1-BLV25	09-N-0008	40 27 02
POLYMER FEED PUMPS	DRAIN BALL VALVE NO. 26	NEW	H090-DEW1-BLV26	09-N-0008	40 27 02
POLYMER FEED PUMPS	DRAIN BALL VALVE NO. 27	NEW	H090-DEW1-BLV27	09-N-0008	40 27 02
POLYMER FEED PUMPS	DRAIN BALL VALVE NO. 28	NEW	H090-DEW1-BLV28	09-N-0008	40 27 02
POLYMER FEED PUMPS	BALL VALVE NO. 29	NEW	H090-DEW1-BLV29	09-N-0008	40 27 02
POLYMER FEED PUMPS	DRAIN BALL VALVE NO. 30	NEW	H090-DEW1-BLV30	09-N-0008	40 27 02
POLYMER FEED PUMPS	BALL VALVE NO. 31	NEW	H090-DEW1-BLV31	09-N-0008	40 27 02
POLYMER FEED PUMPS	BALL VALVE NO. 32	NEW	H090-DEW1-BLV32	09-N-0008	40 27 02
POLYMER FEED PUMPS	BALL VALVE NO. 33	NEW	H090-DEW1-BLV33	09-N-0008	40 27 02
POLYMER FEED PUMPS	BALL VALVE NO. 34	NEW	H090-DEW1-BLV34	09-N-0008	40 27 02
POLYMER FEED PUMPS	BALL VALVE NO. 35	NEW	H090-DEW1-BLV35	09-N-0008	40 27 02
POLYMER FEED PUMPS	BALL VALVE NO. 36	NEW	H090-DEW1-BLV36	09-N-0008	40 27 02
POLYMER FEED PUMPS	BALL VALVE NO. 37	NEW	H090-DEW1-BLV37	09-N-0008	40 27 02
POLYMER FEED PUMPS	BALL VALVE NO. 38	NEW	H090-DEW1-BLV38	09-N-0008	40 27 02
POLYMER FEED PUMPS	BALL VALVE NO. 39	NEW	H090-DEW1-BLV39	09-N-0008	40 27 02
POLYMER FEED PUMPS	BALL VALVE NO. 40	NEW	H090-DEW1-BLV40	09-N-0008	40 27 02
POLYMER FEED PUMPS	BALL VALVE NO. 41	NEW	H090-DEW1-BLV41	09-N-0008	40 27 02
POLYMER FEED PUMPS	BALL VALVE NO. 42	NEW	H090-DEW1-BLV42	09-N-0008	40 27 02
POLYMER FEED PUMPS	BALL VALVE NO. 43	NEW	H090-DEW1-BLV43	09-N-0008	40 27 02
POLYMER FEED PUMPS	BALL VALVE NO. 44	NEW	H090-DEW1-BLV44	09-N-0008	40 27 02
POLYMER FEED PUMPS	BALL VALVE NO. 45	NEW	H090-DEW1-BLV45	09-N-0008	40 27 02
POLYMER FEED PUMPS	BALL VALVE NO. 46	NEW	H090-DEW1-BLV46	09-N-0008	40 27 02
POLYMER FEED PUMPS	BALL VALVE NO. 47	NEW	H090-DEW1-BLV47	09-N-0008	40 27 02
POLYMER FEED PUMPS	BALL VALVE NO. 48	NEW	H090-DEW1-BLV48	09-N-0008	40 27 02
POLYMER FEED PUMPS	BALL VALVE NO. 49	NEW	H090-DEW1-BLV49	09-N-0008	40 27 02
POLYMER FEED PUMPS	BALL VALVE NO. 50	NEW	H090-DEW1-BLV50	09-N-0008	40 27 02
POLYMER FEED PUMPS	BALL VALVE NO. 51	NEW	H090-DEW1-BLV51	09-N-0008	40 27 02
POLYMER FEED PUMPS	BALL VALVE NO. 52	NEW	H090-DEW1-BLV52	09-N-0008	40 27 02
POLYMER FEED PUMPS	BALL VALVE NO. 53	NEW	H090-DEW1-BLV53	09-N-0008	40 27 02
POLYMER FEED PUMPS	BALL VALVE NO. 54	NEW	H090-DEW1-BLV54	09-N-0008	40 27 02
POLYMER FEED PUMPS	BALL VALVE NO. 55	NEW	H090-DEW1-BLV55	09-N-0008	40 27 02
POLYMER FEED PUMPS	BALL VALVE NO. 56	NEW	H090-DEW1-BLV56	09-N-0008	40 27 02
POLYMER FEED PUMPS	POLYMER TRUCK FILL CHECK VALVE	NEW	H090-DEW1-CKV04	09-N-0008	40 27 02
POLYMER FEED PUMPS	CHECK VALVE FOR POLYMER BLENDING UNIT NO. 1	NEW	H090-DEW1-CKV05	09-N-0008	40 27 02
POLYMER FEED PUMPS	CHECK VALVE FOR POLYMER BLENDING UNIT NO. 2	NEW	H090-DEW1-CKV06	09-N-0008	40 27 02
POLYMER FEED PUMPS	CHECK VALVE FOR POLYMER BLENDING UNIT NO. 3	NEW	H090-DEW1-CKV07	09-N-0008	40 27 02
POLYMER FEED PUMPS	CONTROL PANEL FOR POLYMER RECIRCULATION PUMP NO. 1	NEW	H090-DEW1-CPL06	09-N-0008	
POLYMER FEED PUMPS	CONTROL PANEL FOR POLYMER BLENDING UNIT NO. 1	NEW	H090-DEW1-CPL07	09-N-0008	44 44 63.01
POLYMER FEED PUMPS	CONTROL PANEL FOR POLYMER BLENDING UNIT NO. 2	NEW	H090-DEW1-CPL08	09-N-0008	44 44 63.01
POLYMER FEED PUMPS	CONTROL PANEL FOR POLYMER BLENDING UNIT NO. 3	NEW	H090-DEW1-CPL09	09-N-0008	44 44 63.01
POLYMER FEED PUMPS	CENTRIFUGE NO. 1 FLOW INDICATOR FROM POLYMER BLENDING UNITS	NEW	H090-DEW1-FMT04	09-N-0008	
POLYMER FEED PUMPS	CENTRIFUGE NO. 2 FLOW INDICATOR FROM POLYMER BLENDING UNITS	NEW	H090-DEW1-FMT05	09-N-0008	
POLYMER FEED PUMPS	CENTRIFUGE NO. 3 FLOW INDICATOR FROM POLYMER BLENDING UNITS	NEW	H090-DEW1-FMT06	09-N-0008	
POLYMER FEED PUMPS	POLYMER BULK STORAGE TANK RADAR LEVEL INDICATOR	NEW	H090-DEW1-LIT02	09-N-0008	
POLYMER FEED PUMPS	POLYMER BLENDING UNIT NO. 1	NEW	H090-DEW1-PBU01	09-N-0008	44 44 63.01
POLYMER FEED PUMPS	POLYMER BLENDING UNIT NO. 2	NEW	H090-DEW1-PBU02	09-N-0008	44 44 63.01
POLYMER FEED PUMPS	POLYMER BLENDING UNIT NO. 3	NEW	H090-DEW1-PBU03	09-N-0008	44 44 63.01

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LOCATION	DESCRIPTION	STATUS	EQUIPMENT ID	DRAWING NO.	SPECIFICATION NO.
POLYMER FEED PUMPS	POLYMER FEED PUMP NO. 1	NEW	H090-DEW1-PFP01	09-N-0008	44 44 63.01
POLYMER FEED PUMPS	POLYMER FEED PUMP NO. 2	NEW	H090-DEW1-PFP02	09-N-0008	44 44 63.01
POLYMER FEED PUMPS	POLYMER FEED PUMP NO. 3	NEW	H090-DEW1-PFP03	09-N-0008	44 44 63.01
POLYMER FEED PUMPS	DRAIN PLUG VALVE NO. 17	NEW	H090-DEW1-PGV17	09-N-0008	40 27 02
POLYMER FEED PUMPS	POLYMER MIXER NO. 1	NEW	H090-DEW1-PMX01	09-N-0008	44 44 63.01
POLYMER FEED PUMPS	POLYMER MIXER NO. 2	NEW	H090-DEW1-PMX02	09-N-0008	44 44 63.01
POLYMER FEED PUMPS	POLYMER MIXER NO. 3	NEW	H090-DEW1-PMX03	09-N-0008	44 44 63.01
POLYMER FEED PUMPS	POLYMER FILL PANEL	NEW	H090-DEW1-PNL01	09-N-0008	
POLYMER FEED PUMPS	POLYMER RECIRCULATION PUMP NO. 1 LOW DISCHARGE PRESSURE SWITCH	NEW	H090-DEW1-PRS07	09-N-0008	
POLYMER FEED PUMPS	POLYMER RECIRCULATION PUMP NO. 1 HIGH DISCHARGE PRESSURE SWITCH	NEW	H090-DEW1-PRS08	09-N-0008	
POLYMER FEED PUMPS	POLYMER BLENDING UNIT NO. 1 DIFFERENTIAL PRESSURE SWITCH	NEW	H090-DEW1-PRS09	09-N-0008	
POLYMER FEED PUMPS	POLYMER BLENDING UNIT NO. 1 DIFFERENTIAL PRESSURE SWITCH	NEW	H090-DEW1-PRS10	09-N-0008	
POLYMER FEED PUMPS	POLYMER BLENDING UNIT NO. 2 DIFFERENTIAL PRESSURE SWITCH	NEW	H090-DEW1-PRS11	09-N-0008	
POLYMER FEED PUMPS	POLYMER BLENDING UNIT NO. 2 DIFFERENTIAL PRESSURE SWITCH	NEW	H090-DEW1-PRS12	09-N-0008	
POLYMER FEED PUMPS	POLYMER BLENDING UNIT NO. 3 DIFFERENTIAL PRESSURE SWITCH	NEW	H090-DEW1-PRS13	09-N-0008	
POLYMER FEED PUMPS	POLYMER BLENDING UNIT NO. 3 DIFFERENTIAL PRESSURE SWITCH	NEW	H090-DEW1-PRS14	09-N-0008	
POLYMER FEED PUMPS	POLYMER RECIRCULATION PUMP NO. 1	NEW	H090-DEW1-RCP01	09-N-0008	43 40 01
CENTRATE DRAIN PUMP STATION	CENTRATE WET WELL DISCHARGE FLOW INDICATOR	NEW	H090-DEW1-FMT07	09-N-0009	
CENTRATE DRAIN PUMP STATION	CENTRATE WET WELL SUBMERSIBLE LEVEL INDICATOR	NEW	H090-DEW1-LIT03	09-N-0009	
CENTRATE DRAIN PUMP STATION	PLUG VALVE NO. 18	NEW	H090-DEW1-PGV18	09-N-0009	40 27 02
CENTRATE DRAIN PUMP STATION	PLUG VALVE NO. 19	NEW	H090-DEW1-PGV19	09-N-0009	40 27 02
CENTRATE DRAIN PUMP STATION	PLUG VALVE NO. 20	NEW	H090-DEW1-PGV20	09-N-0009	40 27 02
CENTRATE DRAIN PUMP STATION	PLUG VALVE NO. 21	NEW	H090-DEW1-PGV21	09-N-0009	40 27 02
CENTRATE DRAIN PUMP STATION	PLUG VALVE NO. 22	NEW	H090-DEW1-PGV22	09-N-0009	40 27 02
CENTRATE DRAIN PUMP STATION	PLUG VALVE NO. 23	NEW	H090-DEW1-PGV23	09-N-0009	40 27 02
CENTRATE DRAIN PUMP STATION	PLUG VALVE NO. 24	NEW	H090-DEW1-PGV24	09-N-0009	40 27 02
CENTRATE DRAIN PUMP STATION	CENTRATE PUMP NO. 1	NEW	H090-DEW1-PMP04	09-N-0009	44 42 56.09
CENTRATE DRAIN PUMP STATION	CENTRATE PUMP NO. 2	NEW	H090-DEW1-PMP05	09-N-0009	44 42 56.09
CENTRATE DRAIN PUMP STATION	CENTRATE PUMP NO. 3	NEW	H090-DEW1-PMP06	09-N-0009	44 42 56.09
CENTRATE DRAIN PUMP STATION	CENTRATE PUMP NO. 1 LOW INTAKE PRESSURE SWITCH	NEW	H090-DEW1-PRS15	09-N-0009	
CENTRATE DRAIN PUMP STATION	CENTRATE PUMP NO. 1 HIGH DISCHARGE PRESSURE SWITCH	NEW	H090-DEW1-PRS16	09-N-0009	
CENTRATE DRAIN PUMP STATION	CENTRATE PUMP NO. 2 LOW INTAKE PRESSURE SWITCH	NEW	H090-DEW1-PRS17	09-N-0009	
CENTRATE DRAIN PUMP STATION	CENTRATE PUMP NO. 2 HIGH DISCHARGE PRESSURE SWITCH	NEW	H090-DEW1-PRS18	09-N-0009	
CENTRATE DRAIN PUMP STATION	CENTRATE PUMP NO. 3 LOW INTAKE PRESSURE SWITCH	NEW	H090-DEW1-PRS19	09-N-0009	
CENTRATE DRAIN PUMP STATION	CENTRATE PUMP NO. 3 HIGH DISCHARGE PRESSURE SWITCH	NEW	H090-DEW1-PRS20	09-N-0009	
CENTRATE DRAIN PUMP STATION	VFD FOR CENTRATE PUMP NO. 1	NEW	H090-DEW1-VFD04	09-N-0009	26 29 23
CENTRATE DRAIN PUMP STATION	VFD FOR CENTRATE PUMP NO. 2	NEW	H090-DEW1-VFD05	09-N-0009	26 29 23
CENTRATE DRAIN PUMP STATION	VFD FOR CENTRATE PUMP NO. 3	NEW	H090-DEW1-VFD06	09-N-0009	26 29 23
COMPOSTING STORAGE	SPRAY BAR BALL VALVE	NEW	H090-DEW1-BLV57	09-N-0010	40 27 02
COMPOSTING STORAGE	DRAIN BALL VALVE NO. 58	NEW	H090-DEW1-BLV58	09-N-0010	40 27 02
COMPOSTING STORAGE	DRIP PAN WASHDOWN BALL VALVE NO. 59	NEW	H090-DEW1-BLV59	09-N-0010	40 27 02
COMPOSTING STORAGE	DRIP PAN WASHDOWN BALL VALVE NO. 60	NEW	H090-DEW1-BLV60	09-N-0010	40 27 02
COMPOSTING STORAGE	SLUDGE CONVEYOR NO. 1	NEW	H090-DEW1-CNV01	09-N-0010	44 46 13.01
COMPOSTING STORAGE	CONTROL PANEL FOR SLUDGE CONVEYOR NO. 1	NEW	H090-DEW1-CPL05	09-N-0010	44 46 13.01
COMPOSTING MIXERS AND CONVEYORS	COMPOST CONVEYOR NO. 1	NEW	H095-COM2-CNV01	09-N-0011	44 46 13.05
COMPOSTING MIXERS AND CONVEYORS	COMPOST CONVEYOR NO. 2	NEW	H095-COM2-CNV02	09-N-0011	44 46 13.05
COMPOSTING MIXERS AND CONVEYORS	CONTROL PANEL FOR COMPOSTER MIXERS, SCALES, & CONVEYORS	NEW	H095-COM2-CPL01	09-N-0011	44 46 13.05
COMPOSTING MIXERS AND CONVEYORS	WEIGHING SCALE NO. 1 INDICATOR	NEW	H095-COM2-CPL02	09-N-0011	44 46 13.05

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LOCATION	DESCRIPTION	STATUS	EQUIPMENT ID	DRAWING NO.	SPECIFICATION NO.
COMPOSTING MIXERS AND CONVEYORS	WEIGHING SCALE NO. 2 INDICATOR	NEW	H095-COM2-CPL03	09-N-0011	44 46 13.05
COMPOSTING MIXERS AND CONVEYORS	CONTROL PANEL FOR EXHAUST FANS	NEW	H095-COM2-CPL04	09-N-0011	
COMPOSTING MIXERS AND CONVEYORS	EXHAUST FAN NO. 1	NEW	H095-COM2-EHF01	09-N-0011	
COMPOSTING MIXERS AND CONVEYORS	EXHAUST FAN NO. 2	NEW	H095-COM2-EHF02	09-N-0011	
COMPOSTING MIXERS AND CONVEYORS	EXHAUST FAN NO. 3	NEW	H095-COM2-EHF03	09-N-0011	
COMPOSTING MIXERS AND CONVEYORS	EXHAUST FAN NO. 4	NEW	H095-COM2-EHF04	09-N-0011	
COMPOSTING MIXERS AND CONVEYORS	EXHAUST FAN NO. 5	NEW	H095-COM2-EHF05	09-N-0011	
COMPOSTING MIXERS AND CONVEYORS	EXHAUST FAN NO. 6	NEW	H095-COM2-EHF06	09-N-0011	
COMPOSTING MIXERS AND CONVEYORS	EXHAUST FAN NO. 7	NEW	H095-COM2-EHF07	09-N-0011	
COMPOSTING MIXERS AND CONVEYORS	COMPOST SCALE NO. 1	NEW	H095-COM2-SCA01	09-N-0011	44 46 13.05
COMPOSTING MIXERS AND CONVEYORS	COMPOST SCALE NO. 2	NEW	H095-COM2-SCA02	09-N-0011	44 46 13.05
COMPOSTING MIXERS AND CONVEYORS	MAIN CONTROL PANEL FOR COMPOSTING	NEW	H095-COM1-MCP01	09-N-0011 09-N-0012	
COMPOSTING MIXERS AND CONVEYORS	PLC FOR COMPOSTING	NEW	H095-COM1-PLC01	09-N-0011 09-N-0012 09-N-0013 09-N-0014	
ACTIVE COMPOSTING BLOWER SYSTEM	VFD FOR COMPOST FAN NO. 1	NEW	H095-COM1-VFD01	09-N-0012	26 29 23
ACTIVE COMPOSTING BLOWER SYSTEM	VFD FOR COMPOST FAN NO. 2	NEW	H095-COM1-VFD02	09-N-0012	26 29 23
ACTIVE COMPOSTING BLOWER SYSTEM	VFD FOR COMPOST FAN NO. 3	NEW	H095-COM1-VFD03	09-N-0012	26 29 23
ACTIVE COMPOSTING BLOWER SYSTEM	VFD FOR COMPOST FAN NO. 4	NEW	H095-COM1-VFD04	09-N-0012	26 29 23
ACTIVE COMPOSTING BLOWER SYSTEM	VFD FOR COMPOST FAN NO. 5	NEW	H095-COM1-VFD05	09-N-0012	26 29 23
ACTIVE COMPOSTING BLOWER SYSTEM	VFD FOR COMPOST FAN NO. 6	NEW	H095-COM1-VFD06	09-N-0012	26 29 23
ACTIVE COMPOSTING BLOWER SYSTEM	VFD FOR COMPOST FAN NO. 7	NEW	H095-COM1-VFD07	09-N-0012	26 29 23
ACTIVE COMPOSTING BLOWER SYSTEM	VFD FOR COMPOST FAN NO. 8	NEW	H095-COM1-VFD08	09-N-0012	26 29 23
ACTIVE COMPOSTING BLOWER SYSTEM	VFD FOR COMPOST FAN NO. 9	NEW	H095-COM1-VFD09	09-N-0012	26 29 23
ACTIVE COMPOSTING BLOWER SYSTEM	VFD FOR COMPOST FAN NO. 10	NEW	H095-COM1-VFD10	09-N-0012	26 29 23
ACTIVE COMPOSTING BLOWER SYSTEM	DAMPER FOR COMPOST FAN NO. 1	NEW	H095-COM2-DMP01	09-N-0012	23 31 13.05
ACTIVE COMPOSTING BLOWER SYSTEM	DAMPER FOR COMPOST FAN NO. 2	NEW	H095-COM2-DMP02	09-N-0012	23 31 13.05
ACTIVE COMPOSTING BLOWER SYSTEM	DAMPER FOR COMPOST FAN NO. 3	NEW	H095-COM2-DMP03	09-N-0012	23 31 13.05
ACTIVE COMPOSTING BLOWER SYSTEM	DAMPER FOR COMPOST FAN NO. 4	NEW	H095-COM2-DMP04	09-N-0012	23 31 13.05
ACTIVE COMPOSTING BLOWER SYSTEM	DAMPER FOR COMPOST FAN NO. 5	NEW	H095-COM2-DMP05	09-N-0012	23 31 13.05
ACTIVE COMPOSTING BLOWER SYSTEM	DAMPER FOR COMPOST FAN NO. 6	NEW	H095-COM2-DMP06	09-N-0012	23 31 13.05
ACTIVE COMPOSTING BLOWER SYSTEM	DAMPER FOR COMPOST FAN NO. 7	NEW	H095-COM2-DMP07	09-N-0012	23 31 13.05
ACTIVE COMPOSTING BLOWER SYSTEM	DAMPER FOR COMPOST FAN NO. 8	NEW	H095-COM2-DMP08	09-N-0012	23 31 13.05
ACTIVE COMPOSTING BLOWER SYSTEM	DAMPER FOR COMPOST FAN NO. 9	NEW	H095-COM2-DMP09	09-N-0012	23 31 13.05
ACTIVE COMPOSTING BLOWER SYSTEM	DAMPER FOR COMPOST FAN NO. 10	NEW	H095-COM2-DMP10	09-N-0012	23 31 13.05
ACTIVE COMPOSTING BLOWER SYSTEM	COMPOST FAN NO. 1	NEW	H095-COM2-FAN01	09-N-0012	23 34 05
ACTIVE COMPOSTING BLOWER SYSTEM	COMPOST FAN NO. 2	NEW	H095-COM2-FAN02	09-N-0012	23 34 05
ACTIVE COMPOSTING BLOWER SYSTEM	COMPOST FAN NO. 3	NEW	H095-COM2-FAN03	09-N-0012	23 34 05
ACTIVE COMPOSTING BLOWER SYSTEM	COMPOST FAN NO. 4	NEW	H095-COM2-FAN04	09-N-0012	23 34 05
ACTIVE COMPOSTING BLOWER SYSTEM	COMPOST FAN NO. 5	NEW	H095-COM2-FAN05	09-N-0012	23 34 05
ACTIVE COMPOSTING BLOWER SYSTEM	COMPOST FAN NO. 6	NEW	H095-COM2-FAN06	09-N-0012	23 34 05
ACTIVE COMPOSTING BLOWER SYSTEM	COMPOST FAN NO. 7	NEW	H095-COM2-FAN07	09-N-0012	23 34 05
ACTIVE COMPOSTING BLOWER SYSTEM	COMPOST FAN NO. 8	NEW	H095-COM2-FAN08	09-N-0012	23 34 05
ACTIVE COMPOSTING BLOWER SYSTEM	COMPOST FAN NO. 9	NEW	H095-COM2-FAN09	09-N-0012	23 34 05
ACTIVE COMPOSTING BLOWER SYSTEM	COMPOST FAN NO. 10	NEW	H095-COM2-FAN10	09-N-0012	23 34 05
ACTIVE COMPOSTING BLOWER SYSTEM	REOTEMP TEMPERATURE PROBE FOR COMPOST BAY	NEW	H095-COM2-TTM01	09-N-0012	

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LOCATION	DESCRIPTION	STATUS	EQUIPMENT ID	DRAWING NO.	SPECIFICATION NO.
ACTIVE COMPOSTING BLOWER SYSTEM	REOTEMP TEMPERATURE PROBE FOR COMPOST BAY	NEW	H095-COM2-TTM02	09-N-0012	
ACTIVE COMPOSTING BLOWER SYSTEM	REOTEMP TEMPERATURE PROBE FOR COMPOST BAY	NEW	H095-COM2-TTM03	09-N-0012	
ACTIVE COMPOSTING BLOWER SYSTEM	REOTEMP TEMPERATURE PROBE FOR COMPOST BAY	NEW	H095-COM2-TTM04	09-N-0012	
ACTIVE COMPOSTING BLOWER SYSTEM	REOTEMP TEMPERATURE PROBE FOR COMPOST BAY	NEW	H095-COM2-TTM05	09-N-0012	
ACTIVE COMPOSTING BLOWER SYSTEM	REOTEMP TEMPERATURE PROBE FOR COMPOST BAY	NEW	H095-COM2-TTM06	09-N-0012	
ACTIVE COMPOSTING BLOWER SYSTEM	REOTEMP TEMPERATURE PROBE FOR COMPOST BAY	NEW	H095-COM2-TTM07	09-N-0012	
ACTIVE COMPOSTING BLOWER SYSTEM	REOTEMP TEMPERATURE PROBE FOR COMPOST BAY	NEW	H095-COM2-TTM08	09-N-0012	
ACTIVE COMPOSTING BLOWER SYSTEM	REOTEMP TEMPERATURE PROBE FOR COMPOST BAY	NEW	H095-COM2-TTM09	09-N-0012	
ACTIVE COMPOSTING BLOWER SYSTEM	REOTEMP TEMPERATURE PROBE FOR COMPOST BAY	NEW	H095-COM2-TTM10	09-N-0012	
ACTIVE COMPOSTING BLOWER SYSTEM	REOTEMP TEMPERATURE PROBE FOR COMPOST BAY	NEW	H095-COM2-TTM11	09-N-0012	
ACTIVE COMPOSTING BLOWER SYSTEM	REOTEMP TEMPERATURE PROBE FOR COMPOST BAY	NEW	H095-COM2-TTM12	09-N-0012	
ACTIVE COMPOSTING BLOWER SYSTEM	REOTEMP TEMPERATURE PROBE FOR COMPOST BAY	NEW	H095-COM2-TTM13	09-N-0012	
ACTIVE COMPOSTING BLOWER SYSTEM	REOTEMP TEMPERATURE PROBE FOR COMPOST BAY	NEW	H095-COM2-TTM14	09-N-0012	
ACTIVE COMPOSTING BLOWER SYSTEM	REOTEMP TEMPERATURE PROBE FOR COMPOST BAY	NEW	H095-COM2-TTM15	09-N-0012	
ACTIVE COMPOSTING BLOWER SYSTEM	REOTEMP TEMPERATURE PROBE FOR COMPOST BAY	NEW	H095-COM2-TTM16	09-N-0012	
ACTIVE COMPOSTING BLOWER SYSTEM	REOTEMP TEMPERATURE PROBE FOR COMPOST BAY	NEW	H095-COM2-TTM17	09-N-0012	
ACTIVE COMPOSTING BLOWER SYSTEM	REOTEMP TEMPERATURE PROBE FOR COMPOST BAY	NEW	H095-COM2-TTM18	09-N-0012	
ACTIVE COMPOSTING BLOWER SYSTEM	REOTEMP TEMPERATURE PROBE FOR COMPOST BAY	NEW	H095-COM2-TTM19	09-N-0012	
ACTIVE COMPOSTING BLOWER SYSTEM	REOTEMP TEMPERATURE PROBE FOR COMPOST BAY	NEW	H095-COM2-TTM20	09-N-0012	
ACTIVE COMPOSTING BLOWER SYSTEM	REOTEMP TEMPERATURE PROBE FOR COMPOST BAY	NEW	H095-COM2-TTM21	09-N-0012	
ACTIVE COMPOSTING BLOWER SYSTEM	REOTEMP TEMPERATURE PROBE FOR COMPOST BAY	NEW	H095-COM2-TTM22	09-N-0012	
ACTIVE COMPOSTING BLOWER SYSTEM	REOTEMP TEMPERATURE PROBE FOR COMPOST BAY	NEW	H095-COM2-TTM23	09-N-0012	
ACTIVE COMPOSTING BLOWER SYSTEM	REOTEMP TEMPERATURE PROBE FOR COMPOST BAY	NEW	H095-COM2-TTM24	09-N-0012	
ACTIVE COMPOSTING BLOWER SYSTEM	REOTEMP TEMPERATURE PROBE FOR COMPOST BAY	NEW	H095-COM2-TTM25	09-N-0012	
ACTIVE COMPOSTING BLOWER SYSTEM	REOTEMP TEMPERATURE PROBE FOR COMPOST BAY	NEW	H095-COM2-TTM26	09-N-0012	
ACTIVE COMPOSTING BLOWER SYSTEM	REOTEMP TEMPERATURE PROBE FOR COMPOST BAY	NEW	H095-COM2-TTM27	09-N-0012	
ACTIVE COMPOSTING BLOWER SYSTEM	REOTEMP TEMPERATURE PROBE FOR COMPOST BAY	NEW	H095-COM2-TTM28	09-N-0012	
ACTIVE COMPOSTING BLOWER SYSTEM	REOTEMP TEMPERATURE PROBE FOR COMPOST BAY	NEW	H095-COM2-TTM29	09-N-0012	
ACTIVE COMPOSTING BLOWER SYSTEM	REOTEMP TEMPERATURE PROBE FOR COMPOST BAY	NEW	H095-COM2-TTM30	09-N-0012	
ACTIVE COMPOSTING BLOWER SYSTEM	REOTEMP CONTROL PANEL	NEW	H095-COM1-CPL01	09-N-0012 09-N-0014	
ACTIVE COMPOSTING BLOWER SYSTEM	COMPOSTING MAIN CONTROL CENTER	NEW	H095-COM1-MCC01	09-N-0012 09-N-0014	
BIOFILTER	BIOFILTER NO. 1	NEW	H095-COM2-BFT01	09-N-0013	
BIOFILTER	FRESH AIR INTAKE DAMPER NO. 11	NEW	H095-COM2-DMP11	09-N-0013	23 31 13.05
BIOFILTER	FRESH AIR INTAKE DAMPER NO. 12	NEW	H095-COM2-DMP12	09-N-0013	23 31 13.05
BIOFILTER	BIOFILTER FAN DAMPER NO. 13	NEW	H095-COM2-DMP13	09-N-0013	23 31 13.05
BIOFILTER	BIOFILTER FAN DAMPER NO. 14	NEW	H095-COM2-DMP14	09-N-0013	23 31 13.05
BIOFILTER	BIOFILTER FAN DAMPER NO. 15	NEW	H095-COM2-DMP15	09-N-0013	23 31 13.05
BIOFILTER	BIOFILTER FAN DAMPER NO. 16	NEW	H095-COM2-DMP16	09-N-0013	23 31 13.05
BIOFILTER	BIOFILTER DAMPER NO. 17	NEW	H095-COM2-DMP17	09-N-0013	23 31 13.05
BIOFILTER	BIOFILTER FAN NO. 1	NEW	H095-COM2-FAN11	09-N-0013	23 34 05
BIOFILTER	BIOFILTER FAN NO. 2	NEW	H095-COM2-FAN12	09-N-0013	23 34 05
BIOFILTER	BIOFILTER FAN NO. 1 DISCHARGE FLOW INDICATOR	NEW	H095-COM2-FMT01	09-N-0013	
BIOFILTER	BIOFILTER FAN NO. 2 DISCHARGE FLOW INDICATOR	NEW	H095-COM2-FMT02	09-N-0013	
BIOFILTER	BIOFILTER FAN NO. 1 DISCHARGE PRESSURE INDICATOR	NEW	H095-COM2-PTM01	09-N-0013	
BIOFILTER	BIOFILTER FAN NO. 2 DISCHARGE PRESSURE INDICATOR	NEW	H095-COM2-PTM02	09-N-0013	
BIOFILTER	BIOFILTER FAN NO. 1 DISCHARGE TEMPERATURE INDICATOR	NEW	H095-COM2-TTM31	09-N-0013	

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LOCATION	DESCRIPTION	STATUS	EQUIPMENT ID	DRAWING NO.	SPECIFICATION NO.
BIOFILTER	BIOFILTER FAN NO. 2 DISCHARGE TEMPERATURE INDICATOR	NEW	H095-COM2-TTM32	09-N-0013	
SCREENING, CURING, AND STORAGE	VFD FOR CURING FAN NO. 1	NEW	H095-COM1-VFD013	09-N-0014	26 29 23
SCREENING, CURING, AND STORAGE	VFD FOR CURING FAN NO. 2	NEW	H095-COM1-VFD014	09-N-0014	26 29 23
SCREENING, CURING, AND STORAGE	VFD FOR CURING FAN NO. 3	NEW	H095-COM1-VFD015	09-N-0014	26 29 23
SCREENING, CURING, AND STORAGE	VFD FOR CURING FAN NO. 4	NEW	H095-COM1-VFD016	09-N-0014	26 29 23
SCREENING, CURING, AND STORAGE	CURING FAN NO. 1	NEW	H095-COM3-FAN01	09-N-0014	23 34 05
SCREENING, CURING, AND STORAGE	CURING FAN NO. 2	NEW	H095-COM3-FAN02	09-N-0014	23 34 05
SCREENING, CURING, AND STORAGE	CURING FAN NO. 3	NEW	H095-COM3-FAN03	09-N-0014	23 34 05
SCREENING, CURING, AND STORAGE	CURING FAN NO. 4	NEW	H095-COM3-FAN04	09-N-0014	23 34 05
SCREENING, CURING, AND STORAGE	REOTEMP TEMPERATURE PROBE FOR CURING BAY	NEW	H095-COM3-TTM01	09-N-0014	
SCREENING, CURING, AND STORAGE	REOTEMP TEMPERATURE PROBE FOR CURING BAY	NEW	H095-COM3-TTM02	09-N-0014	
SCREENING, CURING, AND STORAGE	REOTEMP TEMPERATURE PROBE FOR CURING BAY	NEW	H095-COM3-TTM03	09-N-0014	
SCREENING, CURING, AND STORAGE	REOTEMP TEMPERATURE PROBE FOR CURING BAY	NEW	H095-COM3-TTM04	09-N-0014	
SCREENING, CURING, AND STORAGE	REOTEMP TEMPERATURE PROBE FOR CURING BAY	NEW	H095-COM3-TTM05	09-N-0014	
SCREENING, CURING, AND STORAGE	REOTEMP TEMPERATURE PROBE FOR CURING BAY	NEW	H095-COM3-TTM06	09-N-0014	
SCREENING, CURING, AND STORAGE	REOTEMP TEMPERATURE PROBE FOR CURING BAY	NEW	H095-COM3-TTM07	09-N-0014	
SCREENING, CURING, AND STORAGE	REOTEMP TEMPERATURE PROBE FOR CURING BAY	NEW	H095-COM3-TTM08	09-N-0014	
SANITARY LIFT STATION	AIR RELIEF VALVE FOR SANITARY PUMP NO. 1	NEW	H110-LFT1-ARV01	09-N-0015	40 27 02
SANITARY LIFT STATION	AIR RELIEF VALVE FOR SANITARY PUMP NO. 2	NEW	H110-LFT1-ARV02	09-N-0015	40 27 02
SANITARY LIFT STATION	CHECK VALVE FOR SANITARY PUMP NO. 1	NEW	H110-LFT1-CKV01	09-N-0015	40 27 02
SANITARY LIFT STATION	CHECK VALVE FOR SANITARY PUMP NO. 2	NEW	H110-LFT1-CKV02	09-N-0015	40 27 02
SANITARY LIFT STATION	CONTROL PANEL FOR SANITARY LIFT STATION	NEW	H110-LFT1-CPL01	09-N-0015	33 32 13
SANITARY LIFT STATION	PLUG VALVE FOR SANITARY PUMP NO. 1	NEW	H110-LFT1-PGV01	09-N-0015	40 27 02
SANITARY LIFT STATION	PLUG VALVE FOR SANITARY PUMP NO. 2	NEW	H110-LFT1-PGV02	09-N-0015	40 27 02
SANITARY LIFT STATION	SANITARY PUMP NO. 1	NEW	H110-LFT1-PMP01	09-N-0015	33 32 13
SANITARY LIFT STATION	SANITARY PUMP NO. 2	NEW	H110-LFT1-PMP02	09-N-0015	33 32 13
FUEL TANK	ABOVE GROUND FUEL STORAGE TANK	NEW	H001-OPS1-FTK1	09-N-0016	
WAS FEED PUMPS	HVAC FOR WASTE ACTIVATED SLUDGE AREA	NEW	H040-WAS1-HVAC1	09-N-0020	
DEWATERING	HVAC FOR DEWATERING BUILDING	NEW	H090-DEW1-HVAC1	09-N-0020	
SLUDGE MIXING ROOM	HVAC FOR SLUDGE MIXING ROOM	NEW	H090-DEW2-HVAC1	09-N-0020	
DEWATERING	AIR CONDITIONING UNIT, OUTDOORS	NEW	H090-DEW1-ACU01	01-G-0036	23-81-00
DEWATERING	AIR CONDITIONING UNIT, OUTDOORS	NEW	H095-COM1-ACU01	01-G-0036	23-81-00
COMPOSTING	AIR CONDITIONING UNIT, OUTDOORS	NEW	H090-DEW2-ACU01	01-G-0036	23-81-00
WAS FEED PUMPS	AIR CONDITIONING UNIT, OUTDOORS	NEW	H040-WAS1-ACU01	01-G-0036	23-81-00
COMPOSTING BUILDING	HVAC FOR COMPOSTING BUILDING	NEW	H095-COM1-HVAC1	09-N-0020	
SCUM WET WELL	SECONDARY SCUM PUMP NO.1	NEW	H050-FCL1-SCP01	09-N-0002	44 42 56.04
SCUM WET WELL	SECONDARY SCUM PUMP NO.2	NEW	H050-FCL1-SCP02	09-N-0002	44 42 56.04
SCUM WET WELL	TERMINAL JUNCTION BOX	NEW	H050-FCL1-TJB01	50-FCL1-E-2000	
SCUM WET WELL	TERMINAL JUNCTION BOX	NEW	H050-FCL1-TJB02	50-FCL1-E-2000	
WAS FEED PUMPS	HVAC CONTROL PANEL	NEW	H040-WAS1-ACP01	40-WAS1-H-6001	
DEWATERING	HVAC CONTROL PANEL	NEW	H090-DEW1-ACP01	90-D1BL-H-6001	
DEWATERING	HVAC CONTROL PANEL	NEW	H090-DEW2-ACP01	90-D2BL-H-6001	
COMPOSTING BUILDING	HVAC CONTROL PANEL	NEW	H095-COM1-ACP01	95-C1BL-H-6001	
COMPOSTING BUILDING	HVAC CONTROL PANEL	NEW	H095-COM-HTR01	95-C1BL-H-2000	
COMPOSTING OPERATIONS BUILDING	BACKFLOW PREVENTOR	NEW	H095-COM1-BFL01	95-C1BL-P-2100	22-30-00
COMPOSTING OPERATIONS BUILDING	RECIRCULATION PUMP	NEW	H095-COM1-RCP01	95-C1BL-P-2100	22-30-00
DEWATERING	BACKFLOW PREVENTOR	NEW	H090-DEW2-BFL01	90-D1BL-P-2000	22-30-00
DEWATERING	BACKFLOW PREVENTOR	NEW	H090-DEW1-BFL01	90-D1BL-P-2000	22-30-00

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LOCATION	DESCRIPTION	STATUS	EQUIPMENT ID	DRAWING NO.	SPECIFICATION NO.
DEWATERING	BACKFLOW PREVENTOR	NEW	H090-DEW1-BFL02	90-D1BL-P-2000	22-30-00
DEWATERING	BACKFLOW PREVENTOR	NEW	H090-DEW1-BFL03	90-D1BL-P-2000	22-30-00
DEWATERING CENTRIFUGE BUILDING	DEWATERING TRANSFORMER	NEW	H090-DEW1-TRN01	08-E-6003	26 22 00
SLUDGE MIXING ELECTRICAL BUILDING	TRASFORMER FOR EXISITNG SLUDGE MIXING BUILDING	NEW	H090-DEW3-TRN01	08-E-6003	26 22 00
COMPOSTING OPERATIONS BUILDING	COMPOSTING TRANSFORMER	NEW	H095-COM1-TRN01	08-E-6002	
COMPOSTING OPERATIONS BUILDING	COMPOSTING SWITCHGEAR	NEW	H095-COM1-SWT01	08-E-6002	
DEWATERING CENTRIFUGE BUILDING	HOT WATER HEATER	NEW	H090-DEW1-HWH01	90-DEW1-P-2100	22-30-00
COMPOSTING OPERATIONS BUILDING	HOT WATER HEATER	NEW	H095-COM1-HWH01	95-C1BL-P-2000	22-30-00
COMPOSTING OPERATIONS BUILDING	LIGHTING PANEL FOR COMPOSTING OPERATIONS BUILDING	NEW	H095-COM1-LVP01	08-E-6101	26 24 16
DEWATERING CENTRIFUGE BUILDING	LIGHTING PANEL FOR DEWATERING CENTRIFUGE FUILDING	NEW	H090-DEW1-LVP01	08-E-6101	26 24 16
SLUDGE MIXING ELECTRICAL BUILDING	LIGHTING PANEL FOR EXISITNG SLUDGE MIXING BUILDING	NEW	H090-DEW3-LVP01	08-E-6101	26 24 16
DEWATERING CENTRIFUGE BUILDING	POWER PANEL FOR DEWATERING CENTRIFUGE BUILDING	NEW	H090-DEW1-MDP04	08-E-6101	26 24 16
COMPOSTING MIXERS AND CONVEYORS	COMPOST MIXER NO.1	NEW	H095-COM2-MXR01	09-N-0011	44 46 13.05
COMPOSTING MIXERS AND CONVEYORS	COMPOST MIXER NO.2	NEW	H095-COM2-MXR02	09-N-0011	44 46 13.05
COMPOSTING OPERATIONS BUILDING	COMPOSTING TRANSFORMER	NEW	H095-COM1-TRN02	08-E-6003	26 22 00

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SECTION 01 88 15
ANCHORAGE AND BRACING

PART 1 GENERAL

1.01 SUMMARY

A. This section covers requirements for anchorage and bracing of equipment, distribution systems, and other nonstructural components required in accordance with the ICC 2018 International Building Code (IBC), for seismic, wind, gravity, soil, and operational loads.

1.02 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Institute of Steel Construction (AISC) 360, Specification for Structural Steel Buildings.
2. American Society of Civil Engineers (ASCE): ASCE 7, Minimum Design Loads for Buildings and Other Structures.
3. International Code Council (ICC): International Building Code (IBC).
4. National Fire Protection Association (NFPA): 13, Standard for the Installation of Sprinkler Systems.

1.03 DEFINITIONS

A. Authority Having Jurisdiction (AHJ): Permitting building agency; may be a federal, state, local, or other regional department, or individual including building official, fire chief, fire marshal, chief of a fire prevention bureau, labor department, or health department, electrical inspector; or others having statutory authority. AHJ may be Owner when authorized to be self-permitting by governmental permitting agency or when no governmental agency has authority.

B. Designated Seismic System: Architectural, electrical, and mechanical system or their components for which component importance factor is greater than 1.0.

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1.04 DESIGN AND PERFORMANCE REQUIREMENTS

A. General:

1. Anchorage and bracing systems shall be designed by a qualified professional engineer registered in the State of Oklahoma.
2. Design anchorage into concrete including embedment in accordance with ACI 318-14; Chapter 17 (or other industry standard approved by Engineer), and Project Specifications.
    a. Unless otherwise noted, design for cracked concrete condition.
3. Design anchorage and bracing of architectural, mechanical, and electrical components and systems in accordance with this section, unless a design is specifically provided within Contract Documents or where exempted hereinafter.
4. Design attachments, braces, and anchors for equipment, components, and distribution systems to structure for gravity, seismic, wind, and operational loading.
5. Design anchorage and bracing for modified existing architectural, mechanical, or electrical systems where code requirements would dictate design for similar new components.
6. Anchor and brace piping and ductwork, whether exempt or not exempt for this section, so that lateral or vertical displacement does not result in damage or failure to essential architectural, mechanical, or electrical equipment.
7. Architectural Components: Includes, but are not limited to, nonstructural walls and elements, partitions, cladding and veneer, access flooring, signs, cabinets, suspended ceilings, and glass in glazed curtain walls and partitions.
8. Provide supplementary framing where required to transfer anchorage and bracing loads to structure.
9. Adjust equipment pad sizes or provide additional anchorage confinement reinforcing to provide required anchorage capacities.
10. Design anchorage and bracing for:
    a. Equipment and components that weigh more than 400-pound.
    b. Equipment weighing more than 75 pounds that has center of mass located more than 4 feet above adjacent finished floor.
    c. Mechanical and electrical components that are not provided with flexible connections between components and associated ductwork, piping, or conduit.
    d. Distribution systems that weigh more than 5 pounds per foot that have center of mass located more than 5 feet above adjacent finished floor.
11. For components exempted from design requirements of this section, provide bolted, welded, or otherwise positively fastened attachments to supporting structure.

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B. Design Loads:

1. Gravity: Design anchorage and bracing for self-weight and superimposed loads on components and equipment.
2. Wind: Design anchorage and bracing for wind criteria provided on General Structural Notes on the Drawings for exposed architectural components and exterior and wind-exposed mechanical and electrical equipment. Alternately, manufacturer certification may be provided for components such as roofing and flashing to verify attachments meet Project-specific design criteria.
3. Operational:
    a. For loading supplied by equipment manufacturer for IBC required load cases.
    b. Loads may include equipment vibration, torque, thermal effects, effects of internal contents (weight and sloshing), water hammer, and other load-inducing conditions.
    c. Locate braces to minimize vibration to or movement of structure.
    d. For vibrating loads, use anchors meeting requirements of Section 05 50 00, Metal Fabrications or Section 05 05 19, Post-Installed Anchors, for anchors with designated capacities for vibratory loading per manufacturer’s ICC-ES report.
4. Seismic:
    a. In accordance with 2018 IBC, Section 1613, and Chapter 13 of ASCE 7.
    b. Design anchorage and bracing for design criteria listed on General Structural Notes on the Drawings.
    c. Design forces for anchors in concrete or masonry shall be in accordance with ASCE 7, Section 13.4.2 as applicable for Project Seismic Design Category.

C. Seismic Design Requirements:

1. Analyze local region of body of nonstructural component for load transfer of anchorage attachment if component Ip equals 1.5.
2. The following are exempt from requirements for provision of seismic anchorages and bracing, in addition to those items specifically exempted in ASCE 7, Part 13.5 for architectural components and Part 13.6 for electrical and mechanical equipment:
    a. Furniture, except storage cabinets and bookshelves over 6 feet tall.
    b. Temporary or movable equipment.
3. Fire protection sprinkler systems designed and constructed in accordance with NFPA 13 shall be considered to meet requirements of Chapter 13 of ASCE 7.
4. Provide support drawings and calculations for electrical distribution components if any of the following conditions apply:

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a. Conduit diameter is greater than 2.5-inch trade size.
b. Total weight of bus duct, cable tray, or conduit supported by trapeze assemblies exceeds 10 pounds per foot.

5. Existing components, systems, and equipment in their final condition that are modified by Project requirements and are not exempted by above paragraph require the same anchorage and bracing drawing and calculation submittals as new equipment. Field verify existing conditions.
6. Other seismic design and detailing information identified in ASCE 7, Chapter 13, is required to be provided for new and modified or noted architectural, mechanical and electrical components, systems, or equipment.

1.05 SUBMITTALS

A. Action Submittals:

1. Shop Drawings:
   a. List of architectural, mechanical, and electrical equipment requiring Contractor-designed anchorage and bracing, unless specifically exempted.
   b. Manufacturers' engineered seismic and non-seismic hardware product data.
   c. Attachment assemblies' drawings including seismic attachments; include connection hardware, braces, and anchors or anchor bolts for nonexempt components, equipment, and systems.
   d. Drawings for seismic attachment assemblies include connection hardware, braces, and anchors (or anchor bolts) for modified, nonexempt existing components, equipment, and systems where a combination of new and existing systems or components' final condition would require anchorage or bracing under this specification for new equipment.
   e. Submittal will be rejected if proposed anchorage method would create excessive stress to supporting member. Revise anchorages and strengthen structural support to eliminate overstressed condition.

B. Informational Submittals:

1. Anchorage and Bracing Calculations: For attachments, braces, and anchorages, include IBC and Project-specific criteria as noted on General Structural Notes on the Drawings, in addition to manufacturer's specific criteria used for design; sealed by a civil engineer registered in the State of Oklahoma.
2. Manufacturer's hardware installation requirements.

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1.06 SOURCE QUALITY CONTROL

A. Contractor and supplier responsibilities to accommodate Owner-furnished shop fabrication related special inspections and testing are provided in Project's Statement of Special Inspections on the Drawings, and Section 01 45 33, Special Inspection, Observation, and Testing.

B. Provide all other specified, regulatory required, or required repair verification inspection and testing that is not listed in Statement of Special Inspections in accordance with Section 01 45 16.13, Contractor Quality Control.

C. Provide Source Quality Control for welding and hot-dip galvanizing of anchors in accordance with Section 05 50 00, Metal Fabrications.

PART 2 PRODUCTS

2.01 GENERAL

A. Design and construct attachments and supports transferring seismic and non-seismic loads to structure of materials and products suitable for application and in accordance with design criteria shown on the Drawings and nationally recognized standards.

B. Provide anchor bolts for anchorage of equipment to concrete or masonry in accordance with Section 05 50 00, Metal Fabrications. Provide anchor bolts of the size, minimum embedment, and spacing designated in calculations submitted by Contractor and accepted by Engineer.

C. Provide post-installed concrete and masonry anchors for anchorage of equipment to concrete or masonry in accordance with Section 05 05 19, Post-Installed Anchors. Provide post-installed anchors of the size, minimum embedment, and spacing designated in calculations submitted by Contractor and accepted by Engineer.

D. Do not use powder-actuated fasteners or sleeve anchors for seismic attachments and anchorage where resistance to tension loads is required. Do not use expansion anchors, other than undercut anchors, for nonvibration isolated mechanical equipment rated over 10 hp.

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PART 3 EXECUTION

3.01 GENERAL

A. Make attachments, bracing, and anchorage in such a manner that component lateral force is transferred to lateral force resisting system of structure through a complete load path.

B. Design, provide, and install overall seismic anchorage system to provide restraint in all directions, including vertical, for each component or system so anchored.

C. Provide snubbers in each horizontal direction and vertical restraints for components mounted on vibration isolation systems where required to resist overturning.

D. Provide piping anchorage that maintains design flexibility and expansion capabilities at flexible connections and expansion joints.

1. Piping and ductwork suspended more than 12 inches below supporting structure shall be braced for seismic effects to avoid significant bending of hangers and their attachments, unless high- or limited- deformability piping is used per ASCE 7, Section 13.6.8 or HVAC ducts have a cross-sectional area of less than 6 square feet or weigh 17 pounds per foot or less.

E. Anchor tall and narrow equipment such as motor control centers and telemetry equipment at base and within 12 inches from top of equipment, unless approved otherwise by Engineer.

F. Do not attach architectural, mechanical, or electrical components to more than one element of a building structure at a single restraint location where such elements may respond differently during a seismic event. Do not make such attachments across building expansion and contraction joints.

3.02 INSTALLATION

A. Do not install components or their anchorages or restraints prior to review and acceptance by Engineer and AHJ.

B. Notify Engineer upon completion of installation of seismic restraints in accordance with Section 01 45 33, Special Inspection, Observation, and Testing.

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3.03 FIELD QUALITY ASSURANCE AND QUALITY CONTROL

A. In accordance with Section 05 50 00, Metal Fabrications, and Section 05 05 19, Post-Installed Anchors.

B. Owner-Furnished Quality Assurance, in accordance with IBC Chapter 17 requirements, is provided in Statement of Special Inspections Plan on the Drawings. Contractor responsibilities and related information are included in Section 01 45 33, Special Inspection, Observation, and Testing.

C. Provide any other specified, regulatory required, or required repair verification inspection and testing that is not listed in Statement of Special Inspections in accordance with Section 01 45 16.13, Contractor Quality Control.

END OF SECTION

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SECTION 01 91 14
EQUIPMENT TESTING AND FACILITY STARTUP

PART 1 GENERAL

1.01 DEFINITIONS

A. Facility: Entire Project, or an agreed-upon portion, including all of its unit processes.

B. Facility Performance Demonstration:

1. A demonstration, conducted by Contractor, with assistance of Owner, to demonstrate and document the performance of the entire operating facility, both manually and automatically (if required), based on criteria developed in conjunction with Owner and as accepted by Engineer.
2. Such demonstration is for the purposes of (i) verifying to Owner entire facility performs as a whole, and (ii) documenting performance characteristics of completed facility for Owner's records. Neither the demonstration nor the evaluation is intended in any way to make performance of a unit process or entire facility the responsibility of Contractor, unless such performance is otherwise specified.

C. Functional Test: Test or tests in presence of Engineer and Owner to demonstrate that installed equipment meets manufacturer's installation, calibration, and adjustment requirements and other requirements as specified.

D. Performance Test: Test or tests performed after any required functional test in presence of Engineer and Owner to demonstrate and confirm individual equipment meets performance requirements specified in individual sections.

E. Unit Process: As used in this section, a unit process is a portion of the facility that performs a specific process function.

1.02 SUBMITTALS

A. Informational Submittals:

1. Facility Startup and Performance Demonstration Plan.
2. Functional and performance test results.
3. Completed Unit Process Startup Form for each unit process.
4. Completed Facility Performance Demonstration/Certification Form.

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1.03 FACILITY STARTUP AND PERFORMANCE DEMONSTRATION PLAN

A. Develop a written plan, in conjunction with Owner's operations personnel; to include the following:

1. Step-by-step instructions for startup of each unit process and the complete facility.
2. Unit Process Startup Form (sample attached), to minimally include the following:
   a. Description of the unit process, including equipment numbers/nomenclature of each item of equipment and all included devices.
   b. Detailed procedure for startup of the unit process, including valves to be opened/closed, order of equipment startup, etc.
   c. Startup requirements for each unit process, including water, power, chemicals, etc.
   d. Space for evaluation comments.
3. Facility Performance Demonstration/Certification Form (sample attached), to minimally include the following:
   a. Description of unit processes included in the facility startup.
   b. Sequence of unit process startup to achieve facility startup.
   c. Description of computerized operations, if any, included in the facility.
   d. Contractor certification facility is capable of performing its intended function(s), including fully automatic operation.
   e. Signature spaces for Contractor and Engineer.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 GENERAL

A. Facility Startup Meetings: Schedule, in accordance with requirements of Section 01 31 19, Project Meetings, to discuss test schedule, test methods, materials, chemicals and liquids required, facilities operations interface, and Owner involvement.

B. Contractor's Testing and Startup Representative:

1. Designate and furnish one or more personnel to coordinate and expedite testing and facility startup.
2. Representative(s) shall be present during startup meetings and shall be available at all times during testing and startup.

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C. Provide temporary valves, gauges, piping, test equipment and other materials and equipment required for testing and startup.

D. Provide Subcontractor and equipment manufacturers' staff adequate to prevent delays. Schedule ongoing work so as not to interfere with or delay testing and startup.

E. Owner will:

1. Operate process units and facility with support of Contractor.
2. Provide labor and materials as required for laboratory analyses.

3.02 EQUIPMENT TESTING

A. Preparation:

1. Complete installation before testing.
2. Furnish qualified manufacturers' representatives, when required by individual specification sections.
3. Obtain and submit from equipment manufacturer's representative Manufacturer's Certificate of Proper Installation Form, in accordance with Section 01 43 33, Manufacturers' Field Services, when required by individual specification sections.
4. Equipment Test Report Form:
    a. Provide written test report for each item of equipment to be tested, to include the minimum information:
        1) Owner/Project Name.
        2) Equipment or item tested.
        3) Date and time of test.
        4) Type of test performed (Functional or Performance).
        5) Test method.
        6) Test conditions.
        7) Test results.
        8) Signature spaces for Contractor and Engineer as witness.
5. Cleaning and Checking:
    a. Prior to beginning functional testing:
        1) Calibrate testing equipment in accordance with manufacturer's instructions.
        2) Inspect and clean equipment, devices, connected piping, and structures to ensure they are free of foreign material.
        3) Lubricate equipment in accordance with manufacturer's instructions.
        4) Turn rotating equipment by hand when possible to confirm that equipment is not bound.

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5) Open and close valves by hand and operate other devices to check for binding, interference, or improper functioning.
6) Check power supply to electric-powered equipment for correct voltage.
7) Adjust clearances and torque.
8) Test piping for leaks.

6. Ready-to-test determination will be by Engineer based at least on the following:
   a. Acceptable Operation and Maintenance Data.
   b. Notification by Contractor of equipment readiness for testing.
   c. Receipt of Manufacturer's Certificate of Proper Installation, if so specified.
   d. Adequate completion of work adjacent to, or interfacing with, equipment to be tested.
   e. Availability and acceptability of manufacturer's representative, when specified, to assist in testing of respective equipment.
   f. Satisfactory fulfillment of other specified manufacturer's responsibilities.
   g. Equipment and electrical tagging complete.
   h. Delivery of all spare parts and special tools.

B. Functional Testing:

1. Conduct as specified in individual specification sections.
2. Notify Owner and Engineer in writing at least 10 days prior to scheduled date of testing.
3. Prepare Equipment Test Report summarizing test method and results.
4. When, in Engineer's opinion, equipment meets functional requirements specified, such equipment will be accepted for purposes of advancing to performance testing phase, if so required by individual specification sections. Such acceptance will be evidenced by Engineer/Owner's signature as witness on Equipment Test Report.

C. Performance Testing:

1. Conduct as specified in individual specification sections.
2. Notify Engineer and Owner in writing at least 10 days prior to scheduled date of test.
3. Performance testing shall not commence until equipment has been accepted by Engineer as having satisfied functional test requirements specified.
4. Type of fluid, gas, or solid for testing shall be as specified.
5. Unless otherwise indicated, furnish labor, materials, and supplies for conducting the test and taking samples and performance measurements.
6. Prepare Equipment Test Report summarizing test method and results.

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7. When, in Engineer's opinion, equipment meets performance requirements specified, such equipment will be accepted as to conforming to Contract requirements. Such acceptance will be evidenced by Engineer's signature on Equipment Test Report.

3.03 STARTUP OF UNIT PROCESSES

A. Prior to unit process startup, equipment within unit process shall be accepted by Engineer and Owner as having met functional and performance testing requirements specified.

B. Startup sequencing of unit processes shall be as chosen by Contractor to meet schedule requirements.

C. Make adjustments, repairs, and corrections necessary to complete unit process startup.

D. Startup shall be considered complete when, in opinion of Engineer, unit process has operated in manner intended for 5 continuous days without significant interruption. This period is in addition to functional or performance test periods specified elsewhere.

E. Significant Interruption:

1. May include any of the following events:
   a. Failure of Contractor to provide and maintain qualified onsite startup personnel as scheduled.
   b. Failure to meet specified functional operation for more than 2 consecutive hours.
   c. Failure of any critical equipment or unit process that is not satisfactorily corrected within 5 hours after failure.
   d. Failure of any noncritical equipment or unit process that is not satisfactorily corrected within 8 hours after failure.
   e. As determined by Engineer.

F. A significant interruption will require startup then in progress to be stopped. After corrections are made, startup test period to start from beginning again.

3.04 FACILITY PERFORMANCE DEMONSTRATION

A. When, in the opinion of Engineer, startup of all unit processes has been achieved, sequence each unit process to the point that facility is operational.

B. Demonstrate proper operation of required interfaces within and between individual unit processes.

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C. After facility is operating, complete performance testing of equipment and systems not previously tested.

D. Document, as defined in Facility Startup and Performance Demonstration Plan, the performance of the facility until all unit processes are operable and under control of computer system.

E. Certify, on the Facility Performance Demonstration/Certification Form, that facility is capable of performing its intended function(s), including fully automatic and computerized operation.

3.05 SUPPLEMENTS

A. The supplements listed below, following “End of Section,” are a part of this specification:

1. Unit Process Startup Form.
2. Facility Performance Demonstration/Certification Form.

END OF SECTION

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UNIT PROCESS STARTUP FORM

OWNER:_____ **PROJECT:**_____

Unit Process Description: (Include description and equipment number of all equipment and devices):

Startup Procedure (Describe procedure for sequential startup and evaluation, including valves to be opened/closed, order of equipment startup, etc.):

Startup Requirements (Water, power, chemicals, etc.):_____

Evaluation Comments:_____

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FACILITY PERFORMANCE DEMONSTRATION/CERTIFICATION FORM

OWNER:_____ **PROJECT:**_____

Unit Processes Description (List unit processes involved in facility startup):

_____

_____

_____

_____

Unit Processes Startup Sequence (Describe sequence for startup, including computerized operations, if any):

_____

_____

_____

_____

_____

Contractor Certification that Facility is capable of performing its intended function(s), including fully automatic operation:

Contractor: _____ **Date:** _____**, 20____**

Engineer: _____ **Date:** _____**, 20____**

(Authorized Signature)

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SECTION 02 41 00
DEMOLITION

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. Air-Conditioning, Heating, and Refrigeration Institute (AHRI): Guideline K, Containers for Recovered Non-flammable Fluorocarbon Refrigerants.
2. American National Standards Institute (ANSI): A10.6, Safety Requirements for Demolition Operations.
3. Environmental Protection Agency (EPA), U.S. Code of Federal Regulations (CFR), Title 40:
   a. Part 61—National Emission Standards for Hazardous Air Pollutants.
   b. Part 82—Protection of Stratospheric Ozone.
   c. Part 273—Standards for Universal Waste Management.
4. Occupational Safety and Health Administration (OSHA), U.S. Code of Federal Regulations (CFR) Title 29 Part 1926—Occupational Safety and Health Regulations for Construction.

1.02 DEFINITIONS

A. ACM: Asbestos-containing material.

B. Demolition: Dismantling, razing, destroying, or wrecking of any fixed building or structure or any part thereof. Demolition also includes removal of pipes, manholes tanks, conduit, and other underground facilities, whether as a separate activity or in conjunction with construction of new facilities.

C. Modify: Provide all necessary material and labor to modify an existing item to the condition indicated or specified.

D. Relocate: Remove, protect, clean and reinstall equipment, including electrical, instrumentation, and all ancillary components required to make the equipment fully functional, to the new location identified on the Drawings.

E. Renovation: Altering a facility or one or more facility components in any way.

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F. Salvage/Salvageable: Remove and deliver, to the specified location(s), the equipment, building materials, or other items so identified to be saved from destruction, damage, or waste; such property to remain that of Owner. Unless otherwise specified, title to items identified for demolition shall revert to Contractor.

G. Universal Waste Lamp: In accordance with 40 CFR 273, the bulb or tube portion of an electric lighting device, examples of which include, but are not limited to, fluorescent, high-intensity discharge, neon, mercury vapor, high-pressure sodium, and metal halide lamps.

H. Universal Waste Thermostat: A temperature control device that contains metallic mercury in an ampule attached to a bimetal sensing element, and mercury-containing ampules that have been removed from these temperature control devices in compliance with the requirements of 40 CFR 273.

1.03 SUBMITTALS

A. Informational Submittals:

1. Submit proposed Demolition/Renovation Plan, in accordance with requirements specified herein, for approval before such Work is started.
2. Submit copies of any notifications, authorizations and permits required to perform the Work.
3. Copies of reports and other documentation required for abandoning wells.

1.04 REGULATORY AND SAFETY REQUIREMENTS

A. When applicable, demolition Work shall be accomplished in strict accordance with 29 CFR 1926-Subpart T.

B. Comply with federal, state, and local hauling and disposal regulations. In addition to the requirements of the General Conditions, Contractor’s safety requirements shall conform to ANSI A10.6.

1.05 DEMOLITION/RENOVATION PLAN

A. Demolition/Renovation Plan shall provide for safe conduct of the Work and shall include:

1. Detailed description of methods and equipment to be used for each operation.
2. The Contractor’s planned sequence of operations, including coordination with other work in progress.

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B. Include statements affirming Contractor inspection of the existing roof deck, floors, walls, and framing members, and their suitability to perform as a safe working platform or, if inspection reveals a safety hazard to workers, state provisions for securing the safety of the workers throughout the performance of the Work.

1.06 SEQUENCING AND SCHEDULING

A. The Work of this specification shall not commence until Contractor's Demolition/Renovation Plan has been approved by Engineer.

B. Include the Work of this specification in the progress schedule, as specified in Section 01 32 00, Construction Progress Documentation.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 EXISTING FACILITIES TO BE DEMOLISHED OR RENOVATED

A. Facilities:

1. Buildings and adjacent designated areas scheduled for complete demolition are as shown.
2. Portions of buildings and other areas scheduled for selective demolition, partial demolition, and renovation Work are as shown.

B. Structures:

1. Existing above-grade structures indicated shall be removed completely.
2. Interior walls, other than retaining walls and partitions, shall be removed to top of concrete slab on ground.
3. Partition walls shall be removed as shown.
4. Core drill concrete slabs and other concrete improvements scheduled to remain in place below ground, or break holes at the structure's lowest point to allow water to freely migrate through.
5. Sidewalks, curbs, gutters and street light bases shall be removed as indicated.

C. Utilities and Related Equipment:

1. Notify Owner or appropriate utilities to turn off affected services at least 48 hours before starting demolition or renovation activities.
2. Remove existing utilities as indicated and terminate in a manner conforming to the nationally recognized code covering the specific utility and approved by Engineer.

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3. When utility lines are encountered that are not indicated on the Drawings, notify Engineer and Owner prior to further work in that area.
4. Remove meters and related equipment and deliver to a location as determined by the Owner.
5. Excavate and remove utility lines serving buildings to be demolished to a distance of 5 feet beyond the outside perimeter of the demolition.
6. Provide a permanent leak-proof closure for water and gas lines.
7. Plug sewer lines with concrete to a minimum plug length of 5 feet to prevent groundwater infiltration.

D. Paving and Slabs:

1. Remove concrete and asphaltic concrete paving and slabs including aggregate base to a depth of 12 inches below existing adjacent grade.
2. Provide neat sawcuts at limits of pavement removal.

E. Reroofing:

1. Sequence Work to minimize building exposure between the time of existing roof removal and new roof material installation. Install temporary roofing and flashing as necessary to maintain a watertight condition throughout the course of the Work.
2. Remove temporary roofing and flashing prior to installation of permanent roof system materials unless otherwise approved by Engineer.

F. Masonry: Sawcut and remove masonry so as to prevent damage to surfaces to remain and to facilitate the installation of new Work. Where new masonry adjoins existing, the new Work shall abut or tie into the existing construction as indicated.

G. Concrete:

1. Core drill corners of new opening to avoid overcutting adjacent reinforcing in existing concrete to remain. Saw concrete along straight lines to a depth of not less than 2 inches. Make each cut in walls perpendicular to the face and in alignment with the cut in the opposite face. Break out the remainder of the concrete provided that the broken area is concealed in the finished Work, and the remaining concrete is sound.
2. At locations where the broken face cannot be concealed, grind smooth or saw cut entirely through the concrete. Repair exposed rebar ends and embeds as shown on the Drawings.
3. Where new concrete adjoins existing concrete, thoroughly clean and mechanically roughen existing concrete surfaces to roughness profile of 3/16 inch. Rebar and small embeds at existing concrete may be required

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to be left to engage new concrete. Saturate surface with water for 24 hours prior to placing new concrete. The new Work shall tie into the existing construction as shown on the Drawings.

4. At submerged locations not to receive new concrete, paint exposed rebar or metal embed ends with System No. 19a at wastewater surfaces per Section 09 90 00, Painting and Coating.

H. Patching:

1. Where removals leave holes and damaged surfaces exposed in the finished Work, patch and repair to match adjacent finished surfaces as to texture and finish.
2. Where new Work is to be applied to existing surfaces, perform removals and patching in a manner to produce surfaces suitable for receiving new Work.
3. Patching shall be as specified and indicated, and shall include:
   a. Fill holes and depressions caused by previous physical damage or left as a result of removals in existing walls with an approved patching material, applied in accordance with the manufacturer's printed instructions.

I. Tile Flooring:

1. Where existing partitions have been removed leaving damaged or missing resilient tile flooring, patch to match existing floor tile.

J. Ceilings: Patch acoustic lay-in ceiling where partitions have been removed. The transition between the different ceiling heights shall be effected by continuing the higher ceiling level over to the first runner on the lower ceiling and closing the vertical opening with a painted sheet metal strip.

K. Door Locksets: Remove all locksets from all doors indicated to be removed and disposed of. Turn locksets over to Owner immediately after their removal.

L. Electrical:

1. Cut off concealed or embedded conduit, boxes, or other materials a minimum of 3/4-inch below final finished surface.
2. When removing designated equipment, conduit and wiring may require rework to maintain service to other equipment.
3. Rework existing circuits, or provide temporary circuits as necessary during renovation to maintain service to existing lighting and equipment not scheduled to be renovated. Existing equipment and circuiting shown are based upon limited field surveys. Verify existing conditions, make all necessary adjustments, and record the Work on the Record

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Drawings. This shall include, but is not limited to, swapping and other adjustments to branch circuits and relocation of branch circuit breakers within panelboards as required to accomplish the finished work.

4. Reuse of existing luminaires, devices, conduits, boxes, or equipment will be permitted only where specifically indicated.
5. Raceways and cabling not scheduled for reuse.
6. Inaccessibly Concealed: Cut off and abandon in place.
7. Exposed or Concealed Above Accessible Ceilings: Remove.
8. Raceways and Cabling Scheduled for Future Use: Cap/seal and tag.
9. Relocating Equipment: Extend existing wiring or run new wiring from the source.
10. Where the existing raceway is concealed, the outlet box shall be cleaned, and a blank cover plate installed.
11. Where the concealed raceway is uncovered remove raceway (or extended to new location if appropriate).
12. Provide new typewritten panelboard circuit directory cards.

M. Universal Waste Lamps and Thermostats: Manage, contain, package, and label in strict accordance with 40 CFR 273.

3.02 PROTECTION

A. Dust and Debris Control:

1. Prevent the spread of dust and debris to occupied portions of the building and avoid the creation of a nuisance or hazard in the surrounding area. Do not use water if it results in hazardous or objectionable conditions such as, but not limited to, ice, flooding, or pollution.
2. Vacuum and dust the Work area daily.
3. Sweep pavements as often as necessary to control the spread of debris that may result in foreign object damage potential to vehicular traffic.

B. Traffic Control Signs: Where pedestrian and driver safety is endangered in the area of removal Work, use traffic barricades with flashing lights.

C. Existing Work:

1. Survey the site and examine the Drawings and Specifications to determine the extent of the Work before beginning any demolition or renovation.
2. Take necessary precautions to avoid damage to existing items scheduled to remain in place, to be reused, or to remain the property of Owner; any Contractor-damaged items shall be repaired or replaced as directed by Engineer.

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3. Provide temporary weather protection during interval between removal of existing exterior surfaces and installation of new to ensure that no water leakage or damage occurs to structure or interior areas of existing building.
4. Ensure that structural elements are not overloaded as a result of or during performance of the Work. Responsibility for additional structural elements or increasing the strength of existing structural elements as may be required as a result of any Work performed under this Contract shall be that of the Contractor. Repairs, reinforcement, or structural replacement must have Engineer approval.
5. Do not overload pavements to remain.

D. Weather Protection: For portions of the building scheduled to remain, protect building interior and materials and equipment from weather at all times. Where removal of existing roofing is necessary to accomplish the Work, have materials and workmen ready to provide adequate and temporary covering of exposed areas so as to ensure effectiveness and to prevent loss.

E. Trees: Protect trees within the Site that might be damaged during demolition and are indicated to be left in place, by a 6-foot high fence. The fence shall be securely erected a minimum of 5 feet from the trunk of individual trees or follow the outer perimeter of branches or clumps of trees. Any tree designated to remain that is damaged during the Work shall be replaced in kind, as approved by the Engineer.

F. Facilities:

1. Protect electrical and mechanical services and utilities. Where removal of existing utilities and pavement is specified or indicated, provide approved barricades, temporary covering of exposed areas, and temporary services or connections for electrical and mechanical utilities.
2. Floors, roofs, walls, columns, pilasters, and other structural elements that are designed and constructed to stand without lateral support or shoring, and are determined by Contractor to be in stable condition, shall remain standing without additional bracing, shoring, or lateral support until demolished, unless directed otherwise by the Engineer.
3. Protect all facility elements not scheduled for demolition.
4. Provide interior shoring, bracing, or support to prevent movement, settlement, or collapse of structure or element to be demolished and adjacent facilities.

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G. Protection of Personnel:

1. During demolition, continuously evaluate the condition of the structure being demolished and take immediate action to protect all personnel working in and around the demolition site.
2. Provide temporary barricades and other forms of protection to protect Owner's personnel and the general public from injury due to demolition Work.
3. Provide protective measures as required to provide free and safe passage of Owner's personnel and the general public to occupied portions of the structure.

3.03 BURNING

A. The use of burning at the Site for the disposal of refuse and debris will not be permitted.

3.04 RELOCATIONS

A. Perform the removal and reinstallation of relocated items as indicated with workmen skilled in the trades involved. Clean all items to be relocated prior to reinstallation, to the satisfaction of Engineer. Repair items to be relocated which are damaged or replace damaged items with new undamaged items as approved by Engineer.

3.05 BACKFILL

A. Do not use demolition debris as backfill material.

B. Fill excavations, open basements and other hazardous openings to existing ground level or foundation level of new construction in accordance with Section 31 23 23, Fill and Backfill.

3.06 TITLE TO MATERIALS

A. All salvaged materials will remain the property of Owner.

B. With the exception of the following listed salvaged materials, all items designated to be removed shall become the property of Contractor:

C. Canopy structure located to the east of the existing Dewatering Building. Title to equipment and materials resulting from demolition is vested in the Contractor upon approval by Engineer of Contractor's Demolition/Renovation Plan, and the resulting authorization by Engineer to begin demolition.

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3.07 DISPOSITION OF MATERIAL

A. Do not remove equipment and materials without approval of Contractor's Demolition/Renovation Plan by Engineer.

B. Salvage equipment and material to the maximum extent possible.

C. Remove salvaged items designated as the property of Owner in a manner to prevent damage, and pack or crate to protect the items from damage while in storage or during shipment. Properly identify containers as to contents.

D. Repair or replace, at the discretion of Owner, items damaged during removal or storage.

E. Deliver salvaged items that are designated as the property of Owner to a storage site as directed by Owner.

F. Owner will not be responsible for the condition or loss of, or damage to, property scheduled to become Contractor's property after Engineer's authorization to begin demolition. Materials and equipment shall not be viewed by prospective purchasers or sold on the site.

G. Owner will not be responsible for the condition or loss of, or damage to, such property after Engineer's authorization to begin demolition.

H. Store salvaged items as approved by Engineer and remove them from Owner's property before completion of the Contract. Materials and equipment shall not be either viewed by prospective purchasers or sold on the Site.

3.08 REUSE OF MATERIALS AND EQUIPMENT

A. Properly store and maintain equipment and materials in same condition as when removed.

B. Equipment and material designated to be reused shall be cleaned, serviced and checked for proper operability before being put back into service.

C. Engineer will determine condition of equipment and materials prior to removal.

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3.09 CLEANUP

A. Debris and rubbish shall be removed from basement and similar excavations. Debris and rubbish shall be removed and transported in a manner that prevents spillage on streets or adjacent areas. Local regulations regarding hauling and disposal shall apply.

END OF SECTION

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SECTION 03 01 32
REPAIR OF VERTICAL AND OVERHEAD CONCRETE SURFACES

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Concrete Institute (ACI):
   a. 301, Specifications for Structural Concrete.
   b. 506.2, Specification for Shotcrete.
2. ASTM International (ASTM):
   a. A82/A82M, Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
   b. A185/A185M, Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
   c. A615/A615M, Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
   d. A706/A706M, Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
   e. C42/C42M, Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
   f. C78/C78M, Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading).
   g. C109/C109M, Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-inch or [50-mm] Cube Specimens).
   h. C157/C157M, Standard Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete.
   i. C348, Standard Test Method for Flexural Strength of Hydraulic-Cement Mortars.
   j. C496/C496M, Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens.
   k. C531, Standard Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes.
   l. C596, Standard Test Method for Drying Shrinkage of Mortar Containing Hydraulic Cement.
   m. C666/C666M, Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing.
   n. C882/C882M, Standard Test Method for Bond Strength of Epoxy-Resin Systems Used with Concrete by Slant Shear.

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o. C1202, Standard Test Method for Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration.
p. C1583/C1583M, Standard Test Method for Tensile Strength of Concrete Surfaces and the Bond Strength or Tensile Strength of Concrete Repair and Overlay Materials by Direct Tension (Pull-off Method).
q. D4258, Standard Practice for Surface Cleaning Concrete for Coating.
r. D4259, Standard Practice for Abrading Concrete.
s. E699, Standard Practice for Evaluation of Agencies Involved in Testing, Quality Assurance, and Evaluating of Building Components.

1.02 DEFINITIONS

A. Abrasive Blasting: Surface preparation method that uses compressed air intermixed with an abrasive medium to clean surface of substrate concrete, exposed steel, and steel reinforcement. Compressed air and abrasive medium is projected at high speed through a nozzle directly at the surface. Method is used to remove corrosion by-products, laitance, or other materials that may inhibit bond of repair concrete.

B. Defective Area: As defined in Section 03 30 00, Cast-in-Place Concrete.

C. High-Pressure Water Blasting: Sometimes referred to as hydro-demolition. Uses water that may contain an abrasive medium, projected under high pressure and high velocity. Used for demolition, cutting, partial or full depth removal, cleaning, scarifying, or roughening of concrete surfaces, or removing existing coatings, for preparation of substrate concrete surfaces.

D. Low-Pressure Spray Mortar: Mortar suitable to be applied by low-pressure spraying, and in small areas may be applied by hand troweling.

E. New Concrete: As defined in Section 03 30 00, Cast-in-Place Concrete.

F. Rebound: Shotcrete material, mostly aggregates, that bounce off a surface against which shotcrete was projected.

G. Shotcrete: Mortar pumped through hose and projected at high velocity.

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1.03 SUBMITTALS

A. Action Submittals:

1. Product data sheets for each material supplied.
2. Drawings supplemented by photographs indicating location, size, estimated quantity, and proposed repair mortar for each repair location in concrete.

B. Informational Submittals:

1. Repair Mortar System: Manufacturer's preparation and installation instructions.
2. Written description of equipment proposed for concrete removal and surface preparation.
3. Certificates:
    a. Shotcrete Nozzleman: Current ACI Certification for each proposed nozzleman.
    b. Manufacturer's Certificate of Compliance, in accordance with Section 01 61 00, Common Product Requirements, that proposed repair mortar systems are prepackaged, shrinkage compensated, specially designed for use on vertical and overhead surfaces that are exposed to weather.
    c. Mortar Manufacturer's Certificate of Proper Installation.
4. Statements of Qualification: Independent Testing Laboratory.
5. Field and laboratory test reports.

1.04 QUALITY ASSURANCE

A. Qualifications:

1. Repair Mortar System Applicator:
    a. For Repair System A – Shotcrete Mortar, trained and experienced applicator recognized or certified by repair mortar system manufacturer.
    b. For Repair System B – Low-Pressure Spray Mortar, in lieu of recognition or certification, demonstrate application of repair mortar manufacturer's system and obtain Certification of Proper Installation, in accordance with Article Manufacturer's Services.

B. Independent Testing Laboratory: Meet criteria stated in ASTM E699.

C. Compression Strength Test: Make compression test samples from wet mortar during demonstration placement and deliver to independent testing laboratory for testing at 7 days and 28 days.

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D. Pre-repair Conference:

1. Required Meeting Attendees:
   a. Contractor.
   b. Repair Subcontractor.
   c. Engineer.
2. Schedule and conduct prior to conducting mockups and incorporation of respective products into Project. Notify Engineer of location and time.
3. Agenda shall include, but not limited to:
   a. Review of field conditions. Conduct field observations of Work to be performed.
   b. Based on above observations, confirm material selection and make Project-specific repair method recommendations.
   c. Review proposed surface preparation, material application, consolidation, finishing, curing, and protection of repair material from weather conditions.
   d. Other specified requirements requiring coordination.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Package repair mortar system products in moisture-resistant bags, pails, or moisture-resistant bulk bags.

B. Deliver, store, and handle repair materials in accordance with manufacturer's printed instructions.

PART 2 PRODUCTS

2.01 REPAIR SYSTEM A – SHOTCRETE MORTAR

A. Mortar Materials:

1. Blend of selected portland cements, microsilica, and specially graded aggregates and fibers applicable for vertical and overhead surfaces.
2. Materials shall not contain asbestos, chlorides, nitrates, added gypsum, added lime, or high aluminum cements.
3. Noncombustible before and after cure.
4. Furnish in factory proportioned unit.
5. Workability from 1/4 inch in depth and greater.

B. Mixed Mortar Properties:

1. Working Time: 5 minutes to 10 minutes.
2. Finishing Time: 10 minutes to 20 minutes.
3. Color: Dark gray.

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C. Cured Mortar Properties:

1. Compressive strength for 2-inch cubes in accordance with ASTM C109/C109M, or 3-inch cubes in accordance with manufacturer's modification to ASTM C109/C109M:
   a. 7 Days: 6,000 pounds per square inch minimum.
   b. 28 Days: 7,000 pounds per square inch minimum.
2. Flexural Strength (Modulus of Rupture), ASTM C78/C78M or ASTM C348 (Modified) at 28 Days: 1,100 pounds per square inch minimum.
3. Splitting Tensile Strength, ASTM C496/C496M at 28 Days: 400 pounds per square inch minimum.
4. Chloride Ion Permeability Based on Charge Passed, ASTM C1202: 800 coulombs maximum.
5. Mortar shall not produce a vapor barrier.

D. Manufacturers and Products:

1. BASF Construction Chemicals, LLC - Building Systems, Shakopee, MN; MasterEmaco S 211SP.
2. Sika Corp., Lyndhurst, NJ; SIKACEM 103F.
3. Euclid Chemical Co., Cleveland, OH; Eucoshot F.

2.02 REPAIR SYSTEM B – LOW-PRESSURE SPRAY MORTAR

A. One or two-component, cement based, fiber reinforced, shrinkage compensated, gray in color, with a minimum 30-minute working time.

B. Cured materials mixed in accordance with manufacturer's instructions shall conform to the following criteria:

1. Compressive Strength, ASTM C109/C109M at 28 Days: 6,000 pounds per square inch minimum.
2. Flexural Strength, ASTM C348 at 28 Days: 1,100 pounds per square inch minimum.
3. Slant Shear Bond Strength, ASTM C882/C882M Test Method Modified with No Bonding Agent, at 28 Days: 3,000 pounds per square inch minimum.
4. Splitting Tensile Strength, ASTM C496/C496M at 28 Days: 600 pounds per square inch minimum.
5. Drying Shrinkage, ASTM C157/C157M Modified at 28 Days or ASTM C531: 0.1 percent maximum.
6. Chloride Ion Permeability Based on Charge Passed, ASTM C1202: 1,000 coulombs maximum.
7. System shall not produce a vapor barrier.

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8. Sprayable, extremely low permeability, sulfate resistant, easy to use and requiring only addition of water.
9. Free of chlorides and other chemicals causing corrosion.

C. Manufacturers and Products:

1. BASF Construction Chemicals, LLC - Building Systems, Shakopee, MN; MasterEmaco S 488CI.
2. Sika Corp., Lyndhurst, NJ; SikaRepair 224.
3. Euclid Chemical Co., Cleveland, OH; Tamms Structural Mortar.

2.03 REPAIR SYSTEM C – POLYMER-MODIFIED REPAIR MORTAR

A. Polymer-modified, one- or two-component, cementitious based, chloride resistant, flowable, gray in color, working time of 20 minutes minimum, surface renovation mortar.

B. Cured Mortar Properties:

1. Compressive Strength, ASTM C109/C109M at 28 Days: 7,000 pounds per square inch minimum.
2. Flexural Strength, ASTM C348 at 28 Days: 1,200 pounds per square inch minimum.
3. Slant Shear Bond Strength, ASTM C882/C882M Test Method Modified with No Bonding Agent at 28 Days: 2,000 pounds per square inch minimum.
4. Splitting Tensile Strength, ASTM C496/C496M at 28 Days: 500 pounds per square inch minimum.
5. Drying Shrinkage, ASTM C596 at 28 Days: 0.12 percent maximum. Not required for small repair areas approximately 1-square foot in area or less.
6. Freeze Thaw Resistance, ASTM C666/C666M, at 300 Cycles: 90 percent RDM.
7. Chloride Ion Permeability Based on Charge Passed, ASTM C1202: 800 coulombs maximum for liquid holding and belowgrade repairs.

C. Manufacturers and Products:

1. Sika Corp., Lyndhurst, NJ; SikaTop 123 PLUS.
2. Euclid Chemical Co., Cleveland, OH; DuralTop Gel.

2.04 WATER

A. Clean and free from oil, acid, alkali, organic matter, or other deleterious substances, meeting federal drinking water standards, as specified in Section 03 30 00, Cast-in-Place Concrete.

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2.05 REINFORCEMENT

A. Deformed Steel Reinforcement: Per Section 03 21 00, Steel Reinforcement.

B. Tie Wire: 16-gauge, galvanized.

2.06 CEMENTITIOUS BONDING AGENT AND REINFORCEMENT COATING

A. Cementitious adhesive, specifically formulated for bonding plastic portland cement concrete or mortar to hardened portland cement concrete.

1. Mixed Bonding Agent Properties:
    a. Pot Life: 75 minutes to 105 minutes.
    b. Contact Time: 24 hours.
2. Cured Cementitious Adhesive Properties:
    a. Splitting Tensile Strength, ASTM C496/C496M at 28 Days: 500 pounds per square inch minimum.
    b. Flexural Strength, ASTM C348: 1,000 pounds per square inch minimum.
    c. Slant Shear Bond Strength, ASTM C882/C882M at 14 Days:
        1) 2-Hour Open Time: 2,500 pounds per square inch minimum.
        2) 24-Hour Open Time: 2,000 pounds per square inch minimum.
3. Bonding agent shall not produce a vapor barrier.
4. Compatible with and from same manufacturer as the repair system used.

B. Manufacturers and Products:

1. Sika Corp., Lyndhurst, NJ; Sika Armatec 110 EpoCem.
2. Euclid Chemical Co., Cleveland, OH: Dural Prep AC.

2.07 EVAPORATION RETARDANT

A. As specified in Section 03 39 00, Concrete Curing.

2.08 CURING COMPOUND

A. As specified in Section 03 39 00, Concrete Curing.

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PART 3 EXECUTION

3.01 GENERAL

A. New Concrete Work: Repair deficiencies in new concrete structures constructed under this Contract with applicable repair system. Refer to Section 03 30 00, Cast-in-Place Concrete.

B. Existing Concrete Work: Repair concrete as identified in Contract Documents.

3.02 APPLICATION

A. General:

1. Repair System A: Large areas and number of repair areas.
2. Repair System B: Medium to large areas and number of repair areas.
3. Repair System C: Small and limited areas and number of repair areas.

3.03 PREPARATION

A. Identify unsound and deteriorated concrete by sounding techniques, or as directed by Engineer, and review proposed extent of repair with Engineer.

B. Remove unsound, honeycombed, deteriorated, or otherwise defective areas of concrete from work areas.

1. Use 8,000 pounds per square inch minimum high-pressure water or abrasive blasting machine as required for Site conditions.
2. Remove concrete to abrade substrate concrete surfaces to a minimum amplitude roughness of 3/16-inch measured between high and low points with a 3-foot long straightedge, in accordance with ASTM D4259.
3. For existing structures, extent of concrete removal as shown on the Drawings.
4. Where final surface is required to be flush with existing adjacent surface remove existing concrete depth as required for application of minimum thickness of repair mortar.

C. Do not use power-driven jackhammers, chipping hammers, or scabblers unless water blasting is not permitted or practical because of Site conditions, or may cause other damage to equipment or facilities. In such cases where chipping hammers are required, limit size of chipping hammer to 16 pounds or lighter, or use small electric chipping hammer, to reduce formation of micro-fractures in substrate concrete surface.

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D. Following removal of unsound or deteriorated concrete, check substrate concrete surface by sounding techniques to identify unsound concrete remaining or resulting from use of chipping hammer.

E. Remove unsound concrete to satisfaction of Engineer.

F. Square edges of patch areas by sawing or chipping to avoid tapered shoulders or featheredges. Avoid cutting embedded steel reinforcement. Roughen polished saw-cut edge by high-pressure water or abrasive blasting.

G. Remove concrete adjacent to steel reinforcement to a minimum of 1-inch clearance around steel reinforcement for application and bonding of new repair mortar to circumference of exposed steel reinforcement if one or more of the following surface conditions exist:

1. 50 percent or more of circumference around steel reinforcement is exposed during concrete removal.
2. 25 percent or more of circumference around steel reinforcement is exposed during concrete removal and corrosion is present to extent that more than 25 percent loss of section has occurred.
3. Otherwise evident that bond between existing concrete and steel reinforcement has been destroyed or has deteriorated as determined by Engineer.

H. Clean exposed steel reinforcement of loose rust and concrete splatter per recommendations of repair material manufacturer and in accordance with ASTM D4258.

I. Keep areas from which concrete has been removed free of dirt, dust, and water blasting waste slurry. Remove laitance and other bond inhibiting contaminates from prepared areas.

J. Dampen repair areas at least 6 inches beyond area to receive repair mortar for at least 24 hours to provide saturated surface dry (SSD) condition without standing water at time of application of mortar as required by and in accordance with repair mortar manufacturer’s printed instructions.

K. Collect and dispose of spent water and concrete debris from removal operations offsite in manner and location acceptable to Owner.

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3.04 PROTECTION

A. If cementitious coating or bonding agent is used, protect adjacent surfaces from over application. Promptly remove bonding agent applied beyond repair area.

B. Protect adjacent surfaces, and equipment, from being damaged by overshooting, rebound, and dust, as applicable for repair mortar system used, from shotcrete mortar or low-pressure spray mortar.

3.05 REPAIR SYSTEM A – SHOTCRETE MORTAR PLACEMENT

A. Apply shotcrete mortar in accordance with manufacturer's instructions.

B. Do not reuse rebound materials.

C. Apply mortar using dry mix process, in accordance with ACI 506.2.

D. Shotcrete mortar shall emerge from nozzle in a steady, uninterrupted flow. If flow becomes intermittent, direct flow away from the Work until flow of mortar becomes constant.

E. Applied Shotcrete Mortar: Minimum thickness of 1-1/2 inches to 2 inches of cover over existing reinforcement, or to level of surrounding concrete surface, whichever results in thicker coat.

F. Nozzle Position: Hold nozzle approximately at right angles to and at a distance from surface in accordance with shotcrete repair mortar system manufacturer's instructions for type of application, nozzle, and air pressure used.

G. Steel Reinforcement Encasement:

1. Modify procedure of shooting shotcrete mortar to better direct material around reinforcement bars.
2. Prevent shotcrete mortar from building up on reinforcement steel when shooting on, around, through, and behind steel to eliminate voids.
3. Provide dense void-free encasement of reinforcement steel.

H. Shotcreting More than One Layer: In accordance with shotcrete repair mortar system manufacturer's printed instructions.

I. Slice off excess material with a wire screed approximately 5 minutes to 10 minutes after initial set.

J. Apply finish to exposed shotcrete mortar surface to match existing surface Steel trowel finish when finish coat is not applied.

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K. Rebound Removal: Continuously throughout shotcrete mortar application, remove rebound, sand, and miscellaneous debris, and dispose off Site at an approved disposal facility.

L. Cure as specified in Article Curing.

3.06 REPAIR SYSTEM B – LOW-PRESSURE SPRAY MORTAR PLACEMENT

A. Mix mortar in accordance with manufacturer's printed instructions.

B. After priming prepared substrate concrete surface per manufacturer's recommendations, apply mortar by low-pressure spraying equipment, unless noted otherwise.

C. Bonding Agent:

1. Use bonding agent when manufacture required for hand applied areas, in accordance with repair mortar manufacturer's instructions.
2. Application of repair mortar over bonding agent shall be completed within time frame recommended by bonding agent manufacturer.
3. Consult with manufacturer for optimum and minimum acceptable degrees of surface tackiness of coat.

D. Work mortar firmly and quickly into repair area.

E. Finish repair mortar to match adjacent concrete surface.

F. Cure as specified in Article Curing.

3.07 REPAIR SYSTEM C – POLYMER-MODIFIED REPAIR MORTAR PLACEMENT

A. Mix mortar in accordance with manufacturer's printed instructions.

B. Bond Coat: Apply to prepared substrate concrete surface before application of mortar in accordance with repair mortar manufacturer's printed instructions. Do not apply more bond coat than can be covered with mortar before bond coat dries. Do not retemper bond coat.

C. Place mortar by hand or low-pressure spray and trowel to specified surface finish, in accordance with requirements of repair material's printed instructions.

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D. Finish repair mortar to smooth even surface to match adjacent concrete surface.

E. Cure as specified in Article Curing, and in accordance with manufacturer's printed instructions.

3.08 CURING

A. Prior to curing, apply water fog to repair mortar system in accordance with repair mortar system manufacturer's printed instructions.

B. Cure in accordance with repair mortar manufacturer's printed instructions.

C. Where permitted by repair mortar manufacturer's printed instructions, commence water curing after repair mortar system application and when curing will not cause erosion of mortar.

D. Continuously water cure repair mortar system for a period of 7 days.

E. Do not cure using curing compound or membrane, unless method is part of repair mortar system manufacturer's printed instructions and approval is obtained from Engineer.

F. Cure intermediate layers of repair mortar in accordance with repair mortar manufacturer's printed instructions.

G. Where curing compound is permitted by repair mortar system manufacturer, apply curing compound in accordance with Section 03 39 00, Concrete Curing.

3.09 FIELD QUALITY CONTROL

A. Sounding for Hollow Areas:

1. Light hammer tap repaired areas listening for hollow sound to determine areas that have not properly bonded to substrate concrete.
2. Mark hollow areas for removal and replacement.

B. Compression Strength Test:

1. Test in accordance with ASTM C109/C109M, except modified by making samples using repair mortar.
2. Obtain production samples of mixed wet mortar materials from nozzle, or mixer, during construction for compliance with the Specifications for testing at 7 days, and 28 days.

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3. Provide a minimum of three samples for each 1,000 square feet of mortar repair, and a minimum of three samples in total, whichever is greater, for testing.
4. Record location where repair mortar is being applied at time production samples are obtained.

C. Direct Tension Bond Test:

1. In Situ Bond Testing: Perform tension bond test in accordance with ASTM C1583/C1583M.
2. Record locations on in situ bond tests on each type of applied repair mortar.

D. Testing laboratory retained by Contractor will provide the following:

1. Compression Strength Test:
   a. Testing will follow a “modified” ASTM C109/C109M.
   b. A minimum of three production samples of mixed material will be obtained from each 200 square feet of mortar repair, and a minimum of three samples in total, whichever is greater, for testing at 7 days, and 28 days.
   c. Record location where repair mortar is being applied at time production samples are obtained.

E. Retest mortar repairs that do not meet test requirements.

F. Repair and fill holes using same repair mortar where core samples have been removed.

3.10 MORTAR REPAIR FAILED TEST

A. Remove and replace unacceptable Work.

B. Hollow Sounding Areas: Saw cut hollow sounding areas to a new square edge. Remove unsound mortar repair. Prepare substrate surface and reapply repair mortar as specified herein above.

C. Failed Compression Strength Test: Remove affected areas of repair mortar represented by failed compression strength test results. Prepare substrate surface and reapply repair mortar as specified herein above.

D. Retest areas where repair mortar was removed and replaced, in accordance with test requirements specified herein above.

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3.11 CLEANING

A. Remove overshot shotcrete, Repair System low-pressure spray, Repair System site-mixed portland-cement, Repair System D repair mortar and rebound materials as the Work proceeds. Remove waste materials, unsound material from concrete surfaces, material chipped from structure, and water used in preparation of or repair areas, finishing, and curing, and dispose offsite at an approved disposal site.

END OF SECTION

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SECTION 03 01 33
REPAIR OF HORIZONTAL CONCRETE SURFACES

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Association of State Highway and Transportation Officials (AASHTO): T277, Standard Method of Test for Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration.
2. ASTM International (ASTM):
   a. A82/A82M, Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
   b. A185/A185M, Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
   c. A615/A615M, Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
   d. A706/A706M, Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
   e. C42/C42M, Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
   f. C78/C78M, Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading).
   g. C109/C109M, Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-inch or [50-mm] Cube Specimens).
   h. C157/C157M, Standard Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete.
   i. C348, Standard Test Method for Flexural Strength of Hydraulic-Cement Mortars.
   j. C469, Standard Test Method for Static Modulus of Elasticity and Poisson's Ratio of Concrete in Compression.
   k. C496/C496M, Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens.
   l. C666/C666M, Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing.
   m. C779/C779M, Standard Test Method for Abrasion Resistance of Horizontal Concrete Surfaces.
   n. C882/C882M, Standard Test Method for Bond Strength of Epoxy-Resin Systems Used with Concrete by Slant Shear.
   o. C928/C928M, Standard Specification for Packaged, Dry, Rapid-Hardening Cementitious Materials for Concrete Repairs.

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p. C1012/C1012M, Standard Test Method for Length Change of Hydraulic-Cement Mortars Exposed to a Sulfate Solution.
q. C1202, Standard Test Method for Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration.
r. C1583/C1583M, Standard Test Method for Tensile Strength of Concrete Surfaces and the Bond Strength or Tensile Strength of Concrete Repair and Overlay Materials by Direct Tension (Pull-off Method).
s. D638, Standard Test Method for Tensile Properties of Plastics.
t. D695, Standard Test Method for Compressive Properties of Rigid Plastics.
u. D4258, Standard Practice for Surface Cleaning Concrete for Coating.
v. D4259, Standard Practice for Abrading Concrete.
w. E699, Standard Practice for Evaluation of Agencies Involved in Testing, Quality Assurance, and Evaluating of Building Components.

1.02 DEFINITIONS

A. Abrasive Blasting: Surface preparation method that uses compressed air intermixed with an abrasive medium to clean surface of substrate concrete, exposed steel, and steel reinforcement. Compressed air and abrasive medium is projected at high speed through a nozzle directly at the surface. Method is used to remove corrosion by-products, laitance, or other materials that may inhibit bond of repair concrete.

B. Defective Area: As defined in Section 03 30 00, Cast-in-Place Concrete.

C. High-Pressure Water Blasting (sometimes referred to as hydro-demolition): Uses water that may contain an abrasive medium, projected under high pressure and high velocity. Used for demolition, cutting, partial or full depth removal, cleaning, scarifying, or roughening of concrete surfaces, or removing existing coatings, for preparation of substrate concrete surfaces.

D. New Concrete: As defined in Section 03 30 00, Cast-in-Place Concrete.

1.03 SUBMITTALS

A. Action Submittals:

1. Product data sheets for each material supplied.
2. Drawings supplemented by photographs indicating location, size, estimated quantity, and proposed repair mortar system for each repair location in concrete.

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B. Informational Submittals:

1. Repair Mortar System: Manufacturer's preparation and installation instructions.
2. Written description of equipment proposed for concrete removal and surface preparation.
3. Certificates:
   a. Manufacturer's Certificate of Compliance, in accordance with Section 01 61 00, Common Product Requirements, that repair mortar systems are prepackaged, shrinkage compensated, specially designed for use on horizontal surfaces that are exposed to weather.
   b. Mortar Manufacturer's Certificate of Proper Installation.
4. Statements of Qualification:
   a. Repair mortar system applicator.
   b. Independent Testing Laboratory.
5. Field and laboratory test results.

1.04 QUALITY ASSURANCE

A. Qualifications:

1. Repair Mortar System Applicator: Trained and experienced applicator endorsed by repair mortar system manufacturer.

B. Independent Testing Laboratory: Meet criteria stated in ASTM E699.

C. Pre-repair Conference:

1. Required Meeting Attendees:
   a. Contractor.
   b. Repair Subcontractor.
   c. Engineer.
2. Schedule and conduct prior to incorporation of respective products into Project. Notify Engineer of location and time.
3. Agenda shall include, but not limited to:
   a. Review of field conditions. Conduct field observations of the Work to be performed.
   b. Based on above observations, confirm material selection and make Project specific repair method recommendations.
   c. Review proposed surface preparation, material application, consolidation, finishing, curing, and protection of repair material from weather conditions.
   d. Other specified requirements requiring coordination.

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1.05 DELIVERY, STORAGE, AND HANDLING

A. Package repair mortar system products in moisture-resistant bags, pails, or moisture-resistant bulk bags.

B. Deliver, store, and handle repair materials in accordance with manufacturer's printed instructions.

PART 2 PRODUCTS

2.01 REPAIR MORTAR SYSTEM NO. 1—MAGNESIUM PHOSPHATE REPAIR MORTAR

A. One or two-component, magnesium-ammonium-phosphate concrete mortar.

B. Compressive Strength, ASTM C109/C109M modified:

1. 1-Hour: 2,000 pounds per square inch minimum.
2. 3 Hours: 5,000 pounds per square inch minimum.
3. 1-Day: 6,000 pounds per square inch minimum.
4. 28 Days: 7,500 pounds per square inch minimum.

C. Flexural Strength, ASTM C78/C78M Modified (3-inch by 4-inch by 16-inch prism) at 1-Day: 550 pounds per square inch minimum.

D. Modulus of Elasticity, ASTM C469 at 7 Days: 4.18 by 10^6 pounds per square inch minimum.

E. Freeze-thaw Resistance and Resistance to Deicing Chemicals, ASTM C666/C666M, Procedure A, at 300 Cycles: 80 percent RDM minimum.

F. Sulfate Resistance, ASTM C1012/C1012M, Length Change after 52 Weeks: 0.09 percent maximum.

G. Application Temperature Range: 20 degrees F to 85 degrees F for normal weather applications.

H. Manufacturers and Products:

1. BASF Construction Chemicals, LLC - Building System, Shakopee, MN; MasterEmaco T 545.
2. Euclid Chemical Co., Cleveland, OH; Eucospeed MP.

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2.02 REPAIR MORTAR SYSTEM NO. 2—HIGH EARLY STRENGTH REPAIR MORTAR

A. One or two-component, fast-setting, high early strength repair mortar.

B. Compressive Strength, ASTM C109/C109M:

1. 2 Hours: 1,500 pounds per square inch minimum.
2. 1-Day: 4,500 pounds per square inch minimum.
3. 7 Days: 8,000 pounds per square inch minimum.
4. 28 Days: 9,000 pounds per square inch minimum.

C. Flexural Strength, ASTM C348:

1. 1-Day: 850 pounds per square inch minimum.
2. 7 Days: 1,000 pounds per square inch minimum.
3. 28 Days: 1,100 pounds per square inch minimum.

D. Modulus of Elasticity, ASTM C469:

1. 1-Day: 3.8 by 10^6 pounds per square inch minimum.
2. 28 Days: 4.5 by 10^6 pounds per square inch minimum.

E. Slant Shear Bond Strength, ASTM C882/C882M (Modified):

1. 1-Day: 2,500 pounds per square inch minimum.
2. 7 Days: 2,900 pounds per square inch minimum.
3. 28 Days: 3,100 pounds per square inch minimum.

F. Splitting Tensile Strength, ASTM C496/C496M:

1. 1-Day: 850 pounds per square inch minimum.
2. 7 Days: 1,200 pounds per square inch minimum.
3. 28 Days: 1,300 pounds per square inch minimum.

G. Freeze-thaw Resistance, ASTM C666/C666M, Procedure A, at 300 Cycles: 98 percent RDM.

H. Chloride Ion Permeability Based on Charge Passed, ASTM C1202 or AASHTO T277, 28 Days: 960 coulombs maximum.

I. Manufacturers and Products:

1. BASF Construction Chemicals, LLC - Building Systems, Shakopee, MN; MasterEmaco T 415.
2. Euclid Chemical Co., Cleveland, OH; VersaSpeed.

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2.03 REPAIR MORTAR SYSTEM NO. 3—SHRINKAGE COMPENSATED REPAIR MORTAR

A. One or two-component cement-based, flowable, shrinkage compensated repair mortar system.

B. Compressive Strength, ASTM C109/C109M:

1. 1-Day: 2,500 pounds per square inch minimum.
2. 7 Days: 6,000 pounds per square inch minimum.
3. 28 Days: 8,000 pounds per square inch minimum.

C. Flexural Strength, ASTM C348 at 28 Days: 770 pounds per square inch minimum.

D. Modulus of Elasticity, ASTM C469 at 28 Days: 5.9 by 10^6 pounds per square inch minimum.

E. Slant Shear Bond Strength, ASTM C882/C882M Modified:

1. 7 Days: 2,150 pounds per square inch minimum.
2. 28 Days: 3, 000 pounds per square inch minimum.

F. Freeze-thaw Resistance, ASTM C666/C666M, Procedure A, at 300 Cycles: 97.0 percent RDM.

G. Chloride Ion Permeability Based on Charge Passed, ASTM C1202 at 28 Days: 650 coulombs maximum.

H. Sulfate Resistance, ASTM C1012/C1012M after 6 Months: 0.01 percent length change maximum.

I. Manufacturers and Products:

1. BASF Construction Chemicals, LLC - Building Systems, Shakopee, MN; MasterEmaco S 466 CI.
2. Euclid Chemical Co., Cleveland, OH; Eucocrete Supreme.

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2.04 REPAIR MORTAR SYSTEM NO. 4—METALLIC AGGREGATE REPAIR MORTAR

A. One or two-component cement-based, flowable, metallic-aggregate repair mortar system.

B. Compressive Strength, ASTM C109/C109M:

1. 1-Day: 5,000 pounds per square inch minimum.
2. 7 Days: 8,800 pounds per square inch minimum.
3. 28 Days: 12,000 pounds per square inch minimum.

C. Abrasion Resistance, ASTM C779/C779M, Procedure A: Eight times more wear resistance than plain concrete.

D. Density: 215-pound per cubic foot.

E. Manufacturers and Products:

1. BASF Construction Chemicals, LLC - Building Systems, Shakopee, MN; Master T 300.
2. Euclid Chemical Co. (The), Cleveland, OH; Super Euco-Top.

2.05 REPAIR MORTAR SYSTEM NO. 5—POLYMER MODIFIED REPAIR MORTAR

A. One or two-component, fast-setting, polymer modified cementitious based repair mortar system.

B. Compressive Strength, ASTM C109/C109M:

1. 1-Day: 2,500 pounds per square inch minimum.
2. 7 Days: 5,000 pounds per square inch minimum.
3. 28 Days: 7,000 pounds per square inch minimum.

C. Flexural Strength, ASTM C348 at 28 Days: 1,500 pounds per square inch minimum.

D. Slant Shear Bond Strength, ASTM C882/C882M Modified at 28 Days: 2,000 pounds per square inch minimum.

E. Splitting Tensile Strength, ASTM C496/C496M at 28 Days: 600 pounds per square inch minimum.

F. Abrasion Resistance Depth of Wear, ASTM C779/C779M, Procedure A, at 60 Minutes: 0.033-inch maximum.

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G. Drying Shrinkage, ASTM C157/C157M Modified, at 28 Days: 0.09 percent maximum.

H. Rapid Chloride Ion Permeability Based on Charge Passed, ASTM C1202: 28 Days: Under 850 coulombs maximum.

I. Manufacturers and Products:

1. Euclid Chemical Co., Cleveland, OH; Duraltop Flowable Mortar.
2. Sika Corp., Lyndhurst, NJ; SikaTop 122 PLUS.

2.06 WATER

A. Clean and free from oil, acid, alkali, organic matter, or other deleterious substances, meeting federal drinking water standards, as specified in Section 03 30 00, Cast-in-Place Concrete.

2.07 REINFORCEMENT

A. Deformed Steel Reinforcement: Per Section 03 21 00, Steel Reinforcement.

B. Tie Wire: 16-gauge, galvanized.

2.08 CEMENTITIOUS BONDING AGENT AND REINFORCEMENT COATING

A. Cementitious adhesive, specifically formulated for bonding plastic portland cement concrete or mortar to hardened portland cement concrete.

1. Mixed Bonding Agent Properties:
   a. Pot Life: 75 minutes to 105 minutes.
   b. Contact Time: 24 hours.
2. Cured Cementitious Adhesive Properties:
   a. Splitting Tensile Strength, ASTM C496/C496M at 28 Days: 600 pounds per square inch minimum.
   b. Flexural Strength, ASTM C348: 1,000 pounds per square inch minimum.
   c. Slant Shear Bond Strength, ASTM C882/C882M:
      1) 2-Hour Open Time: 2,500 pounds per square inch minimum.
      2) 24-Hour Open Time: 2,000 pounds per square inch minimum.
3. Bonding agent shall not produce a vapor barrier.
4. Compatible with, and from same manufacturer as the repair mortar system used.

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B. Manufacturers and Products:

1. BASF Construction Chemicals, LLC - Building Systems, Shakopee, MN; MasterEmaco P 124.
2. Sika Corp., Lyndhurst, NJ; Sika Armatec 110 EpoCem.
3. Euclid Chemical Co., Cleveland, OH; Dural Prep AC.

2.09 EPOXY BONDING AGENT

A. Two-component, moisture insensitive, 100 percent solids epoxy resin.

B. Tensile Strength, ASTM D638, at 14 Days: 4,400 pounds per square inch minimum.

C. Elongation at Break, ASTM D638: 1.49 percent minimum.

D. Compressive Strength, ASTM D695, at 28 Days for Application Temperature of 73 Degrees F to 77 Degrees F: 8,000 pounds per square inch minimum.

E. Bond Strength, ASTM C882/C882M, at 14 Days: 1,800 pounds per square inch minimum.

F. Pot Life, at 73 Degrees F to 77 Degrees F: 75 minutes minimum.

G. Manufacturers and Products: BASF Construction Chemicals, LLC - Building Systems, Shakopee, MN; MasterEmaco ADH 326 when ambient temperature is 73 degrees F or higher.

2.10 EVAPORATION RETARDANT

A. As specified in Section 03 39 00, Concrete Curing.

2.11 CURING COMPOUND

A. As specified in Section 03 39 00, Concrete Curing.

PART 3 EXECUTION

3.01 GENERAL

A. New Concrete Work: Repair deficiencies in new concrete structures constructed under this Contract with applicable repair system.

B. Existing Concrete Work: Repair concrete as identified in Contract Documents.

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3.02 APPLICATION

A. General:

1. Repair Mortar System No. 1: Patches, joints, and overlays 1/2-inch to 3 inches thick. Return to service in 1-hour.
2. Repair Mortar System No. 2: Patches, joints, or overlays 1/2-inch to 3 inches thick. Return to service in 3 hours to 7 days.
3. Repair Mortar System No. 3: Patches, joints, or overlays 1-inch thick or greater. Return to service in 7 days or more.
4. Repair Mortar System No. 4: Heavy-duty joints or overlays 2 inches thick or greater. Return to service in 7 days or more.
5. Repair Mortar System No. 5:
   a. Patches and Overlays: 1/4-inch to 3 inches thick.
   b. Return to service for foot traffic in 4 hours; wheel traffic in 7 days.
   c. Working Time: 30 minutes at 70 degrees F.
   d. Application Temperature Range: 45 degrees F to 90 degrees F.

3.03 PREPARATION

A. Identify unsound and deteriorated concrete by sounding techniques, or as directed by Engineer. Review proposed extent of repair with Engineer.

B. Remove unsound, deteriorated, or otherwise defective areas of concrete from Work areas.

1. Use 8,000 pounds per square inch minimum high-pressure water or abrasive blasting machine, as appropriate to suit Site conditions.
2. Remove concrete to abrade substrate concrete surface to a minimum amplitude roughness of 3/16-inch measured between high and low points with a 3-foot long straightedge, in accordance with ASTM D4259.
3. For existing structures, extent of concrete removal as shown on the Drawings.
4. Where final surface is required to be flush with existing adjacent surface, remove existing concrete depth as required for application of minimum thickness of repair mortar.

C. Do not use power-driven jackhammers, chipping hammers, scabblers, or scarifiers unless water blasting is not permitted or practical because of Site conditions, or may cause other damage to equipment or facilities. In such cases where chipping hammers are required, limit size of chipping hammer to 16 pounds or lighter, or use small electric chipping hammer, to reduce formation of micro-fractures in substrate concrete surface.

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D. Following removal of unsound or deteriorated concrete, check substrate concrete surface by sounding techniques to identify unsound concrete remaining or resulting from use of chipping hammer.

E. Remove unsound concrete to satisfaction of Engineer.

F. Square edges of patch areas by sawing or chipping to avoid tapered shoulders or featheredges. Avoid cutting embedded steel reinforcement. Roughen polished saw-cut edge by high-pressure water blasting or abrasive blasting.

G. Remove concrete adjacent to steel reinforcement to a minimum of 1-inch clearance around steel reinforcement for application and bonding of new repair mortar to entire circumference of exposed steel reinforcement if one or more of the following surface conditions exist:

1. 50 percent or more of circumference around steel reinforcement is exposed during concrete removal.
2. 25 percent or more of circumference around steel reinforcement is exposed during concrete removal and corrosion is present to extent that more than 25 percent loss of section has occurred.
3. Otherwise evident that bond between existing concrete and steel reinforcement has been destroyed or has deteriorated as determined by Engineer.

H. Clean exposed steel reinforcement of loose rust and concrete splatter per recommendations of repair material manufacturer and in accordance with ASTM D4258.

I. Keep areas from which concrete has been removed free of dirt, dust, and water blasting waste slurry. Remove laitance and other bond inhibiting contaminates from prepared areas.

J. Preparation of Substrate Concrete Surface in Areas to Receive Repair Mortar System No. 1, No. 2, No. 3, and No. 5: Dampen repair areas at least 6 inches beyond area to receive repair mortar for at least 24 hours to provide saturated surface dry (SSD) condition without standing water at time of application of mortar, as required by and in accordance with repair mortar manufacturer’s printed instructions.

K. Preparation of Substrate Concrete Surface in Areas to Receive Repair Mortar System No. 4 Repair Mortar: Dry, in accordance with material manufacturer’s printed instructions.

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L. Spalled Joints:

1. Saw cut edge 1 inch deep and 6 inches back from old joint.
2. Remove unsound concrete and concrete between saw cut and joint.
3. Place wood or fiber spacer to thickness of joint at joint line.

M. Overlays:

1. Square cut edges to a minimum of 1/4-inch deep.
2. Do not feather edge area.
3. Perform special preparation recommended by mortar manufacturer.

N. Collect and dispose of spent water and concrete debris from removal operations offsite in manner and location acceptable to Owner.

3.04 PROTECTION

A. If cementitious coating or bonding agent is used, protect adjacent surfaces from over application. Promptly remove bonding agent applied beyond repair area.

B. Protect adjacent surfaces, and equipment from spillage of repair mortar and dust, as applicable for repair mortar system used.

3.05 PLACEMENT

A. Repair Mortar System No. 1, No. 2, No. 3, and No. 5:

1. Remove standing and free water from prepared area.
2. Apply bond scrub coat of mortar to prepared surface in accordance with manufacturer’s instructions. Do not apply more scrub coat of mortar than can be covered with repair mortar before scrub coat begins drying.
3. Immediately place mixed repair mortar into prepared area from one side to the other side.
4. Work material firmly into bottom and sides of patch to ensure a good continuous bond.
5. Level repair mortar and screed to elevation of existing concrete.
6. Finish to same texture as existing concrete around patch.
7. Repair Mortar System No. 5 screed or use self-leveling mixture to obtain a uniform and plane surface.

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B. Repair Mortar System No. 4:

1. Remove free water from prepared area.
2. Apply bonding agent to prepared surface in accordance with manufacturer's instructions. Do not apply more bonding agent than can be covered with mortar before bonding agent cures, past tacky to the touch.
3. Immediately place mixed repair mortar into prepared area from one side to the other side.
4. Work material firmly into bottom and sides of patch to ensure a good continuous bond.
5. Level repair mortar and screed to elevation of existing concrete.
6. Finish to same texture as existing concrete around patch.

C. Joint Repair:

1. Remove joint spacer when repair mortar is hard enough that a pointed trowel will penetrate surface less than 1/2-inch.
2. When repair mortar is cured and ready for use, fill joint in accordance with repair mortar system manufacturer's instructions.

3.06 FINISHING

A. Spray full strength evaporation retardant on fresh concrete to prevent rapid drying during hot and windy weather.

3.07 CURING

A. Repair Mortar System No. 1:

1. No curing is required.
2. Protect from rain immediately after placing.
3. Liquid-membrane curing compounds or plastic sheeting may be used in accordance with repair mortar manufacturer's instructions to protect the surface from precipitation.
4. Never wet cure.

B. Repair Mortar System No. 2, No. 3, No. 4, or No. 5: Apply curing compound in accordance with Section 03 39 00, Concrete Curing.

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3.08 FIELD QUALITY CONTROL

A. Sounding for Hollow Areas:

1. Chain drag or light hammer tap repaired areas listening for hollow sound to determine areas that have not properly bonded to substrate concrete.
2. Mark hollow areas for removal and replacement.

B. Compression Strength Test:

1. Test in accordance with ASTM C109/C109M, except modified by making samples using repair mortar.
2. Obtain production samples of mixed materials from mixer during construction for compliance with Specifications.
3. Provide minimum of three samples for each 200 square feet of mortar repair, and a minimum of three samples in total, whichever is greater for testing.
4. Record location where repair mortar is being applied at time production samples are obtained.

C. Testing laboratory retained by Contractor shall provide the following:

1. Compression Strength Test:
   a. Testing will follow a “modified” ASTM C109/C109M.
   b. A minimum of three production samples of mixed material will be obtained from each 200 square feet of mortar repair, and a minimum of three samples in total, whichever is greater, for testing at 7 days, and 28 days.
   c. Record location where repair mortar is being applied at time production samples are obtained.

D. Retest mortar repairs that do not meet test requirements.

E. Repair and fill holes using same repair mortar where core samples have been removed.

3.09 MORTAR REPAIR FAILED TEST

A. Remove and replace unacceptable Work.

B. Hollow Sounding Areas: Saw cut hollow sounding areas to a new square edge, remove unsound mortar repair. Prepare substrate surface and reapply repair mortar as specified herein above.

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C. Failed Compression Strength Test: Remove affected areas of repair mortar represented by failed compression strength test results. Prepare substrate surface and reapply repair mortar as specified herein above.

D. Retest areas where repair mortar was removed and replaced, in accordance with test requirements specified herein above.

3.10 CLEANING

A. Remove excess repair mortar materials as the Work proceeds. Remove waste materials, unsound material from concrete surfaces, material chipped from structure, and water used in preparation of repair areas, finishing, and curing, and dispose offsite at approved disposal site.

END OF SECTION

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SECTION 03 10 00
CONCRETE FORMING AND ACCESSORIES

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Concrete Institute (ACI):
   a. 117, Specification for Tolerances for Concrete Construction and Materials.
   b. 301, Specifications for Structural Concrete.
   c. 318, Building Code Requirements for Structural Concrete 350, Code Requirements for Environmental Engineering Concrete Structures.

1.02 DEFINITIONS

A. Architectural Concrete: See definition in Section 03 30 00, Cast-in-Place Concrete.

B. Defective Areas: See definition in Section 03 30 00, Cast-in-Place Concrete.

C. Exposed Concrete: See definition in Section 03 30 00, Cast-in-Place Concrete.

1.03 DESIGN REQUIREMENTS

A. Design formwork in accordance with ACI 301 and ACI 318 to provide concrete finishes specified in Section 03 30 00, Cast-in-Place Concrete.

B. Unless otherwise specified, limit deflection of facing materials for concrete surfaces to comply with ACI 301. Limit deflection of facing materials to comply with tolerance limits established by Contract Documents and with tolerances required by equipment manufacturers. Coordinate tolerance requirements with equipment manufacturers.

1.04 SUBMITTALS

A. Action Submittals:

1. Shop Drawings: Formwork drawings signed and sealed by a licensed professional engineer in the state of the Project.

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2. Product Data:
    a. Form release agent.
    b. Form ties.
    c. Products to be used for sealing tie holes.

B. Informational Submittals: Statement of qualifications for formwork designer.

1.05 QUALITY ASSURANCE

A. Qualifications:

1. Formwork Designer: Formwork, falsework, and shoring design shall be designed by an engineer licensed in the state of Project.

PART 2 PRODUCTS

2.01 FORM MATERIALS

A. Wall Forms and Underside of Slabs and Beams:

1. Materials: Plywood, hard plastic finished plywood, overlaid waterproof particle board, or steel in “new and undamaged” condition, of sufficient strength and surface smoothness to produce specified finish.
2. Where steel forms are used, treat steel surfaces to prevent rusting using products approved for use on steel forms.
3. Circular Structure:
    a. Wall forms shall conform to circular shape of structure.
    b. Straight panels may be substituted for circular forms provided panels do not exceed 2 feet in horizontal width and angular deflection is no greater than 3-1/2 degrees per joint.

B. Column Forms:

1. Rectangular Columns: As specified for walls.
2. Circular Columns: Fabricated steel or fiber-reinforced plastic with bolted sections or spirally wound laminated fiber form. Internally treat with release agent for full height of column.

C. Sandblasted Surface Forms: Medium-density overlay plywood for flat concrete surfaces to be sandblasted.

D. Painted Surface Forms: High-density overlay plywood for flat concrete surfaces to be painted.

E. All Other Forms: Materials as specified for wall forms.

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2.02 EXPANDED POLYSTYRENE (EPS) GEOFOAM

A. General: Use to form voided area between concrete elements of structure as shown on the Drawings.

B. Meets ASTM D6817, Type EPS22.

C. Sized as required to assemble and completely fill void area

2.03 ACCESSORIES

A. Form Release Agent:

1. Material:
   a. Shall not bond with, stain, or adversely affect concrete surfaces.
   b. Shall not impair subsequent treatments of concrete surfaces when applied to forms.
   c. Ready-to-use water based material formulated to reduce or eliminate surface imperfections.
   d. Contain no mineral oil or organic solvents.
2. Manufacturers and Products: Not for surfaces exposed to potable water.
   a. BASF, Shakopee, MN; MBT MasterFinish RL 211.
   b. Cresset Chemical Company; Crete-Lease 20-VOC-Xtra.

B. Rustication Grooves and Beveled Edge Corner Strips: Nonabsorbent material, compatible with form surface, fully sealed on all sides prohibiting loss of paste or water between the two surfaces.

C. Form Snap-Ties:

1. Material: Steel.
2. Spreader Inserts:
   a. Conical or spherical type.
   b. Design to maintain positive contact with forming material.
   c. Furnish units that will leave no metal closer than 1.5 inches to concrete surface when forms, inserts, and tie ends are removed.
3. Wire ties not permitted.
4. Flat bar ties for panel forms; furnish plastic or rubber inserts with minimum 1.5-inch depth and sufficient dimensions to permit patching of tie hole.

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D. Form Snap-Ties with Waterstop:

1. For water-holding structures, basements, pipe galleries, and accessible spaces below finish grade, furnish one of the following:
   a. Integral steel waterstop 0.103-inch thick and 0.625-inch diameter tightly and continuously welded to tie.
   b. Neoprene waterstop 3/16-inch thick and 15/16-inch diameter whose center hole is one-half diameter of tie, or molded plastic waterstop of comparable size.
   c. Orient waterstop perpendicular to tie and symmetrical about center of tie.
   d. Design ties to prevent rotation or disturbance of center portion of tie during removal of ends and to prevent water leaking along tie.

E. Through-Bolts:

1. At Contractor's option, may be used as alternate to form snap-tie or form snap-tie with waterstop.
2. Tapered minimum 1-inch diameter at smallest end.
3. Elastic Vinyl Plug for Through-Bolt Tie Holes:
   a. Design and size of plug to allow insertion with tool to enable plug to elongate and return to original length and diameter upon removal; forms watertight seal.
   b. Manufacturers and Products:
      1) Dayton Superior, Miamisburg, OH; A58 Sure Plug.
      2) Greenstreak Group, Inc., St Louis, MO; X-Plug.

PART 3 EXECUTION

3.01 FORM SURFACE PREPARATION

A. Prior to coating surface, thoroughly clean form surfaces that will be in contact with concrete or that have been in contact with previously cast concrete, dirt, and other surface contaminants.

B. Exposed Wood Forms in Contact with Concrete: Apply form release agent as recommended by manufacturer.

C. Steel Forms: Apply form release agent as soon as they are cleaned to prevent discoloration of concrete from rust.

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3.02 ERECTION

A. General: In accordance with ACI 301, unless otherwise specified.

B. Beveled Edges (Chamfer):

1. Form 3/4-inch bevels at concrete edges, unless otherwise shown.
2. Where beveled edges on existing adjacent structures are other than 3/4 inch, obtain Engineer's approval of size prior to placement of beveled edge.

C. Wall Forms:

1. Do not reuse forms with damaged surfaces.
2. Locate form ties and joints in uninterrupted uniform pattern.
3. Inspect form surfaces prior to installation to ensure conformance with specified tolerances.

D. Form Tolerances:

1. Provide forms in accordance with ACI 117 and ACI 318, and the following tolerances for finishes specified:
    a. See the Schedule of Concrete Finishes in Section 03 30 00, Cast-in-Place Concrete, for beam, column, and wall types related to required form tolerances.
    b. Wall Tolerances:
        1) Straight Vertical or Horizontal Wall Surface: Flat planes within tolerance specified.
        2) Wall Type W-A:
            a) Plumb within 1/4-inch in 10 feet or within 1-inch from top to bottom for walls over 40 feet high.
            b) Depressions in Wall Surface: Maximum 5/16 inch when 10-foot straightedge is placed on high points in all directions.
        3) Wall Type W-B:
            a) Plumb within 1/8-inch in 10 feet or within 1/2 inch from top to bottom for walls over 40 feet high.
            b) Depressions in Wall Surface: Maximum 1/8-inch when 10-foot straightedge is placed on high points in all directions.
        4) Thickness: Maximum 1/4-inch minus or 1/2-inch plus from dimension shown.
        5) Form Offset: Between adjacent pieces of formwork, facing material shall not exceed 1/4 inch.

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c. Beams and Columns Tolerances:
   1) Exposed Straight Horizontal and Vertical Surfaces: Flat planes within tolerances specified.
   2) Lateral Alignment:
      a) Centerlines shall be within plus or minus 1/2 inch from dimensions shown.
      b) At intersections, centerlines shall intersect within plus or minus 1/2 inch of dimensions shown.
   3) Beam Type B-A:
      a) Physical Dimensions: Maximum 1/4-inch minus or 1/2-inch plus from dimension shown.
      b) Elevations: Within plus or minus 1/2 inch, except where tops of beams become part of finished slab. In this case refer to slab tolerances.
   4) Column Type C-A:
      a) Physical Dimensions: Maximum 1/4-inch minus or 1/2-inch plus from dimension shown.
      b) Plumb within 1/4-inch in 10 feet in all directions with maximum 1/2 inch out-of-plumb at top with respect to bottom.

3.03 FORM REMOVAL

A. Nonsupporting forms, sides of beams, walls, columns, and similar parts of Work, may be removed after cumulatively curing at not less than 50 degrees F for 24 hours from time of concrete placement if:

   1. Concrete is sufficiently hard so as not to sustain damage by form removal operations.
   2. Curing and protection operations are maintained.

B. Elevated Structural Slabs or Beams: In accordance with ACI 318, Chapter 6, and at such time as concrete has reached compressive strength equal to 80 percent of specified 28-day compressive strength as determined by test cylinders.

C. Form Ties: Remove conical inserts or through bolts and plug holes as specified in Section 03 30 00, Cast-in-Place Concrete.

3.04 GEOFOAM INSTALLATION

A. Exact dimensions of EPS Geofoam products to suit Site conditions are determined by the installer in collaboration with the manufacturer.

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B. Geofoam blocks shall be factory-trimmed as necessary so surfaces are within tolerances of ASTM D6817; additional field cutting or trimming may be required and shall be completed on site by the installer with a hot wire cutter.

C. Fit, cut, and assemble individual blocks as required to completely fill voided area. Place geofoam blocks so that all vertical and horizontal joints between geofoam blocks are tight. All geofoam blocks must butt tightly against adjacent blocks on all sides.

D. Cut and fit geofoam tightly around projections and penetrations. Complete additional fabrication for the installation of Geofoam products as required.

E. Properly secure Geofoam blocks as needed to prevent dislocation from water, wind, concrete placement, or other Site activities.

3.05 FIELD QUALITY ASSURANCE AND QUALITY CONTROL

A. Owner-Furnished Quality Assurance, in accordance with IBC Chapter 17 requirements, is provided in Statement of Special Inspections Plan on the Drawings. Contractor responsibilities and related information are included in Section 01 45 33, Special Inspection, Observation, and Testing.

B. Contractor-Furnished Quality Control: Inspection and testing as required in Section 01 45 16.13, Contractor Quality Control.

END OF SECTION

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SECTION 03 15 00
CONCRETE JOINTS AND ACCESSORIES

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. ASTM International (ASTM):
   a. A36/A36M, Specification for Carbon Structural Steel.
   b. A615/A615M, Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
   c. A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   d. A767/A767M, Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement.
   e. C920, Specification for Elastomeric Joint Sealants.
   f. D226, Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
   g. D227, Specification for Coal-Tar Saturated Organic Felt Used in Roofing and Waterproofing.
   h. D994, Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).
   i. D1056, Specification for Flexible Cellular Materials—Sponge or Expanded Rubber.
   j. D1171, Standard Guide for Evaluating Nonwoven Fabrics.
   k. D1751, Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
   l. D1752, Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.
   m. D2240, Standard Test Method for Rubber Property – Durometer Hardness.
2. Corps of Engineers (COE): CRD-C-572, Corps of Engineers Specifications for Polyvinylchloride Waterstop.

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1.02 SUBMITTALS

A. Action Submittals:

1. Shop Drawings:
   a. Waterstop: Details of splices, method of securing and supporting waterstop in forms to maintain proper orientation and location during concrete placement.
   b. Construction Joints, Expansion Joints, and Control Joints: Layout and location for each type. Include joint locations shown on the Drawings, additional required joint locations, and any proposed alternate locations.
2. Product Data:
   a. Waterstops.
   b. Bond breaker.
   c. Premolded joint fillers.
   d. Roofing felt.
   e. Accessories not specified in other sections.
3. Samples: PVC waterstop splice, joint, and fabricated cross of each size, shape, and fitting of waterstop.

B. Informational Submittals:

1. Certification:
   a. Manufacturer’s application instructions for:
      1) Bonding agent.
      2) Bond breaker.
2. Manufacturer’s written instructions for product shipment, storage, handling, installation/application, and repair for:
   a. Waterstops.
   b. Bond breaker.
   c. Bonding agent.
   d. Premolded joint fillers.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Acceptance at Site: Verify delivered materials are in accordance with Specifications, regulatory agencies, and Manufacturer’s product data sheets prior to unloading and storing onsite.

B. Storage: Store materials under tarps to protect from oil, dirt, and sunlight or as required by Manufacturer.

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PART 2 PRODUCTS

2.01 POLYVINYL CHLORIDE (PVC) WATERSTOP

A. Extruded from elastomeric plastic compound of which basic resin shall be prime virgin polyvinyl chloride (PVC). Compound shall not contain scrapped material, reclaimed material, or pigment.

B. Specific Gravity: Approximately 1.37.

C. Shore Durometer Type A Hardness: Approximately 80.

D. Performance Requirements: COE Specification CRD-C-572.

E. Type Required in Expansion Joints: Where waterstop is indicated on the Drawings, provide 9 inches wide with center bulb and parallel longitudinal ribs or protrusions on each side of strip center.

F. Type Required in Contraction and Control Joints: Where waterstop is indicated on the Drawings, provide 6 inches wide or 9 inches wide with center bulb and parallel longitudinal ribs or protrusions on each side of strip center.

G. Type Required in Construction Joints: Where waterstop is indicated on the Drawings, provide flat ribbed, 6 inches wide or 9 inches wide with parallel longitudinal ribs or protrusions on each side of strip center. Center bulb is optional.

H. Corrugated or tapered type waterstops are not acceptable.

I. Thickness: Constant from bulb edge (or center of waterstop) to outside stop edge.

J. Minimum Weight per Foot of Waterstop:

1. 1.60 pounds for 3/8-inch by 6 inches.
2. 2.30 pounds for 3/8-inch by 9 inches.

K. Factory Fabrications: Use only factory fabrications for intersections, transitions, and changes of direction.

L. Manufacturers and Products for Center Bulb Type:

1. Use same manufacturers for flat ribbed profile:
   a. Vinylex Corp., St. Louis, MO; No. RB638H (6 inches by 3/8-inch) and No. RB938H (9 inches by 3/8-inch).
   b. Sika Corporation, Lyndhurst, NJ; Style 732 (6 inches by 3/8-inch) and Style 735 (9 inches by 3/8-inch).

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c. Durajoint, Garrettsville, OH; Type 9 (6 inches by 3/8-inch), and Type 10 (9 inches by 3/8-inch).
d. JP Specialties, Inc., Murrieta, CA; PVC638 (6 inches by 3/8-inch ribbed center bulb), and PVC938 (9 inches by 3/8-inch).
e. BoMetals, Carrollton, GA; No. RCB-638LB (6 inches by 3/8-inch) and No. RCB-938NT (9 inches by 3/8-inch).
f. Dacon Plastics LLC, Jacksonville, TX; No. RCB17 (6 inches by 3/8-inch) and No. RCB18 (9 inches by 3/8-inch).

2.02 WIRE LOOPED PLASTIC WATERSTOP

A. Furnish as alternative to plastic waterstops.

B. Same material and geometry as plastic waterstops.

C. Furnish with continuous galvanized wire looping at edge for convenience in positioning and securing stop in place in forms.

D. Manufacturer and Product: Paul Murphy Plastics, Roseville, MI; “Wire Stop Waterstop;” geometry numbers ACR 6380, ACR 9380, as shown on Paul Murphy Plastics Co. Drawing No. CCP-120-12M.

2.03 HYDROPHILIC WATERSTOP

A. For use at construction joints only, where new concrete is placed against existing concrete and as shown on the Drawings.

B. Material shall be a nonbentonite hydrophilic rubber compound.

C. Manufacturers and Products:

1. Sika Corporation, Lyndhurst, NJ; Hydrotite CJ-1020-2K with Leakmaster LV-1 adhesive and sealant.
2. JP Specialties, Inc., Murrieta, CA; Type NB190 Profile A with Type NB190 Waterstop Paste and NB 190 Waterstop Adhesive sealant.

2.04 BOND BREAKER

A. Tape for Joints: Adhesive-backed glazed butyl or polyethylene tape. Same width as joint that will adhere to premolded joint material or concrete surface.

B. Use bond prevention material as specified in Section 03 30 00, Cast-in-Place Concrete, except where bond breaker tape is specifically called for on the Drawings.

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2.05 PREMOLDED JOINT FILLER

A. Bituminous Type: ASTM D994 or ASTM D1751.

B. Sponge Rubber:

1. Neoprene, closed cell, expanded; ASTM D1056, Type 2C5, with compression deflection, 25 percent deflection (limits), 119 kPa to 168 kPa (17 pounds per square inch to 24 pounds per square inch) minimum. Use in joints for potable and nonpotable water containment structures.
2. Manufacturer and Product: Monmouth Rubber and Plastics, Corp, Long Branch, NJ; Durafoam DK5151.

2.06 ACCESSORIES

A. Joint Sealant: Polyurethane as specified in Section 07 92 00, Joint Sealants.

B. Roofing Felt: ASTM D226, Type II, 30-pound asphalt-saturated or equal weight of ASTM D227 coal-tar saturated felt.

C. Steel Reinforcement: As specified in Section 03 21 00, Steel Reinforcement.

D. Nails: Galvanized, as required for securing premolded joint filler.

E. Galvanized Rebar at Control Joints: ASTM A767/A767M and ASTM A615/A615M Grade 60 prior to galvanizing.

F. Ties for PVC Waterstop: “Hog Rings” or grommets for each edge at 12-inch maximum spacing.

PART 3 EXECUTION

3.01 GENERAL

A. Commence concrete placement after joint preparation is complete.

B. Time Between Concrete Pours: As specified in Section 03 30 00, Cast-in-Place Concrete.

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3.02 SURFACE PREPARATION

A. Construction Joints: Clean concrete surface prior to placement of abutting concrete.

1. Remove laitance and spillage from steel reinforcement and dowels.
2. Roughen surface to minimum of 1/4-inch amplitude:
   a. Sandblast after concrete has fully cured.
   b. Water blast after concrete has partially cured.
   c. Green cut fresh concrete with high-pressure water and hand tools.
3. If present in joint, do not damage waterstop.

B. Contraction Joint:

1. Coat concrete surfaces above and below plastic waterstop with bond breaker.
2. If present in joint, do not damage or coat waterstop.

C. Construction Joint with Hydrophilic Waterstop:

1. Follow hydrophilic waterstop manufacturer’s written instructions.
2. Concrete surface along which waterstop will be installed must be smooth, clean, and dry. Grind concrete as required.
3. Clean debris, dirt, dust, and foreign material from concrete and waterstop surfaces.

3.03 INSTALLATION OF WATERSTOPS

A. General:

1. Continuous waterstop shall be installed in all construction joints in walls and slabs of liquid-containing basins and channels and in walls of belowgrade structures, unless specifically noted otherwise.
2. Join waterstop at intersections to provide continuous seal.
3. Center waterstop on joint.
4. Secure waterstop in correct position. Tie waterstop to steel reinforcement using grommets, “Hog Rings,” or tiewire at maximum spacing of 12 inches. Do not displace waterstop during concrete placement.
5. Repair or replace damaged waterstop.
6. Place concrete and vibrate to obtain impervious concrete in vicinity of joints.

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7. Joints in Footings and Slabs:
    a. Ensure that space beneath horizontal waterstop is completely filled with concrete.
    b. During concrete placement, make visual inspection of waterstop area.
    c. Limit concrete placement to elevation of waterstop in first pass, vibrate concrete under waterstop, lift ribbed waterstop to confirm full consolidation without voids, then place remaining concrete to full height of slab.

B. Plastic (PVC) Waterstops:

1. Install in accordance with manufacturer's written instructions.
2. Splice in accordance with waterstop manufacturer's written instructions using Teflon-coated thermostatically controlled heating iron at approximately 380 degrees F.
    a. Allow at least 10 minutes before new splice is pulled or strained in any way.
    b. Finished splices shall provide cross section that is dense and free of porosity with tensile strength of not less than 80 percent of unspliced materials.
    c. Use only factory made waterstop fabrications for all intersections, changes of directions and transitions.
    d. Field splice permitted only for straight butt welds.
    e. Edge welding not permitted.
    f. Additional splicing defects which are unacceptable and are cause for rejection:
        1) Misalignment of center bulbs and ribs greater than 1/16-inch or where waterstop cross-section is reduced by more than 15 percent.
        2) Charred or burnt material.
3. Wire looped plastic waterstop may be substituted for plastic waterstop.

C. Hydrophilic Waterstop:

1. Install in accordance with manufacturer's written instructions.
2. Provide minimum of 2-1/2 inches of concrete cover over waterstop. When structure has two layers of steel reinforcement, locate centered between layers of steel or as shown.
3. Apply adhesive to concrete surface and allow to dry for specified time before applying waterstop strip.
4. Lap ends of waterstop strip together at splices and corners and join with sealant.

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5. Verify that waterstop is anchored firmly in place before placing concrete. Do not allow vibrator to come into contact with waterstop.
6. Lap hydrophilic waterstop 2 feet minimum with intersecting plastic waterstops.

3.04 JOINT FILLER INSTALLATION

A. Premolded Joint Filler:

1. Sufficient in width to completely fill joint space where shown.
2. Install per manufacturer's written instructions.
3. If waterstop is in joint, cut premolded joint filler to butt tightly against waterstop and concrete face.
4. Precut premolded joint filler to required depth at locations where joint filler or sealant is to be applied.
5. Form cavities for joint filler with either precut, premolded joint filler, or smooth removable accurately shaped material. Entire joint above waterstop, in slabs, shall be formed and removed so that entire space down to waterstop can be filled with the pourable joint filler.
6. Vibrate concrete thoroughly along joint form to produce dense, smooth surface.

B. Bituminous Type Premolded Joint Filler:

1. Drive nails approximately 1 foot 6 inches on center through filler, prior to installing, to provide anchorage embedment into concrete during concrete placement.
2. Secure premolded joint filler in forms before concrete is placed.

3.05 CONTROL JOINT INSTALLATION

A. Locate galvanized steel reinforcement as shown.

B. Install waterstop.

C. Vibrate concrete thoroughly along the joint form to produce a dense, smooth surface. Do not roughen surface.

D. Install bond breaker to concrete surfaces above and below waterstop.

3.06 MANUFACTURER'S SERVICES

A. Provide manufacturer's representative at Site for installation assistance, inspection, and certification of proper installation for products specified.

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3.07 FIELD QUALITY ASSURANCE AND QUALITY CONTROL

A. Owner-Furnished Quality Assurance, in accordance with IBC Chapter 17 requirements, is provided in the Statement of Special Inspections Plan on the Drawings. Contractor responsibilities and related information are included in Section 01 45 33, Special Inspection, Observation, and Testing.

B. Contractor-Furnished Quality Control: Inspection and testing as required in Section 01 45 16.13, Contractor Quality Control.

END OF SECTION

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SECTION 03 21 00
STEEL REINFORCEMENT

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

A. Unless otherwise specified, Work shall conform to requirements of ACI 301, Specifications for Concrete Construction.

B. Unless otherwise specified, requirements of this section shall comply with requirements for corresponding term in ACI 301.

C. Scope: In accordance with 3.1.1 *Scope* of ACI 301.

1.02 REFERENCES

A. Unless otherwise noted, see 1.4 *Referenced standards* of ACI 301 for referenced standards.

B. Additional references include the following:

1. American Concrete Institute (ACI): 301, Specifications for Structural Concrete.
2. International Code Council (ICC): Evaluation Services Report.

1.03 SUBMITTALS

A. Unless specified otherwise, in accordance with 3.1.2 *Submittals* of ACI 301.

B. Action Submittals:

1. Unless otherwise specified, comply with the following before fabrication and execution of Work:
   a. Placing Drawings.
   b. Splices.
   c. Column Dowels.

C. Informational Submittals:

1. Reinforcement mill test results.
2. Mechanical Splicing Systems:
   a. Current ICC Evaluation Services Report or equivalent code agency report listing findings to include acceptance, special inspection requirements, and restrictions.

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b. Manufacturer’s written instructions for storage, handling, and installation.

3. Zinc-Coated (Galvanized) Reinforcement: Written certification in accordance with c1:10.1 of ASTM A767/A767M.
4. Test results of field testing.

PART 2 PRODUCTS

2.01 MATERIALS

A. Unless otherwise specified, in accordance with ACI 301 and the following:

1. Steel Reinforcing Bars:
   a. Conform to ASTM A615/A615M, Grade 60, and the following:
      1) Unless otherwise specified in Contract Documents, steel reinforcing bars shall be deformed.
2. Coated Reinforcing Bars:
   a. Zinc-Coated (Galvanized) Reinforcing Bars: Conform to ASTM A767/A767M.
3. Reinforcement Supports and Spacers:
   a. Plastic Protected Wire Bar Supports: In compliance with ANSI/CRSI – RB 4.1 Class 1 Reinforcement Supports, except provide Class 1A with epoxy-coated or dual-coated reinforcing steel.
   b. Stainless Steel Protected Wire Bar Supports: In compliance with ANSI/CRSI – RB 4.1 Class 2B Reinforcement Supports, except the non-stainless steel portion of the supports shall not extend closer than 3/4 inch from the surface of the concrete.
   c. Precast Cementitious Bar Supports and Spacers:
      1) In compliance with ANSI/CRSI – RB 4.1 Cementitious (Precast) Reinforcement Supports and the following:
         a) Precast cementitious bar supports shall have equal or greater strength than the surrounding concrete.
4. Tie Wire:
   a. Unless Otherwise Specified: Black, soft-annealed 16-gauge wire.
   b. Epoxy-Coated or Dual Coated Reinforcement: Tie wires coated with epoxy or other polymer.
   c. Stainless Steel Reinforcement: Stainless steel or plastic-coated tie wires.
5. Mechanical Splices:
   a. In accordance ACI 301 and following:
      1) Capable of developing reinforcing in tension or compression.
      2) Specific product within system/series shall be certified to comply with ACI 318 Type 2.

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3) Shall be configured such that concrete cover over coupler complies with specified minimum cover for steel reinforcement and maintains position of reinforcement within specified placement tolerances.
4) Manufacturers and Products:
   a) nVent Erico, Solon, OH; Erico CADWELD.
   b) nVent LENTON, Solon, OH; Mechanical Splice System.
   c) Dayton Superior Corporation, Miamisburg, OH; 100 Series through 400 Series.

2.02 FABRICATION

A. Unless otherwise specified, fabrication shall be in accordance ACI 301.

B. Bending:

1. Minimum inside bend diameters are specified in other Contract Documents.
2. Minimum finished bend diameters for reinforcing bars that are galvanized before fabricating shall be equal to or greater than those specified in Table 2 of ASTM A767/A767M.

C. Welding:

1. Steel reinforcement shall not be welded except for the following welded assemblies produced under factory conditions:
   a. Welded wire reinforcement.
   b. Deformed bar anchors.
2. Proceed with Work only after welding Action Submittals have been approved and Informational Submittals have been accepted.

PART 3 EXECUTION

3.01 PLACING

A. Tying Reinforcing Bars:

1. Unless otherwise specified, reinforcing bars shall be tied as required to maintain position of reinforcing bars within specified tolerances, after concrete has been placed.
2. Tie every other intersection on mats of reinforcing steel made up of No. 3, No. 4, No. 5, and No. 6 bars.

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B. Reinforcement Around Openings: Unless otherwise specified, provide one half the equivalent area of reinforcing bars interrupted by opening and penetration, on each side, above, and below openings and penetrations. Extend reinforcing bars lap length beyond opening at each end, which shall be calculated based on the minimum net spacing between typical and additional reinforcement.

C. Reinforcement Supports and Spacers:

1. Install reinforcement in accordance ACI 301 and the following:
    a. Bar supports and spacers shall have sufficient strength and stiffness to carry loads without failure, displacement, or significant deformation. Space bar supports so minimum concrete cover is maintained for reinforcing between supports, and location of reinforcement remains within tolerance throughout work.
    b. Bar supports and spacers in contact with waterproofing barrier or vapor barrier, shall not damage barrier system.
    c. Place reinforcement supported from ground or mud mat on precast cementitious reinforcement supports.
    d. Place zinc-coated (galvanized) reinforcement supported from formwork on wire reinforcement supports that unless otherwise specified, are galvanized or coated with dielectric material. Zinc-coated reinforcement may be supported from formwork on supports made of dielectric material, provided concrete surface satisfies both of the following:
        1) Not exposed to moisture.
        2) Not exposed to view in finished construction regardless of whether surface is specified to receive paint or coating.
    e. Reinforcement and embedded steel items used with zinc-coated (galvanized) reinforcement shall be zinc-coated (galvanized) or coated with non-metallic materials.
    f. Bar Supports and Spacers in Contact with Forms: Unless otherwise specified, bar supports shall be plastic protected wire bar supports, stainless steel protected wire bar supports, or precast concrete bar supports.
        1) Unless otherwise specified, use Class 1 bar supports.
            a) Use Class 1A to support epoxy-coated and dual-coated reinforcing steel.
        2) Use stainless steel protected wire bar supports or precast concrete bar supports at formed surfaces that will be exposed to view in finished construction regardless of whether surface is specified to receive paint or coating.
        3) Use stainless steel protected wire bar supports or precast concrete bar supports at formed surfaces that will receive abrasive blasting, hydro-blasting, or grinding.

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D. Lap Splices, Mechanical Splices, and Development of Reinforcement:

1. In accordance with ACI 301 and the following:
   a. Lap Splice Lengths and Development Lengths of Reinforcing Bars: Refer to other Contract Documents for additional information and requirements.
   b. Stagger splices in adjacent bars where indicated.
   c. Mechanical Splices:
      1) Provide mechanical splices where shown on the Drawings.
      2) Install assembly in accordance with manufacturer's written instructions and in accordance with ICC Evaluation Services Report or equivalent code agency report.

E. Field Bending or Straightening:

1. Unless otherwise specified, steel reinforcement shall not be field bent or straightened.
2. Where field bending and straightening is specified in the Contract Documents, field bending and straightening may be performed only once per reinforcing bar and shall be in accordance with ACI 301.
3. Unless otherwise specified, bend diameters shall comply with ACI 301.

F. Reinforcement through Movement Joints:

1. In accordance with ACI 301 and the following:
   a. Movement joints include expansion joints and contraction joints.
   b. Smooth dowels may continue through movement joints when unbonded on one side of joint.

G. Where reinforcement does not extend through a joint, terminate reinforcement 2 inches from face of joint.

3.02 FIELD QUALITY ASSURANCE AND QUALITY CONTROL

A. Owner-Furnished Quality Assurance, in accordance with IBC Chapter 17 requirements, is provided in the Statement of Special Inspections Plan on the Drawings. The Contractor responsibilities and related information are included in Section 01 45 33, Special Inspection, Observation, and Testing.

B. Contractor-Furnished Quality Control: Inspection and testing as required in Section 01 45 16.13, Contractor Quality Control.

END OF SECTION

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SECTION 03 30 00
CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards that may be referenced in this section:

1. American Concrete Institute (ACI):
   a. 117, Specification for Tolerances for Concrete Construction and Materials.
   b. 301, Specifications for Structural Concrete.
   c. 305.1, Specification for Hot Weather Concreting.
   d. 306.1, Standard Specification for Cold Weather Concreting.
   e. 350.1, Specification for Tightness Testing of Environmental Engineering Concrete Containment Structures.
   f. CP-1, Technical Workbook for ACI Certification of Concrete Field Testing Technician – Grade 1.
2. ASTM International (ASTM):
   a. C31/C31M, Standard Practice for Making and Curing Concrete Test Specimens in the Field.
   b. C33/C33M, Standard Specification for Concrete Aggregates.
   c. C39/C39M, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
   d. C94/C94M, Standard Specification for Ready-Mixed Concrete.
   e. C109/C109M, Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens).
   f. C143/C143M, Standard Test Method for Slump of Hydraulic-Cement Concrete.
   g. C150/C150M, Standard Specification for Portland Cement.
   h. C157/C157M, Standard Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete.
   i. C227, Standard Test Method for Potential Alkali Reactivity of Cement-Aggregate Combinations (Mortar-Bar Method).
   j. C231/C231M, Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
   k. C260/C260M, Standard Specification for Air-Entraining Admixtures for Concrete.
   l. C494/C494M, Standard Specification for Chemical Admixtures for Concrete.
   m. C595/C595M, Standard Specification for Blended Hydraulic Cements.

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n. C618, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
o. C881/C881M, Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.
p. C979/C979M, Standard Specification for Pigments for Integrally Colored Concrete.
q. C989, Standard Specification for Slag Cement for Use in Concrete and Mortars.
r. C1012/C1012M, Standard Test Method for Length Change of Hydraulic-Cement Mortars Exposed to a Sulfate Solution.
s. C1017/C1017M, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
t. C1074, Standard Practice for Estimating Concrete Strength by the Maturity Method.
u. C1077, Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation.
v. C1218/C1218M, Standard Test Method for Water-Soluble Chloride in Mortar and Concrete.
w. C1240, Standard Specification for Silica Fume Used in Cementitious Mixtures.
x. C1260, Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method).
y. C1293, Standard Test Method for Determination of Length Change of Concrete Due to Alkali-Silica Reaction.
z. C1567, Standard Test Method for Determining the Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregate (Accelerated Mortar-Bar Method).
aa. C1582/C1582M, Standard Specification for Admixtures to Inhibit Chloride-Induced Corrosion of Reinforcing Steel in Concrete.
bb. C1602/C1602M, Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete.
cc. D4580, Standard Practice for Measuring Delaminations in Concrete Bridge Decks by Sounding.
dd. E329, Standard Specification for Agencies Engaged in Construction Inspection, Special Inspection, or Testing Materials Used in Construction.

3. National Ready Mixed Concrete Association (NRMCA).

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1.02 DEFINITIONS

A. Basin Train: Series of interconnected basins that operate as a unit with same water level.

B. Cold Weather: When ambient temperature is below 40 degrees F or is approaching 40 degrees F and falling.

C. Contractor's Licensed Design Engineer: Individual representing Contractor who is licensed to practice engineering as defined by statutory requirements of professional licensing laws in state or jurisdiction in which Project is to be constructed.

D. Defective Area: Surface defects that include honeycomb, rock pockets, indentations, and surface voids greater than 3/16-inch deep, surface voids greater than 3/4 inch in diameter, cracks in liquid containment structures and below grade habitable spaces with visible leakage or that are 0.005-inch wide and wider, and cracks in other structures that are 0.010-inch wide and wider, spalls, chips, embedded debris, sand streaks, mortar leakage from form joints, deviations in formed surface that exceed specified tolerances and include but are not limited to fins, form pop-outs, and other projections. At exposed concrete, defective areas also include texture irregularities, stains, and other color variations that cannot be removed by cleaning.

E. Exposed Concrete: Concrete surface that can be seen inside or outside of structure regardless of whether concrete is above water, dry at all times, or can be seen when structure is drained. Surfaces must be considered exposed concrete, even if covered by paint, sealers, or similar applications.

F. Hot Weather: As defined in ACI 305.1.

G. Hydraulic Structure: Liquid containment structure.

H. Mass Concrete:

1. Concrete sections with a minimum specified dimension that is equal to or greater than 3 feet 0 inches.
2. Concrete sections with a minimum specified dimension that is equal to or greater than 2 feet 0 inches, and concrete mixture includes an accelerating admixture.

I. New Concrete: Less than 60 days old.

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1.03 SUBMITTALS

A. Action Submittals:

1. Mix Designs:
   a. Contain proportions of materials and admixtures to be used on Project, signed by mix designer.
   b. Documentation of average strength for each proposed mix design in accordance with ACI 301.
   c. Manufacturer's certificate of compliance, in accordance with Section 01 61 00, Common Product Requirements, for the following:
      1) Portland cement.
      2) Fly ash.
      3) Slag cement.
      4) Aggregates, including specified class designation for coarse aggregate.
      5) Admixtures.
      6) Concrete producer has verified compatibility of constituent materials in design mix.
   d. Test Reports:
      1) Water-soluble Chloride-ion Content in Hardened Concrete:
         a) One of the following:
            (1) Test report in accordance with ASTM C1218/C1218M at an age between 28 days and 42 days.
            (2) Calculation of water-soluble chloride content based on certified chloride content of each constituent material and proportion of constituent material in concrete mixture.
            (3) All of the following:
               (a) Manufacturer's certificate of compliance that each admixture does not intentionally add chlorides and/or that the chloride content of each admixture does not exceed trace amounts.
               (b) Verification that potable water is used in the concrete mix or test data documenting the chloride content of the water.
               (c) Letter from the concrete supplier stating that fine and coarse aggregates are from sources that are not known to be susceptible to chlorides in the aggregates.

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(4) Shrinkage Test Results: In accordance with ASTM C157/C157M as modified herein.
(5) Alkali Aggregate Reactivity: Aggregate shall be classified as nonpotentially reactive in accordance with Article Concrete Mix Design. Include documentation of test results per applicable standards.

e. Aggregates:
1) Percent of fine aggregate weight to total aggregate weight.
2) Deleterious substances in fine aggregate per ASTM C33/C33M, Table 2.
3) Deleterious substances in coarse aggregate per ASTM C33/C33M, Table 4.

f. Admixtures: Manufacturer's catalog cut sheets and product data sheets for each admixture used in proposed mix designs.

2. Product Data: Specified ancillary materials.
3. Detailed plan for curing and protection of concrete placed and cured in cold weather. Details shall include, but not be limited to, the following:
a. Procedures for protecting subgrade from frost and accumulation of ice or snow on reinforcement, other metallic embeds, and forms prior to placement.
b. Procedures for measuring and recording temperatures of reinforcement and other embedded items prior to concrete placement.
c. Methods for temperature protection during placement.
d. Types of covering, insulation, housing, or heating to be provided.
e. Curing methods to be used during and following protection period.
f. Use of strength accelerating admixtures.
g. Methods for verification of in-place strength.
h. Procedures for measuring and recording concrete temperatures.
i. Procedures for preventing drying during dry, windy conditions.
4. Detailed plan for hot weather placements, including curing and protection for concrete placed in ambient temperatures over 80 degrees F. Plan shall include, but not be limited to, the following:
a. Procedures for measuring, and recording temperatures of reinforcement and other embedded items prior to concrete placement.
b. Use of retarding admixture.
c. Methods for controlling temperature of reinforcement and other embedded items and concrete materials before and during placement.
d. Types of shading and wind protection to be provided.
e. Curing methods, including use of evaporation retardant.

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f. Procedures for measuring and recording concrete temperatures.
g. Procedures for preventing drying during dry, windy conditions.

B. Informational Submittals:

1. Preinstallation Conference minutes.
2. Manufacturer's application instructions for bonding agent and bond breaker.
3. Statement of Qualification:
   a. Batch Plant: Certification as specified herein.
   b. Mix designer.
   c. Installer.
   d. Testing agency.
4. Field test reports.
5. Thermal Control Plan: For mass concrete sections in accordance with ACI 301.
6. Recorded temperature data from concrete placement where specified.
7. Liquid tightness test results.
8. Concrete Delivery Tickets:
   a. For each batch of concrete before unloading at Site.
   b. In accordance with ASTM C94/C94M, including requirements 14.2.1. through 14.2.10.
   c. Indicate amount of mixing water withheld and maximum amount that may be permitted to be added at Site.

1.04 QUALITY ASSURANCE

A. Concrete construction shall conform to requirements of ACI 117 and ACI 301, except as modified herein.

B. Qualifications:

1. Batch Plant: NRMCA Program for Certification of Ready-Mixed Concrete Production Facilities or approved equivalent program.
2. Mix Designer: Person responsible for developing concrete mixture proportions certified as NRMCA Concrete Technologist Level 2 or DOT certified mix designer in jurisdiction of the Work. Requirement may be waived if individual is Contractor's Licensed Design Engineer.
3. Testing Agency: Unless otherwise permitted, an independent agency, qualified according to ASTM C1077 and ASTM E329 for testing indicated.
   a. Where field testing is required of Contractor, personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.

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b. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.

C. Thermal Control Plan:

1. Include the following minimum requirements:
   a. Calculated or measured adiabatic temperature rise of concrete.
   b. Upper limit for concrete temperature at time of placement.
   c. Description of specific measures and equipment that will be used to ensure maximum temperature in placement will not exceed specified maximum temperature limit.
   d. Calculated maximum temperature in placement based on expected conditions at time of placement and use of proposed measures to control temperatures.
   e. Description of specific measures and equipment that will be used to ensure temperature difference will not exceed specified temperature difference limit.
   f. Calculated maximum temperature difference in placement based on expected conditions at time of placement and use of proposed measures to control temperature differences.
   g. Description of equipment and procedures that will be used to monitor and log temperatures and temperature differences.
   h. Drawing showing locations for temperature sensors in placement.
   i. Description of format and frequency of providing temperature data to Engineer.
   j. Description of measures to address and reduce excessive temperatures and temperature differences if they occur.
   k. Description of curing procedures, including materials and methods, and curing duration.
   l. Description of formwork removal procedures to ensure temperature difference at temporarily exposed surface will not exceed temperature difference limit, and how curing will be maintained.
   m. Alternate temperature limits when permitted by Engineer.
      1) Determination of alternate temperature limits shall be based on detailed thermal and crack analyses.
      2) Analyses shall be stamped by Contractor’s Licensed Design Engineer.
   n. If concrete design mixture is changed, thermal control plan must be updated.

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D. Mockup Panels:

1. Construct in accordance with requirements of Contract Documents to demonstrate wall finish Type W-9.
   a. Dimensions: 10 feet by 8 feet, minimum.
2. Before concrete work starts, construct panels with specified materials, forming systems, reinforcing details, and leakage prevention techniques.
3. Show architectural details, joints, form ties, reveals, and rebar spacers to produce finished surface required.
4. Test form release agent on one mockup panel to ensure no adverse effects are caused on form or form liner materials.
5. Surface finish and color shall be uniform in appearance to Samples.
6. Approved panels shall establish standards of quality by which Work will be judged.
7. Replace panels if not representative of Work as specified.
8. Panels may be incorporated into Work if approved by Engineer.

E. Preinstallation Conference:

1. Required Meeting Attendees:
   a. Contractor, including pumping, placing, and finishing, and curing subcontractors.
   b. Ready-mix producer.
   c. Admixture representative.
   d. Testing and sampling personnel.
   e. Engineer who authored Statement of Special Inspection Plan or Engineer’s designee.
2. Schedule and conduct prior to incorporation of respective products into Project. Notify Engineer of location and time.
3. Agenda shall include:
   a. Admixture types, dosage, performance, and redosing at Site.
   b. Mix designs, test of mixes, and Submittals.
   c. Placement methods, techniques, equipment, consolidation, and form pressures.
   d. Slump and placement time to maintain slump.
   e. Finish, curing, and water retention.
   f. Thermal control plan.
   g. Protection procedures for weather conditions.
   h. Other specified requirements requiring coordination.
4. Conference minutes as specified in Section 01 31 19, Project Meetings.

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PART 2 PRODUCTS

2.01 MATERIALS

A. Cementitious Materials:

1. Cement:
   a. Portland Cement: Unless otherwise specified, conform to requirements of ASTM C150/C150M.
   b. Blended Hydraulic Cement:
      1) Unless otherwise specified, conform to requirements of ASTM C595/C595M.
      2) Portland cement used in blended hydraulic cement, conform to requirements of ASTM C150/C150M.
   c. Furnish from one source.
2. Supplementary Cementitious Materials (SCM):
   a. Fly Ash (Pozzolan):
      1) Class F fly ash in accordance with ASTM C618, except as modified herein:
         a) Shall not be produced from process that has utilized hazardous or potentially hazardous materials.
         b) ASTM C618, Table 1, Loss on Ignition: Unless permitted otherwise, maximum 3 percent.
   b. Slag Cement: In accordance with ASTM C989, Grade 100 or Grade 120.
      1) Shall not be produced from process that has utilized hazardous or potentially hazardous materials.

B. Aggregates:

1. Unless otherwise permitted, furnish from one source for each aggregate type used in a mix design.
2. In accordance with ACI 301, except as modified herein.
3. Free of materials and aggregate types causing popouts, discoloration, staining, or other defects on surface of concrete.
4. Resistant to Alkali Silica Reactivity: See Article Concrete Mix Design.
5. Coarse Aggregate:
   a. Combination of gravels and crushed gravels, crushed stone, or combination of these materials containing no more than 15 percent flat or elongated particles (long dimension more than five times the short dimension).
   b. Limit deleterious substances in accordance with ASTM C33/C33M, Table 4 for specified class designation.
   c. Class designation in accordance with ASTM C33, Table 3: 4S unless otherwise specified.

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6. Fine Aggregates:
    a. Clean, sharp, natural sand.
    b. Limit deleterious substances in accordance with ASTM C33/C33M, Table 2 and as follows:
        1) Limit material finer than 75-µm (No. 200) sieve to 5 percent mass of total sample.
        2) Limit coal and lignite to 1.0 percent.

C. Admixtures:

1. Characteristics:
    a. Compatible with other constituents in mix.
    b. Contain at most, only trace amount chlorides in solution.
    c. Do not use admixtures known to be toxic after concrete is 30 days.
    d. Furnish type of admixture as recommended by manufacturer for anticipated temperature ranges.
2. Air-Entraining Admixture: ASTM C260/C260M.
3. Water-Reducing Admixture: ASTM C494/C494M, Type A or Type D.
4. Retarding Admixture: ASTM C494/C494M, Type B.
5. Accelerating Admixture: ASTM C494/C494M, Type C.
6. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F or Type G.
7. Shrinkage Reducing Admixture:
    a. Manufacturers and Products:
        1) Euclid Chemical Co., Cleveland, OH; Eucon SRA Series.
        2) GCP Applied Technologies, Alpharetta, GA; Eclipse Series.
8. Do not use calcium chloride as an admixture.
9. Admixtures with no standard, ASTM or other, designation may be used where permitted.

D. Water and Ice: Mixing water for concrete and water used to make ice shall be potable water, unless alternative sources of water are permitted.

1. Water from alternative sources shall comply with requirements of ASTM C1602/C1602M, and concentration of chemicals in combined mixing water shall be less than:
    a. Chloride Content: 1,000 ppm.
    b. Sulfate Content as SO4: 3,000 ppm.
    c. Alkalis as (Na2O + 0.658 K2O): 600 ppm.
    d. Total Solids by Mass: Less than 50,000 ppm.

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2.02 ANCILLARY MATERIALS

A. Bonding Agent:

1. Unless otherwise specified, in accordance with the following:
   a. ASTM C881/C881M, Type V.
   b. Two-component, moisture insensitive, 100 percent solids epoxy.
   c. Consult manufacturer for surface finish, pot life, set time, vertical or horizontal application, and forming restrictions.
   d. Manufacturers and Products:
      1) Euclid Chemical Co., Cleveland, OH; Euco # 352 Epoxy System LV.
      2) Prime Resins, Conyers, GA; Prime Bond 3000 to 3900 Series.
      3) Sika Chemical Corp., Lyndhurst, NJ; Sikadur 32 Hi-Mod.

B. Bond Breaker:

1. Nonstaining type, providing positive bond prevention.
2. Manufacturers and Products:
   a. Dayton Superior Corporation, Miamisburg, OH; Sure Lift J6WB.
   b. Nox-Crete Products Group, Omaha, NE; Silcoseal Select.

C. Repair Material:

1. In accordance with requirements of Section 03 01 32, Repair of Vertical and Overhead Concrete Surfaces.
2. In accordance with requirements of Section 03 01 33, Repair of Horizontal Concrete Surfaces.

D. Crack Repair: In accordance with requirements of Section 03 64 23, Epoxy Resin Injection Grouting, and Section 03 64 24, Polyurethane Injection Grouting.

2.03 CONCRETE MIX DESIGN

A. General:

1. See Supplement at the end of this section for mix design requirements for each class of concrete used on Project.
2. Prepare design mixtures for each type and strength of concrete, selecting and proportioning ingredients in accordance with requirements of ACI 301, unless otherwise specified.
3. Selection of constituent materials and products in mix design are optional, unless specified otherwise.

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4. Unless otherwise permitted, use water-reducing admixture or water-reducing admixture and high-range, water-reducing admixture in pumped concrete, in concrete with a water-cementitious materials ratio below 0.50, and in concrete that is part of a liquid-containment structure.
5. Unless otherwise permitted, use water-reducing admixture and high-range, water-reducing admixture in columns, piers, pilasters, and walls.
6. Use water-reducing admixture or high-range, water-reducing admixture to achieve fresh properties that facilitate handling, placing, and consolidating of concrete, and specified hardened properties.
7. Use water-reducing and retarding admixture when anticipated high temperatures, low humidity, or other adverse placement conditions can adversely affect fresh properties of concrete.
8. Unless otherwise specified, desired fresh properties of concrete shall be determined by Contractor, and coordinated with concrete producer. Fresh properties of concrete shall remain stable to satisfaction of Contractor, for duration of placement and consolidation, and shall remain in conformance with requirements of Contract Documents.
9. Contractor is encouraged to consider using environmentally sustainable concrete mix design technologies such as use of supplementary cementitious materials and aggregate packing.

B. Potential Alkali-aggregate Reactivity of Concrete:

1. Do not use aggregates known to be susceptible to alkali-carbonate reaction (ACR).
2. Aggregates shall have been tested to determine potential alkali-aggregate reactivity in concrete in accordance with ASTM C1260 or ASTM C1567.
    a. Aggregates that indicate expansion greater than 0.10 percent at 16 days after casting shall not be used unless they have been shown to be nondeleteriously reactive in accordance with ASTM C227 or ASTM C1293, with less than 0.04 percent expansion at 1 year for cement-aggregate combinations or less than 0.04 percent expansion at 2 years for combinations with pozzolan or slag.
    b. Alkali content of cement used in proposed concrete mixture shall not be greater than alkali content of cement used in test for potential alkali-aggregate reactivity.
    c. Use low-alkali cement or incorporate pozzolans into concrete mixture as necessary to satisfy testing for potential alkali reactivity.

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C. Proportions:

1. Design mix to meet aesthetic, durability, and strength requirements.
2. Where fly ash is included in mix, minimum fly ash content shall be a minimum of 15 percent of weight of total cementitious materials.

D. Concrete Shrinkage Limits:

1. Where shrinkage limits are specified, design mix for following shrinkage limits and test in accordance with ASTM C157/C157M, with the following modifications:
   a. Prisms shall be moist cured for 7 days prior to 28-day drying period.
   b. Comparator reading at end of 7-day moist cure shall be used as initial length in length change calculation.
   c. Reported results shall be average of three prisms.
   d. If shrinkage of a specimen departs from average of that test age by more than 0.004 percent, disregard results obtained from that specimen.
   e. Unless otherwise specified, results at end of 28-day drying period shall not exceed 0.040 percent if 3-inch prisms are used, or exceed 0.038 percent if 4-inch prisms are used. Aggregate will be rejected if test values exceed these limits.

E. Slump Range at Site:

1. Prior to submitting mix design, consult with concrete producer and select a target slump value at point of delivery, for each application of each design mix. Unless otherwise permitted, target slump value will then be enforced for duration of Project.
2. Design mixes that include a high-range, water-reducing admixture shall have a minimum slump of 2 inches prior to addition of admixture. Unless otherwise permitted, slump shall be 8 inches maximum at point of delivery, for concrete with a high-range, water-reducing admixture.
3. Slump tolerance shall meet requirements of ACI 117.

F. Combined Aggregate Gradation:

1. Combined Gradation Limits: Fine aggregate shall be in range of 36 percent to 40 percent of total aggregate weight.

2.04 CONCRETE MIXING

A. General: Unless otherwise specified, in accordance with ACI 301.

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2.05 TEMPERATURE LIMITS

A. For mass concrete, and unless otherwise permitted, provide documentation that maximum concrete temperature in structure will not exceed 160 degrees F, and maximum temperature differential between center of section and external surfaces of concrete will not exceed 35 degrees F.

2.06 SOURCE QUALITY CONTROL

A. Source Quality Control Inspection: Engineer shall have access to and have right to inspect batch plants, cement mills, and supply facilities of suppliers, manufacturers, and Subcontractors, providing products included in this section.

PART 3 EXECUTION

3.01 GENERAL

A. Unless otherwise specified, in accordance with ACI 301.

3.02 PLACING CONCRETE

A. Preparation: In accordance with ACI 301, except as modified herein.

B. Inspection: Notify Engineer and Special Inspector at least 1 full working day in advance before starting to place concrete.

C. Placement into Formwork:

1. Where vapor retarder or barrier is required, coordinate subgrade preparation with requirements in Division 07, Thermal and Moisture Protection, of the Specifications.
2. Reinforcement: Secure in position before placing concrete.
3. Placement frequency shall be such that lift lines will not be visible in exposed concrete finishes.
4. Use placement devices as required to prevent segregation.
5. Trowel and round off top exposed edges of walls with 1/4-inch radius steel edging tool.
6. Cure concrete as specified in Section 03 39 00, Concrete Curing.

D. Retempering: Not permitted for concrete where cement has partially hydrated.

E. Pumping of Concrete: Provide standby pump, conveyor system, crane and concrete bucket, or other system onsite during pumping, for adequate redundancy to ensure completion of concrete placement without cold joints in case of primary placing equipment breakdown.

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F. Mass Concrete:

1. Cure and protect concrete in accordance with accepted thermal control plan and as follow:
   a. Minimum curing period shall be 14 days.
   b. Unless otherwise permitted, preserve moisture by maintaining forms in place.
2. Strength measurement shall be representative of in-place concrete within 2 inches of concrete surface.
3. Concrete strength shall be verified through correlation of concrete temperature and compressive strengths established by cylinder compressive tests and in accordance with ASTM C1074.
4. Unless otherwise specified, control concrete temperatures to within specified limits from time concrete is placed until time internal temperature has cooled from its maximum, such that difference between average daily ambient and maximum internal concrete temperature at time of protection removal, is less than specified temperature difference limit.
5. Unless otherwise specified, place one temperature sensor at center of mass of placement and one temperature sensor at a depth 2 inches from center of nearest exterior surface. Place additional sensor at each location to serve as a backup in event that other temperature sensor fails. In addition, provide temperature sensor in shaded location for monitoring ambient onsite temperature.
   a. Unless otherwise specified, monitor temperatures hourly using electronic sensors capable of measuring temperature from 32 degrees F to 212 degrees F to an accuracy of 2 degrees F.
   b. Ensure temperature sensors are operational before placing concrete.
   c. Unless otherwise specified, provide daily data from sensors to Engineer to show requirements are met.
   d. Compare temperatures and temperature differences with maximum limits specified in Article Temperature Limits every 12 hours, unless otherwise permitted. If either exceeds specified limits, take immediate action as described in accepted thermal control plan to remedy situation. Do not place additional mass concrete until cause of excessive temperature or temperature difference has been identified and corrections are accepted.

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G. Maximum Size of Concrete Placements:

1. Locate expansion, control, and contraction joints where shown on the Drawings.
2. Construction Joints:
   a. Locate construction joints as follows:
      1) Where approved in joint location submittal required in Section 03 15 00, Concrete Joints and Accessories.
3. Consider beams, girders, brackets, column capitals, and haunches as part of floor or roof system and place monolithically with floor or roof system.
4. Should placement sequence result in cold joint located below finished water surface, install waterstop in joint.

H. Consolidation and Visual Observation:

1. Consolidation Equipment and Methods: ACI 301.
2. Provide at least one standby vibrator in operable condition at Site prior to placing concrete.

I. Hot Weather:

1. Prepare ingredients, mix, place, cure, and protect in accordance with ACI 301, ACI 305.1, and as follows:
   a. Maintain concrete temperature below 85 degrees F at time of placement, or furnish test data or other proof that admixtures and mix ingredients do not produce flash set plastic shrinkage, or cracking as a result of heat of hydration. Cool ingredients before mixing to maintain fresh concrete temperatures as specified or less.
   b. Provide for windbreaks, shading, fog spraying, sprinkling, ice, wet cover, or other means as necessary to maintain concrete at or below specified temperature.
2. Concrete Curing: As specified in Section 03 39 00, Concrete Curing.

J. Cold Weather Placement:

1. Unless otherwise permitted, shall be in accordance with requirements of ACI 306.1 and as follows:
   a. Cold weather requirements shall apply when ambient temperature is below 40 degrees F or approaching 40 degrees F and falling.
   b. Do not place concrete over frozen earth or against surfaces with frost or ice present. Frozen earth shall be thawed to acceptance of Engineer.

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c. Unless otherwise permitted, do not place concrete in contact with surfaces less than 35 degrees F; requirement is applicable to all surfaces including reinforcement and other embedded items.
d. Provide supplemental external heat as needed when other means of thermal protection are unable to maintain minimum surface temperature of concrete as specified in ACI 306.1.
e. Maintain minimum surface temperature of concrete as specified in ACI 306.1 for no less than 3 days during cold weather conditions.
f. Cure concrete as specified in Section 03 39 00, Concrete Curing.
1) Protect concrete from freezing until end of curing period and until concrete has attained a compressive strength of 3,500 psi or design compressive strength if less than 3,500 psi.

2. Provide maximum and minimum temperature sensors placed on concrete surfaces spaced throughout Work to allow monitoring of concrete surface temperatures representative of Work. Unless otherwise permitted, record surface temperature of concrete at least once every 12 hours during specified curing period.
3. External Heating Units: Do not exhaust heater flue gases directly into enclosed area as it causes concrete carbonation as a result of concentrated carbon dioxide.
4. Maintain curing conditions as specified in Section 03 39 00, Concrete Curing.

3.03 CONCRETE BONDING

A. Construction Joints in New Concrete Members: Prepare surface of construction joint as specified in Section 03 15 00, Concrete Joints and Accessories.

B. Construction Joints at Existing Concrete:

1. Thoroughly clean and mechanically roughen existing concrete surfaces to roughness profile of 1/4 inch.
2. Saturate surface with water for 24 hours prior to placing new concrete.

3.04 REPAIRING CONCRETE

A. General:

1. Inject cracks that leak with crack repair epoxy as specified in Section 03 64 23, Epoxy Resin Injection Grouting, and Section 03 64 23, Polyurethane Injection Grouting.
2. Repair defective areas of concrete.
3. Repair horizontal concrete surfaces in accordance with Section 03 01 33, Repair of Horizontal Concrete Surfaces.

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4. Repair vertical and overhead concrete surfaces in accordance with Section 03 01 32, Repair of Vertical and Overhead Concrete Surfaces.
5. Develop repair techniques with material manufacturer on surface that will not be visible in final construction prior to starting actual repair work and show how finish color will blend with adjacent surfaces. Obtain approval from Engineer.
6. Obtain quantities of repair material and manufacturer's detailed instructions for use to provide repair with finish to match adjacent surface or apply sufficient repair material adjacent to repair to blend finish appearance.
7. Repair of concrete shall provide structurally sound surface finish, uniform in appearance or upgrade finish by other means until acceptable to Engineer.

B. Tie Holes: Unless otherwise specified, fill with specified repair material.

1. Prepare substrate and mix, place, and cure repair material per manufacturer's written recommendations.

C. Alternate Form Ties, Through-Bolts:

1. Mechanically roughen entire interior surface of through hole.
2. Apply bonding agent to roughened surface and drive elastic vinyl plug to half depth.
3. Dry pack entire hole from both sides of plug with nonshrink grout, as specified in Section 03 62 00, Grouting.
4. Use only enough water to dry pack grout.
5. Dry pack while bonding agent is still tacky.
6. If bonding agent has dried, remove bonding agent by mechanical means and reapply new coat of bonding agent.
7. Compact grout using steel hammer and steel tool to drive grout to high density.
8. Cure grout with water.

D. Exposed Metal Objects:

1. Remove metal objects not intended to be exposed in as-built condition of structure including wire, nails, and bolts, by chipping back concrete to depth of 1 inch and then cutting or removing metal object.
2. Repair area of chipped-out concrete as specified for defective areas.

E. Blockouts at Pipes or Other Penetrations: Where shown install in accordance with requirements of the Drawings.

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3.05 CONCRETE WALL FINISHES

A. Type W-1 (Ordinary Wall Finish):

1. Patch tie holes.
2. Remove projections.
3. Repair defective areas.
4. Inject cracks.

B. Type W-2 (Smooth Wall Finish):

1. Patch tie holes.
2. Grind off fins and other projections.
3. Repair defective areas to provide smooth uniform appearance.
4. Inject cracks.

C. Type W-5 (Finish for Painting):

1. In accordance with requirements for Type W-2 except as follows:
   a. Leave surface ready for painting as specified in Section 09 90 00, Painting and Coating.

D. Type W-9 (Grout Cleaned Wall Finish):

1. Begin cleaning operations after contiguous surfaces are completed and accessible. Do not clean surfaces as adjacent work progresses.
2. Grout: Mixed with one-part portland cement and one and one half parts fine sand and bonding agent to produce grout with consistency of thick paint. White portland cement shall be substituted for part of gray portland cement in order to produce color matching color of surrounding concrete, as determined by trial patch.
3. Wet surface of concrete sufficiently to prevent absorption of water from grout and apply grout uniformly with brushes or spray gun.
4. Immediately after applying grout, scrub surface vigorously with cork float or stone to coat surface and fill air bubbles and holes.
5. While grout is still plastic, remove excess grout by working surface with rubber float, burlap, or other means. After surface whitens from drying, about 30 minutes at 70 degrees F, rub vigorously with clean burlap. Continue to water cure wall until curing period of 7 days is complete.
6. Latex bonding admixture may be used.

E. Type W-11 (Abrasive Blast Wall Finish):

1. Repair cracks before abrasive blasting.
2. Perform abrasive blasting on concrete surfaces in same area of view, at same time, to obtain uniformity of appearance.

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3. Same person shall accomplish sandblasting on one structure and on concrete in same area.
4. Perform abrasive blasting to match approved mockup panel.
5. Abrasive: Use clean silica sand, free of foreign materials, and supplied in sealed sacks.
6. When specified, begin abrasive blasting to expose aggregate when concrete has a compressive strength of at least 2,000 psi and after safe removal of forms and supports. Blast to match mockup. Achieve degree of abrasive blasting as specified in Contract Documents:
   a. Brush: Dull surface sheen.
   b. Light: Exposure of fine aggregate.
   c. Medium: Coarse aggregate exposure.
   d. Heavy: Coarse aggregate revealed.
7. When abrasive grits contain free water for dust abatement, wash abrasive blasting debris off finished wall surface before drying occurs.

3.06 CONCRETE SLAB FINISHES

A. General:

1. Use manual screeds, vibrating screeds, or roller compacting screeds to place concrete level and smooth.
2. Do not use “jitterbugs” or other special tools designed for purpose of forcing coarse aggregate away from surface and allowing layer of mortar, which will be weak and cause surface cracks or delamination, to accumulate.
3. Finish slab in accordance with specified slab finish.
4. Do not dust surfaces with dry materials nor add water to surfaces.
5. Cure concrete as specified in Section 03 39 00, Concrete Curing.

B. Type S-1 (Steel Troweled Finish):

1. Finish by screeding and floating with straightedges to bring surfaces to required finish elevation.
2. Wood float to true, even plane with no coarse aggregate visible.
3. Use sufficient pressure on wood floats to bring moisture to surface.
4. After surface moisture has disappeared, hand steel trowel concrete to produce smooth, smooth dense surface, free from trowel marks.
5. Provide light steel-troweled finish (two trowelings) at air-entrained slabs. Provide hard steel-troweled finish (ringing sound from the trowel) for nonair-entrained slabs.
6. Do not use dry cement or additional water during troweling, nor will excessive troweling be permitted.

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7. Power Finishing:
    a. Approved power machine may be used in lieu of or in addition to hand finishing in accordance with directions of machine manufacturer.
    b. Do not use power machine when concrete has not attained necessary set to allow finishing without introducing high and low spots in slab.
    c. Do first steel troweling for slab S-1 finish by hand.

C. Type S-2 (Wood Float Finish):

1. Finish slab to receive fill and mortar setting bed by screeding with straightedges to bring surface to required finish plane.
2. Wood float finish to compact and seal surface.
3. Remove laitance and leave surface clean.
4. Coordinate with other finish procedures.

D. Type S-3 (Underside Elevated Slab Finish):

1. When forming is removed, grind off projections on underside of slab and repair defective areas, including small shallow air pockets where schedule of concrete finishes requires:
    a. Prepare surfaces to match Wall Type of adjacent walls.

E. Type S-5 (Broomed Finish):

1. Finish as specified for Type S-1 floor finish, except use only a light-steel troweled finish, and then finish surface by drawing fine-hair broom lightly across surface.
2. Broom in same direction and parallel to expansion joints, or, in case of inclined slabs, perpendicular to slope, except for round roof slab, broom surface in radial direction.

F. Type S-6 (Sidewalk Finish):

1. Slope walks down 1/4 inch per foot away from structures, unless otherwise shown.
2. Strike off surface by means of strike board and float with wood or cork float to true plane, then flat steel trowel before brooming.
3. Broom surface at right angles to direction of traffic or as shown.
4. Lay out sidewalk surfaces in blocks, as shown or as directed by Engineer, with grooving tool.

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G. Concrete Curbs:

1. Float top surface of curb smooth, and finish all discontinuous edges with steel edger.
2. After concrete has taken its initial set, remove front form and give exposed vertical surface an ordinary wall finish, Type W-1.

3.07 CONCRETE SLAB TOLERANCES

A. Slab Tolerances:

1. Exposed Slab Surfaces: Comprise of flat planes as required within tolerances specified.
2. Slab Finish Tolerances and Slope Tolerances: Crowns on floor surface not too high as to prevent 10-foot straightedge from resting on end blocks, nor low spots that allow block of twice the tolerance in thickness to pass under supported 10-foot straightedge.
3. Slab Type S-A: Steel gauge block 5/16 inch thick.
4. Slab Type S-B: Steel gauge block 1/8 inch thick.
5. Slab Type S-A and S-B:
   a. Finish Slab Elevation: Slope slabs to floor drain and gutter, and shall adequately drain regardless of tolerances.
6. Thickness: Maximum 1/4 inch minus or 1/2 inch plus from thickness shown. Where thickness tolerance will not affect slope, drainage, or slab elevation, thickness tolerance may exceed 1/2 inch plus.

B. Slab Elevation and Thickness:

1. Finish Slab Elevation: Slope slabs to floor drains and gutter. Slabs shall adequately drain regardless of tolerances.
2. Thickness: Maximum 1/4 inch minus or 1/2 inch plus from thickness shown. Where thickness tolerance will not affect slope, drainage, or slab elevation, thickness tolerance may exceed 1/2 inch plus.

3.08 BEAM AND COLUMN FINISHES

A. Match surface finish for adjacent walls.

3.09 BACKFILL AGAINST STRUCTURES

A. Do not backfill against walls until concrete has obtained specified 28-day compressive strength.

B. Refer to General Structural Notes on the Drawings for additional requirements, including elevated slab and diaphragm completion prior to backfill.

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C. Unless otherwise permitted, place backfill simultaneously on both sides of structure, where such fill is required, to prevent differential pressures.

3.10 FIELD QUALITY CONTROL

A. General:

1. Unless otherwise noted, concrete field testing services will be provided by Owner.
2. The following is an overview of types and frequency of concrete field testing.
3. Provide adequate facilities for safe storage and proper curing of concrete test specimens onsite for first 24 hours, and for additional time as may be required before transporting to test lab.
4. Unless otherwise specified, concrete will be sampled for making test specimens, from point of delivery.
5. Unless otherwise specified, sampled concrete used to mold strength test specimens (ASTM C31/C31M) will be tested for slump (ASTM C143/C143M), temperature (ASTM C1064/C1064M), and density (ASTM C138/C138M).
6. Air Content:
   a. When concrete is pumped, concrete will be sampled for testing air content at point of delivery and at point of placement.
      1) For Each Concrete Mixture: Provided results of air content tests for first load of the day are within specified limits, testing need only be performed at point of delivery for subsequent loads of that concrete mixture except that testing should be performed at point of placement every 4 hours.
   b. When measured air content at point of delivery is greater than specified limit, a check test of air content will be performed immediately on a new sample from delivery unit. If check test fails, concrete has failed to meet requirements of Contract Documents.
   c. If measured air content is less than lower specified limit, adjustments will be permitted in accordance with ASTM C94/C94M, unless otherwise specified. If check test of adjusted mixture fails, concrete has failed to meet requirements of Contract Documents.
   d. Concrete that has failed to meet requirements of Contract Documents must be rejected.
7. Test specimens will be stored and cured in accordance with ASTM C31/C31M and tested in accordance ASTM C39/C39M.
8. Frequency of testing may be changed at discretion of Engineer.
9. Evaluation and acceptance will be in accordance with ACI 301 and the Contract Documents.

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B. Concrete Strength Test:

1. Unless otherwise specified, specimens will be made and tested as follows:
   a. One specimen at age of 7 days for information.
   b. Two 6-inch diameter or three 4-inch diameter test specimens at age of 28 days for acceptance.
   c. A minimum of one spare test specimen per sample.
2. If result of 7-day concrete strength test is less than 50 percent of specified 28-day strength, moist cure in-situ concrete in accordance with Section 03 39 00, Concrete Curing, for an additional 7 days.

C. Tolerances:

1. Concrete tolerances must comply with the more stringent of equipment manufacturers' tolerances, and specified tolerances.
2. Formed Surfaces: Measure and inspect for compliance with tolerances specified in Section 03 10 00, Concrete Forming and Accessories.
3. Slab Finish Tolerances and Slope Tolerances:
   a. Make floor flatness measurements day after floor is finished and before shoring is removed to eliminate effects of shrinkage, curing, and deflection.
   b. Support 10-foot long straightedge at each end with steel gauge blocks of thicknesses equal to specified tolerance.
   c. Compliance with designated limits in four of five consecutive measurements is satisfactory, unless defective conditions are observed.

D. Liquid Tightness Tests:

1. Purpose: To determine integrity and liquid-tightness of finished exterior and interior concrete surfaces of liquid containment structures.
2. Test all water-holding structures for liquid-tightness.
3. Water for initial tightness test will be provided by Owner.
4. Provide means to transport water to structure to be tested.
5. If additional tightness tests are required because of failure to meet criteria, provide water for subsequent tests.
6. After testing has been completed, dispose of test water in a manner approved by Owner.
7. Liquid-Tightness Test Requirement:
   a. Perform tightness tests in accordance with ACI 350.1 and as specified herein.

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b. Do not place backfill or install brick facing, grout topping slab, coatings, or other work that will cover concrete surfaces until tightness testing has been completed and approved.
c. Measure evaporation, precipitation, and temperature as specified.

8. Measure water surface at two points 180 degrees apart when possible where attachments, such as ladders exist, at 24-hour intervals.
9. Acceptance Criteria:
   a. Acceptance of the containment structure shall be based on criteria for both Part 1 and Part 2. Containment structures shall be retested until compliance is achieved.
   b. Part 1, Qualitative: If moisture is observed on the containment structure surfaces, exterior to the contained liquid, where moisture can be picked up on a dry hand, the containment structure is non-compliant.
   c. Part 2, Quantitative:
      1) Volume loss shall not exceed 0.050 percent of contained liquid volume per 24-hour period, adjusted for evaporation, precipitation, and temperature.
      2) Acceptance that structure has passed Part 2 of the tightness test shall be based on total volume loss at end of specified test period.
10. Repairs When Test Fails:
    a. Dewater structure; fill leaking cracks with crack repair epoxy as specified in Section 03 64 23, Epoxy Resin Injection Grouting, and Section 03 64 24, Polyurethane Injection Grouting.
    b. Patch areas of damp spots previously recorded, and repeat water leakage test in its entirety until structure successfully passes test.

3.11 MANUFACTURER'S SERVICES

A. Provide representative at Site in accordance with Section 01 43 33, Manufacturers' Field Services, for installation assistance, inspection, and certification of proper installation for concrete ingredients, mix design, mixing, and placement.

1. Concrete Producer Representative:
   a. Observe how concrete mixes are performing.
   b. Assist with concrete mix design, performance, placement, weather problems, and problems as may occur with concrete mix throughout Project, including instructions for redosing.
   c. Establish control limits on concrete mix designs.
   d. Provide equipment for control of concrete redosing for air entrainment or high-range, water-reducing admixture, superplasticizers, at Site to maintain proper slump and air content if needed.

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2. Admixture Manufacturer's Representative: Available for consultations as required to ensure proper installation and performance of specified products.
3. Bonding Agent Manufacturer's Representative: Available for consultations as required to ensure proper installation and performance of specified products.

3.12 PROTECTION OF INSTALLED WORK

A. After curing as specified in Section 03 39 00, Concrete Curing, and after applying final floor finish, cover slabs with plywood or particle board or plastic sheeting or other material to keep floor clean and protect it from material and damage as a result of other construction work.

B. Repair areas damaged by construction, using specified repair materials and approved repair methods.

3.13 SCHEDULE OF CONCRETE FINISHES

A. Form Tolerances: As specified in Section 03 10 00, Concrete Forming and Accessories.

B. Provide concrete finishes as scheduled:

Area	Type of Finish	Required Form Tolerances
Exterior Wall Surfaces		
Abovegrade/exposed (above point 6" below finish grade)	W-9	W-B
Abovegrade/covered with brick veneer or other finish material	W-1	W-A
Backfilled/waterproofed (below point 6" below finish grade)	W-1	W-A
Backfilled/not waterproofed (below point 6" below final grade)	W-1	W-A
Interior Wall Surfaces		
Open top water-holding tanks and basins/not painted or coated	W-2	W-A
Covered water-holding tanks and basins/not painted or coated	W-1	W-A

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Area	Type of Finish	Required Form Tolerances
Covered bulk solids and compost handling areas/not painted or coated	W-2	W-A
Water-holding tanks, channels, and basins/painted or coated	W-5	W-A
Buildings, pipe galleries, and other dry areas/not painted or coated	W-9	W-A
Buildings, pipe galleries, and other dry areas/painted or coated	W-5	W-A
Exterior Slabs		
Roof slab/exposed	S-5	S-B
Roof slab/covered with roofing material	S-1	S-A
Water-holding tanks and basins/top of wall	S-5	S-B
Top of footing	S-2	S-A
Other water-holding tanks and basins	S-1	S-A
Stairs and landings	S-5	S-B
Sidewalks	S-6	S-B
Other exterior slabs	S-5	S-A
Interior Slabs		
Buildings and other dry areas not otherwise listed	S-1	S-B
Covered bulk solids and compost handling areas/not painted or coated	S-1	S-B
Slabs to receive mortar setting bed for tile	S-2	S-A
Slabs to receive resilient flooring or carpet	S-1	S-A
Hydraulic channels	S-1	S-A
Underside of elevated slabs	S-3	S-A

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Area	Type of Finish	Required Form Tolerances
Beams and Columns		
Beams/coated		B-A
Beams/not coated		B-A
Columns/coated		C-A
Columns/not coated		C-A

3.14 SUPPLEMENTS

A. Requirements of concrete mix designs following “End of Section,” are a part of this specification and supplement requirements of Part 1 through Part 3 of this section:

1. Concrete Mix Design, Class 4500F2S1W1C1.
2. Concrete Mix Design, Class GM3500F1S1W1C1.
3. Concrete Mix Design, Class 3500F1S1W1C1.
4. Concrete Mix Design, Class CP4500F2S1W1C1.

END OF SECTION

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CONCRETE MIX DESIGN, CLASS 4500F2S1W1C1

A. Mix Locations: Typical, unless otherwise specified.

B. Exposure Categories and Classifications: F2S1W1C1.

C. Mix Properties:

1. Limit water to cementitious materials ratio (W/Cm) in mix design to maximum value of 0.42.
2. Minimum concrete compressive strength (f'c) shall be 4,500 psi at 28 days.
3. Designed to conform to shrinkage limits.
4. Unless otherwise specified, provide air content based on nominal maximum size of aggregate as follows:

Nominal Maximum Aggregate Size in.	**Air Content (%)***
3/4	6.0
1	6.0
1-1/2	5.5
*Tolerance of air content is +/- 1-1/2 percent.	

5. Limit supplementary cementitious materials measured as a percent of weight of total cementitious materials in mix design, as follows:
   a. Fly Ash and Other Pozzolans: 25 percent.
   b. Slag Cement: 50 percent.
   c. Combined Fly Ash and Other Pozzolans and Slag Cement: 50 percent, with fly ash and other pozzolans not exceeding 25 percent.
   d. Total cementitious materials include ASTM C150/C150M and ASTM C595/C595M cement.
      1) Fly ash and other pozzolans in Type IP, blended cement, ASTM C595/C595M.
      2) Slag used in the manufacture of an IS blended cement, ASTM C595/C595M.
6. Provide cementitious materials in accordance with one of the following:
   a. ASTM C150/C150M Type II; inclusion of supplementary cementitious materials in design mix is optional.
   b. ASTM C150/C150M types other than Type II, plus supplementary cementitious materials in accordance with one of the following:
      1) Tricalcium Aluminate Content of Total Cementitious Materials: Maximum 8 percent by weight.

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2) Provide documentation of test results in accordance with ASTM C1012/C1012M, for combinations of cementitious materials providing sulfate resistance with expansion less than 0.10 percent at 6 months.

c. ASTM C595/C595M Type IP, IL, or Type IS (less than 70), tested to comply with moderate sulfate resistance option (MS).

1) Provide documentation of test results in accordance with ASTM C1012/C1012M, for combinations of cementitious materials providing sulfate resistance with expansion less than 0.10 percent at 6 months.

7. Unless otherwise permitted, minimum cementitious materials content in mix design shall be as follows:
   a. 515 pounds per cubic yard for concrete with 1-1/2-inch nominal maximum size aggregate.
   b. 535 pounds per cubic yard for 1-inch nominal maximum size aggregate.
   c. 560 pounds per cubic yard for 3/4-inch nominal maximum size aggregate.
   d. Unless otherwise permitted, limit cementitious materials content to 100 pounds per cubic yard greater than specified minimum cementitious materials content in mix design.
8. Limit water-soluble, chloride-ion content in hardened concrete to 0.10 percent, unless otherwise specified.
   a. Limits are stated in terms of chloride ions in percent by weight of cement.
   b. Unless otherwise permitted, provide documentation from concrete tested in accordance with ASTM C1218/C1218M at an age between 28 days and 42 days.

D. Refer to Part 1 through Part 3 of this section for additional requirements.

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CONCRETE MIX DESIGN, CLASS GM3500F1S1W1C1

A. Mix Locations: Grout fill in trenches.

B. Exposure Categories and Classifications: F1S1W1C1.

C. Mix Properties:

1. Limit water to cementitious materials ratio (W/Cm) in mix design to maximum value of 0.50.
2. Minimum concrete compressive strength (f'c) shall be 3,500 psi at 28 days.
3. Maximum Nominal Aggregate: 3/8 inch.
4. Unless otherwise specified, provide 7.5 percent air content.
    a. See ASTM C33/C33M for tolerance on oversize for various nominal maximum size designations.
    b. Tolerance of air content is plus or minus 1.5 percent.
5. Provide cementitious materials in accordance with one of the following:
    a. ASTM C150/C150M Type II; inclusion of supplementary cementitious materials in design mix is optional.
    b. ASTM C150/C150M types other than Type II, plus supplementary cementitious materials in accordance with one of the following:
        1) Tricalcium Aluminate Content of Total Cementitious Materials: Maximum 8 percent by weight.
        2) Provide documentation of test results in accordance with ASTM C1012/C1012M, for combinations of cementitious materials providing sulfate resistance with expansion less than 0.10 percent at 6 months.
    c. ASTM C595/C595M Type IP, IL, or Type IS (less than 70), tested to comply with moderate sulfate resistance option (MS).
        1) Provide documentation of test results in accordance with ASTM C1012/C1012M, for combinations of cementitious materials providing sulfate resistance with expansion less than 0.10 percent at 6 months.
6. Limit water-soluble, chloride-ion content in hardened concrete to 0.10 percent, unless otherwise specified.
    a. Limits are stated in terms of chloride ions in percent by weight of cement.
    b. Unless otherwise permitted, provide documentation from concrete tested in accordance with ASTM C1218/C1218M at an age between 28 days and 42 days.

D. Refer to Part 1 through Part 3 of this section for additional requirements.

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CONCRETE MIX DESIGN, CLASS 3500F1S1W1C1

A. Mix Locations:

1. Electrical duct banks.
2. Pipe encasements that are not cast monolithically with concrete base mats or slabs.
3. Concrete fill.
4. Curbs and Sidewalks.

B. Exposure Categories and Classifications: F1S1W1C1.

C. Mix Properties:

1. Limit water to cementitious materials ratio (W/Cm) in mix design to maximum value of 0.50.
2. Minimum concrete compressive strength (f'c) shall be 3,500 psi at 28 days.
3. Unless otherwise specified, provide air content based on nominal maximum size of aggregate as follows:

Nominal Maximum Aggregate Size in.	**Air Content (%)***
3/4	5.0
1	4.5
1-1/2	4.5
*Tolerance of air content is +/- 1-1/2 percent.	

4. Provide cementitious materials in accordance with one of the following:
   a. ASTM C150/C150M Type II; inclusion of supplementary cementitious materials in design mix is optional.
   b. ASTM C150/C150M types other than Type II, plus supplementary cementitious materials in accordance with one of the following:
      1) Tricalcium Aluminate Content of Total Cementitious Materials: Maximum 8 percent by weight.
      2) Provide documentation of test results in accordance with ASTM C1012/C1012M, for combinations of cementitious materials providing sulfate resistance with expansion less than 0.10 percent at 6 months.

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3) ASTM C595/C595M Type IP, IL, or Type IS (less than 70), tested to comply with moderate sulfate resistance option (MS).
   a) Provide documentation of test results in accordance with ASTM C1012/C1012M, for combinations of cementitious materials providing sulfate resistance with expansion less than 0.10 percent at 6 months.

5. Limit water-soluble, chloride-ion content in hardened concrete to 0.30 percent, unless otherwise specified.
   a. Limits are stated in terms of chloride ions in percent by weight of cement.
   b. Unless otherwise permitted, provide documentation from concrete tested in accordance with ASTM C1218/C1218M at an age between 28 days and 42 days.

D. Refer to Part 1 through Part 3 of this section for additional requirements.

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CONCRETE MIX DESIGN, CLASS CP4500F2S1W1C1

A. Mix Locations: Concrete Paving.

B. Exposure Categories and Classifications: F2S1W1C1.

C. Mix Properties:

1. Limit water to cementitious materials ratio (W/Cm) in mix design to maximum value of 0.45.
2. Minimum concrete compressive strength (f'c) shall be 4,500 psi at 28 days.
3. Unless otherwise specified, provide air content based on nominal maximum size of aggregate as follows:

Nominal Maximum Aggregate Size in.	**Air Content (%)***
3/4	6.0
1	6.0
1-1/2	5.5
*Tolerance of air content is +/- 1-1/2 percent.	

4. Limit supplementary cementitious materials measured as a percent of weight of total cementitious materials in mix design, as follows:
   a. Fly Ash and Other Pozzolans: 25 percent.
   b. Slag Cement: 50 percent.
   c. Combined Fly Ash and Other Pozzolans and Slag Cement: 50 percent, with fly ash and other pozzolans not exceeding 25 percent.
   d. Total cementitious materials include ASTM C150/C150M and ASTM C595/C595M cement.
      1) Fly ash and other pozzolans in Type IP, blended cement, ASTM C595/C595M.
      2) Slag used in the manufacture of an IS blended cement, ASTM C595/C595M.
5. Provide cementitious materials in accordance with one of the following:
   a. ASTM C150/C150M Type II; inclusion of supplementary cementitious materials in design mix is optional.
   b. ASTM C150/C150M types other than Type II, plus supplementary cementitious materials in accordance with one of the following:
      1) Tricalcium Aluminate Content of Total Cementitious Materials: Maximum 8 percent by weight.
      2) Provide documentation of test results in accordance with ASTM C1012/C1012M, for combinations of cementitious

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materials providing sulfate resistance with expansion less than 0.10 percent at 6 months.

c. ASTM C595/C595M Type IP, IL, or Type IS (less than 70), tested to comply with moderate sulfate resistance option (MS).
   1) Provide documentation of test results in accordance with ASTM C1012/C1012M, for combinations of cementitious materials providing sulfate resistance with expansion less than 0.10 percent at 6 months.

6. Unless otherwise permitted, minimum cementitious materials content in mix design shall be as follows:
   a. 515 pounds per cubic yard for concrete with 1-1/2-inch nominal maximum size aggregate.
   b. 535 pounds per cubic yard for 1-inch nominal maximum size aggregate.
   c. 560 pounds per cubic yard for 3/4-inch nominal maximum size aggregate.
   d. Unless otherwise permitted, limit cementitious materials content to 100 pounds per cubic yard greater than specified minimum cementitious materials content in mix design.
7. Limit water-soluble, chloride-ion content in hardened concrete to 0.10 percent, unless otherwise specified.
   a. Limits are stated in terms of chloride ions in percent by weight of cement.
   b. Unless otherwise permitted, provide documentation from concrete tested in accordance with ASTM C1218/C1218M at an age between 28 days and 42 days.

D. Refer to Part 1 through Part 3 of this section for additional requirements.

E. Refer to specification Section 32 13 13, Concrete Paving for additional requirements including flexural strength testing.

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SECTION 03 39 00
CONCRETE CURING

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Concrete Institute (ACI): 308.1, Specification for Curing Concrete.
2. ASTM International (ASTM):
   a. C309, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
   b. C1315, Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.

1.02 SUBMITTALS

A. Action Submittals:

1. Manufacturers' data indicating compliance with the requirements specified herein for the following products:
   a. Exposed aggregate finish retardant on formed surface.
   b. Evaporation retardant.
   c. Curing compound.
   d. Clear sealer.
   e. Clear hardener.
2. Curing methods proposed for each type of element such as slab, walls, beams, and columns in each facility.

B. Informational Submittals:

1. Manufacturer's Certificate of Compliance, in accordance with Section 01 61 00, Common Product Requirements, for the following:
   a. Curing compound showing moisture retention requirements.
   b. Retardants for exposed aggregate finish.

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PART 2 PRODUCTS

2.01 MATERIALS

A. Curing Compound:

1. Water-based, high-solids content, nonyellowing, curing compound meeting requirements of ASTM C309 Type I or Type II, Class A.
2. Manufacturers and Products:
   a. Euclid Chemical Co., Cleveland, OH; EucoCure VOX.
   b. Euclid Chemical Co., Cleveland, OH; Kurez VOX White Pigmented.

B. Wet Curing Blankets:

1. Single-use wet curing blankets consisting of white reflective polyethylene vapor barrier and cellulose fabric.
2. Capable of maintaining a 100 percent relative humidity condition on the concrete surface for a curing period of 14 days.
3. Manufacturers and Products:
   a. Sika Chemical Corp., Lyndurst, NJ; Sika UltraCure DOT.
   b. Or equal.

C. Evaporation Retardant:

1. Optional: Fluorescent fugitive dye color tint that disappears completely upon drying.
2. Manufacturers and Products:
   a. Euclid Chemical Co., Cleveland, OH; Eucobar.
   b. “Or-equal.”

D. Clear Sealer (One-Component Penetrating Silane Sealer):

1. Manufacturers and Products:
   a. Euclid Chemical Co.; Baracade WB 244.
   b. “Or-equal.”

E. Clear Hardener:

1. Colorless, aqueous solution containing silicate.
2. Manufacturers and Products:
   a. Euclid Chemical Co., Cleveland, OH; Euco Diamond Hard.
   b. W.R. Meadows, Inc., Hampshire, IL; Liqui-Hard.

F. Water: Clean and potable, containing less than 500 ppm of chlorides.

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PART 3 EXECUTION

3.01 CONCRETE CURING

A. General:

1. Cure all concrete in accordance with the Specifications and ACI 308.1.
2. Where surfaces are to receive coatings, painting, cementitious material, or other similar finishes, use only water curing procedures. Refer to Interior Finish Schedule for surfaces to receive coatings.
3. Use only water curing on water holding structures.
4. Where curing compound cannot be used, water curing as described below or special methods using moisture shall be agreed upon by Engineer prior to placing concrete.
5. As required in Section 03 30 00, Cast-in-Place Concrete, if result of 7-day concrete strength test is less than 50 percent of specified 28-day strength, extend period of moist curing specified below, by 7 additional days.

B. Use one of the following methods as approved by Engineer:

1. Vertical Surfaces:
   a. Method 1: Leave concrete forms in place and keep surfaces of forms and concrete wet for 7 days.
   b. Method 2: Continuously sprinkle with water 100 percent of exposed surfaces for 7 days starting immediately after removal of forms.
   c. Method 3: Apply curing compound, where allowed, immediately after removal of forms.
2. Horizontal Surfaces:
   a. Method 1: Protect surface by water ponding for 7 days.
   b. Method 2: Cover with wet curing blankets in accordance with manufacturer’s directions for minimum of 7 days.
   c. Method 3: Cover with 1-inch layer of wet sand, earth, or sawdust, and keep continuously wet for 7 days.
   d. Method 4: Continuously sprinkle exposed surface for 7 days.
   e. Method 5: Apply curing compound, where allowed, immediately after final finishing when surface will no longer be damaged by traffic.

3.02 EVAPORATION RETARDANT APPLICATION

A. Use on flatwork when environmental conditions are anticipated to cause rapid drying of the concrete surface.

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B. Spray onto surface of fresh flatwork concrete immediately after screeding to react with surface moisture.

C. Reapply as needed to ensure a continuous moist surface until final finishing is completed.

3.03 CLEAR SEALER APPLICATION

A. Apply where indicated on Interior Finish Schedule on the Drawings.

B. Water cure concrete.

C. Do not apply to concrete surface until concrete has aged a minimum of 28 days.

D. Before application, protect concrete surface to receive sealer, keep clean, unpainted, and free from membrane curing compounds.

E. Concrete to receive penetrating sealer shall be dry for a minimum 24 hours immediately prior to application.

F. Apply per manufacturer's recommendations utilizing low pressure airless spray equipment.

1. Actual coverage and number of coats to be determined by field test sample application and water absorption testing. Final approval by Owner is required.

G. Apply at a coverage rate of 125 square feet per gallon to 200 square feet per gallon. Cure penetrating sealer on slabs for the minimum time recommended by manufacturer prior to allowing foot or vehicular traffic.

3.04 CLEAR HARDENER APPLICATION

A. Apply in the following areas:

1. Where indicated in Interior Finish Schedule on the Drawings.
2. Composting Facility Floor slab.
3. Compost Storage Facility slab.
4. Biofilter slab.

B. Water cure concrete.

C. Do not apply to concrete surface until concrete has aged a minimum of 28 days.

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D. Before application, protect concrete surface to receive sealer, keep clean, unpainted, and free from membrane curing compounds.

E. Apply liquid densifier evenly, using three coats, allowing 24 hours between coats.

1. First coat 1/3 strength, second coat 1/2 strength, and third coat 2/3 strength, mix with water.
2. Apply each coat so as to remain wet on surface for 15 minutes.
3. Apply approved liquid densifier in accordance with manufacturer's instructions.
4. After final coat is completed and dry, remove surplus liquid densifier from surface by scrubbing and mopping with water.

3.05 MANUFACTURER'S SERVICES

A. Provide manufacturer's representative at Site for installation assistance, inspection, and certification of proper installation for products specified.

B. Provide clear hardener manufacturer's representative to demonstrate proper mixing and application of product.

C. Provide curing compound manufacturer's representative to demonstrate proper application of curing compound to show coverage in one coat.

END OF SECTION

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SECTION 03 62 00
GROUTING

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. ASTM International (ASTM):
   a. C230, Standard Specification for Flow Table for Use in Tests of Hydraulic Cement.
   b. C307, Standard Test Method for Tensile Strength of Chemical-Resistant Mortar, Grouts, and Monolithic Surfacings.
   c. C531, Standard Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes.
   d. C579, Standard Test Methods for Compressive Grout Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes.
   e. C882, Standard Test Method for Bond Strength of Epoxy-Resin Systems Used With Concrete By Slant Shear.
   f. C939, Standard Test Method for Flow of Grout for Preplaced-Aggregate Concrete (Flow Cone Method).
   g. C940, Standard Test Method for Expansion and Bleeding of Freshly Mixed Grouts for Preplaced-Aggregate Concrete in the Laboratory.
   h. C1107/C1107M, Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
   i. C1181, Standard Test Methods for Compressive Creep of Chemical-Resistant Polymer Machinery Grouts.
   j. D4263, Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method.

1.02 SUBMITTALS

A. Action Submittals:

1. Product data of grouts.
2. Proposed method for keeping existing concrete surfaces wet prior to placing nonshrink grout.
3. Forming method for fluid grout placements.
4. Curing method for grout.

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B. Informational Submittals:

1. Manufacturer's Written Instructions: Mixing of grout.
2. Manufacturer's proposed training schedule for grout work.
3. Manufacturer's Certificate of Compliance in accordance with Section 01 61 00, Common Product Requirements.
    a. Grout free from chlorides and other corrosion-causing chemicals.
    b. Nonshrink grout properties of Category II and Category III, verifying expansion at 3 days or 14 days will not exceed the 28-day expansion and nonshrink properties are not based on gas or gypsum expansion.
4. Manufacturer's Certificate of Proper Installation.
5. Statements of Qualification: Grout manufacturer's representative.
6. Test Reports:
    a. Test report for 24-hour evaluation of nonshrink grout.
    b. Test results and service report from demonstration and training session.
    c. Field test reports and laboratory test results for field-drawn Samples.
7. List of Contractor's installation staff trained by grout manufacturer's representative in:
    a. Nonshrink grout installation and curing.
    b. Epoxy grout installation and curing.

1.03 QUALIFICATIONS

A. Grout Manufacturer's Representative: Authorized and trained representative of grout manufacturer. Minimum of 1-year experience that has resulted in successful installation of grouts similar to those for this Project.

B. For grout suppliers not listed herein, provide completed 24-hour Evaluation of Nonshrink Grout Test Form, attached at the end of this section. Provide independent testing laboratory test results for testing conducted within last 18 months.

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PART 2 PRODUCTS

2.01 NONSHRINK GROUT AND EPOXY GROUT SCHEDULE

A. Furnish nonshrink grout (Category I, Category II, and Category III) and epoxy grout for applications as indicated in the following schedule:

Application	Temperature Range	Max. Placing Time	
	40 deg F to 100 deg F	20 Min.	Greater Than 20 Min.
Blockouts for gate guides	I or II		II
Column baseplates single-story	I or II		II
Roof beam bearing plates	I or II		II
Machine bases 25 hp or less	II	II	II
Baseplates for pipe supports, nonvibratory equipment	II	II	II
Form Tie-Through bolt openings	II	II	II
Machine bases 26 hp and up	III or Epoxy Grout	III or Epoxy Grout	III or Epoxy Grout
Baseplates and/or soleplates with vibration, thermal movement, etc.	III or Epoxy Grout	III or Epoxy Grout	III or Epoxy Grout

2.02 NONSHRINK GROUT

A. Category I:

1. Nonmetallic and nongas-liberating.
2. Prepackaged natural aggregate grout requiring only the addition of water.
3. Test in accordance with ASTM C1107/C1107M:
   a. Grout shall have flowable consistency.
   b. Flowable for 15 minutes.
4. Grout shall not bleed at maximum allowed water.

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5. Minimum strength of flowable grout, 3,000 pounds per square inch at 3 days, 5,000 pounds per square inch at 7 days, and 7,000 pounds per square inch at 28 days.
6. Manufacturers and Products:
    a. Master Builders Solutions, Shakopee, MN; MasterFlow 100.
    b. Euclid Chemical Co., Cleveland, OH; NS Grout.
    c. Dayton Superior Corp., Miamisburg, OH; 1107 Advantage Grout.
    d. US MIX Co., Denver, CO; US SPEC GP Grout.
    e. Five Star Products Inc., Fairfield, CT; Five Star Grout.

B. Category II:

1. Nonmetallic, nongas-liberating.
2. Prepackaged natural aggregate grout requiring only the addition of water.
3. Aggregate shall show no segregation or settlement at fluid consistency at specified times or temperatures.
4. Test in accordance with ASTM C1107/C1107M:
    a. Fluid consistency 20 seconds to 30 seconds in accordance with ASTM C939.
    b. Temperatures of 40 degrees F, 80 degrees F, and 90 degrees F.
5. One hour after mixing, pass fluid grout through flow cone with continuous flow.
6. Minimum strength of fluid grout, 3,500 pounds per square inch at 1-day, 4,500 pounds per square inch at 3 days, and 7,500 pounds per square inch at 28 days.
7. Maintain fluid consistency when mixed in 1-yard to 9-yard loads in ready-mix truck.
8. Manufacturers and Products:
    a. Master Builders Solutions, Shakopee, MN; MasterFlow 928.
    b. Five Star Products Inc., Fairfield, CT; Five Star Fluid Grout 100.
    c. Euclid Chemical Co., Cleveland, OH; Hi Flow Grout.
    d. Dayton Superior Corp., Miamisburg, OH; Sure-Grip High Performance Grout.
    e. US MIX Co., Denver, CO; US SPEC MP Grout.

C. Category III:

1. Metallic and nongas-liberating.
2. Prepackaged aggregate grout requiring only the addition of water.
3. Aggregate shall show no segregation or settlement at fluid consistency at specified times or temperatures.

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4. Test in accordance with ASTM C1107/C1107M:
   a. Fluid consistency 20 seconds to 30 seconds in accordance with ASTM C939.
   b. Temperatures of 40 degrees F and 100 degrees F.
5. One hour after mixing, pass fluid grout through flow cone with continuous flow.
6. Minimum strength of fluid grout, 4,000 pounds per square inch at 1-day, 5,000 pounds per square inch at 3 days, and 9,000 pounds per square inch at 28 days.
7. Maintain fluid consistency when mixed in 1-yard to 9-yard loads in ready-mix truck.
8. Manufacturer and Product:
   a. Master Builders Solutions, Shakopee, MN; MasterFlow 885.
   b. Euclid Chemical Co, Cleveland, OH; Hi-Flow Metallic Grout.

2.03 EPOXY GROUT

A. High-strength, nonshrink, high-temperature epoxy grouting material developed for the support of heavy equipment with vibratory loads.

B. Three-component mixture of a two-component epoxy resin system (100 percent solids) with a graded, precision aggregate blend.

C. Premeasured, prepackaged system.

D. Flowable.

E. Minimum compressive strength in accordance with ASTM C579 Method B, 9,500 pounds per square inch at 75 degrees F at 7 days, 11,000 pounds per square inch at post cure.

F. Maximum creep resistance in accordance with ASTM C1181 at 600 pounds per square inch, 140 degrees F; 6.0 by 10^{-3} in/in.

G. Minimum bond strength in accordance with ASTM C882, 2,000 pounds per square inch.

H. Minimum tensile strength in accordance with ASTM C307, 2,000 pounds per square inch.

I. Maximum coefficient of thermal expansion in accordance with ASTM C531 at 73 degrees F to 210 degrees F, 23.0 by 10^{-6} in/in/degrees F.

J. Working Time: Minimum 2 hours at 50 degrees F; 1.5 hours at 70 degrees F; 50 minutes at 90 degrees F.

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K. Noncorrosive.

L. Moisture insensitive.

M. Modify resin and aggregate content where recommended by epoxy grout manufacturer to provide desired epoxy grout flow properties.

N. Manufacturer and Product:

1. Master Builders Solutions, Shakopee MN; MasterFlow 648.
2. Euclid Chemical Co., Cleveland, OH; E^3-Series.
3. Dayton Superior Corp., Miamisburg, OH; Pro-Poxy 2000 Normal Set.
4. Five Star Products Inc., Fairfield, CT; DP Epoxy Grout.

PART 3 EXECUTION

3.01 GENERAL

A. Unless otherwise specified, prepare and condition concrete substrate in accordance with grout manufacturer's training instructions.

B. Mix, place, and cure grout in accordance with grout manufacturer's representative's training instructions.

C. Epoxy Grout: Concrete slab shall be fully cured for 28 days to ensure excess water has evaporated. Test concrete surface for moisture in accordance with ASTM D4263 before epoxy grout is placed.

D. Form Tie-Through Bolt Holes: Provide nonshrink grout, Category II, fill space with dry pack dense grout hammered in with steel tool and hammer. Through-bolt holes; coordinate dry pack dense grout application with vinyl plug in Section 03 10 00, Concrete Forming and Accessories, and bonding agent in Section 03 30 00, Cast-in-Place Concrete.

E. Form Snap-Tie Hole: Fill tie hole in accordance with requirements of Section 03 30 00, Cast-in-Place Concrete.

3.02 GROUTING MACHINERY FOUNDATIONS

A. Block out original concrete or finish off at distance shown below bottom of machinery base with grout. Prepare concrete surface by sandblasting, chipping, or by mechanical means to remove any soft material. Surface roughness in accordance with manufacturer's written instructions.

B. Clean metal surfaces of all paint, oil, grease, loose rust, and other foreign material that will be in contact with grout.

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C. Sandblast to bright metal all metal surfaces in contact with epoxy grout in accordance with manufacturer's written instructions.

D. Set machinery in position and wedge to elevation with steel wedges, or use cast-in leveling bolts. Remove wedges after grout is set and pack void with grout.

E. Form with watertight forms at least 2 inches higher than bottom of plate.

F. Fill space between bottom of machinery base and original concrete in accordance with manufacturer's representative's training instructions.

G. If grout cannot be placed from one edge and flowed to the opposite edge, air vents shall be provided through the plate to prevent air entrapment.

H. Radius corners of grout pad.

I. Install expansion joints for epoxy grout placement in accordance with manufacturer's written instructions.

3.03 FIELD QUALITY CONTROL

A. General:

1. Performed by Project representative's inspection staff.
2. Perform the following quality control inspections. Grout manufacturer's representative shall accompany the Project representative's inspection staff on the first installation of each size and type of equipment.

B. Evaluation and Acceptance of Nonshrink Grout:

1. Inspect surface preparation of concrete substrates onto which nonshrink grout materials are to be applied, for conformance to the specified application criteria including, but not limited to, substrate profile, degree of cleanliness, and moisture.
2. Inspect preparation and application of nonshrink grout form work for conformance to the manufacturer's recommendations.
3. Conduct a final review of completed nonshrink grout installation for conformance to these Specifications.
4. Provide a flow cone and cube molds with restraining plates onsite. Continue tests during Project as demonstrated by grout manufacturer's representative.
5. Perform flow cone and bleed tests, and make three 2-inch by 2-inch cubes for each 25 cubic feet of each type of nonshrink grout used. Use restraining caps for cube molds in accordance with ASTM C1107/C1107M.

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6. For large grout applications, make three additional cubes and one more flow cone test. Include bleed test for each additional 25 cubic feet of nonshrink grout placed.
7. Consistency: As specified in Article Nonshrink Grout. Flow cone test in accordance with ASTM C939. Grout with consistencies outside range requirements shall be rejected.
8. Segregation: As specified in Article Nonshrink Grout. Grout when aggregate separates shall be rejected.
9. Nonshrink grout cubes shall test equal to or greater than minimum strength specified.
10. Strength Test Failures: Nonshrink grout work failing strength tests shall be removed and replaced.
11. Perform bleeding test in accordance with ASTM C940 to demonstrate grout will not bleed.
12. Store cubes at 70 degrees F.
13. Independent testing laboratory shall prepare, store, cure, and test cubes in accordance with ASTM C1107/C1107M.
14. All grout, already placed, which fails to meet the requirements of these Specifications, is subject to removal and replacement at no additional cost to the Owner.

C. Evaluation and Acceptance of Epoxy Grout:

1. Inspect ambient conditions during various phases of epoxy grouting installation for conformance with the epoxy grout manufacturer’s requirements.
2. Inspect the surface preparation of concrete substrates onto which epoxy grout materials are to be applied, for conformance to the specified application criteria including, but not limited to, substrate profile, degree of cleanliness, and moisture.
3. Inspect the surface preparation of the metallic substrates onto which the epoxy primer is to be applied.
4. Inspect the epoxy-primed metallic substrate for coverage and adhesion.
5. Inspect preparation and application of epoxy grout form work for conformance to the manufacturer’s recommendation.
6. Verify consistency obtained is sufficient for the proper field placement at the installed temperatures.
7. Inspect and record that the “pot life” of epoxy grout materials is not exceeded during the installation.
8. Inspect epoxy grout for cure.
9. Inspect and record that localized repairs made to grout voids are in conformance with the specification requirements.
10. Conduct a final review of completed epoxy grout installation for conformance to these Specifications.

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11. Compression tests and fabrication of specimens for epoxy grout shall be made in accordance to ASTM C579, Method B, at intervals during construction as selected by the Project representative. Set of three specimens shall be made for testing at 7 days, and each earlier time period as appropriate.
12. Independent testing laboratory shall prepare, store, cure, and test cubes in accordance with ASTM C579.
13. Grout, already placed, which fails to meet the requirements of these Specifications, is subject to removal and replacement at no additional cost to the Owner.

3.04 MANUFACTURER'S SERVICES

A. General:

1. Coordinate demonstrations, training sessions, and applicable Site visits with grout manufacturer's representative. Allow 2-week notice to grout manufacturer's representative for scheduling purposes.
2. Provide and conduct onsite, demonstration and training sessions for bleed tests, mixing, flow cone measurement, cube testing, application, and curing for each category and type of grout.
3. Necessary equipment and materials shall be available for demonstration.
4. Conduct training prior to equipment mount installation work on equipment pads.
5. Training for each type of grout shall be not less than 4 hours' duration.

B. Nonshrink Grout Training:

1. Training is required for all Type III grout installations.
2. Provide nonshrink grout installation training by the qualified grout manufacturer's representative for Contractor's workers that will be installing nonshrink grout for baseplates and equipment mounts. Schedule training to allow Engineer's attendance.
3. Mix nonshrink grouts to required consistency, test, place, and cure on actual Project, such as, baseplates and form tie-through bolt holes to provide actual on-the-job training.
4. Use minimum of two bags for each grout Category III. Mix grout to fluid consistency and conduct flow cone and two bleed tests, make a minimum of six cubes for testing of two cubes at 1 day, 3 days, and 28 days. Use remaining grout for final Work.
5. Include recommended grout curing methods in the training.
6. Transport test cubes to independent test laboratory and obtain test reports.

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7. Training by manufacturer's representative does not relieve Contractor of overall responsibility for this portion of the work.
8. Submit a list of attendees that have been satisfactorily trained to perform epoxy grout installation for equipment mounting.

C. Epoxy Grout Training:

1. Provide epoxy grout installation training by the qualified epoxy grout manufacturer's representative for Contractor's workers that will be installing epoxy grout for equipment mounts. Schedule training to allow Engineer's attendance.
2. Include training in:
   a. Performance testing such as compressive strength testing of epoxy grout.
   b. All aspects of using the products, from mixing to application.
3. Transport test cubes to independent test laboratory and obtain test reports.
4. Training by manufacturer's representative does not relieve Contractor of overall responsibility for this portion of the work.
5. Submit a list of attendees that have been satisfactorily trained to perform epoxy grout installation for equipment mounting.

3.05 SUPPLEMENT

A. The supplement listed below, following "End of Section," is a part of this specification:

1. 24-hour Evaluation of Nonshrink Grout Test Form and Grout Testing Procedures.

END OF SECTION

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SUPPLEMENT 1

_____

(Test Lab Name)

_____

(Address)

_____

(Phone No.)

24-HOUR EVALUATION OF NONSHRINK GROUT TEST FORM

OBJECTIVE: Define standard set of test procedures for an independent testing laboratory to perform and complete within a 24-hour period.

SCOPE: Utilize test procedures providing 24-hour results to duplicate field grouting demands. Intent of evaluation is to establish grout manufacturer's qualifications.

PRIOR TO TEST: Obtain three bags of each type of grout.

1. From intended grout supplier for Project.
2. Three bags of grout shall be of same lot number.

ANSWER THE FOLLOWING QUESTIONS FOR GROUT BEING TESTED FROM LITERATURE, DATA, AND PRINTING ON BAG:

A.	Product data and warranty information contained in company literature and data?	Yes_____ No_____
B.	Literature and bag information meet specified requirements?	Yes_____ No_____
C.	Manufacturer guarantees grout?	Yes_____ No_____
D.	Guarantee extends beyond grout replacement value and allows participation with Contractor in replacing and repairing defective areas?	Yes_____ No_____
E.	Water demands and limits printed on bag?	Yes_____ No_____
F.	Mixing information printed on the bag?	Yes_____ No_____
G.	Temperature restrictions printed on bag?	Yes_____ No_____

*Rejection of a grout will occur if one or more answers are noted NO.

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GROUT TESTING PROCEDURES

A. Bagged Material:

1. List lot numbers. _____
2. List expiration date. _____
3. Weigh bags and record weight. _____

Owner's Representative will disqualify grout if bag weights have misstated measure plus or minus 2 pounds by more than one out of three bags. (Accuracy of weights is required to regulate amount of water used in mixing since this will affect properties.)

B. Mixing and Consistency Determination:

1. Mix full bag of grout in 10-gallon pail.
2. Use electric drill with a paddle device to mix grout (jiffy or jiffler type paddle).
3. Use maximum water allowed per water requirements listed in bag instructions.
4. Mix grout to maximum time listed on bag instructions.
5. In accordance with ASTM C939 (flow cone) determine time of mixed grout through the flow cone. _____ seconds.
6. Add water to attain 20-second to 30-second flow in accordance with ASTM C939.
7. Record time of grout through cone at new water demand. _____ seconds.
8. Record total water needed to attain 20- to 30-second flow. _____ pounds.
9. Record percent of water. _____ percent.

C. When fluid grout is specified and additional water is required beyond grout manufacturer's listed maximum water, ASTM C1107/C1107M will be run at new water per grout ratio to determine whether grout passes using actual water requirements to be fluid. Use new water per grout ratio on remaining tests.

D. Bleed Test:

1. Fill two gallon cans half full of freshly mixed grout at ambient temperatures for each category and at required consistency for each.
2. Place one can of grout in tub of ice water and leave one can at ambient temperature.
3. Cover top of both cans with glass or plastic plate preventing evaporation.
4. Maintain 38 degrees F to 42 degrees F temperature with grout placed in ice and maintain ambient temperature for second container for 1 hour.

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5. Visually check for bleeding of water at 15-minute intervals for 2 hours.

6. Perform final observation at 24 hours.

If grout bleeds a small amount at temperatures specified, grout will be rejected.

E. Extended Flow Time and Segregation Test (for Category II and Category III):

1. Divide the remaining grout into two 3-gallon cans. Place the cans into the 40-degree F and 90-degree F containers and leave for 20, 40, and 60 minutes. Every 20 minutes remove and check for segregation or settlement of aggregate. Use a gloved hand to reach to the bottom of the can, if more than 1/4 inch of aggregate has settled to the bottom or aggregate has segregated into clumps reject the grout.

2. Right after the settlement test mix the grout with the drill mixer for 10 seconds. Take an ASTM C939 flow cone test of grout and record flow time. Maintain this process for 1 hour at ambient temperatures of 40 degrees F and 90 degrees F.

   a. 20 min _____, sec. @ 40 degrees F.

   b. 40 min _____, sec. @ 40 degrees F.

   c. 60 min _____, sec. @ 40 degrees F.

   d. 20 min _____, sec. @ 90 degrees F.

   e. 40 min _____, sec. @ 90 degrees F.

   f. 60 min _____, sec. @ 90 degrees F.

All Category II and Category III grout that will not go through the flow cone with continuous flow after 60 minutes will be disqualified.

_____ _____

Qualified Disqualified

F. 24-hour Strength Test:

1. Using grout left in mixing cans in accordance with ASTM C1107/C1107M for mixing and consistency determination test and for extended time flow test, make minimum of nine cube samples.

2. Store cubes at 70 degrees F for 24 hours.

3. Record average compressive strength of nine cubes at 24 hours.

Grout will be disqualified if 24-hour compressive strengths are less than 2,500 pounds per square inch for grouts claiming fluid placement capabilities.

Grouts that have not been disqualified after these tests are qualified for use on the Project for the application indicated in Nonshrink Grout Schedule.

_____ _____

Signature of Independent Testing Laboratory Date Test Conducted

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SECTION 03 63 00
CONCRETE DOWELING

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards that may be referenced in this section:

1. American National Standards Institute (ANSI).
2. ASTM International (ASTM):
   a. C881/C881M, Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.
   b. E488, Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements.
3. International Code Council (ICC):
   a. 2018 International Building Code (IBC).
   b. Evaluation Services Reports.

1.02 DEFINITIONS

A. ICC Evaluation Services Report: Published by ICC for products provided by concrete adhesive anchor manufacturers.

B. Special Inspection: As defined in the ICC IBC and indicated on the Statement of Special Inspection (Plan) on the Drawings.

1.03 SUBMITTALS

A. Action Submittals:

1. Product Data: Manufacturer’s catalog information.

B. Informational Submittals:

1. Manufacturer’s instructions for preparation, placement, drilling of holes, installation of anchors and adhesive, and handling of cartridges, nozzles, and equipment.
2. ICC Evaluation Services Report: Specific to proposed doweling system manufacturer.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Container Markings: Include manufacturer’s name, product name, batch number, product expiration date, ANSI hazard classification, and appropriate ANSI handling precautions.

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B. Store adhesive components in accordance with manufacturer's written instructions.

C. Dispose of when:

1. Shelf life has expired.
2. Stored other than per manufacturer's instructions.

PART 2 PRODUCTS

2.01 MATERIALS

A. Adhesive:

1. Approved by an ICC Evaluation Services Report for conformance to 2018 IBC requirements for doweling of steel reinforcing bars in cracked concrete.
2. Suitable for long-term loads as well as for wind and seismic loads.
3. Meet requirements of ASTM C881/C881M.
4. Two-component, insensitive to moisture, designed to be used in adverse freeze/thaw environments.
5. Disposable, Self-Contained Cartridge System:
   a. Capable of dispensing both components in proper mixing ratio.
   b. Fit into manually or pneumatically operated caulking gun.
6. Manufacturers and Products:
   a. Hilti, Inc., Tulsa, OK; HIT-RE 500 V3 (ESR-3814) or HIT-HY 200 (ESR 3187) Adhesive Anchors.
   b. Powers Fasteners, Brewster, NY; Power PURE110+ Epoxy Adhesive Anchor System (ESR-3298).
   c. Simpson Strong-Tie Co., Inc., Pleasanton, CA; SET-XP Epoxy Adhesive Anchors (ESR-2508).

B. Mixing Nozzles: Disposable, manufactured in several sizes to accommodate size of reinforcing dowels.

C. Reinforcing Dowels: As specified in Section 03 21 00, Steel Reinforcement.

PART 3 EXECUTION

3.01 INSTALLATION

A. Drilling Equipment:

1. Drilling Hammers for Dowel Holes:
   a. Electric or pneumatic rotary type with medium or light impact.
   b. Hollow drills with flushing air systems are preferred.

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2. Where edge distances are less than 2 inches, use lighter impact equipment to prevent microcracking and concrete spalling during drilling process.

B. Hole Diameter: Use drill bit diameter meeting ICC Evaluation Services Report requirements and as recommended by manufacturer.

C. Obstructions in Drill Path: When existing steel reinforcement is encountered during drilling, obtain Engineer approval for proposed fix.

D. Doweling:

1. Install per details shown on the Drawings and in accordance with adhesive manufacturer's instructions.
2. When using epoxy anchors, dowels may be prebent prior to installation to 15 degrees to align with other bars. Do not heat dowels to bend.
3. Bent Bar Dowels: Where edge distances are critical and intersection with steel reinforcement or other obstruction is likely, slant drill to address edge distance or to clear obstruction. If drill must be slanted more than indicated in the manufacturer's installation instructions to clear obstruction, notify Engineer for direction on how to proceed.

E. Adhesive:

1. Install in accordance with written manufacturer's instructions.
2. Dispense components through specially designed static mixing nozzle that thoroughly mixes components and places mixed adhesive at base of predrilled hole.

3.02 FIELD QUALITY ASSURANCE AND QUALITY CONTROL

A. Owner-Furnished Quality Assurance, in accordance with IBC Chapter 17 requirements, is provided in the Statement of Special Inspection (Plan) on the Drawings. Contractor responsibilities and related information on special inspection and testing are included in Section 01 45 33, Special Inspection, Observation, and Testing.

1. Special inspection will be performed by the Special Inspector in accordance with ICC ESR requirements and as specified in Section 01 45 33, Special Inspection, Observation, and Testing.
2. Continuous inspection required where noted on the Drawings and where concrete dowels are installed in overhead applications.
3. Periodic inspection required where continuous inspection is not specified.

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4. Special Inspector will observe installation in accordance with requirements of the ICC Evaluation Services Report and will submit report including the following:
   a. Product Description: Product name, rod diameter, and length.
   b. Drill bit compliance.
   c. Hole diameter, diameter, and depth and cleanliness.
   d. Adhesive expiration date.
5. Verification of dowel installation in accordance with manufacturer's published instructions

B. Contractor-Furnished Quality Control: Inspection and testing as required in Section 01 45 16.13, Contractor Quality Control.

END OF SECTION

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SECTION 03 64 23
EPOXY RESIN INJECTION GROUTING

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. ASTM International (ASTM):
   a. C882, Standard Specification for Test Method for Bond Strength of Epoxy Resin System Used with Concrete by Slant Shear.
   b. D570, Standard Test Method for Water Absorption of Plastics.
   c. D638, Standard Test Method for Tensile Properties of Plastics.
   d. D648, Standard Test Method for Deflection Temperature of Plastics under Flexural Load in the Edgewise Position.
   e. D695, Standard Test Method for Compressive Properties of Rigid Plastics.
   f. D790, Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

1.02 DEFINITIONS

A. Crack: Complete or incomplete separation of concrete into two or more parts produced by breaking or fracturing.

B. Defective Area: As defined in Section 03 30 00, Cast-in-Place Concrete.

C. Hydraulic Structure: Liquid containment structure and/or structure designed to mitigate liquid infiltration.

D. Injection: Method of bonding together, addressing or eliminating leakage through cracks or joints by installing resin under pressure to fill the void in crack or joint.

E. Joint: A planned and formed discontinuity in concrete structure at junction of adjacent and sequential concrete placements and may contain embedded waterstops.

F. Leak or Leakage: Crack or joint exhibiting presence of moisture, sign of efflorescence, intermittently wet to touch, or continuous flow of liquid.

G. Narrow Cracks: Width equal to or less than 0.015-inch.

H. Wide Cracks: Wider than 0.015-inch.

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1.03 SUBMITTALS

A. Action Submittals:

1. Physical and chemical properties for epoxy resin.
2. Technical data for metering, mixing, and injection equipment.
3. Depth of penetration, length, material used, and procedures where epoxy is approved for use.
4. Marked up drawings of proposed epoxy injection repair crack locations, widths, and lengths and direction on structure.
5. Sample bottle.
6. Pot Life Test.
7. Slant Shear Test (Bond Strength).

B. Informational Submittals:

1. Manufacturer's recommended surface preparation procedures and application instructions for epoxy resins.
2. Manufacturer's Certificate of Compliance in accordance with Section 01 61 00, Common Product Requirements. Certified test results for each batch of epoxy resin.
3. Statements of Qualification for Epoxy Resin:
   a. Manufacturer's Site representative.
   b. Injection applicator.
   c. Injection pump operating technician.
4. Sample of epoxy resin two component ratio and injection pressure test records for concrete crack repair work.
5. Installation instructions for repairing core holes with repair mortar.
6. Epoxy resin two component ratio and injection pressure test records for concrete crack repair work.

1.04 QUALITY ASSURANCE

A. Qualifications for Injection Staffs:

1. Manufacturer's Site Representative:
   a. Capable of instructing successful methods of epoxy injection process for concrete structure.
   b. Understands and is capable of explaining technical aspects of correct material selection and use.
   c. Experienced in operation, maintenance, and troubleshooting of application equipment.

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2. Injection Crew and Job Foreman:
   a. Provide written and verifiable evidence showing compliance with the following requirements:
      1) Licensed or certified by epoxy resin material manufacturer.
      2) Minimum 3 years' experience in successful epoxy injection for at least 10,000 linear feet of successful crack injection, including 2,000 linear feet of wet crack injection to stop water leakage.

B. Injected Epoxy Resin: Fill cracks and joints with minimum resin depth penetration no less than 90 percent of full thickness of concrete section for cracks or joints.

C. Injected cracks and joints which leak shall be considered deficient work irrespective of depth of penetration. Reinjection of deficient work or, with approval of Engineer, provide other repairs to eliminate leakage.

D. Bond Strength Test for Epoxy Resin:

1. Concrete failure before resin failure.
2. 1,500 pounds per square inch minimum bond strength per ASTM C882 test requirements with no failure of either concrete or epoxy resin.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Packing and Shipping:

1. Package resin material in new sealed containers and label with following information:
   a. Manufacturer's name.
   b. Product name and lot number.

B. Storage and Protection: Store epoxy resin material containers in accordance with manufacturer's printed instructions and at ambient temperatures below 110 degrees F and above 45 degrees F.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Materials and accessories specified in this section shall be products of:

1. BASF Construction Chemicals, LLC-Building Systems, Shakopee, MN; SCB Concresive Series products that meet properties indicated in sub-section 2.2.B.

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2. Sika Corp., Lyndhurst, NJ; Sikadur Series products that meet properties below.
3. Euclid Chemical Co., Cleveland, OH; Euco Series (No. 452) products that meet properties below.

2.02 EPOXY INJECTION RESIN

A. Two-component A and B structural epoxy resin for injection into cracks or joints or other voids in concrete structures for bonding or grouting.

B. Uncured Resin Properties:

1. When mixed in ratio specified on resin container label:

	Test Method	Wide Cracks or Joints	Narrow Cracks or Joints
Pot Life (60-gram mass) @ 77, plus or minus 4 deg F	As specified in Article Source Quality Control	13 to 25 minutes	15 to 30 minutes
Pot Life (60-gram mass) @ 100, plus or minus 4 deg F	As specified in Article Source Quality Control	3 to 10 minutes	10 to 20 minutes
Viscosity @ 40, plus or minus 3 deg F	Brookfield RVT Spindle No. 4 @ 20 rpm	4,400 cps	600 cps
Viscosity @ 75 to 77 deg F	Brookfield RVT Spindle No. 2 @ 20 rpm	375 to 350 cps	175 to 140 cps

C. Epoxy Resin Properties: When cured for 7 days at 77-degree F, plus or minus 3 degrees F and conditioned at test temperature 12 hours prior to test, unless otherwise specified.

	Test Method	Wide Cracks or Joints	Narrow Cracks or Joints
Ultimate Tensile Strength, psi	ASTM D368	8,000 min.	5,000 min.
Tensile Elongation @ Break, percent	ASTM D638	4.2 max.	3.0 max.
Flexural Strength, psi	ASTM D790	10,000 min.	10,000 min.
Flexural Modulus, psi	ASTM D790	5.5×10^5 min.	4.5×10^5 min.
Compressive Yield Strength, psi	ASTM D695*	15,000 min.	12,000 min.

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	Test Method	Wide Cracks or Joints	Narrow Cracks or Joints
Compressive Modulus, psi	ASTM D695*	$4.0x10^5$ min.	$4.0x10^5$ min.
Heat Deflection Temperature	ASTM D648*	130 deg F min.	140 deg F min.
Cured 3 days @ 40 deg F – Wet Concrete		3,500 psi min.	3,500 psi min.
Cured 1 day @ 77 deg F – Dry Concrete		5,000 psi min.	5,000 psi min.
Cured 3 days @ 77 deg plus or minus 3 deg F		5,000 psi min.	5,000 psi min.
*Cure test specimens so that peak exothermic temperature of resin does not exceed 100 degrees F. Note: See referenced specifications for preparation method of test specimens.			

2.03 SURFACE SEAL

A. Sufficient strength and adhesion for holding injection fittings firmly in place and to resist pressures preventing leakage during injection.

B. Capable of removal after injection resin has cured.

2.04 WATER

A. Clean and free from oil, acid, alkali, organic matter, or other deleterious substances, meeting federal drinking water standards.

2.05 SAMPLE BOTTLE

A. 5-inch natural wide mouth HDPE bottle or 4-ounce clear PVC cylinder bottle; supplied with caps.

2.06 SOURCE QUALITY CONTROL

A. Test Requirements: Perform tests for each batch of epoxy resin.

B. Pot Life Test:

1. Condition Component A and Component B to required temperature.
2. Measure components in ratio of Component B as stated on manufacturer’s label into an 8-fluid ounce paper cup.
3. Mix components for 60 seconds using non-metallic stirring instrument. Scrape sides and bottom of cup periodically.

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4. Probe mixture once with non-metallic stirring instrument every 30 seconds, starting 2 minutes prior to minimum specified pot life.
5. Pot Life Definition: Time at which a soft stringy mass forms in center of cup.

C. Slant Shear Test: Prepare specimens and perform tests in accordance with ASTM C882.

PART 3 EXECUTION

3.01 GENERAL

A. Unless permitted otherwise, structurally repair cracks or joints listed below:

1. Cracks considered to be defective as defined in Section 03 30 00, Cast-in-Place Concrete.

B. Do not proceed with injection work until submittals have been reviewed and approved by Engineer.

C. Perform cracks or joints injection work after removing defective surface materials and after performing surface preparation, but prior to applying surface repair material unless otherwise noted. See Section 03 01 32, Repair of Vertical and Overhead Concrete Surfaces, Section 03 01 33, Repair of Horizontal Concrete Surfaces, for concrete surface repair system.

D. Width of cracks may vary along length and through thickness of concrete section.

E. Remove all excess, unused epoxy resin materials on concrete surfaces exposed to view prior to end of Work.

3.02 EQUIPMENT

A. Portable, positive displacement type pumps with in-line metering to meter and mix two epoxy resin components and inject mixture into cracks or joints.

B. Pumps:

1. Electric or air powered with interlocks providing positive ratio control of proportions for the two components at nozzle.
2. Primary injection pumps for each material of different mix ratio, including a standby backup pump of similar ratio.
3. Capable of immediate compensation for changes in resins.
4. Do not use batch mix pumps.

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C. Discharge Pressure: Automatic pressure controls capable of discharging mixed epoxy resin at pressures in accordance with epoxy resin manufacturer's printed instruction and able to maintain pressure.

D. Automatic Shutoff Control: Provide sensors on both Component A and Component B reservoirs for stopping machine automatically when only one component is being pumped to mixing head.

E. Proportioning Ratio Tolerance: Maintain epoxy resin manufacturer's prescribed mix ratio within a tolerance of plus or minus 5 percent by volume at discharge pressure up to 160 pounds per square inch.

F. Ratio/Pressure Check Device:

1. Two independent valve nozzles capable of controlling flow rate and pressure by opening or closing valve to restrict material flow.
2. Pressure gauge capable of sensing pressure behind each valve.

3.03 PREPARATION

A. Free cracks or joints from loose matter, dirt, laitance, oil, grease, efflorescence, salt, and other contaminants.

B. Clean cracks or joints in accordance with epoxy resin manufacturer's instructions.

C. Clean surfaces adjacent to cracks or joints from dirt, dust, grease, oil, efflorescence, and other foreign matter detrimental to bond of surface seal system and to expose the full extent of cracks and joints in accordance with manufacturer's printed instruction by low pressure water cleaning using a pressure of 1,000 pounds per square inch to 3,000 pounds per square inch.

D. Do not use acids and corrosives for cleaning, other than those specified herein unless neutralized prior to injecting epoxy resin.

E. During installation and curing of materials, if ambient temperature is expected to drop below manufacturer's recommended minimum temperature, provide enclosures and heat as required.

F. Provide work platforms as required.

G. Dry out cracks or joints if required by manufacturer's instructions.

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3.04 APPLICATION

A. All liquid is to be removed from hydraulic structure prior to commencing with epoxy injection, unless approved otherwise.

B. Entry Ports:

1. Establish openings for epoxy resin entry in surface seal along crack.
2. Determine space between entry ports equal to thickness of concrete member to allow epoxy resin to penetrate to the full thickness of the member.
3. Drill injection holes at an angle between 45 degrees and 60 degrees from surface of concrete and perpendicular to alignment of cracks or joints, to intersect crack or joint at midpoint of concrete section, except as noted otherwise.
4. Locate drill holes on alternate sides of crack or joint where possible, unless orientation of crack or joint is known or has been verified by non-destructive testing techniques or core drilling.
5. Drill Hole Spacing: Do not to exceed concrete thicknesses or 12 inches maximum, except as noted otherwise.
6. Adjust location and angle of drill holes to suit orientation of crack or joint and at commencement of drilling holes for injection.
7. Take measures to prevent drilling holes for injection too shallow or too deep, or damaging existing waterstop in joints.
8. Remove dust and debris in drill holes and on surface of structure resulting from drilling operation, by flushing with water prior to installing the injection packers or ports.
9. Space entry ports closer together to allow adjustment of injection pressure to obtain minimum loss of epoxy to soil at locations where:
    a. Cracks or joints extend entirely through concrete element.
    b. Backfill of walls on one side.
    c. Slab-on-grade.
    d. Difficult to excavate behind wall to seal both surfaces of crack.
10. Install injection packers or ports in drill holes in accordance with manufacturer’s printed instructions with zerk coupling or other one-way ball or check valve, to permit testing for watertightness and acid flushing of cracks and joints.

C. Application of Surface Seal along Cracks and Joints:

1. Apply surface seal in accordance with manufacturer’s instructions to designated cracks and joints face prior to injection. Seal surface of cracks or joints to contain and prevent escape of injection epoxy.
2. Cure surface seal in accordance with manufacturer’s printed instructions before commencing inject work.

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D. Epoxy Injection:

1. Ensure zerk coupling is not installed in ports or packers next to the one being injected.
2. Start injection into each crack or joint at lowest elevation entry port or packer along vertical or diagonal crack or joint, and at one end of horizontal crack or joint.
3. Where injection entry ports or packers are used, continue injection at first port or packer until resin begins to flow out of port or packer at next highest elevation. Plug first port or packer and start injection at second port or packer until resin flows from next port or packer.
4. Inject entire crack or joint with same sequence.
5. At no time inject more than 6 feet length of first vertical crack or joint before verifying resin in sample bottle has start to set and cure.
6. Prior to commencing injection work along a horizontal crack or joint in structure when processed using ports or packers with zerk couplings are used, remove zerk couplings from injection ports or packers except for two ports or packers located where injection work will commence. Commence injection work in first two ports or packers. Once clean resin is vented from third injection port or packer, cease injection at first port or packer, and install zerk coupling and commence injection at third port or packer. Repeat process for fourth and subsequent ports or packers until full length of crack or joint has been injected.

E. Finishing:

1. Allow epoxy resin to cure in accordance with manufacturer’s instruction after cracks or joints have been completely injected to allow surface seal removal without draining or runback of uncured epoxy resin material from cracks or joints.
2. Remove surface seal and injection packers or ports from cured injection resin along crack.
3. Finish crack or joint faces flush with adjacent concrete.
4. Indentations or protrusions caused by placement of entry ports, packers, drill holes, or damage from removal of surface seal is not acceptable.
5. Grind off protrusions and patch indentations and holes from injection packers and entry ports with a suitable patch material to satisfaction of Engineer.
6. Remove surplus surface seal material splatters and injection resin material runs and spills from concrete surfaces.

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3.05 FIELD QUALITY CONTROL

A. Epoxy Resin Two Component Ratio Tests:

1. Disconnect mixing head and pump two resin components simultaneously through ratio check device.
2. Adjust discharge pressure to 160 pounds per square inch for both resin components.
3. Simultaneously discharge both resin components into separate calibrated containers.
4. Compare amounts simultaneously discharged into calibrated containers during same time period to determine mix ratio.
5. Complete test at 160 pounds per square inch discharge pressure and repeat procedure for 0 pounds per square inch discharge pressure.
6. Run ratio test for each injection unit at beginning and end of each injection work day, and when injection work has stopped for more than 1-hour.
7. Document and maintain complete accurate records of ratios and pressure checks.

B. Injection Pressure Test:

1. Disconnect mixing head of injection equipment and connect two resin component delivery lines to pressure check device.
2. Pressure Check Device:
   a. Two independent valved nozzles capable of controlling flow rate and pressure by opening or closing of valve.
   b. Pressure gauge capable of sensing pressure buildup behind each valve.
3. Close valves on pressure check device and operate equipment until gauge pressure on each line reads 160 pounds per square inch.
4. Stop pumps and observe pressure; do not allow pressure gauge to drop below 150 pounds per square inch within 3 minutes.
5. Run pressure test for each injection equipment unit:
   a. Beginning and end of each injection work day.
   b. When injection work stop for more than 45 minutes.
6. Check tolerance to verify equipment capable of meeting specified ratio tolerance.

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C. Bottled Sample Tests:

1. During injection operation, provide at least one sample of mixed epoxy resin for each injection pump per shift per injection work day in a sample bottle.
2. Provide sufficient sample to demonstrate sample material epoxy resin will set and cure correctly.
3. Label each bottled sample with Contractor's name, date, and time sample was taken, and location in structure where sample was taken. Record details of bottle sample tests.
4. Place filled sample bottle upright in a container and allow sample to cure.
5. After sample has been allowed to cure, cut bottled sample open and visually inspect contents to verify that epoxy resin material has completely reacted and cured.
6. Evaluation and Assessment of Test:
    a. Should bottled sample(s) indicate a problem; such as epoxy resin not cured or foreign liquid in sample bottle, take verifying core sample immediately from cracks or joints, where material was used.
    b. Should above-referenced bottle sample(s) and core sample(s) indicate a problem with epoxy resin, arrange to have a Technical Representative of the epoxy resin manufacturer come to Site to review bottled sample(s) and core drilled sample(s) with Engineer and provide technical advice on corrective measures.
    c. Carry out further investigation work or corrective measures recommended by Technical Representative of epoxy resin manufacturer.

END OF SECTION

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SECTION 03 64 24
POLYURETHANE INJECTION GROUTING

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards that may be referenced in this section:

1. ASTM International (ASTM):
   a. D638, Standard Test Method for Tensile Properties of Plastics.
   b. D1622, Standard Test Method for Apparent Density of Rigid Cellular Plastics.
   c. D1623, Standard Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics.
   d. D3574, Standard Test Method for Flexible Cellular Material Slab, Bonded, and Molded Urethane Foams.

1.02 DEFINITIONS

A. Crack: Complete or incomplete separation of concrete into two or more parts produced by breaking or fracturing.

B. Injection: Method of bonding together; method of addressing or eliminating leakage through cracks or joints by installing polymer under pressure to fill the void in crack or joint.

C. Joint: Planned and formed discontinuity in concrete structure at junction of adjacent and sequential concrete placements, and may contain embedded waterstops.

D. Leak or Leakage: Crack or joint exhibiting moisture, sign of efflorescence, intermittent wet to touch, or continuous flow of liquid.

E. Narrow Cracks: Width equal to or less than 0.015-inch.

F. Wide Crack: Wider than 0.015-inch.

1.03 SUBMITTALS

A. Action Submittals:

1. Physical and chemical properties for polyurethane injection resin.
2. Technical data for metering, mixing, and injection equipment.

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3. Marked up drawings showing locations of proposed polyurethane injection work, including the following:
    a. Exact locations for injection.
    b. Depth of penetration or crack.
    c. Width of crack measured every 4 feet minimum.
    d. Length of penetration or crack.
4. Proposed materials.
5. Injection procedure, including the following:
    a. Preparation of penetration for polyurethane.
    b. Fittings for installation for injection.
    c. Temperature of installation.
    d. Measurement and monitoring of injection pressure.
    e. Surface cleaning and repair.

B. Informational Submittals:

1. Manufacturer’s recommended surface preparation procedures and application instructions for polyurethane resin injection.
2. Manufacturer’s Certificate of Compliance in accordance with Section 01 61 00, Common Product Requirements. Certified test results for each batch of polyurethane.
3. Statements of Qualification for Polyurethane Resin Injection:
    a. Manufacturer’s Site representative.
    b. Injection applicator.
    c. Injection pump operating technician.
4. Sample of polyurethane resin mix ratio and injection pressure test records for concrete crack and joint injection work.
5. Installation instructions for repairing core holes with repair mortar.
6. Polyurethane resins injection pressure test records for concrete crack and joint injection work.

1.04 QUALITY ASSURANCE

A. Qualifications for Injection Staff:

1. Manufacturer’s Site Representative:
    a. Capable of instructing successful methods of polyurethane injection process for concrete structures.
    b. Understands and is capable of explaining technical aspects of correct material selection and use.
    c. Experienced in the operation, maintenance, and troubleshooting of application equipment.

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2. Injection crew and job foreman shall provide written and verifiable evidence showing compliance with the following requirements:
   a. Licensed or certified by polyurethane resin manufacturer.
   b. Minimum 3 years' experience in successful polyurethane injection.

1.05 PERFORMANCE REQUIREMENTS

A. Injected polyurethane resin shall fill cracks and joints, and in no case shall depth of penetration of injection material be less than 90 percent of full thickness of the concrete section for cracks.

B. In cured state, injected polyurethane resin forms a dense rubber-like closed cell flexible foam compression gasket-type seal material.

C. Notwithstanding the foregoing, injected cracks or joints which exhibit leakage are considered deficient work irrespective of the depth of penetration observed in quality control core drilled samples. Reinject deficient work as required to meet the performance requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Packing and Shipping:

1. Package adhesive material in new sealed containers and label with following information:
   a. Manufacturer's name.
   b. Product name and lot number.

B. Storage and Protection: Store polyurethane resin material containers in accordance with manufacturer's printed instructions or in the absence of such information at ambient temperatures below 110 degrees F and above 68 degrees F.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Sika Corp., Lyndhurst, NJ; SikaFix HH Hydrophilic.

B. Euclid Chemical Co., Cleveland, OH; DURAL Aqua-Fil.

C. Prime Resins, Inc., Conyers, GA; Prime Flex 900 XLV.

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2.02 POLYURETHANE RESIN

A. Single-component, water-activated, hydrophilic polyurethane injection resin.

B. Elongation: Minimum 350 percent, in accordance with ASTM D3574 or ASTM D638 test method.

C. Tensile Strength: Minimum 150 pounds per square inch, in accordance with ASTM D3574 or ASTM D638 test method.

2.03 SURFACE SEAL

A. Provide seal with sufficient strength and adhesion for holding injection fittings firmly in place, and to resist pressures preventing leakage during injection.

B. Capable of removal after injection resin has cured.

2.04 WATER

A. Clean and free from oil, acid, alkali, organic matter, or other deleterious substances, meeting federal drinking water standards.

2.05 SAMPLE BOTTLE

A. 5 inches natural wide mouth HDPE bottle or 4 ounces clear PVC cylinder bottle, supplied with caps.

2.06 SOURCE QUALITY CONTROL

A. Test Requirements: Perform tests for each batch of polyurethane resins.

PART 3 EXECUTION

3.01 GENERAL

A. Use of polyurethane injection shall be limited to locations as determined by Structural Engineer.

B. Do not proceed with injection work until action submittals have been reviewed and approved by the Structural Engineer of Record.

C. Perform injection work after performing surface preparation.

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D. Width of the cracks shown may vary along the length and through the thickness of the concrete section.

E. Remove all excess unused polyurethane resins materials inside the structure prior to the end of the work.

3.02 EQUIPMENT

A. Portable, positive displacement type pumps with in-line metering to meter mixed components, and inject mixture into crack or joint.

B. Pumps: Positive displacement type pump.

C. Controls capable of discharging mixed polyurethane resin at pressures in accordance with polyurethane resin manufacturer’s printed instructions, and able to maintain such pressure.

D. Proportioning Ratio Tolerance: Maintain polyurethane manufacturer’s prescribed mix ratio within a tolerance in accordance with polyurethane resin manufacturer’s printed instructions.

E. Pressure gauge capable of sensing pressure behind valve.

3.03 PREPARATION

A. Free cracks and joints from loose matter, dirt, laitance, oil, grease, salt, and other contaminants.

B. Clean cracks and joints in accordance with polyurethane resins manufacturer’s printed instructions.

C. Clean surfaces adjacent to cracks and joints from dirt, dust, grease, oil, efflorescence, encrustation, and other foreign matter detrimental to bond of surface seal system and to expose the full extent of cracks and joints in accordance with manufacturer’s printed instructions.

D. Do not use acids and corrosives for cleaning, other than those specified herein, unless neutralized prior to injecting polyurethane resin.

E. During installation and curing of materials, if the ambient temperature is expected to drop below the manufacturer’s recommended minimum temperature, provide enclosures and heat as required.

F. Provide work platforms as required.

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3.04 APPLICATION

A. Injection Ports:

1. Drill holes shall be installed along cracks and joints designated for injection as required to meet the performance requirements for injection.
2. The requirements for installing drill holes for injection provided below represent acceptable minimum standards of practice.
3. Drill holes for injection at an angle between 45 degrees and 60 degrees from the surface of the concrete and perpendicular to the cracks or joints alignment, to intersect the cracks at the midpoint of the concrete section, and intersect the joints at the midpoint between the waterstop and interior concrete surface, except as noted otherwise.
4. Locate drill holes on alternate sides of the crack or joint where possible, unless orientation of the crack or joint is known or has been verified by nondestructive testing techniques or core drilling.
5. The spacing of drill holes not to exceed the concrete thickness or 12 inches (maximum), except as noted otherwise.
6. Adjust location and angle of drill holes to suit orientation of crack or joint and at required angle, such as using a template, during the Work especially at the commencement of drilling holes for injection.
7. Take measures to prevent drilling holes for injection too shallow, or too deep, and/or damaging the existing waterstop in the joints. Shallow hole injections lead to concrete spalls. Repair spalls at Contractor’s expense.
8. Remove dust and debris in drill holes and on interior surface of the structure resulting from drilling operation, by flushing with water prior to installing injection packers or ports.
9. Install injection packers or ports in drill holes in accordance with manufacturer’s printed instructions with zerk coupling, or other one-way ball or check valve, to permit testing for watertightness and acid flushing of cracks and joints.

B. Application of Surface Seal Along Cracks and Joints:

1. Apply surface seal along the length of the cracks and joints designated for injection on the top side and underside of slabs, or both sides of walls, where possible in order to contain, confine, and prevent escape of the injected polyurethane resin, in accordance with manufacturer’s printed instructions.
2. Cure the surface seal in accordance with the material’s manufacturer’s printed instructions.

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C. Mixing Polyurethane Injection Resin:

1. Add accelerator to polyurethane injection resin at the required dosage to produce cured polyurethane material meeting performance requirements, and mix thoroughly in accordance with manufacturer's printed instructions until a homogeneous mixture is obtained outside of the structure.
2. Heat polyurethane injection resin materials prior to and during mixing and injection as required and in accordance with manufacturer's printed instructions to a temperature between 85 degrees F and 130 degrees F. Injection of polyurethane resin when it is less than 85 degrees F or more than 130 degrees F is prohibited.

D. Polyurethane Injection of Cracks and Joints:

1. Inject polyurethane resins, mixed with accelerator or in a neat form, into cracks and joints in a sequential manner, and reinjection as required, to meet the performance requirements.
2. Start injection into each crack or joint at lowest elevation entry port for vertical or diagonal cracks and joints and at one end for horizontal cracks and joints in vertical structure. Continue injection at first port until pure uncontaminated resin begins to flow out of next port. Plug first port and start injection at second port until polyurethane resin flows from next port. Inject crack or joint in a sequential manner until the full length of the crack or joint has been injected. At no time inject more than 6 feet length of vertical crack or joint before verifying that the first 12 inches of injected crack or joint is set and cured.
3. Prior to commencing the injection work along a crack or joint in horizontal structure when packers with zerk couplings are used, remove the zerk couplings from the injection packers or ports except for the two packers located where the injection work will commence. Commence injection work in the first two packers. Once clean resin is vented from the third injection packer, cease injection at the first packer, and install the zerk coupling and commence injection at the third packer. Repeat the process for the fourth and subsequent packers until the full length of the crack or joint has been injected.

E. Finishing:

1. Cure polyurethane resins after crack or joints has been completely filled without draining or runback of polyurethane resin material from crack or joints.
2. Remove surface seal and injection packers or ports from along the crack or joints.
3. Finish surface flush and to match surrounding concrete.

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4. Indentations or protrusions caused by placement of entry ports drill holes, or damage from removal of surface seal, is not acceptable.
5. Grind off protrusions, and patch indentations and holes from packers and ports with a suitable patch material to the satisfaction of the Engineer.
6. Remove surplus surface seal material on splatters and injection material runs and spills from concrete surfaces.

3.05 FIELD QUALITY CONTROL

A. Injection Pressure Test:

1. Disconnect mixing head of injection equipment and connect polyurethane component delivery line to pressure check device.
2. Pressure Check Device:
   a. Two independent valved nozzles capable of controlling flow rate and pressure by opening or closing of valve.
   b. Pressure gauge capable of sensing pressure buildup behind each valve.
3. Close valves on pressure check device and operate equipment until gauge pressure on each line reads 160 pounds per square inch.
4. Stop pumps and observe pressure; do not allow pressure gauge to drop below 150 pounds per square inch within 3 minutes.
5. Run pressure Test for Each Injection Equipment Unit:
   a. Beginning and end of each injection work day.
   b. When injection work has stopped for more than 45 minutes.
6. Check tolerance to verify equipment capable of meeting specified ratio tolerance.

B. Bottled Samples:

1. During the injection operation, provide at least one sample of the mixed polyurethane injection resins per shift per injection pump in a sample bottle.
2. Half fill each sample bottle, containing a small amount of water (5 percent by volume) with polyurethane injection resin material from the pump discharge hose. Swirl or lightly shake sample to thoroughly mix resin with the water. When foaming rises near the top of the bottle, install the cap to contain the expanding resin material.
3. Label each bottled sample with Contractor’s name, date and time sample was taken, and location in structure where sample was taken. Maintain a log of bottle samples.
4. Place filled sample bottle upright in a box or pail and allow sample to cure.

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5. After sample cured, cut bottled sample open and visually inspect contents to verify that polyurethane injection resins material has completely reacted and cured.
6. Evaluation and Assessment of Test:
    a. If a bottled sample(s) indicates a problem with the polyurethane injection resins, such as polyurethane resin not cured; take verifying core sample immediately from the cracks or joints, where the material was used.
    b. If the above-referenced bottle sample(s) and core sample(s) indicate a problem with the polyurethane injection resins, have a Technical Representative of the polyurethane injection resins manufacturer come to site to review bottled sample(s) and core drilled sample(s) with Engineer and provide technical advice on corrective measures.
    c. Carry out further investigation work or corrective measures recommended by the Technical Representative of the polyurethane injection resins manufacturer.

C. Visual Inspection:

1. Confirm injection of polyurethane has stopped the leaking material.
2. Confirm installation of material is in accordance with manufacturers' requirements.
3. Confirm installation of material is not damaging concrete.

END OF SECTION

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SECTION 04 22 00
CONCRETE UNIT MASONRY

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. ASTM International (ASTM):
   a. A82/A82M, Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
   b. A153/A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
   c. C33, Standard Specification for Concrete Aggregates.
   d. C90, Standard Specification for Loadbearing Concrete Masonry Units.
   e. C140, Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.
   f. C144, Standard Specification for Aggregate for Masonry Mortar.
   g. C150, Standard Specification for Portland Cement.
   h. C207, Standard Specification for Hydrated Lime for Masonry Purposes.
   i. C270, Standard Specification for Mortar for Unit Masonry.
   j. C404, Standard Specification for Aggregates for Masonry Grout.
   k. C476, Standard Specification for Grout for Masonry.
   l. C618 12 Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
   m. C744, Standard Specification for Prefaced Concrete and Calcium Silicate Masonry Units.
   n. C979, Pigments for Integrally Colored Concrete.
   o. C989, Standard Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars.
   p. C1314, Standard Test Method for Compressive Strength of Masonry Prisms.
   q. C1403, Standard Test Method for Rate of Water Absorption of Masonry Mortars.
   r. E514/E514M, Standard Test Method for Water Penetration and Leakage through Masonry.
2. The Masonry Society (TMS):
   a. TMS 402; Building Code Requirements for Masonry Structures and Companion Commentaries.
   b. TMS 602; Specification for Masonry Structures.

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3. International Code Council (ICC):
    a. International Building Code (IBC).
    b. ICC Evaluation Service (ICC-ES) Reports.

1.02 SUBMITTALS

A. Action Submittals:

1. Shop Drawings.
2. Data Sheets:
    a. Preformed control joint materials.
    b. Water repellant masonry sealer.
    c. Grout mix design.
    d. Prebagged mortar properties and data sheets.
    e. Grout sand gradation in accordance with ASTM C404.
3. Samples:
    a. Sample:
        1) Manufacturer’s standard color chart for initial color selection.
        2) One of each type of masonry unit to be used on Project from the proposed manufacturer for final color verification.
        3) Mortar colors for color selection.

B. Informational Submittals:

1. Method and Location of Placing Grout: High lift or low lift.
2. Mix design test results.
3. Certifications:
    a. Units comply with ASTM C55 and ASTM C90.
    b. Grout test results conform to ASTM C1019.
    c. Grout aggregates conform to requirements of ASTM C33, including nonreactivity.
    d. Mortar sand conform to requirements of ASTM C144.
4. Test results of Project samples from masonry unit manufacturer stating that units comply with ASTM C90. Documentation of material testing shall be one less than 1 year old.
5. Test results of proposed grout mix deign stating that units comply with ASTM C1019. Documentation of material testing shall be 1-year old or less.
6. Test reports stating aggregates for mortar meet requirements of ASTM C144.
7. Test reports or letter of certification stating aggregates for grout meet requirements of ASTM C404.
8. Method and materials for removal of efflorescence.

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9. Field test results to qualify materials.
    a. Grout tests in accordance with ASTM C1019.
10. Preinstallation conference minutes.

1.03 QUALITY ASSURANCE

A. Mockups:

1. Lay up Sample panel for each type of masonry at Site.
2. Dimensions: Minimum 4 feet high by 4 feet long.
3. Use approved materials and procedures.
4. Leave intact after approval until acceptance of permanent masonry work and then remove at the end of the project. May be part of permanent construction.
5. Approved panels shall serve as basis of color, texture, bond, quality of finished joints, surface applied finishes, and for acceptance of permanent construction.
6. Demonstrate ability to keep insulation and grout isolated and in certain cells during any sequence of placement, and to demonstrate materials will be restricted to cells and bond beams intended to receive insulation and grout.
7. Construction shall show areas required to receive mortar, including webs on each side of each grouted cell to prevent grout from entering adjacent cells or courses.
8. Where bond beams are to be used, demonstrate proper placement of both insulation and grout to bond beam level, and proper placement of bond beam prior to placement of insulation and grout above bond beam level.
9. Demonstrate proper use of running bond.
10. Compliance Requirements: For masonry finish and appearance, dimension tolerances, tolerances of construction, joint tolerances, and wall plumb tolerances, comply with the requirements and criteria of NCMA, ASTM C90, and TMS 602.1.

B. Masonry Unit Manufacturer: Qualified by manufacturer of water repellent admixture to use product.

C. Preinstallation Conference:

1. Required Meeting Attendees:
    a. Masonry subcontractor, including masonry foreman.
    b. Ready-mix producer.
    c. Admixture representative.
    d. Testing and sampling personnel.
    e. Design Structural Engineer.

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2. Schedule and conduct prior to start of masonry construction.
3. Notify Engineer of location and time.
4. Agenda shall include:
    a. High lift and low lift procedures.
    b. Mortar, grout, unit, and reinforcing submittals.
    c. Types and locations of rebar splices.
    d. Joint tooling.
    e. Admixture types, dosage, performance, and redosing at Site.
    f. Mix designs and test of mix.
    g. Placement methods, techniques, equipment, consolidation, and reconsolidation.
    h. Protection procedures for environmental conditions.
    i. Other specified requirements requiring coordination.
5. Submit conference minutes as specified in Section 01 31 19, Project Meetings.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Storage and Protection: Keep units and mortar/grout cementitious ingredients, including lime, dry.

PART 2 PRODUCTS

2.01 COMPRESSIVE STRENGTH OF MASONRY ASSEMBLAGE

A. Minimum 28-Day Specified Compressive Strength (f'm) of Masonry: 2,000 pounds per square inch.

2.02 CONCRETE MASONRY UNITS (CMU)

A. ASTM C90: Medium weight.

1. Net Area Compressive Strength: 2,000 pounds per square inch minimum, in accordance with TMS 602, Table 2.
    a. Water Repellent Admixture:
        1) Structural concrete masonry units in weather exposed exterior wall shall be manufactured with integral liquid polymeric admixture to provide resistance to water penetration.
        2) Manufacturers and Products:
            a) W.R. Grace & Co.; Dry-Block Block Admixture.
            b) BASF Construction Chemicals; MasterPel 240.
2. Nominal Size: 16 inches long by 8 inches high by thickness shown on the Drawings.

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3. Color of Units:
   a. Exterior Exposed: As indicated on the Drawings.
   b. Interior or Concealed: Natural.
4. Surface Texture on Exposed Surfaces: Smooth.
5. Surface Texture: Smooth on interior, concealed exterior, and surface 1 foot below finished grade.

B. General Concrete Masonry Unit (CMU) Requirements:

1. Furnish or cut special shapes for corners, jambs, lintels, and other areas shown or required.
2. Special units shall match color and texture of standard units.
3. Where units are placed so end of unit is exposed, such as at a corner or intersection, exposed end of that block shall have surface to match color and texture of sides of other units.
4. Furnish sound, dry, clean units free of cracks, prior to placing in structure.
5. Vertical Cells to be Grouted: Capable of alignment sufficient to maintain clear, unobstructed continuous vertical cell dimensions in accordance with TMS 602, Table 7.
6. Masonry unit size and shape shall allow for all placement patterns. Use vertical grout dams to prevent materials, such as grout or poured insulation, from escaping from cell being filled to adjacent cells where material is not intended to be placed.

2.03 MORTAR MATERIALS

A. Portland Cement-Lime Mortar:

1. Comply with ASTM C270.
2. Aggregates:
   a. Non-reactive in accordance with ASTM C33, Appendix X1.
   b. Mortar: ASTM C144, sand.

B. Mortar Cement Mortar: ASTM C1329.

C. Water: Fresh, clean, and potable.

D. Water Repellent Admixture:

1. ASTM C1403.
2. Mortar for structural concrete masonry units in weather exposed exterior walls shall include an integral liquid polymeric admixture to provide resistance to water penetration.

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3. Manufacturers and Products:
   a. W.R. Grace; DRY-BLOCK.
   b. Harris Specialty Chemicals.
   c. Axim Italcementi Group; Intrapel.
   d. BASF Chemical Co.; MasterPel 240MA.

E. Mortar Color Admixture:

1. Meet the requirements of ASTM C979.
2. Manufacturer and Product: Davis Colors, Los Angeles, CA; True Tone Mortar Color.
3. Color shall be selected by Engineer.

2.04 GROUT MATERIALS

A. Cement:

1. ASTM C150, Type I and Type II portland cement.
2. ASTM C595, Type IL.

B. Fly Ash: Fly Ash (Pozzolan): Class F fly ash in accordance with ASTM C618.

C. Slag Cement: In accordance with ASTM C989, Grade 100 or Grade 120.

D. Lime: ASTM C207, Type S hydrated.

E. Aggregates:

1. ASTM C404, fine and coarse.
2. Non-reactive in accordance with ASTM C33, Appendix X1.

F. Water: Fresh, clean, and potable.

2.05 REINFORCEMENT

A. Reinforcement: Clean and free from loose rust, scale, and coatings that reduce bond.

B. Deformed Bars: As specified in Section 03 21 00, Steel Reinforcement.

2.06 PREFORMED CONTROL JOINTS

A. Solid rubber cross-shape extrusions as manufactured by:

1. Dayton Superior/Dur-O-WalDayton, OH; DA 2001 Control Joint Regular Rubber.
2. Hohmann and Barnard, Inc, Hauppauge, NY; #RS-Standard.

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2.07 MORTAR MIXES

A. In accordance with ASTM C270, Type S and TMS Specifications.

B. Mix Method:

1. Property Method: Minimum average mortar 28-day compressive strength 1,800 pounds per square inch.

C. Mixing:

1. Machine mix in approved mixers in accordance with ASTM C270. Time addition of approved admixtures in accordance with manufacturer's instructions. Procedure used for adding it to mix shall provide good dispersion.
2. Follow manufacturer's instructions for mortar color admixture.
3. Follow manufacturer's instructions for water repellent admixture.
4. Review compatibility with other mortar admixture.

D. Where colored masonry units are used, color mortar to match. Inert coloring pigments may be added, but shall not exceed 6 percent by weight of cement.

2.08 GROUT MIXES

A. Compressive Strength Property: Minimum 2,000 pounds per square inch at 28 days.

B. Mix Design:

1. Proportions: Design mix to meet property/strength requirements.
2. Slump: 8-inch minimum, 11-inch maximum.

C. Mixing:

1. Do not use water reducers, air entrainment, plasticizing, high-range water reducers, or other non-specified admixtures in grout mixes.
2. Transit-Mixed Grout: Meet requirements of ASTM C476.
3. For high lift grouting, add approved grout expansion admixture in accordance with manufacturer's recommendations.
4. Fluid consistency suitable for placing without segregation with a slump of 8 inches to 11 inches.

2.09 AIR AND WATER BARRIER

A. Fluid-applied air and water barrier system as specified in Section 07 15 00, Air and Water Barriers.

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PART 3 EXECUTION

3.01 GENERAL

A. Meet requirements of The Masonry Society (TMS) 602, Part 3, Execution, except as modified in this section.

B. Moisture Protection:

1. Keep units dry while stored on Site.
2. Do not wet units prior to laying.

C. Provide measures to prevent moisture from entering incomplete walls and open cells.

D. Cold Weather: Meet requirements of TMS Specification Section “Cold Weather Construction.”

E. Hot Weather: Meet requirements of TMS Specification Section “Hot Weather Construction.”

F. After construction during cold weather, maintain newly constructed masonry temperature above 32 degrees F for a minimum of 24 hours using TMS or other approved cold weather methods.

G. After construction and during hot weather, fog spray newly constructed masonry in accordance with TMS hot weather construction requirements.

3.02 PREPARATION

A. Concrete Foundations: Meet tolerance requirements of ACI 117 prior to starting any masonry work.

B. Prepare surface contact area of foundation concrete for initial mortar placement by removing laitance, loose aggregate, and other materials, and anything that would prevent mortar from bonding to foundation.

C. Patch or grind out-of-tolerance foundation surfaces to receive mortar prior to starting masonry work.

D. Clean reinforcement dowels and projecting embeds by removing laitance, spillage, or items that will adversely affect grout bond.

E. Prevent surface damage to foundation concrete that will be exposed to view outside of contact area.

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3.03 LAYING MASONRY UNITS

A. General:

1. Finish Tolerances (Measured on Interior Surfaces): Meet requirements of “Site Tolerance” requirements of Part 3, Execution, of the TMS Specifications.
2. Place units with chipped edges or corners such that chipped area is not exposed to view.

B. Wall Units:

1. General:
   a. If necessary to move a unit after once set in-place, remove from wall, clean, and set in fresh mortar.
   b. Toothing of masonry units is not permitted.
2. Running Bond:
   a. Unless otherwise shown, lay up walls in straight, level, and uniform courses using a running bond pattern.
   b. Place units for continuous vertical cells and mortar joints to prevent materials, such as grout and poured insulation, from escaping from cell being filled to adjacent cells where material is not intended to be placed.
   c. Corners: Lay standard masonry bond for overlapping units and grout solid.
   d. Intersecting Walls: Half unit appearance shall not extend and be visible on exterior side of intersecting wall. Provide hooked corner bars in bond beam units and joint reinforcement as shown on the Drawings.
3. Special Shapes:
   a. Provide and place such special units as corner block, doorjamb block, lintel block fillers, and similar blocks as may be required.
   b. Use required shapes and sizes to work to corners and openings, maintaining proper bond throughout wall.

3.04 BUILT-IN ITEMS

A. Position door frames, windows, vents, louvers, and other items to be built in wall, and construct wall around them.

B. Install masonry anchors to secure items to wall.

C. Fill spaces around items with grout except use mortar at mortar joints.

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D. Do not place electrical, instrumentation, or water conduits in a cell containing parallel reinforcement, unless approved in writing by Engineer. Additionally, pipes, sleeves, and conduits shall meet requirements of TMS 402, Building Code Requirements for Masonry Structures and TMS specification construction requirements.

3.05 MORTAR JOINTS

A. General:

1. Meet masonry erection requirements of TMS, Part 3, Execution, Article Laying Masonry Units, Paragraph Wall Units.
2. As units are laid, remove excess mortar from grout space of cells to be filled. Final grout space, including any remaining mortar projections, shall be as required by TMS Table “Grout Space Requirements.”
3. Place mortar before initial setting of cement takes place. Retemper only as required for it to remain plastic. Retempering of colored mortar is not allowed.
4. Remove mortar containing water repellent admixture from face of masonry before it sets.

B. Exposed Joints:

1. Tool joints exposed to view after final construction, unless otherwise noted or shown.
2. Cut joints flush and as mortar takes its initial set; tool to provide a concave joint.
3. Perform tooling with tool that compacts mortar, pressing excess mortar out.
4. Perform tooling when mortar is partially set, but still sufficiently plastic to bond rather than dragging it out.
5. Rake out joints that are not tight at time of tooling, point, and then tool.
6. Rake and tool joints at split-face surfaces, interior and exterior.

C. Concealed Joints: Strike flush with no further treatment required.

3.06 CONTROL JOINTS

A. Preformed Control Joints:

1. Omit mortar from vertical joints.
2. Place in units fabricated to receive rubber control joint material as wall is built.
3. After wall is grouted, cured, and cleaned, install backing rod and sealant as specified in Section 07 92 00, Joint Sealants.
4. Place and tool sealant to match depth of typical joint.

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3.07 REINFORCING

A. Foundation Dowels:

1. Locate first foundation dowel at end of wall in center of first cell; typically 4 inches from end of wall.
2. Locate at each side of control joints and openings and below beam and joist seats, and then locate at maximum required spacing between these bars.
3. Size, number, and location of foundation dowels shall match all typical and additional vertical wall reinforcing, unless otherwise noted.
4. When foundation dowel does not line up with vertical core, do not slope more than 1 horizontal to 6 vertical to bring it into alignment.

B. Vertical Reinforcing:

1. Use deformed bars.
2. Hold in position near ends of bars by wire ties to dowels or by reinforcing positioners.
3. For high lift grouting, hold in position at maximum intervals of 160 bar diameters by reinforcing positioners.
4. Lap reinforcing bars as shown or approved.
5. Wire tie splices together.
6. Minimum Bar Clearance: 1/2-inch from masonry for coarse grout from formed surfaces, and from parallel bars in same grout space.

C. Horizontal Reinforcing:

1. Use deformed bars.
2. Lay on webs of bond beam units and place as wall is built. Increase web depth to ensure 1/2-inch cover over top of rebar.
3. Lap reinforcing bars where spliced and wire tie together.
4. Minimum Bar Clearance: 1/2-inch from masonry for coarse grout from formed surfaces, and from parallel bars in same grout space.
5. Terminate reinforcing bars 2 inches clear from control joints except horizontal bars at roof and floor courses shall be continuous through joints.

3.08 MORTAR PRODUCTION

A. Mix bulk materials in accordance with TMS Specification.

B. Mix prebagged materials with water to produce a workable consistency.

C. Remix or retemper to maintain workability. Discard mortar that has begun to stiffen or is not used within 2-1/2 hours after initial mixing.

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3.09 GROUT PLACEMENT

A. Do not mix, convey, or place with equipment constructed of aluminum.

B. Secure vertical and horizontal reinforcement, ties, bolts, anchors, and other required embedments in place; inspect and verify before placing grout.

C. Grout beams over openings in one continuous operation.

D. Maintain vertical alignment in accordance with TMS 602:

1. Place grout within 1-1/2 hours of addition of water to mix.
2. Use reinforcing positioners to secure vertical reinforcement.

E. Grouting Requirements:

1. Partial grout all walls as shown.
   a. Slump: 8 inches to 11 inches.
   b. Do not start grouting until wall mortar has cured for 24 hours, minimum.
2. Fully embed horizontal steel with grout in an uninterrupted pour.
3. Do not construct wall more than one course above top of grout pour prior to placing grout.
4. Partial Grouting Requirements:
   a. Fill cells containing reinforcing steel, anchor bolts, and other embedded items as shown with grout.
   b. Construct cells to be filled to confine grout within cell.
   c. Cover tops of unfilled vertical cells under a bond beam with metal lath to confine grout fill to bond beam section.
   d. Form horizontal construction joints between pours by stopping grout pour 1-1/2 inches below a mortar joint, except at a bond beam; stop pour 1/2-inch below top of masonry unit.

F. Partial Grouting with Insulation Fill:

1. Where cells of masonry units are to receive masonry fill insulation in some cells and to receive grout in some cells, provide continuous mortar on block webs on each side of cells to be filled with grout to ensure insulation will not enter grout cells.
2. Where bond beams are required with masonry fill insulation and grout, limit pours to less than 6 feet in height.

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G. Vibration:

1. Use internal “pencil” type, low energy vibrator to thoroughly consolidate grout and reduce amount of air voids. Do not use concrete vibrators.
2. After initial water loss and settlement has occurred, but before it has taken any set, reconsolidate grout.
3. Waiting period for reconsolidation will vary depending upon weather conditions and block absorption rates, but under “normal” weather conditions with average masonry units the waiting period should be between 30 minutes and 60 minutes.

H. Cleanouts:

1. Construct in accordance with TMS specification.
2. Provide for grout pours heights over 5 feet 4 inches in accordance with the TMS 602.
3. Provide of sufficient size to permit cleaning of cell, positioning of reinforcing, and inspection at bottom of every vertical cell containing reinforcing and maximum of 32 inches on center.
4. Location: Concealed from view after final construction, unless otherwise approved by Engineer.
5. After wall has been inspected and approved and prior to grouting, cap cleanouts in a manner that will seal them from grout leakage and provide a flush finish.

3.10 WATER REPELLENT MASONRY SEALER

A. Remove efflorescence prior to applying water repellents. Dispose of waste generated.

B. Apply to exposed exterior concrete masonry walls.

C. Repoint loose, cracked, or disintegrating mortar at least 7 days prior to application. Ensure joint sealants and caulking are fully cured and wall surfaces are clean, dry, and free of chemical cleaners, efflorescence, dirt, oils, mortar smears, and other surface contaminants.

D. Follow manufacturer’s recommendations for weather conditions during application.

E. Test a 5-foot by 5-foot wall area to ensure proper coverage, and desired surface appearance when sealer is fully dried.

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F. Apply with spray, brush, or roller following manufacturer's recommendations, at a coverage rate of 50 square feet to 150 square feet per gallon, as determined by testing. Use two-coat application where recommended by manufacturer.

3.11 AIR AND WATER BARRIER

A. Fluid-applied air and water barrier system as specified in Section 07 15 00, Air and Water Barriers.

3.12 FIELD QUALITY CONTROL

A. Owner-Furnished Quality Assurance, in accordance with IBC Chapter 17 requirements, is provided in the Statement of Special Inspections Plan on the Drawings. Contractor responsibilities and related information are included in Section 01 45 33, Special Inspection, Observation, and Testing.

B. Contractor-Furnished Quality Control: Inspection and testing as required in Section 01 45 16.13, Contractor Quality Control.

C. Masonry shall be tested by testing agency retained by Owner.

D. Provide adequate facilities for safe storage and proper curing of masonry prisms, mortar samples, and grout samples, as applicable, onsite for first 24 hours, and for additional time as may be required before transporting to test lab.

E. Masonry Testing:

1. Masonry strength shall be determined using unit strength method as shown.
2. Masonry test prisms, when required or desired, shall be constructed onsite with same materials and workmanship to be used for Project and in accordance with ASTM C1314. Method and frequency of prism testing shall be as shown on the Special Inspection and Testing Plan.
3. Unit Strength Method:
    a. Method and frequency for mortar, grout, and masonry unit sampling and testing shall be as shown.
    b. Provide masonry units for test samples required.

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F. Corrective Action:

1. If compressive strength tests made prior to construction of permanent structure fail to meet Specifications, adjustments shall be made to mix designs for mortar, or grout, or both, as needed to produce specified strength.
2. If strength tests performed on materials representative of in-place construction fail to meet Specifications, prisms or cores shall be cut from constructed walls in sufficient locations to adequately determine strength in accordance with TMS.

3.13 CLEANING

A. Immediately after completion of grouting, clean masonry surfaces of excess mortar, grout spillage, scum, stains, dirt, and other foreign substances using clean water and fiber brushes.

B. Clean walls not requiring painting or sealing so there are no visible stains.

3.14 PROTECTION OF INSTALLED WORK

A. Do not allow grout and mortar stains to dry on face of exposed masonry.

B. Protect tops of walls at all times. Cover tops of walls with waterproof paper when rain or snow is imminent and when the Work is discontinued.

C. Adequately brace walls until walls and roof are completed.

D. Provide sufficient bracing to protect walls against damage from elements, including wind and snow.

E. Protect masonry against freezing for minimum 72 hours after being laid.

F. Protect masonry from damage until final acceptance of the Work. Damaged units will not be accepted.

END OF SECTION

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SECTION 05 05 19
POST-INSTALLED ANCHORS

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Concrete Institute (ACI):
   a. 318, Building Code Requirements for Structural Concrete.
   b. 355.2, Qualification of Post-Installed Mechanical Anchors in Concrete.
   c. 355.4, Qualification of Post-Installed Adhesive Anchors in Concrete.
2. American Iron and Steel Institute (AISI): Stainless Steel Type 316.
3. American National Standards Institute (ANSI).
4. ASTM International (ASTM):
   a. A153/A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
   b. A193/A193M, Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High Temperature or High Pressure Service and Other Special Purpose Applications.
   c. A194/A194M, Standard Specification for Carbon Steel, Alloy Steel, and Stainless Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both.
   d. E488/E488M, Standard Test Methods for Strength of Anchors in Concrete Elements.
   e. F436/F436M, Standard Specification for Hardened Steel Washers.
   f. F593, Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
   g. F594, Standard Specification for Stainless Steel Nuts.
   h. F1554, Standard Specification for Anchor Bolts, Steel, 36-ksi, 55-ksi, and 105-ksi Yield Strength.
5. International Association of Plumbing and Mechanical Officials Uniform ES (IAPMO-UES): Evaluation Reports for Concrete and Masonry Anchors.
6. International Code Council Evaluation Service (ICC-ES):
   a. Evaluation Reports for Concrete and Masonry Anchors.
   b. AC193, Acceptance Criteria for Mechanical Anchors in Concrete Elements.
   c. AC308, Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements. Evaluation Reports for Concrete and Masonry Anchors.

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7. Specialty Steel Industry of North America (SSINA):
    a. Specifications for Stainless Steel.
    b. Design Guidelines for the Selection and Use of Stainless Steel.
    c. Stainless Steel Fabrication.
    d. Stainless Steel Fasteners.

1.02 DEFINITIONS

A. Corrosive Area: Containment area or area exposed to delivery, storage, transfer, or use of chemicals.

B. Exterior Area: Location not protected from weather by a building or other enclosed structure to include buried roof structures.

C. Interior Dry Area: Location inside building or structure where floor is not subject to liquid spills or wash down, and where wall or roof slab is not common to a water-holding or earth-retaining structure.

D. Interior Wet Area: Location inside building or structure where floor is sloped to floor drains or gutters and is subject to liquid spills or wash down, or where wall, floor, or roof slab is common to a water-holding or earth-retaining structure.

E. Submerged: Location at or below top of wall of open water-holding structure, such as a basin or channel, or wall, ceiling, or floor surface inside a covered water-holding structure, or exterior belowgrade wall or roof surface of water-holding structure, open or covered.

1.03 SUBMITTALS

A. Action Submittals:

1. Shop Drawings: Specific instructions for concrete anchor installation, including drilled hole size and depth, preparation, placement, procedures, and instructions for safe handling of anchoring systems.

B. Informational Submittals:

1. Concrete and Masonry Anchors:
    a. Manufacturer’s product description and installation instructions.
    b. Current ICC-ES or IAPMO-UES Report for each type of post-installed anchor to be used.
    c. Adhesive Anchor Installer Certification.
2. Passivation method for stainless steel members.

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1.04 QUALITY ASSURANCE

A. Qualifications:

1. Installers of adhesive anchors horizontally or upwardly inclined to support sustained tension loads shall be certified by an applicable certification program. Certification shall include written and performance tests in accordance with the ACI/CRSI Adhesive Installer Certification Program or equivalent.
2. Galvanized Coating Applicator: Company specializing in hot-dip galvanizing after fabrication and following procedures of Quality Assurance Manual of the American Galvanizers Association.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Package stainless steel items in a manner to provide protection from carbon impregnation.

B. Protect hot-dip galvanized finishes from damage because of metal banding and rough handling.

PART 2 PRODUCTS

2.01 GENERAL

A. Unless otherwise indicated, meet the following requirements:

Item	ASTM Reference
Stainless Steel:	
Threaded Rods	F593, AISI Type 316, Condition CW
Nuts*	F594, AISI Type 316, Condition CW
Carbon Steel:	
Threaded Rods	F1554, Grade 36
Flat and Beveled Washers (Hardened)	F436/F436M
Nuts*	A194/A194M, Grade 2H

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Item	ASTM Reference
Galvanized Steel:	
All	A153/A153M
*Nuts of other grades and styles having specified proof load stresses greater than specified grade and style are also suitable. Nuts must have specified proof load stresses equal to or greater than minimum tensile strength of specified threaded rod.	

B. Bolts, Washers, and Nuts: Use stainless steel, hot-dip galvanized steel, and zinc-plated steel material types as indicated in Fastener Schedule at end of this section.

2.02 POST-INSTALLED CONCRETE ANCHORS

A. General:

1. AISI Type 316 stainless steel, hot-dip galvanized or zinc-plated steel, as shown in Fastener Schedule at end of this section.
2. Post-installed anchor systems used in concrete shall be approved by ICC Evaluation Services Report or equivalent for use in cracked concrete and for short-term and long-term loads including wind and earthquake.
3. Mechanical Anchors: Comply with the requirements of ICC-ES AC193 or ACI 355.2.
4. Adhesive Anchors: Comply with the requirements of ICC-ES AC308 or ACI 355.4.

B. Torque-Controlled Expansion Anchors (Wedge Anchors):

1. Manufacturers and Products:
   a. Hilti, Inc., Tulsa, OK; KWIK Bolt-TZ2 Expansion Anchor Safe Set System with hollow drill bit and vacuum and SI-AT-A22 tool with adaptive torque for applicable sizes (ESR-4266).
   b. DeWalt/Powers Fasteners, Brewster, NY; Power-Stud +SD1, +SD2, +SD4, or +SD6 Anchors (ESR-2502 and ESR-2818).
   c. Simpson Strong-Tie Co., Inc., Pleasanton, CA; Strong-Bolt 2 Anchors (ESR-1771 and ESR-3037).

C. Self-Tapping Concrete Screw Anchors:

1. Do not use for equipment anchorage unless specifically shown on the Drawings.
2. Manufacturers and Products:
   a. DeWalt/Powers Fasteners, Brewster, NY; Screw-Bolt+ (ESR-3889).

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b. DeWalt/Powers Fasteners, Brewster, NY; Hangermate+ Rod Hanger Screw Anchor (ESR-3889).
c. DeWalt/Powers Fasteners, Brewster, NY; Snake+ Flush Mount Screw Anchor (ESR-2272).
d. Hilti, Inc., Tulsa, OK; Kwik HUS, KH-EZ, KH-EZ CRC, KH-EZ SS316, KH-EZ C, KH-EZ E, KH-EZ I, and KH-EZ P Screw Anchor Safe Set System with hollow drill bit and vacuum (ESR-3027).
e. Simpson Strong-Tie Co., Inc., Pleasanton, CA; Titen HD Screw Anchor (ESR-2713 and IAPMO UES-493).

D. Adhesive Anchors:

1. Threaded Rod:
   a. Diameter as shown on the Drawings.
   b. Length as required to provide minimum depth of embedment indicated and thread projection required.
   c. Clean and free of grease, oil, or other deleterious material.
2. Adhesive:
   a. Two-component, insensitive to moisture, designed to be used in adverse freeze/thaw environments.
   b. Cure Temperature, Pot Life, and Workability: Compatible for intended use and anticipated environmental conditions.
3. Packaging and Storage:
   a. Disposable, self-contained system capable of dispensing both components in proper mixing ratio and fitting into a manually or pneumatically operated caulking gun.
   b. Store adhesive on pallets or shelving in a covered storage area.
   c. Package Markings: Include manufacturer’s name, product name, batch number, product expiration date, ANSI hazard classification, and appropriate ANSI handling precautions.
   d. Dispose of When:
      1) Shelf life has expired.
      2) Stored other than in accordance with manufacturer’s instructions.
4. Manufacturers and Products:
   a. Hilti, Inc., Tulsa, OK; HIT Doweling Anchor System, HIT-HY 200 V3 Safe Set System with HAS threaded rod (ESR-4868), HIT-RE 500 V3 Safe Set System with HAS threaded rod (ESR-3814), or HIT-RE 500 V3 Safe Set System with Hilti Roughening Tool (HIT RT) with HAS threaded rod (ESR-3814) for diamond cored holes.
   b. Simpson Strong-Tie Co., Inc., Pleasanton, CA; SET-3G Epoxy Adhesive Anchors. (ESR-4057).

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c. DeWalt/Powers Fasteners, Brewster NY; Pure 220+ Epoxy adhesive anchor system with Dust X+ System (ESR-5144).

E. Adhesive Threaded Inserts:

1. Type 316 stainless steel, internally threaded inserts.
2. Manufacturer and Product: Hilti, Inc., Tulsa, OK; HIS-RN Insert with HIT-RE 500-V3 or HIT-HY 200 adhesive.

2.03 POST-INSTALLED MASONRY ANCHORS

A. General: AISI Type 316 stainless steel, hot-dip galvanized, or zinc-plated steel, as shown in Fastener Schedule at end of section.

B. Current ICC Evaluation Report indicating acceptance for anchors at structural applications in masonry.

C. Manufacturers and Products:

1. Hilti, Inc., Tulsa, OK; HIT-HY 270 Safe Set System with Hilti hollow drill bit and vacuum (ESR-4143) for solid grouted masonry, HIT-HY 200 V3 Safe Set System with Hilti hollow drill bit and vacuum (ESR-4878) for solid grouted masonry, HIT-HY 270 Safe Set System with Hilti hollow drill bit and vacuum (ESR-4144) for unreinforced three-wythe brick.
2. Simpson Strong-Tie Co., Inc., Pleasanton, CA; Strong-Bolt 2 (IAPMO ER 240) for grout filled CMU, Titen-HD (ESR-1056) for grout filled or hollow CMU, AT-XP (IAPMO ER-281) for grout filled CMU.
3. DeWalt/Powers Fasteners, Brewster NY; Power-Stud+ SD1 (ESR-2966) for grout-filled masonry, Screw-Bolt+ (ESR-4042) for grout-filled masonry, AC100+ Gold with Dust X+ System for unreinforced three-wythe brick (ESR-2966 2582).

PART 3 EXECUTION

3.01 CONCRETE AND MASONRY ANCHORS

A. Begin installation only after concrete or masonry to receive anchors is a minimum of 21 days old or has attained design strength whichever requires a longer duration.

B. Locate existing reinforcing with ground penetrating radar or other method approved by the Engineer prior to drilling. Coordinate with the Engineer to adjust anchor locations where installation would result in hitting reinforcing.

C. Install in accordance with written manufacturer’s instructions.

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D. Provide minimum embedment, edge distance, and spacing as indicated on the Drawings.

E. Use only drill type, bit type, and diameter recommended by anchor manufacturer. Use rotary hammer drill unless otherwise approved by the Engineer. Core drilling may only be used if specifically allowed by the Engineer.

F. Clean hole of debris and dust per manufacturer's requirements.

G. When unidentified embedded steel, rebar, or other obstruction is encountered in drill path, slant drill to clear obstruction. If drill must be slanted more than indicated in manufacturer's installation instructions to clear obstruction, notify the Engineer for direction on how to proceed.

H. Adhesive Anchors:

1. Unless otherwise approved by the Engineer and adhesive manufacturer:
   a. Do not install adhesive anchors when temperature of concrete or masonry is below 40 degrees F or above 100 degrees F.
   b. Do not install prior to concrete attaining an age of 21 days.
   c. Remove any standing water from hole with oil-free compressed air. Inside surface of hole shall be dry.
   d. Do not disturb anchor during recommended curing time.
   e. Do not exceed maximum torque as specified in manufacturer's instructions.
2. For hollow-unit masonry, install screen tube in accordance with manufacturer's instructions.
3. Prestressed Concrete: Do not use drilled-in anchors in prestressed or post-tensioned concrete members without the Engineer's prior approval unless specifically shown on the Drawings.

3.02 FIELD QUALITY ASSURANCE AND QUALITY CONTROL

A. Owner-Furnished Quality Assurance, in accordance with IBC Chapter 17 requirements, is provided in the Statement of Special Inspections Plan as shown on the Drawings. The Contractor responsibilities and related information are included in Section 01 45 33, Special Inspection, Observation, and Testing.

B. Contractor-Furnished Quality Control: Inspection and testing as required in Section 01 45 16.13, Contractor Quality Control.

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3.03 MANUFACTURER'S SERVICES

A. Adhesive Anchors: Conduct Site training of installation personnel for proper installation, handling, and storage of adhesive anchor system.

3.04 FASTENER SCHEDULE

A. Unless indicated otherwise on the Drawings, provide fasteners as follows:

Service Use and Location	Product	Remarks
1. Post-Installed Anchors for Metal Components to Cast-in-Place Concrete (such as, Ladders, Handrail Posts, Electrical Panels, Platforms, and Equipment)		
Interior Dry Areas	Anchor material type to match material being anchored (for example, stainless steel anchors to anchor stainless steel equipment, zinc-plated anchors to anchor painted equipment, galvanized anchors to anchor galvanized equipment).	Verify product acceptability and manufacturer's requirements if anchor installation will occur in an overhead application
Submerged, Exterior, Interior Wet, and Corrosive Areas	Stainless steel adhesive anchors	Verify product acceptability and manufacturer's requirements if anchor installation will occur in an overhead application
2. Anchors in Grout-Filled Concrete Masonry Units		
Interior Dry Areas	Anchor material type to match material being anchored (for example, stainless steel anchors to anchor stainless steel equipment, zinc-plated anchors to anchor painted equipment, galvanized anchors to anchor galvanized equipment).	
Submerged, Exterior, Interior Wet, and Corrosive Areas	Stainless steel adhesive anchors	

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Service Use and Location	Product	Remarks
3. Anchors in Hollow Concrete Masonry Units		
Interior Dry Areas	Anchor material type to match material being anchored (for example, stainless steel anchors to anchor stainless steel equipment, zinc-plated anchors to anchor painted equipment, galvanized anchors to anchor galvanized equipment).	Adhesive anchors shall be installed with screen tubes.
Exterior, Interior Wet, and Corrosive Areas	Stainless steel adhesive anchors	Adhesive anchors shall be installed with screen tubes.
4. All Others		
All service uses and locations	Stainless steel fasteners	

B. Antiseizing Lubricant: Use on all stainless steel threads.

C. Do not use adhesive anchors to support fire-resistive construction or where ambient temperature will exceed 120 degrees F.

END OF SECTION

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SECTION 05 05 23
WELDING

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards that may be referenced in this section:

1. American Society of Mechanical Engineers (ASME):
   a. BPVC SEC V, Nondestructive Examination.
   b. BPVC SEC IX, Welding and Brazing Qualifications.
2. American Society of Nondestructive Testing (ASNT): SNT-TC-1A, Personnel Qualification and Certification in Nondestructive Testing.
3. ASTM International (ASTM): A370, Standard Test Methods and Definitions for Mechanical Testing of Steel Products.
4. American Welding Society (AWS):
   a. A2.4, Standard Symbols for Welding, Brazing, and Nondestructive Examination.
   b. A3.0, Standard Welding Terms and Definitions.
   c. D1.1/D1.1M, Structural Welding Code—Steel.
   d. D1.8/D1.8M, Structural Welding Code—Seismic Supplement.
   e. D1.2/D1.2M, Structural Welding Code—Aluminum.
   f. D1.3/D1.3M, Structural Welding Code—Sheet Steel.
   g. D1.4/D1.4M, Structural Welding Code—Reinforcing Steel.
   h. D1.6/D1.6M, Structural Welding Code—Stainless Steel.
   i. QC1, Standard for AWS Certification of Welding Inspectors.

1.02 DEFINITIONS

A. CJP: Complete Joint Penetration.

B. CWI: Certified Welding Inspector.

1. Contractor’s Welding Inspector: Contractor’s CWI acts for, and on behalf of, the Contractor for all inspection and quality matters within the scope of the Contract Documents. Contractor is required to provide a welding inspector to oversee welding operations and be responsible for visual inspection and necessary correction of all deficiencies in materials and workmanship required to meet referenced welding codes. This type of Quality Control Inspection is not classified as Special Inspection.
2. Verification Inspector: This independent inspection is the prerogative of the Owner, who may employ their own, independent CWI, or waive this supplementary, independent CWI inspection.

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C. MT: Magnetic Particle Testing.

D. NDE: Nondestructive Examination.

E. NDT: Nondestructive Testing.

F. PJP: Partial Joint Penetration.

G. PQR: Procedure Qualification Record.

H. PT: Liquid Penetrant Testing.

I. Special Inspection: Nondestructive weld examination including MT, PT, UT, and RT.

1. Special Inspection personnel report to, and are retained by the Owner, except as noted below:
   a. Contractor and fabricator are required to complete nondestructive weld examinations for welded steel tanks, welded steel pipe, and process piping.
2. See additional requirements in Section 01 45 33, Special Inspection, Observation, and Testing.

J. RT: Radiographic Testing.

K. UT: Ultrasonic Testing.

L. VT: Visual Inspection/Testing.

M. WPQ: Welder/Welding Operator Performance Qualification Record.

N. WPS: Welding Procedure Specification.

1.03 SUBMITTALS

A. Action Submittals:

1. Shop Drawings:
   a. Shop and field WPSs and PQRs.
   b. NDT procedure specifications prepared in accordance with ASME BPVC SEC V.
   c. Welding Data (Shop and Field): Submit welding data together with Shop Drawings as a complete package.
      1) Show on Shop Drawings, or on a weld map, complete information regarding base metal ASTM specifications, and location, type, size, and length of welds.

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2) Identify WPS to be used, and NDE requirements in tail of welding symbol.
3) Clearly distinguish between shop and field welds.
4) Indicate, by welding symbols or sketches, details of welded joints and preparation of base metal. Provide complete joint welding details showing bevels, groove angles, and root openings for welds.
5) Welding and NDE Symbols shall be in accordance with AWS A2.4. Welding terms and definitions shall comply with AWS A3.0.

B. Informational Submittals:

1. WPQs.
2. CWI credentials.
3. Testing agency NDE inspector credentials.
4. CWI visual inspection (VT) reports.
5. Welding Documentation: Submit on forms provided in referenced welding codes.

1.04 QUALIFICATIONS

A. WPSs: In accordance with AWS D1.1/D1.1M (Annex J Forms) for shop or field welding; or ASME BPVC SEC IX (Forms QW-482 and QW-483) for shop welding only.

B. WPQs: In accordance with AWS D1.1/D1.1M (Annex J Forms); or ASME BPVC SEC IX (Form QW-484).

C. CWI: Certified in accordance with AWS QC1 and having prior experience with specified welding codes. Alternate welding inspector qualifications require prior approval by Engineer.

D. Testing Agency: Personnel performing tests shall be NDT Level II certified in accordance with ASNT SNT-TC-1A.

1.05 SEQUENCING AND SCHEDULING

A. Unless otherwise specified, Submittals required in this section shall be submitted and approved prior to commencement of welding operations.

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PART 2 PRODUCTS

2.01 SOURCE QUALITY CONTROL

A. Fabricator's CWI shall be present whenever shop welding is performed. CWI shall perform inspection at suitable intervals, prior to assembly, during assembly, during welding, and after welding. CWI shall perform inspections as required in AWS D1.1/D1.1M or referenced welding code and as follows:

1. Verify conformance of specified job materials and proper storage.
2. Monitor conformance with approved WPSs.
3. Monitor welder performance and conformance with approved WPQs.
4. Inspect weld joint fit-up and perform in-process inspections.
5. Provide 100 percent visual inspection of completed welds.
6. Coordinate with nondestructive testing personnel and review NDE results.
7. Maintain records and prepare reports documenting results of CWI VT and required NDE complies with the Work and referenced welding codes.

PART 3 EXECUTION

3.01 GENERAL

A. Welding and Fabrication by Welding: Conform to governing welding codes referenced in attached Welding and Nondestructive Testing Table.

3.02 NONDESTRUCTIVE WELD TESTING REQUIREMENTS

A. Quality Control Inspection:

1. All Welds: 100 percent VT by Contractor's CWI.
2. Acceptance Criteria:
   a. Structural Pipe and Tubing: AWS D1.1/D1.1M, Paragraph 10.24.
   b. All Other Structural Steel: AWS D1.1/D1.1M, Paragraph 8.9, Visual Inspection, Statically Loaded Nontubular Connections.
   c. Stud Connections: AWS D1.1/D1.1M, Paragraph 9.8.1.

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B. Nondestructive Testing Requirements:

1. NDT frequency shall be as specified below, as required by referenced fabrication or welding codes, or as specified in the attached table. In case there is a conflict, the higher frequency level of NDT shall apply.
   a. Nontubular Connections:
      1) CJP Butt Joint Groove Welds: 10 percent random RT. Use UT for CJP butt joint groove welds that cannot be readily radiographed.
      2) All Other CJP Groove Welds: 10 percent random UT.
      3) Fillet Welds and PJP Groove Welds: 10 percent random PT or MT.
   b. Tubular Connections:
      1) CJP butt joint groove welds made from one side without backing: 100 percent RT or UT in accordance with AWS D1.1/D1.1M, Paragraph 10.25.2 requirements..
      2) CJP Butt Joint Groove Welds made with back-gouging: 10 percent random RT.
      3) CJP Butt Joint Groove Welds made with backing and other butt joint groove welds that cannot be readily radiographed: 10 percent random UT.
      4) All Other CJP Groove Welds: 10 percent random UT.
      5) Fillet Welds and PJP Groove Welds: 10 percent random PT or MT.
2. NDT Procedures and Acceptance Criteria:
   a. Nontubular Connections:
      1) RT: Perform in accordance with AWS D1.1/D1.1M, Clause 8, Part E. Acceptance criteria per AWS D1.1/D1.1M, Paragraph 8.12.1.
      2) UT: Perform in accordance with AWS D1.1/D1.1M, Clause 8, Part F. Acceptance criteria per AWS D1.1/D1.1M, Paragraph 8.13.1.
      3) PT and MT:
         a) Perform on fillet and PJP groove welds in accordance with AWS D1.1/D1.1M, Paragraph 8.14.4 and Paragraph 8.14.5.
         b) Acceptance criteria per AWS D1.1/D1.1M, Paragraph 8.9, Visual Inspection, Statically Loaded Nontubular Connections.
   b. Tubular Connections:
      1) RT: Comply with requirements for Nontubular Connections and additional requirements of AWS D1.1/D1.1M, Clause 10, Paragraph 10.27, and Paragraph 10.28.

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2) UT: Comply with requirements for Nontubular Connections and additional requirements of AWS D1.1/D1.1M, Clause 10, Paragraph 10.26, and Paragraph 10.29.
3) PT and MT:
   a) Perform on fillet and PJP groove welds in accordance with AWS D1.1/D1.1M, Paragraph 8.14.4 and Paragraph 8.14.5.
   b) Acceptance criteria per AWS D1.1/D1.1M, Paragraph 10.24.

3.03 FIELD QUALITY CONTROL

A. The Contractor's CWI shall be present whenever field welding is being done and shall perform inspection, at suitable intervals, prior to assembly, during assembly, during welding, and after welding. CWI shall perform inspections as required in AWS D1.1/D1.1M or referenced welding code and as follows:

1. Verify conformance of specified job materials and proper storage.
2. Monitor conformance with approved WPS.
3. Monitor welder performance and conformance with approved WPQs.
4. Inspect weld joint fit-up and perform in-process inspection.
5. Provide 100 percent visual inspection of all welds in accordance with Paragraph Quality Control Inspection.
6. Coordinate with nondestructive testing personnel and review test results.
7. Maintain records and prepare reports confirming results of inspection and testing comply with the Work.

3.04 WELD DEFECT REPAIR

A. Repair and retest rejectable weld defects until sound weld metal have been deposited in accordance with appropriate welding codes.

3.05 SUPPLEMENT

A. The supplement listed below, following "End of Section," is a part of this specification:

1. Welding and Nondestructive Testing Table.

END OF SECTION

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Welding and Nondestructive Testing						
Specification Section	**Governing Welding Codes or Standards**	**Submit WPS**	**Submit WPQ**	**Onsite CWI Required?**	**Submit Written NDT Procedure Specifications**	**NDT Requirements**
05 31 00 Steel Decking	AWS D1.1/D1.1M, Structural Welding Code—Steel or AWS D1.3/D1.3M, Structural Welding Code—Sheet Steel	Yes	Yes	Yes	No	100% VT; also see Section 05 31 00
05 50 00 Metal Fabrications	AWS D1.1/D1.1M, Structural Welding Code–Steel or AWS D1.2/D1.2M, Structural Welding Code—Aluminum or AWS D1.6/D1.6M, Structural Welding Code—Stainless Steel	Yes	Yes	Yes	No	100% VT; also see Section 05 50 00
05 53 00 Metal Gratings	AWS D1.1/D1.1M, Structural Welding Code—Steel or AWS D1.2/D1.2M, Structural Welding Code—Aluminum	No	No	No	No	100% VT; also see Section 05 53 00
40 27 00 Process Piping—General	ASME BPV Code, Section IX; and ASME B31.3 Normal Fluid Service Category	Yes	Yes	Yes	Yes	100% VT and 5% RT; also see Section 40 27 00

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SECTION 05 31 00
STEEL DECKING

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Iron and Steel Institute (AISI): Specifications for the Design of Cold Formed Steel Structural Members.
2. American Welding Society (AWS): D1.3, Structural Welding Code - Sheet Steel.
3. ASTM International (ASTM):
   a. A611, Standard Specification for Structural Steel (SS), Sheet, Carbon, Cold-Rolled.
   b. A653, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   c. A780, Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
   d. A924, Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
4. Factory Mutual (FM):
   a. Factory Mutual Approval Guide.
   b. FM Research Corporation (FMRC): Approval Requirements for Steel Roof Deck Construction.
5. International Code Council Evaluation Service, Inc. (ICC-ES): Evaluation Reports for Deck Fasteners.
6. Steel Deck Institute (SDI):
   a. Design Manual for Composite Decks, Form Decks and Roof Decks.
   b. Diaphragm Design Manual.
7. UL: Fire Resistance Directory.

1.02 SUBMITTALS

A. Action Submittals:

1. Plan view layout of decking showing type and section properties of deck panels, reinforcing channels, pans, special jointing, and accessories.
2. Location of openings, deck laps, and deck attachment details.

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B. Informational Submittals:

1. Decking manufacturer’s installation requirements.
2. Welding Procedures, Qualifications, and Inspection Report: As specified in Section 05 05 23, Welding.
3. Operation manuals for mechanical fastener installation tools.
4. Manufacturer’s Certificate of Compliance, in accordance with Section 01 61 00, Common Product Requirements.

1.03 QUALITY ASSURANCE

A. General: For metal decking section properties, meet requirements of AISI Specifications for Design of Cold-Formed Steel Structural Members.

B. FM Requirements:

1. Steel Roof Deck: Listed in Factory Mutual “Approval Guide” for Class 1 fire rating and Class 1-90 wind uplift rating.
2. Mechanical Fasteners: Packing containers shall show name of manufacturer and product and FMRC approval mark.

C. Qualifications for Field Welding: As specified in Section 05 05 23, Welding.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Store deck bundles on platforms or pallets, with one end elevated to provide drainage.

C. Protect bundles against condensation with a ventilated waterproof covering.

D. Stack bundles so there is no danger of tipping, sliding, rolling, shifting or material damage.

E. Architecturally exposed deck shall be appropriately packaged and protected to prevent damage during shipment.

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PART 2 PRODUCTS

2.01 METAL DECKING

A. Provide metal deck as shown in the following schedule:

STEEL DECK SCHEDULE								
Type	Depth (in)	Panel Width (in)	Design Thickness	Min. Yield Strength Fy (ksi)	Min. (+) S (in^3/ft)	Min. I (in^4/ft)	Minimum Diaphragm Shear Capacity (lbs/ft)	Finish
Roof Deck	1-1/2	36	18 Gage	33	0.322	0.302	600	Galv, G-90

B. Materials and Finishes:

1. Galvanized Deck:
   a. Sheet steel for galvanized deck and accessories shall conform to ASTM A653 Structural Quality Grade 33 or higher, as shown in Steel Deck Schedule.
   b. Galvanizing shall conform to ASTM A924 with coating class G90 as defined in ASTM A653 and as shown in Steel Deck Schedule.
2. Painted Deck:
   a. Sheet steel for primer painted roof deck and accessories shall conform to ASTM A611 with minimum yield strength of 33, or higher as indicated.
   b. Steel deck shall have a coat of manufacturer’s standard rust-inhibitive primer.
3. Vulcraft Division of Nucor Co., Brigham City, UT.
4. BHP Steel Building Products, USA, Inc., West Sacramento, CA.
5. Verco Manufacturing, Inc., Phoenix, AZ.
6. United Steel Deck, Inc., Summit, NJ.

2.02 SHOP PRIMER

A. Surface Preparation and Primer: As specified in Section 09 90 00, Painting and Coating.

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2.03 ACCESSORIES

A. Provide pour stops, column closures, end closures, cover plates, girder fillers, ridge and valley plates, finish strips, reinforcing channels, and other accessories as required for complete installation.

B. Accessories shall be minimum 22-gauge, except edge forms shall be sized as required by the deck manufacturer, unless shown otherwise on the Drawings.

2.04 MECHANICAL FASTENERS

A. Self-Drilling Screws:

1. Self-drilling, self-tapping screws with hexagonal washer head and corrosion-resistant finish.
2. Manufacturers and Products:
   a. ITW Buildex, Itasca, IL; ICH Traxx Self-Drilling Fasteners with Climaseal Coating and Autotraxx Standup Installation Tool.
   b. Hilti, Inc., Tulsa, OK; Kwik-Pro HWH Self-Drilling Screws with Kwik-Cote Treatment and Kwik-Tapper Screwdriver.

B. Powder Driven Fasteners:

1. Knurled shank, minimum 1/2-inch diameter steel washer, corrosion-resistant coating.
2. Pin diameter and length to suit deck type and flange thickness of steel support member.
3. Manufacturers and Products:
   a. ITW Buildex, Itasca, IL; Buildex BX14 pins with yellow dichromate galvanizing and BX900 Installation Tool.
   b. Hilti, Inc., Tulsa, OK; ENP-series fasteners with electroplated zinc coating and DX-750 Installation Tool.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine supporting framing and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance of steel deck.

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3.02 INSTALLATION

A. Locate deck bundles to prevent overloading of support framing members.

B. Install at right angles to supporting members in a three span minimum lay-up, unless shown otherwise, and in accordance with Specification and manufacturer's installation recommendation.

C. Bearing: 1-1/2 inches, minimum.

D. Endlaps: Minimum of 2 inches and located over supports.

E. Do not stretch sidelaps.

F. Closure Plates:

1. Install closure and cover plate accessories as recommended by the metal deck manufacturer, unless shown otherwise on the Drawings.
2. Floor Deck and Form Deck Closures:
    a. Fasten column closures, cell closures, and zee closures to deck to provide tight fitting closures at open ends of ribs and sides of decking.
    b. Fasten cell closures at changes of direction of deck units unless otherwise indicated.

G. Holes and Openings:

1. Cut and fit around roof openings and other work projecting through or adjacent to decking.
2. Locate holes and openings as shown to clear structural framing and bracing members.
3. Reinforcement around openings:
    a. Roof Deck: For hole sizes of at least 6 inches across, but not more than 12 inches across in roof deck, reinforce with 0.0474-inch design thickness steel plate, painted or galvanized to match deck coating. Extend plate at least 12 inches beyond opening in all directions and attach to top of roof deck with No. 10 self-drilling screws at 6-inch spacing and at all corners. For openings larger than 12 inches across, reinforce roof deck with framing as shown on the Drawings.
    b. Composite Floor Deck and Form Deck: Reinforce openings as indicated on the Drawings.

H. Protect deck areas from heavy concentrated loads or wheel traffic with planking or other approved means.

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I. Install temporary shoring, if required, to meet strength and deflection limitations, before placing any concrete topping on deck panels.

J. Completed Deck: Free from buckles and irregularities, and in accordance with FM and UL requirements.

3.03 DECK ATTACHMENT

A. Fasten panels as shown in the following schedule

STEEL DECK ATTACHMENT SCHEDULE							
		At Perpendicular Supports		At Parallel Supports		At Sidelaps	
Type	Depth (in.)	Type	No. Per Sheet	Type	Spacing (in.)	Type	Spacing
Roof Deck	1-1/2	Power driven fasteners	7	Power driven fasteners	6	Verco Punchlok II or equivalent	18"

B. Welded Connections: Weld deck sidelaps, attachment to framing, and accessories in accordance with AWS D1.3 and as specified in Section 05 05 23, Welding.

C. Mechanical Fasteners:

1. Self-Drilling Screws:
   a. Install screws in accordance with manufacturer's written instructions and with special installation tool. Do not over-torque.
   b. Remove and redrive screws at sidelaps where upper sheet is not drawn tightly against lower sheet.
2. Powder Driven Fasteners:
   a. Install fasteners in accordance with manufacturer's written instructions and with special installation tool.
   b. Minimum Sidelap Edge Distance: 3/8-inch.
   c. Minimum End/End Lap Distance: 1-inch.
   d. Head Projection: As specified by manufacturer for correct penetration into flange of steel support member.

3.04 TOUCHUP PAINTING

A. Immediately following erection, remove unused deck edge trimmings, screws, fasteners, welding washers, butt ends of welding rods, and debris from completed installation.

B. Clean field welds, bolted connections, rust spots, and abraded areas.

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C. Repair damaged painted surfaces as specified in Section 09 90 00, Painting and Coating.

D. Repair damaged galvanized surfaces with zinc-rich spray paint in accordance with ASTM A780; color to match galvanized deck.

E. Use magnetic gauge to determine that thickness of repair is equal to or greater than base painted or galvanized coating.

3.05 FIELD QUALITY CONTROL

A. An independent testing agency will be retained by Owner to perform following inspections.

1. Welded Connections: Visually inspect in accordance with AWS D1.3, Section 7, and as specified in Section 05 05 23, Welding.
2. Mechanical Fasteners: Visually inspect, in accordance with manufacturer’s instructions, for each type of fastener.

B. Repair or replace defective welds and fasteners.

C. Special inspection will be provided by Owner where indicated on the Drawings.

END OF SECTION

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SECTION 05 50 00
METAL FABRICATIONS

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. The Aluminum Association, Inc. (AA): The Aluminum Design Manual.
2. American Galvanizers Association (AGA):
   a. Inspection of Hot-Dip Galvanized Steel Products.
   b. Quality Assurance Manual.
3. American Iron and Steel Institute (AISI): Stainless Steel Types.
4. American Ladder Institute (ALI): A14.3, Ladders - Fixed - Safety Requirements.
5. American National Standards Institute (ANSI).
6. American Society of Safety Engineers (ASSE): A10.11, Safety Requirements for Personnel and Debris Nets.
7. American Welding Society (AWS):
   a. D1.1/D1.1M, Structural Welding Code - Steel.
   b. D1.2/D1.2M, Structural Welding Code - Aluminum.
   c. D1.6/D1.6M, Structural Welding Code - Stainless Steel.
8. ASTM International (ASTM):
   a. A36/A36M, Standard Specification for Carbon Structural Steel.
   b. A48/A48M, Specification for Gray Iron Castings.
   c. A53/A53M, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
   d. A108, Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished.
   e. A123/A123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
   f. A143/A143M, Standard for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement.
   g. A153/A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
   h. A193/A193M, Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications.
   i. A194/A194M, Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both.

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j. A240/A240M, Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
k. A276, Standard Specification for Stainless Steel Bars and Shapes.
l. A283/A283M, Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.
m. A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 pounds per square inch Tensile Strength.
n. A380, Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems.
o. A384/A384M, Standard Practice for Safeguarding Against Warpage and Distortion During Hot-Dip Galvanizing of Steel Assemblies.
p. A385/A385M, Standard Practice for Providing High-Quality Zinc Coatings (Hot-Dip).
q. A489, Standard Specification for Carbon Steel Lifting Eyes.
r. A500/A500M, Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
s. A501, Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
t. A563, Standard Specification for Carbon and Alloy Steel Nuts.
u. A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
v. A780/A780, Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
w. A786/A786M, Standard Specification for Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates.
x. A793, Standard Specification for Rolled Floor Plate, Stainless Steel.
y. A967, Standard Specification for Chemical Passivation Treatments for Stainless Steel Parts.
z. A992/A992M, Standard Specification for Structural Steel Shapes.
aa. A1085, Standard Specification for Cold-Formed Welded Carbon Steel Hollow Structural Sections (HSS).
bb. B209, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
cc. B308/B308M, Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles.
dd. B429/B429M, Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube.
ee. B632/B632M, Standard Specification for Aluminum-Alloy Rolled Tread Plate.

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ff. C881/C881M, Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.
gg. D1056, Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber.
hh. F436, Standard Specification for Hardened Steel Washers.
ii. F468, Standard Specification for Nonferrous Bolts, Hex Cap Screws, and Studs for General Use.
jj. F593, Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
kk. F594, Standard Specification for Stainless Steel Nuts.
ll. F844, Standard Specification for Washers, Steel, Plain (Flat), Unhardened for General Use.
mm. F1554, Standard Specification for Anchor Bolts, Steel, 36-ksi, 55-ksi, and 105-ksi Yield Strength.
nn. F3125, Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi and 150 ksi Minimum Tensile Strength.

9. Occupational Safety and Health Administration (OSHA):
   a. 29 CFR 1910.27, Fixed Ladders.
   b. 29 CFR 1926.105, Safety Nets.
   c. 29 CFR 1926.502, Fall Protection Systems Criteria and Practices.
10. Specialty Steel Industry of North America (SSINA):
   a. Specifications for Stainless Steel.
   b. Design Guidelines for the Selection and Use of Stainless Steel.
   c. Stainless Steel Fabrication.
   d. Stainless Steel Fasteners.

1.02 DEFINITIONS

A. Anchor Bolt: Cast-in-place anchor; concrete or masonry.

B. Corrosive Area: Containment area or area exposed to delivery, storage, transfer, or use of chemicals. Corrosive area includes areas exposed to corrosive atmosphere such as hydrogen sulfide from wastewater.

C. Exterior Area: Location not protected from weather by building or other enclosed structure.

D. Interior Dry Area: Location inside building or structure where floor is not subject to liquid spills or washdown, nor where wall or roof slab is common to a water-holding or earth-retaining structure.

E. Interior Wet Area: Location inside building or structure where floor is sloped to floor drains or gutters and is subject to liquid spills or washdown, or where

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wall, floor, or roof slab is common to a water-holding or earth-retaining structure.

F. Submerged: Location at or below top of wall of open water-holding structure, such as basin or channel, or wall, ceiling or floor surface inside a covered water-holding structure, or exterior belowgrade wall or roof surface of water-holding structure, open or covered.

1.03 SUBMITTALS

A. Action Submittals:

1. Shop Drawings: Metal fabrications, including welding and fastener information.

B. Informational Submittals:

1. Pre-engineered Ladders: Letter of certification that ladder meets OSHA 29 CFR 1910.27 requirements.
2. Passivation method for stainless steel members.
3. Galvanized coating applicator qualifications.
4. Hot-Dip Galvanizing: Certificate of compliance signed by galvanizer, with description of material processed and ASTM standard used for coating.

1.04 QUALITY ASSURANCE

A. Qualifications:

1. Galvanized Coating Applicator: Company specializing in hot-dip galvanizing after fabrication and following procedures of Quality Assurance Manual of the American Galvanizers Association.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Insofar as practical, factory assemble specified items. Package assemblies, which have to be shipped unassembled to protect materials from damage and tag to facilitate identification and field assembly.

B. Package stainless steel items to provide protection from carbon impregnation.

C. Protect painted coatings and hot-dip galvanized finishes from damage as a result of metal banding and rough handling. Use padded slings and straps.

D. Store fabricated items in dry area, not in direct contact with ground.

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PART 2 PRODUCTS

2.01 GENERAL

A. Unless otherwise indicated, meet the following requirements:

Item	ASTM Reference
Steel Wide Flange Shapes	A992/992M
Other Steel Shapes and Plates	A36/A36M or A572/A572M, Grade 50 or A992/A992M for other steel shapes
Steel Pipe	A500, Grade B
Hollow Structural Sections (HSS)	A500/A500M, Grade C
Aluminum:	
Aluminum Plates	B209, Alloy y6061-T6
Aluminum Structural Shapes	B308/B308M, Alloy 6061-T6
Stainless Steel:	
Bars and Angles	A276, AISI Type 316 (316L for welded connections)
Shapes	A276, AISI Type 304 (304L for welded connections)
Steel Plate, Sheet, and Strip	A240/A240M, AISI Type 316 (316L for welded connections)
Bolts, Threaded Rods, Anchor Bolts, and Anchor Studs	F593, AISI Type 316, Group 2, Condition SH
Nuts	F594, AISI Type 316, Condition CW
Steel Bolts and Nuts:	
Carbon Steel	A307 bolts, with A563 nuts
High-Strength	F3125, Grade A325, Type 1 bolts, with A563 nuts
Anchor Bolts and Rods	F1554, Grade 36, with weldability supplement S1.
Eyebolts	A489
Threaded Rods	A36/A36M

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Item	ASTM Reference
Flat Washers (Unhardened)	F844
Flat and Beveled Washers (Hardened)	F436
Thrust Ties for Steel Pipe:	
Threaded Rods	A193/A193M, Grade B7
Nuts	A194/A194M, Grade 2H
Plate	A283/A283M, Grade D
Welded Anchor Studs	A108, Grades C-1010 through C-1020
Aluminum Bolts and Nuts	F468, Alloy 2024-T4
Cast Iron	A48/A48M, Class 35

B. Bolts, Washers, and Nuts: Use stainless steel, hot-dip galvanized steel, zinc-plated steel, and aluminum material types as indicated in Fastener Schedule at end of this section.

2.02 ANCHOR BOLTS AND ANCHOR BOLT SLEEVES

A. Cast-In-Place Anchor Bolts:

1. Headed type, unless otherwise shown on the Drawings.
2. Material type and protective coating as shown in Fastener Schedule at end of this section.

B. Anchor Bolt Sleeves:

1. Plastic:
   a. Single unit construction with corrugated sleeve.
   b. Top of sleeve shall be self-threading to provide adjustment of threaded anchor bolt projection.
   c. Material: High-density polyethylene.
2. Fabricated Steel: ASTM A36/A36M.

2.03 POST-INSTALLED CONCRETE AND MASONRY ANCHORS

A. See Section 05 05 19, Post-Installed Anchors.

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2.04 STUD SHEAR CONNECTORS

A. Headed anchor studs (HAS), or threaded anchor studs (TAS), or stud shear connectors, as indicated on the Drawings.

1. Carbon Steel: ASTM A108, Standard Quality Grade 1010 through Grade 1020, inclusive either semi-killed or killed aluminum or silicon dioxidation, unless indicated otherwise.
2. Stainless Steel: ASTM F593, AISI Type 316, Condition CW, where indicated.

B. Manufacturers:

1. Nelson Stud Welding, FabriSteel Co., Elyria, OH.
2. Stud Welding Associates, Inc., Elyria, OH.

2.05 PIPE SLEEVES

A. As specified in Section 40 27 01, Process Piping Specialties.

2.06 STEEL LINTELS AND SHELF ANGLES

A. ASTM A36/A36M, hot-dip galvanize after fabrication in accordance with ASTM A123/A123M.

2.07 EMBEDDED STEEL SUPPORT FRAMES FOR FLOOR PLATE AND GRATING

A. Steel angle support frames to be embedded in concrete shall be stainless steel, ASTM A276, AISI Type 316, unless indicated otherwise.

B. Welded anchors for stainless steel support frames shall also be stainless steel.

2.08 ABRASIVE NOSING FOR STAIRS

A. Unless otherwise shown on the Drawings, furnish flush type abrasive nosings on stairs.

B. Nosing Components:

1. Homogeneous epoxy abrasive, with minimum 50 percent aluminum oxide content, formed and cured upon an extruded aluminum base.
2. Epoxy abrasive shall extend over and form curved front edge of nosing.
3. Base of Nosing: Extruded aluminum alloy 6063-T5, heat-treated.

C. Anchoring System: Double-set anchors consisting of two rows of integrally extruded anchors.

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D. Size: 3 inches wide by 1/4-inch to 3/8-inch thick by length as shown.

E. Color: Selected by Engineer from manufacturer's standard color range.

F. Manufacturers and Products:

1. Wooster Products, Inc., Wooster, OH; Spectra Type WP3C.
2. American Safety Tread Co., Inc., Helena, AL; Type FA-311D.

2.09 FLOOR PLATE

A. Material:

1. Galvanized Steel: Carbon steel, ASTM A786/A786M, commercial grade, hot-dip galvanized after fabrication in accordance with ASTM A123/A123M.
2. Stainless Steel: ASTM A793, AISI Type 304.
3. Aluminum: ASTM B632/B632M, Alloy 6061-T6.

B. Minimum Thickness:

1. Steel: 1/4-inch, unless shown otherwise on the Drawings.
2. Aluminum: 3/8-inch, unless shown otherwise on the Drawings.

C. Surface: Raised-lug pattern or diamond tread, unless shown otherwise on the Drawings.

D. Slip-Resistant Surface:

1. Provide where indicated on the Drawings.
2. Manufacturers and Products:
   a. IKG/Borden, Clark, NJ; MEBAC 2.
   b. W.S. Molnar Co., Detroit, MI; SLIPNOT Grade 2–Medium.

2.10 SIDEWALK DOORS

A. Load Capacity: 300 psf with maximum deflection of 1/150th of span. Provide H-20 wheel loading capacity where indicated on the Drawings.

B. Component Fabrication:

1. Access Door Leaf(s): 1/4-inch aluminum diamond pattern plate. Provide stainless steel safety chain and attachments for end of double-leaf door assembly when open.

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2. Channel Frame: 1/4-inch thick extruded aluminum trough frame with continuous anchor flange around perimeter. Weld 1-1/2-inch diameter drain coupling, and drain pipe, to frame trough at front right corner, unless indicated otherwise on the Drawings.

C. Door Hardware:

1. Hinges: Heavy-duty brass or stainless steel with stainless steel pins through-bolted to cover plate with tamper-proof stainless steel bolts flush with top of cover and to outside leg of channel frame with stainless steel bolts and locknuts.
2. Lifting Mechanism: Stainless steel compression lift springs enclosed in telescoping vertical housing or stainless steel torsion lift springs.
3. Hold-Open Arm:
   a. Locks automatically in open position.
   b. Disengages with slight pull on vinyl grip with one hand.
   c. Door can be easily closed with one hand by pulling forward and down on vinyl grip.
4. Snap Lock:
   a. Stainless steel snap lock mounted on bottom of door leaf with removable topside key wrench and inside fixed lever handle.
   b. Threaded plug for flush outside surface with key wrench removed.

D. Aluminum: Mill finished with protective coating applied to surfaces to be in contact with concrete, as specified in Section 09 90 00, Painting and Coating.

E. Manufacturers and Products:

1. Bilco Co., New Haven, CT; J Series.
2. Nystrom Products Co., Minneapolis, MN; FG Series.
3. U.S.F. Fabrication, Hialeah, FL; T Series.
4. ITT Flygt Corporation, Trumbull, CT; FDRN Series.
5. Thompson Fabricating Co., Birmingham, AL; TE Series.
6. Halliday Products, Orlando, FL; WS Series.

2.11 ACCESS MANWAYS (WATERTIGHT DOORS)

A. Scope of Work:

1. Furnish all materials and incidentals required to install circular watertight access doors/manways to the concrete basins as shown on the Drawings and specified herein.
2. Access manways shall be provided complete with all accessories, spare parts, and other appurtenances as specified and as may be required for a complete and operating installation.

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B. Manways shall be hinged and provide clear opening as indicated on the Drawings.

C. Manways shall be provided with minimum 10-gauge security cover plate, lockable with Owner's preferred padlock. Plate will prevent access to door mechanism while it is in place.

D. Materials:

1. Structural Steel Plate and Shapes: Type 316L stainless steel, except security cover plate may be Type 304 stainless steel.
2. Finish: Hot-rolled, annealed and pickled stainless steel.
3. Door Gaskets: Neoprene Ring gaskets. Gasket shall be 100 percent bonded into rings and tested to a tensile strength of 2,000 pounds per square inch, based on the manufacturer's standard durometer tolerances.
4. Door Hardware: Nonwetted hinges and fastening hardware shall be Type 316 stainless steel. All hardware shall be stainless steel. Where stainless steel is not available, components shall be coated in accordance with Section 09 90 00, Painting and Coating.

E. Design:

1. Access Manways (watertight doors) shall be designed with applicable safety factors in accordance with AISC, AISI, ASCE, and AWS specifications, and shall provide an effective seal against the design pressure of 12 pounds per square inch with no visible leakage.
2. Design of the door shall allow the pressure on the door to be transmitted to the embedded sleeve without load being transferred to the hinges.
3. Manway sleeve shall include suitable wall ring for embedment in concrete.
4. Length of each manway sleeve shall match the thickness of the concrete plus any additional extension as required to seat security cover plate.
5. Manways shall conform with OSHA permit required confined space rules.
6. Stainless steel nameplates shall be permanently attached to each of the access manways indicating the manufacturer, model number and serial number.
7. Manways shall be provided with lock-out protection.

F. Quality Assurance:

1. All welds in the potential "leak path" shall be liquid penetrant tested in accordance with ASME Code Section VIII, Div. 1, Appendix VIII.
2. Manways shall be shop operated to assure proper assembly and operation.

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G. Manufacturer and Product: Chase Associates, Edgecomb, ME; Quick-Opening Manway Model CM-1.

2.12 LADDERS

A. Fabricate ladders with rails, rungs, landings, and cages to meet applicable requirements of OSHA, CFR Part 1910.27, and ALI A14.3.

1. Design ladder for concentrated load of 200 pounds imposed by user concentrated at points that will cause maximum stress in structural member being considered.
2. Include weight of ladder and attached appurtenances together with live load in design of rails and fastenings.
3. Self-closing gates at landings.

B. Flat Bar Ladder:

1. Punch rails, pass rungs through rails, and weld on outside.
2. Weld brackets to ladder for fastening ladder to wall.
3. Hot-dip galvanize steel after fabrication in accordance with ASTM A123/A123M and ASTM A385/A385M.
4. ASTM A276, AISI Type 316L stainless steel.

C. Aluminum Pre-engineered Pipe Ladder:

1. Rungs:
   a. Aluminum extrusions of Alloy 6063-T6.
   b. Diamondback, finish to match rails, as manufactured by Alcoa Building Products, Inc., Sidney, OH.
2. Side Rails: ASTM B429/B429M, Alloy 6063-T6, 1-1/2 inches, Schedule 40 pipe with anodized finish, AA M32-C22-A41.
3. Ladder Attachments and Cage Assembly Fasteners: Stainless steel.
4. Welded, pop riveted, or glued construction is not acceptable.
5. Fabricate to longest length as practical but not to exceed 24 feet.
6. Furnish support attachments to side rails at 6 feet maximum spacing.
7. Manufacturer: Thompson Fabricating Co. Inc., Tarrant, AL.

D. Ladder Safety Post:

1. Telescoping tubular, spring balanced and automatically locking in raised position, with release lever for unlocking.
2. Post: Hot-dip galvanized steel in accordance with ASTM A123/A123M.
3. Hardware: Stainless steel, AISI Type 316.
4. Furnish dissimilar metal protective coatings at connections.

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5. Manufacturers and Products:
    a. Bilco Co., New Haven, CT; “Ladder Up” to fit ladder rungs.
    b. Nystrom Products Co., Minneapolis, MN; Ladder Safety Post.

2.13 SAFETY CLIMB DEVICE

A. General:

1. Conforms to ALI A14.3 and OSHA CFR Part 1910.27.
2. Belt and harness shall withstand minimum drop test of 250 pounds in 6-foot free fall.
3. Fall Prevention System Material: Hot-dip galvanized steel in accordance with ASTM A123/A123M.

B. Components and Accessories:

1. Main Components: Sleeve or trolley, safety harness, and carrier or climbing rail.
2. Ladder rung clamps with stainless steel, AISI Type 316, mounting brackets and hardware.
3. Removable extension kit with tiedown rod or trolley gate, mandrel, and carrier rail for ladders under manholes and hatches.

C. Manufacturers and Products:

1. Miller by Honeywell, Franklin, PA; Miller Saf-T-Climb.
2. TS Products, Cambridge, Ontario, Canada; TS Safety Rail System.

2.14 ACCESSORIES

A. Antiseizing Lubricant for Stainless Steel Threaded Connections:

1. Suitable for potable water supply.
2. Resists washout.
3. Manufacturers and Products:
    a. Bostik, Middleton, MA; Neverseez.
    b. Saf-T-Eze Div., STL Corp., Lombard, IL; Anti-Seize.

B. Neoprene Gasket:

1. ASTM D1056, 2C1, soft, closed-cell neoprene gasket material, suitable for exposure to sewage and sewage gases, unless otherwise shown on the Drawings.
2. Thickness: Minimum 1/4-inch.
3. Furnish without skin coat.

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4. Manufacturer and Product: Monmouth Rubber and Plastics Corporation, Long Branch, NJ; Durafoam DK1111LD.

2.15 FABRICATION

A. General:

1. Finish exposed surfaces smooth, sharp, and to well-defined lines.
2. Furnish necessary rabbets, lugs, and brackets so work can be assembled in neat, substantial manner.
3. Conceal fastenings where practical; where exposed, flush countersink.
4. Drill metalwork and countersink holes as required for attaching hardware or other materials.
5. Grind cut edges smooth and straight. Round sharp edges to small uniform radius. Grind burrs, jagged edges, and surface defects smooth.
6. Fit and assemble in largest practical sections for delivery to Site.

B. Materials:

1. Use steel shapes, unless otherwise noted.
2. Steel to be hot-dip galvanized: Limit silicon content to less than 0.04 percent or to between 0.15 percent and 0.25 percent.
3. Fabricate aluminum in accordance with AA specifications for Aluminum Structures–Allowable Stress Design.

C. Welding:

1. Weld connections and grind exposed welds smooth. When required to be watertight, make welds continuous.
2. Welded fabrications shall be free from twisting or distortion caused by improper welding techniques.
3. Steel: Meet fabrication requirements of AWS D1.1/D1.1M, Section 5.
4. Aluminum: Meet requirements of AWS D1.2/D1.2M.
5. Stainless Steel: Meet requirements of AWS D1.6/D1.6M.
6. Welded Anchor Studs: Prepare surface to be welded and weld with stud welding gun in accordance with AWS D1.1/D1.1M, Section 7, and manufacturer’s instructions.
7. Complete welding before applying finish.

D. Painting:

1. Shop prime with rust-inhibitive primer as specified in Section 09 90 00, Painting and Coating, unless otherwise indicated.

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2. Coat surfaces of galvanized steel and aluminum fabricated items to be in direct contact with concrete, grout, masonry, or dissimilar metals, as specified in Section 09 90 00, Painting and Coating, unless indicated otherwise.
3. Do not apply protective coating to galvanized steel anchor bolts or galvanized steel welded anchor studs, unless indicated otherwise.

E. Galvanizing:

1. Fabricate steel to be galvanized in accordance with ASTM A143/A143M, ASTM A384/A384M, and ASTM A385/A385M. Avoid fabrication techniques that could cause distortion or embrittlement of the steel.
2. Provide venting and drain holes for tubular members and fabricated assemblies in accordance with ASTM A385/A385M.
3. Remove welding slag, splatter, burrs, grease, oil, paint, lacquer, and other deleterious material prior to delivery for galvanizing.
4. Remove by blast cleaning or other methods surface contaminants and coatings not removable by normal chemical cleaning process in the galvanizing operation.
5. Hot-dip galvanize steel members, fabrications, and assemblies after fabrication in accordance with ASTM A123/A123M.
6. Hot-dip galvanize bolts, nuts, washers, and hardware components in accordance with ASTM A153/A153M. Oversize holes to allow for zinc alloy growth. Shop assemble bolts and nuts.
7. Galvanized steel sheets in accordance with ASTM A653/A653M.
8. Galvanize components of bolted assemblies separately before assembly. Galvanizing of tapped holes is not required.

F. Electrolytic Protection: Coat surfaces of galvanized steel and aluminum fabricated items to be in direct contact with concrete, grout, masonry, or dissimilar metals, as specified in Section 09 90 00, Painting and Coating, unless indicated otherwise.

G. Watertight Seal: Where required or shown, furnish neoprene gasket of a type that is satisfactory for use in contact with sewage. Cover full bearing surfaces.

H. Fitting: Where movement of fabrications is required or shown, cut, fit, and align items for smooth operation. Make corners square and opposite sides parallel.

I. Accessories: Furnish as required for a complete installation. Fasten by welding or with stainless steel bolts or screws.

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2.16 SOURCE QUALITY CONTROL

A. Visually inspect all fabrication welds and correct deficiencies.

1. Steel: AWS D1.1/D1.1M, Section 6 and Table 6.1, Visual Inspection Acceptance Criteria.
2. Aluminum: AWS D1.2/D1.2M.
3. Stainless Steel: AWS D1.6/D1.6M.

PART 3 EXECUTION

3.01 INSTALLATION OF METAL FABRICATIONS

A. General:

1. Install metal fabrications plumb and level, accurately fitted, free from distortion or defects.
2. Install rigid, substantial, and neat in appearance.
3. Install manufactured products in accordance with manufacturer's recommendations.
4. Obtain Engineer approval prior to field cutting steel members or making adjustments not scheduled.

B. Aluminum:

1. Do not remove mill markings from concealed surfaces.
2. Remove inked or painted identification marks on exposed surfaces not otherwise coated after installed material has been inspected and approved.
3. Fabrication, mechanical connections, and welded construction shall be in accordance with the AA Aluminum Design Manual.

C. Pipe Sleeves:

1. Provide where pipes pass through concrete or masonry.
2. Holes drilled with a rotary drill may be provided in lieu of sleeves in existing walls.
3. Provide center flange for water stoppage on sleeves in exterior or water-bearing walls.
4. Provide rubber caulking sealant or a modular mechanical unit to form watertight seal in annular space between pipes and sleeves.

D. Steel Lintels and Shelf Angles: Provide as required for support of masonry and other construction not attached to structural steel framing, unless otherwise shown on the Drawings.

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3.02 CAST-IN-PLACE ANCHOR BOLTS

A. Locate and hold anchor bolts in place with templates at time concrete is placed.

B. Use anchor bolt sleeves for location adjustment and provide two nuts and one washer per bolt of same material as bolt.

C. Minimum Bolt Size: 1/2-inch diameter by 12 inches long, unless otherwise shown.

3.03 ABRASIVE NOSINGS

A. Provide abrasive nosings on concrete steps not being supplied or coated with another type of nosing or nonskid material.

3.04 ACCESS COVERS

A. Install access covers, including sidewalk doors, floor hatches, and hinged manhole covers in accordance with manufacturer’s instructions.

B. Accurately position prior to placing concrete, such that covers are flush with floor surface.

C. Protect from damage resulting from concrete placement. Thoroughly clean exposed surfaces of concrete spillage to obtain a clean, uniform appearance.

D. Route drain pipe to exterior face of concrete or as shown on the Drawings.

E. Position cover so that hinge is on side opposite ladder.

3.05 SAFETY CLIMB DEVICE SYSTEM

A. Provide for each ladder where unbroken height between levels exceeds 20 feet, or at lesser height where indicated on the Drawings.

B. Install in accordance with manufacturer’s instructions.

C. Furnish additional accessories required to complete system for each ladder.

D. Furnish one harness for each ladder equipped with safety climb device.

E. Furnish pivot section at platforms, landings, and roofs.

F. When installed to required height, fall prevention system shall be rigid and an integral part of the structure.

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3.06 ELECTROLYTIC PROTECTION

A. Aluminum and Galvanized Steel:

1. Coat surfaces of galvanized steel and aluminum fabricated items to be in direct contact with concrete, grout, masonry, or dissimilar metals, as specified in Section 09 90 00, Painting and Coating, unless indicated otherwise.
2. Do not apply protective coating to galvanized steel anchor bolts or galvanized steel welded anchor studs, unless indicated otherwise.
3. Allow coating to dry before installation of the material.
4. Protect coated surfaces during installation.
5. Should coating become marred, prepare and touch up in accordance with paint manufacturer's written instructions.

B. Stainless Steel:

1. During handling and installation, take necessary precautions to prevent carbon impregnation of stainless steel members.
2. After installation, visually inspect stainless steel surfaces for evidence of iron rust, oil, paint, and other forms of contamination.
3. Remove contamination using cleaning and passivation methods in accordance with requirements of ASTM A380 and ASTM A967.
4. Brushes used to remove foreign substances shall utilize only stainless steel or nonmetallic bristles.
5. After treatment, visually inspect surfaces for compliance.

3.07 PAINTING

A. Painted Galvanized Surfaces: Prepare as specified in Section 09 90 00, Painting and Coating.

B. Repair of Damaged Hot-Dip Galvanized Coating:

1. Conform to ASTM A780/A780M.
2. For minor repairs at abraded areas, use sprayed zinc conforming to ASTM A780/A780M.
3. For flame cut or welded areas, use zinc-based solder, or zinc sticks, conforming to ASTM A780/A780M.
4. Use magnetic gauge to determine thickness is equal to or greater than base galvanized coating.

C. Field Painting of Shop Primed Surfaces: Prepare surfaces and field finish in accordance with Section 09 90 00, Painting and Coating.

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3.08 FIELD QUALITY ASSURANCE AND QUALITY CONTROL

A. Owner-Furnished Quality Assurance:

1. In accordance with IBC Chapter 17 requirements, is provided in the Statement of Special Inspections Plan on the Drawings.
2. Contractor responsibilities and related information on special inspection, observation, and testing are included in Section 01 45 33, Special Inspection, Observation, and Testing.

B. Contractor-Furnished Quality Control:

1. Inspection and testing required in Section 01 45 16.13, Contractor Quality Control.
2. Manufacturer's Certificate of Compliance per Section 01 61 00, Common Product Requirements, for test results, or calculations, or drawings that ensure material and equipment design and design criteria meet requirements of Section 01 61 00, Common Product Requirements, and Section 01 88 15, Anchorage and Bracing.

C. Stud Shear Connectors:

1. At start of each production period, conduct the following test to determine proper generator, control unit, and stud welding gun settings, in accordance with AWS D1.1/D1.1M, Chapter 7:
   a. Weld two test studs and visually inspect for full 360-degree flash.
   b. Bend test studs 30 degrees from vertical for headed anchor studs (HAS). Torque test threaded anchor studs (TAS) studs per AWS D1.1/D1.1M, Section 7.6.6.2.
   c. Test studs will be acceptable if there is no failure of welds.
   d. If weld fails, repeat test until two consecutive test studs test to be satisfactory.
2. During production, if visual inspection reveals weld does not exhibit full 360-degree flash or that stud has been repaired by welding, conduct the following test in accordance with AWS D1.1/D1.1M, Chapter 7:
   a. Bend HAS studs or stud shear connectors approximately 15 degrees from vertical, away from missing portion of flash. For TAS studs, torque test per AWS D1.1/D1.1M, Section 7.6.6.2.
   b. Studs meeting this test without exhibiting cracks in weld will be considered acceptable and left in bent position.
   c. Replace studs failing test.
3. Special inspection will be provided by Owner where indicated in Statement of Special Inspections Plan on the Drawings.

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3.09 FASTENER SCHEDULE

A. Unless indicated otherwise on the Drawings, provide fasteners as follows:

Service Use and Location	Product	Remarks
1. Anchor Bolts Cast Into Concrete for Structural Steel, Metal Fabrications and Castings		
Interior Dry Areas	Hot-dip galvanized steel headed anchor bolts, unless indicated otherwise	
Exterior and Interior Wet Areas	Stainless steel headed anchor bolts	
Submerged and Corrosive Areas	Stainless steel headed anchor bolts with fusion bonded coating	See Section 09 90 00, Painting and Coating
2. Anchor Bolts Cast Into Concrete for Equipment Bases		
Interior Dry Areas	Hot-dip galvanized stainless steel headed anchor bolts, unless otherwise specified with equipment	
Submerged, Exterior, Interior Wet, and Corrosive Areas	Stainless steel headed anchor bolts with fusion bonded coating, unless otherwise specified with equipment	See Section 09 90 00, Painting and Coating
3. Post-Installed Anchors: See Section 05 05 19, Post-Installed Anchors		

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Service Use and Location	Product	Remarks
4. Anchors Cast in Grout-Filled Concrete Masonry Units		
Dry Areas	Hot-dip galvanized steel headed anchor bolts or zinc-plated steel sleeve anchors	
Exterior and Interior Wet Areas	Hot-dip galvanized steel headed anchor bolts, zinc-plated or stainless steel sleeve anchors	
5. Connections for Structural Steel Framing		
Exterior and Interior Wet and Dry Areas	High-strength steel bolted connections	Use hot-dipped galvanized high-strength bolted connections for galvanized steel framing members.
6. Connections for Steel Fabrications and Wood Components		
Exterior and Interior Wet and Dry Areas	Hot-dip galvanized carbon steel bolted connections	
7. Connections of Aluminum Components		
Submerged, Exterior and Interior Wet and Dry Areas	Stainless steel bolted connections, unless otherwise specified with equipment	
8. All Others		
Exterior and Interior Wet and Dry Areas	Stainless steel fasteners	

B. Antiseizing Lubricant: Use on stainless steel threads.

END OF SECTION

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SECTION 05 52 16
ALUMINUM RAILINGS

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. Aluminum Association, Incorporated (AA): DAF45, Designation System for Aluminum Finishes.
2. American Concrete Institute (ACI) 318, Building Code Requirements for Structural Concrete.
3. American Iron and Steel Institute (AISI).
4. ASTM International (ASTM):
    a. A193/A193M, Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications.
    b. A194/A194M, Standard Specification for Carbon Steel, Alloy Steel, and Stainless Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both.
    c. E894, Standard Test Method for Anchorage of Permanent Metal Railing Systems and Rails for Buildings.
    d. E935, Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings.
    e. E985, Standard Specification for Permanent Metal Railing Systems and Rails for Buildings.
5. International Code Council (ICC): International Building Code (IBC).
6. Occupational Safety and Health Act (OSHA): 29 CFR 1910, Code of Federal Regulations.

1.02 DEFINITIONS

A. ICC Evaluation Services Report: ICC report on evaluation of manufactured concrete anchor systems.

B. Railings: This term includes guardrail systems, handrail systems, platform railing systems, ramp-rail systems, and stair-rail systems. Railings may be comprised of a framework of vertical, horizontal, or inclined members, grillwork or panels, accessories, or combination thereof.

C. Special Inspection: As defined by the ICC IBC.

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D. Toeboards: Vertical barrier at floor level usually erected on railings along exposed edges of floor or wall openings, platforms, or ramps to prevent miscellaneous items from falling through.

1.03 DESIGN REQUIREMENTS

A. Structural Performance of Railing Systems: Design, test, fabricate, and install railings to withstand the following structural loads without exceeding allowable design working stress or allowable deflection. Apply each load to produce maximum stress and deflection in railing system components.

1. Railing System:
   a. Capable of withstanding the following load cases applied:
      1) Concentrated load of 200 pounds applied at any point and in any direction in accordance with ICC IBC and OSHA.
      2) Uniform load of 50 pounds per linear foot applied in any direction in accordance with ICC IBC.
      3) Concentrated load need not be assumed to act concurrently with uniform loads in accordance with ICC IBC.
2. In-Fill Area of Railing Systems:
   a. Capable of withstanding a horizontally applied normal load of 50 pounds applied to 1-square foot at any point in system including panels, intermediate rails, balusters, and openings and space between railings.
   b. Horizontal concentrated load need not be assumed to act concurrently with loads on top rails of railings.
3. Toeboard: Capable of withstanding, without failure, force of at least 50 pounds applied in downward or outward direction at any point along toeboard.
4. Calculated lateral deflection at top of posts shall not exceed 1.5-inch.

1.04 SUBMITTALS

A. Action Submittals:

1. Shop Drawings:
   a. Project-specific scaled plans and elevations of railings and detail drawings. Include railing profiles, sizes, connections, anchorage, size and type of fasteners, and accessories.
   b. Manufacturer’s literature and catalog data of railing and components.

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c. Design Data:
1) Calculations or test data using specified design performance loads and including the following:
a) Bending stress in, and deflection of, posts in accordance with ASTM E985 as modified herein.
b) Design of post base connection.
c) Documentation that concrete anchors have been designed in accordance with one of the following:
(1) ACI 318, Chapter 17.
(2) ICC Evaluation Services Report for selected anchor.

2. Samples: Rail sections, 6 inches long showing each type of proposed connection, proposed finish, and workmanship.

B. Informational Submittals:

1. Manufacturer’s assembly and installation instructions.
2. Special Inspection: Manufacturer’s instructions for Special Inspection of post-installed anchors.
3. Test Reports: Test data may supplement load calculations providing data covers complete railing system, including anchorage:
a. Test data for railing and components showing load and deflection as a result of load, in enough detail to prove railing is strong enough and satisfies national, state, local standards, regulations, code requirements, and OSHA 29 CFR 1910, using design loads specified. Include test data for the following:
1) Railing and post connections.
2) Railing wall connections.
3) Railing expansion joint connections.
b. Testing of anchorages shall be in accordance with ASTM E894 and ASTM E935 using applied loads in accordance with ICC IBC.
c. Deflection Criteria:
1) In accordance with ASTM E985 and design loads specified, except as follows: maximum calculated lateral deflection at top of posts shall not exceed 1-inch.
d. Aluminum Rail Piping: Test data showing yield strength of pipe as delivered equals or exceeds specified values.
4. Manufacturer’s written recommendations describing procedures for maintaining railings including cleaning materials, application methods, and precautions to be taken in use of cleaning materials.

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1.05 QUALITY ASSURANCE

A. Qualifications: Calculations required for design data shall be stamped by a registered civil or structural engineer licensed in state where Project will be constructed.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Package and wrap railings to prevent scratching and denting during shipment, storage, and installation. Maintain protective wrapping to extent possible until railing is completely installed.

B. Delivery:

1. Shop assemble into practical modules of lengths not exceeding 24 feet for shipment.
2. Deliver toeboards loose for field assembly.
3. Deliver clear anodized railing pipe and posts with protective plastic wrap.

1.07 ENVIRONMENTAL REQUIREMENTS

A. Thermal Movements: Allow for thermal movement resulting from the following maximum range in ambient temperature in design, fabrication, and installation of railings to prevent buckling, opening up of joints, over stressing of components, connections and other detrimental effects. Base design calculation on actual surface temperature of material as a result of both solar heat gain and night time sky heat loss. Temperature change is difference between high or low temperature and installation temperature.

1. Temperature Change Range: 70 degrees F, ambient; 100 degrees F, material surfaces.

PART 2 PRODUCTS

2.01 ALUMINUM RAILINGS

A. General:

1. Furnish pre-engineered and prefabricated railing systems as shown on the Drawings.
2. Railing systems using pop rivets or glued railing construction are not permitted.
3. Sand cast accessories and components are not permitted.
4. Fasteners shall be AISI Type 316 stainless steel, unless otherwise noted.

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B. Rails, Posts, and Formed Elbows:

1. Extruded Alloy 6105-T5, Alloy 6061-T6, or equivalent.
2. Tensile Strength: 38,000 pounds per square inch, minimum.
3. Yield Strength: 35,000 pounds per square inch, minimum.
4. Nominal Wall Thickness: 0.145-inch, minimum.
5. Posts and railings shall be nominal 1-1/2-inch diameter (1.90-inch outside diameter).

C. Accessories:

1. Fittings and Accessories:
   a. Extruded, machined bar stock, permanent mold castings, or die castings of sufficient strength to meet load requirements.
   b. Gauge metal components are not acceptable for load-resisting components.
   c. Fittings shall match color of pipe in railings.
2. Miscellaneous Extruded Aluminum Parts: Alloy 6063-T6, Alloy 6061-T6, or Alloy 6105 T5 aluminum, or equivalent, and of adequate strength for all loads.
3. Castings for Railings:
   a. Cast Al-mag with sufficient strength to meet load and test requirements.
   b. Anodizable grade finish with excellent resistance to corrosion when subjected to exposure of sodium chloride solution intermittent spray and immersion.
4. Post Anchorages:
   a. Refer to standard details for types of post anchorages and minimum requirements.
   b. Bolts at anchorages shall be minimum 1/2-inch diameter.
5. Wall Brackets: Adjustable wall fitting, with provision for minimum three 3/8-inch diameter AISI Type 316 stainless steel bolts or concrete anchors.
6. Rail Terminals (including Wall Returns): Aluminum wall fitting with provision for three 3/8-inch Type 304 fasteners.
7. Railing System Gate:
   a. Extruded aluminum rail components.
   b. Hardware Manufacturers and Products:
      1) Julius Blum & Co., Inc., Carlstadt, NJ; No. 782/3 gate hinges with springs, and No. 784 gate latch and stop.
      2) CraneVeyor Corp., South El Monte, CA; No. C4370b gate hinges with spring, No. C4369 gate latch, and No. C4368 gate stop.
      3) Moultrie Manufacturing Co., Moultrie, GA; Part No. W60006.

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8. Toeboards:
    a. Molded or extruded Alloy 6063-T6 or Alloy 6061-T6 aluminum.
    b. Provide slotted holes for expansion and contraction where required.

D. Finishes:

1. Pipe and Post: In accordance with AA DAF45, designation AA-M32-C22-A41.
2. Cast Fittings and Toeboards: In accordance with AA DAF45, designation AA-M10-C22-A41.

2.02 ANCHOR BOLTS, FASTENERS, AND CONCRETE ANCHORS

A. Locknuts, Washers, and Screws:

1. Elastic Locknuts, Steel Flat Washers, Round Head Machine Screws (RHMS): AISI Type 316 stainless steel.
2. Flat Washers: Molded nylon.

B. Bolts and Nuts for Bolting Railing to Metal Beams: ASTM A193/A193M and ASTM A194/A194M, Type 316 stainless steel.

C. Concrete Anchors:

1. Stainless steel, AISI Type 316.
2. Post-installed anchors in accordance with Section 05 05 19, Post-installed Anchors, unless otherwise specified herein.
3. Bolt Diameter: 1/2-inch, minimum.

2.03 FABRICATION

A. Shop Assembly:

1. Post Spacing: Maximum 6-foot horizontal spacing.
2. Railing Posts Bolted to Metal or Concrete:
    a. In lieu of field cutting, provide approved fitting with sufficient post overlap, containing provisions for vertical adjustment.
    b. Field fit-up is required.
3. Free of burrs, nicks, and sharp edges when fabrication is complete.
4. Welding is not permitted.

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B. Shop/Factory Finishing:

1. Use same alloy for uniform appearance throughout fabrication for railings.
2. Railing and Post Fittings: Match fittings with color of pipe in railing.

C. Shop Assembly:

1. Shop assemble rails, posts, and formed elbows with a close tolerance for tight fit.
2. Fit dowels tightly inside posts.

D. Repair of Defective Work: Remove stains and replace defective Work.

PART 3 EXECUTION

3.01 GENERAL

A. Field fabrication of aluminum railing systems is not permitted.

B. Where required, provide railing posts longer than needed and field cut to exact dimensions required in order to satisfy vertical variations on actual structure.

C. Install railing with base that provides plus or minus 1/4-inch vertical adjustment inside base fitting. If adjustment is required in field and exceeds plus or minus 1/4-inch, reduce post length not to exceed beyond bottom of lowest set-screw or bolt in base fitting.

D. Modification to supporting structure is not permitted where railing is to be attached.

E. Protection from Entrapped Water:

1. Make provisions in exterior and interior installations subject to high humidity to drain water from railing system.
2. For posts mounted in concrete, bends, and elbows occurring at low points, drill weep holes of 1/2-inch diameter at lowest possible elevations, one hole per post or rail. Drill hole in plane of rail.

3.02 RAILING INSTALLATION

A. Assembly and Installation: Perform in accordance with manufacturer’s written recommendations for installation.

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B. Expansion Joints:

1. Maximum intervals of 54 feet on center and at structural joints.
2. Slip joint with internal sleeve extending 2 inches beyond each side of joint. Provide 1/2-inch slip joint gap to allow for expansion.
3. Fasten to one side using 3/8-inch diameter set-screw. Place set-screw at bottom of pipe.
4. Locate joints within 12 inches of posts. Locate expansion joints in rails that span expansion joints in structural walls and floors supporting the posts.

C. Posts and Rails:

1. Surface Mounted Posts:
   a. Bolt post baseplate connectors firmly in place.
   b. Shims, wedges, grout, and similar devices for railing post alignment not permitted.
2. Set posts plumb and aligned to within 1/8-inch in 12 feet.
3. Set rails horizontal or parallel to slope of steps to within 1/8-inch in 12 feet.
4. Install posts and rails in same plane.
5. Remove projections or irregularities and provide a smooth surface for sliding hands continuously along top rail.
6. Use offset rail for use on stairs and platforms if post is attached to web of stringers or structural platform supports.
7. Support 1-1/2-inch rails directly above stairway stringers with offset fittings.

D. Wall Brackets: Support wall rails on brackets spaced maximum 5 feet on centers as measured on the horizontal projection.

E. Toeboard:

1. Provide at railings, except where 4-inch or higher concrete curbs are installed, at gates, or at stairways unless shown otherwise.
2. Accurately measure in field for correct length; after railing post installation cut and secure to posts.
3. Dimension between bottom of toeboard and walking surface not to exceed 1/4 inch.
4. Install plumb and aligned to within 1/8-inch in 12 feet.
5. Attach toeboards to posts via clamp that complies with design requirements while facilitating expansion and contraction. Do not screw directly to post or base.

F. Railing System Gate: Install in accordance with manufacturer’s installation instructions.

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3.03 FIELD FINISHING

A. Corrosion Protection: Prevent galvanic action and other forms of corrosion caused from direct contact with concrete and dissimilar metals by coating metal surfaces as specified in Section 09 90 00, Painting and Coating.

3.04 FIELD QUALITY ASSURANCE AND QUALITY CONTROL

A. Post-installed anchors supporting railing systems require special inspection.

B. Owner-Furnished Quality Assurance, in accordance with ICC IBC Chapter 17 requirements, is provided in the Statement of Special Inspections Plan on the Drawings. Contractor responsibilities and related information are included in Section 01 45 33, Special Inspection, Observation, and Testing.

C. Contractor-Furnished Quality Control: Inspection and testing as required in Section 01 45 16.13, Contractor Quality Control.

3.05 CLEANING

A. Wash railing system thoroughly using clean water and soap. Rinse with clean water.

B. Do not use acid solution, steel wool, or other harsh abrasive.

C. If stain remains after washing, restore in accordance with railing manufacturer’s recommendations or replace stained railings.

END OF SECTION

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SECTION 05 53 00
METAL GRATINGS

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Association of State Highway and Transportation Officials (AASHTO): Standard Specifications for Highway Bridges.
2. ASTM International (ASTM):
   a. A36/A36M, Standard Specification for Carbon Structural Steel.
   b. A666, Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
   c. A1011/A1011M, 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.
   d. B210/B210M, Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes.
   e. B221, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
3. National Association of Architectural Metal Manufacturers (NAAMM):
   a. MBG 531, Metal Bar Grating Manual.
   b. MBG 532, Heavy-Duty Metal Bar Grating Manual.

1.02 SUBMITTALS

A. Action Submittals:

1. Shop Drawings:
   a. Grating: Show dimensions, weight, size, and location of connections to adjacent grating, supports, and other Work.
   b. Grating Anchorage: Show details of anchorage to supports to prevent displacement from traffic impact.
   c. Product data for grating, grating clips, anchors, accessories, and other manufactured products specified herein.
   d. Manufacturer’s specifications, including coatings, surface treatment, and finishes.

B. Informational Submittals:

1. Special handling and storage requirements.
2. Installation instructions.

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1.03 DELIVERY, STORAGE, AND HANDLING

A. As far is practical, factory assemble items.

B. Package and clearly tag parts and assemblies that are, due to necessity, shipped unassembled.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Materials, equipment, and accessories specified in this section shall be products of:

1. Alabama Metal Industries Corporation (AMICO), Birmingham, AL.
2. IKG, Houston, TX.
3. Ohio Gratings, Inc., Canton, OH.

2.02 GRATING MATERIALS

A. Aluminum: Provide alloy and temper as designated below.

1. Bearing Bars and Banding: ASTM B221 alloy 6061-T6 or alloy 6063-T6.
2. Swaged Crossbar Rods: ASTM B221 alloy 6061 or alloy 6063, or ASTM B210/B210M alloy 3003.
3. Finish: Mill.

B. Carbon Steel:

1. Bearing Bars, Banding, and Rectangular Cross Bars: ASTM A1011/A1011M commercial steel Type II for hot rolled carbon steel sheet and strip, or ASTM A36/A36M.
2. Cross Bars made from Wire Rods: Not permitted.
3. Finish: Galvanized after fabrication.

C. Stainless Steel:

1. Bearing Bars, Banding, and Cross Bars: ASTM A666, Type 304L.
2. Finish: Mill.

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2.03 LIGHT-DUTY AND MEDIUM-DUTY METAL BAR GRATING (TYPE A AND TYPE B)

A. General Requirements:

1. Maximum Service Load:
   a. Light Duty (Type A): 100 psf uniformly distributed load.
   b. Medium Duty (Type B): 500 psf uniformly distributed load.
2. Maximum Deflection: Span/240 or 1/4-inch, whichever is less.
3. Bearing Bar Spacing:
   a. Light Duty: 1-3/16-inch maximum, center-to-center.
   b. Medium Duty: 15/16-inch maximum, center-to-center.
4. Cross Bar Spacing: 4 inches maximum, center-to-center. For aluminum I-bar grating with depths greater than 2 inches, provide cross bars at 2 inches maximum, center-to-center.
5. Bearing Bars, Cross Bars and Banding: Minimum thickness as specified in NAAMM MBG 531 or as shown on the Drawings.

B. Grating Materials:

1. Aluminum, pressure-locked I-bar grating fabricated by swaging crossbars between extruded I-shaped bearing bars.
2. Galvanized steel welded, rectangular bar grating fabricated by electro-forging cross bars to bearing bars.
3. Stainless steel pressure-locked rectangular bar grating fabricated by swaging crossbars between rectangular bearing bars.

C. Surface:

1. Aluminum: Striated.
2. Steel or Stainless Steel: Plain.

D. Stair Treads:

1. Material and Type: Same as grating material and grating type as furnished for connecting walkway or work surface.
2. Nosings: Integral ribbing and serrated edge on one long axis of tread, or nonslip abrasive on each tread along one long edge.
3. Carrier Plate or Angle: Furnish at each end for connection to stair stringers.

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2.04 HEAVY-DUTY METAL BAR GRATING (TYPE C)

A. General Requirements:

1. Maximum Service Load: AASHTO H-20.
2. Maximum Deflection: Span/240.
3. Bearing Bar Spacing: 1-7/8-inch maximum center-to-center.
4. Cross Bar Spacing: 4 inches maximum center-to-center.
5. Bearing Bars, Cross Bars and Banding: Minimum thickness as specified in NAAMM MBG 532 or as shown on the Drawings.

B. Grating Type: Galvanized steel, heavy-duty, rectangular bar grating fabricated by welding crossbars between rectangular bearing bars.

C. Surface: Plain.

2.05 ACCESSORIES

A. Embedded Frames: As indicated on the Drawings and as specified in Section 05 50 00, Metal Fabrications.

B. Grating Clamps:

1. Use at flanged beam and bolted angle frame supports.
2. Removable from above grating walkway surface.
3. Provide hat bracket, recessed bolt, and bottom clamp of same material as grating.
4. Manufacturers and Products:
   a. Direct Metals Company, LLC, Kennesaw, GA; Grating Clamp.
   b. Grating Fasteners, Inc., Harvey, LA; G-Clip.

C. Anchor Stud and Saddle Clip:

1. Use at embedded angle frame supports with stud anchor and nut recessed below top of grating surface.
2. Removable from above grating walkway surface.
3. Provide Type 316 stainless steel welded threaded stud anchor, nut, washer, and saddle clip.
4. Manufacturers and Products:
   a. Welded Stud Anchor:
      1) Nelson Stud Welding, Inc., Elyria, OH.
      2) Stud Welding Associates, Inc. Elyria, OH.
   b. Saddle Clip:
      1) Direct Metals Company, LLC, Kennesaw, GA; Saddle Clip.
      2) Grating Fasteners, Inc., Harvey, LA; Saddle Clip.
      3) Struct-Fast, Inc., Baltimore, MD; Grate-Fast.

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2.06 FABRICATION

A. General:

1. In accordance with NAAMM MBG 531 or NAAMM MBG 532.
2. Do not weld aluminum grating.
3. Conceal fastenings where practical.
4. Drill metalwork and countersink holes as required for attaching hardware or other materials.
5. Cutouts:
   a. Fabricate in grating sections for penetrations indicated.
   b. Arrange to permit grating removal without disturbing items penetrating grating.
   c. Edge band openings in grating that interrupt four or more bearing bars with bars of same size and material as bearing bars.
6. Do not notch bearing bars at supports to maintain elevation.
7. Field measure areas to receive grating. Verify dimensions of new fabricated supports and fabricate to dimension required for specified clearances.
8. Section Length: Sufficient to prevent section from falling through clear opening when oriented in the span direction and one end is touching either the concrete or the vertical leg of grating support.
9. Minimum Bearing: 1-inch for grating depth up to 2-1/4 inches and 2 inches for grating depth greater than 2-1/4 inches.
10. Banding and Toe Plates: Same material as grating and welded to bearing bars in accordance with requirements of NAAMM MBG 531 and NAAMM MBG 532.

B. Light-Duty and Medium-Duty Metal Bar Grating: Single grating section shall be not less than 1.5 feet or greater than 3 feet in width or weigh more than 150 pounds.

C. Heavy-Duty Metal Bar Grating: Minimum width of grating sections shall be 2 feet regardless of length and weight.

D. Supports:

1. Same material as grating, except that supports which are to be embedded in concrete shall be Type 316 stainless steel, unless part of an extruded aluminum system.
2. Coordinate dimensions and fabrication with grating to be supported.

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PART 3 EXECUTION

3.01 PREPARATION

A. Electrolytic Protection:

1. Protect aluminum surfaces in contact with dissimilar metals, or embedded or in contact with masonry, grout, or concrete as specified in Section 09 90 00, Painting and Coating.
2. Allow paint to dry before installation of material.

3.02 INSTALLATION

A. Until grating sections are securely fastened in place, area shall be appropriately barricaded or flagged to alert people working in area of potential fall hazard.

B. Install manufactured products in accordance with manufacturer's recommendations.

C. Install supports such that grating sections have a solid bearing on both ends, and that grating sections will not rock or wobble under design loads.

D. Install grating supports plumb and level as applicable.

E. Install sections of welded frames with anchors to straight plane without offsets.

F. Field locate and install fasteners to fit grating layout.

G. Anchor grating securely to supports using minimum of four fastener clips and bolts per grating section.

H. Each grating section shall be easily removable and replaceable.

I. Completed installation shall be rigid and neat in appearance.

J. Protect painted and galvanized surfaces during installation.

K. Repair damaged coatings as specified in Section 09 90 00, Painting and Coating.

END OF SECTION

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SECTION 06 10 00
ROUGH CARPENTRY

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Lumber Standards Committee's Board of Review (ALSC).
2. American Wood Council (AWC): 2, National Design Specification for Wood Construction.
3. American Wood Preservers' Association (AWPA):
   a. U1, User Specification for Treated Wood.
   b. M4, Standard for the Care of Preservative-Treated Wood Products.
4. APA - The Engineered Wood Association (APA):
   a. Form B445, APA Quality Assurance Policies for Structural-Use Panels Qualified to PRP-108.
5. ASTM International (ASTM):
   a. A153/A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
   b. A307, Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 pounds per square inch Tensile Strength.
   c. C1177/C1177M, Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.
   d. E84, Standard Test Method for Surface Burning Characteristics of Building Materials.
   e. F1667, Standard Specification for Driven Fasteners: Nails, Spikes, and Staples.
6. International Code Council (ICC): ESR-1539, Power-Driven Staples and Nails.
7. National Fire Protection Association (NFPA): 255, Standard Method of Test of Surface Burning Characteristics of Building Materials.
8. UL: 723, Standard for Test for Surface Burning Characteristics of Building Materials.
9. U.S. Department of Commerce—Voluntary Product Standard (DOC):
   a. PS 1, Structural Plywood.
   b. PS 20, American Softwood Lumber Standard.
10. Western Wood Products Association (WWPA): G5, Western Lumber Grading Rules.

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1.02 SUBMITTALS

A. Action Submittals:

1. Product Data: Indicate component materials and dimensions, and include construction and application details for the following:
   a. Construction panel thickness where not shown.

B. Informational Submittals:

1. ICC Evaluation Service Reports, including the following as a minimum:
   a. Connections and Fasteners.
   b. Wood Treatment.
   c. Nails.
2. Wood treatment manufacturer's instructions for handling, storing, installation, and finishing of treated material.
3. Material Certificates: Showing species and grade selected for dimension lumber for each use.
   a. Material certificates for dimensional lumber in compliance with allowable unit stresses. Show species and grade selected for each use as well as design values approved by the ALSC's Board of Review.
   b. For each type of preservative-treated wood product, include certification by treatment plant stating type of preservative solution and pressure process used, net amount of preservative retained, and compliance with applicable standards.
   c. For waterborne-treated products include statement that moisture content of treated materials was reduced to levels indicated prior to shipment to Site.
4. Material test reports from testing laboratory showing and interpreting test results in accordance with test methods UL 723, NFPA 255, and ASTM E84, relative to fire-retardant treated wood products.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Upon delivery to Site, immediately place materials in area protected from weather. Do not store seasoned materials in wet or damp areas.

B. Protect sheet materials from breaking corners and damaging surfaces while unloading.

C. Store materials a minimum of 6 inches above ground on framework or blocking and cover with waterproof covering, providing for adequate air circulation and ventilation. Store sheet materials flat, not on edge.

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D. Protect fire-retardant materials against high humidity and moisture during storage and erection.

E. For lumber and plywood pressure treated with waterborne chemicals, place spacers between each bundle to provide air circulation.

F. Store materials for which maximum moisture content is specified in areas where humidity can be controlled.

PART 2 PRODUCTS

2.01 GENERAL

A. Lumber Standards:

1. In accordance with DOC PS 20 and applicable grading rules and wood species certified by ALSC.
2. Design values for wood members equal to those published in supplement to AWC 2.
3. Stamp or brand each unexposed piece of lumber with grade, species, and moisture content at time of mill surfacing.
4. Furnish exposed lumber pieces with grade stamps applied to ends or back of each piece. If completely exposed, and permitted by local building jurisdiction, omit grade stamps entirely.

B. Lumber sizes shown on the Drawings are nominal, unless shown otherwise. Provide actual sizes as required by DOC PS 20 for use.

C. Dressed lumber S4S, unless shown otherwise on the Drawings.

D. Moisture content of lumber not to exceed 19 percent, unless otherwise specified and marked “DRY.”

E. Each plywood panel identified with designated grade trademark of APA.

2.02 LUMBER

A. Framing Lumber: Douglas Fir-Larch, No. 1 or better unless indicated otherwise below.

Usage	Minimum Grade
Blocking, nailers, and fascia	Douglas Fir-Larch No. 2, Hemlock, nondense
General framing	Douglas Fir-Larch No. 1, or Southern Pine No. 1

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2.03 CONSTRUCTION PANELS

A. Plywood:

1. General:
   a. Where construction panels are shown on the Drawings for the following concealed types of applications, provide APA Performance-Rated Panels complying with requirements designated under each application for grade designation, span rating, exposure durability classification, edge detail, and thickness.
   b. Construction Panel Standards: Comply with DOC PS 1 for plywood construction panels and for products not manufactured under DOC PS 1 provisions, in accordance with APA PRP-108 and APA Form B445.
   c. Trademark: Each construction panel factory-marked with APA trademark evidencing compliance with grade requirements.

B. Plywood Backing Panel: Mounting electrical, telephone, and like equipment; provide fire-retardant treated plywood panel with grade designation, APA C-D Plugged Exposure 1, in thickness shown on the Drawings, or, if not shown on the Drawings, not less than 15/32-inch.

2.04 PRESERVATIVE WOOD TREATMENT BY PRESSURE PROCESS

A. Where lumber or plywood is indicated as preservative-treated wood, in accordance with AWPA U1 and AWPA M4, mark and grade each treated item in accordance with SPIB 1003 or WWPA G5.

1. Kiln-dry after treatment to maximum moisture content of 19 percent.
2. Treat wood in contact with roofing or flashing.
3. Treat wood in contact with masonry or concrete.

B. Aboveground Materials:

1. Pressure treat items with waterborne preservatives to a minimum retention of 0.25 per cubic foot.
2. Interior Use: After treatment, kiln-dry lumber and plywood to maximum moisture content of 19 percent and 15 percent respectively.
3. Treat the following items:
   a. Wood nailers, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
   b. Wood blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.

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C. Complete fabrication of treated items prior to treatment, where possible. If cut after treatment, coat cut surfaces to comply with AWPA M4. Inspect each piece of lumber or plywood after drying and discard damaged or defective pieces.

2.05 FIRE-RETARDANT TREATED WOOD

A. Pressure treat lumber and plywood with fire-retardant chemicals in accordance with applicable AWPA U1 and AWPA M4 standard for species, product, preservative and end use to ensure flame-spread rating not higher than 25 with no evidence of significant progressive combustion when tested for 30 minutes duration under UL 723 and ASTM E84.

B. Treated lumber and plywood labeled and tested by UL shall show performance rating.

2.06 HARDWARE

A. Fasteners and connectors in contact with preservative-treated or fire-retardant-treated wood shall be hot-dipped zinc-coated galvanized steel or stainless steel in accordance with ASTM A153/A153M.

B. Conform to ASTM F1667.

C. Nails:

1. Conform to ASTM F1667.
2. Use hot-dipped zinc-coated nails wherever exposed.

D. Power Driven Fasteners: Conform to ICC ESR-1539.

E. Bolts and Screws: Conform to ASTM A307, galvanized where exposed.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify surfaces to receive rough carpentry materials are prepared to exact grades and dimensions.

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3.02 GENERAL

A. Lay out, cut, fit, and install rough carpentry items. Anchor sufficiently to ensure rigidity and permanence.

B. Install items accurate to dimension, true to line, level, and square unless shown otherwise on the Drawings. Provide for installation and support of other Work.

C. Discard units of material with defects that impair quality of rough carpentry construction and that are too small to use in fabricating rough carpentry with minimum joints or optimum joint arrangement.

D. Countersink nailheads on exposed carpentry work and fill holes.

E. Make provisions for temporary construction loads, and provide temporary bracing sufficient to maintain structure in true alignment and safe condition until completion of erection and installation of permanent bracing.

F. Field treat field cuts and holes in pressure-treated lumber with preservative in accordance with AWPA M4.

G. Holes: 1/16-inch larger than nominal bolt diameter, except provide holes for cast-in-place anchor bolts 3/16-inch larger than nominal bolt diameter.

1. Enlarge tight holes requiring forcible driving of bolts by reaming.

H. Provide washers under bolt heads and nuts bearing on wood.

3.03 INSTALLATION

A. Miscellaneous Framing: Install where shown on the Drawings and as needed to facilitate installation of finishing materials, fixtures, specialty items, hardware, and trim.

3.04 PRESERVATIVE-TREATED WOOD PRODUCTS

A. Provide preservative-treated wood for framing, blocking, furring, nailing strips built into exterior masonry walls, wood in contact with concrete or masonry and in conjunction with roofing.

B. Apply two brush coats of same preservative used in original treatment to sawed or cut surfaces of treated lumber.

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3.05 FIRE-RETARDANT TREATED WOOD

A. Provide fire-retardant treated lumber and plywood for backing panels at electrical, telephones, and like equipment.

B. Use FR-S rated wood on interior only.

C. Use exterior rated wood outside and where relative humidity is above 80 percent.

3.06 FIELD QUALITY ASSURANCE AND QUALITY CONTROL

A. Furnished Quality Assurance, in accordance with IBC Chapter 17 requirements, is provided in Statement of Special Inspections Plan in Supplement located at end of Section 01 45 33, Special Inspection, Observation, and Testing. Contractor responsibilities and related information are included in Section 01 45 33, Special Inspection, Observation, and Testing.

B. Contractor-Furnished Quality Control: Inspect and test as required in Section 01 45 16.13, Contractor Quality Control.

END OF SECTION

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SECTION 06 41 00
ARCHITECTURAL WOOD CASEWORK

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American National Standards Institute, Inc. (ANSI):
   a. Z124.2, Solid Polymer Components.
   b. Z124.6, Properties of Solid Polymer Components.
2. Architectural Woodwork Institute Quality Certification Corporation (AWI) QCC: Quality Certification Program.
3. Architectural Woodwork Institute, Architectural Woodwork Manufacturers Association of Canada, Woodwork Institute (AWI, AWMAC, WI): Architectural Woodwork Standards.
4. Builders Hardware Manufacturers Association (BHMA):
   a. 156.9, Cabinet Hardware.
   b. 156.11, Cabinet Locks.
5. Federal Specifications (FS): A-A-1936, Adhesive, Contact, Neoprene Rubber.
6. National Electrical Manufacturer’s Association (NEMA): LD-3, High-pressure decorative laminates (HPDL).
7. Woodwork Institute (WI): Certified Compliance Program (CCP).

1.02 SUBMITTALS

A. Action Submittals:

1. Product Data for specified items.
2. Shop Drawings:
   a. Show details and dimensions not controlled by job conditions and required field measurements.
   b. Describe and illustrate features of design showing field measurements, construction details, dimensions, materials, and finish.
      1) Use full-size or 1/4-size scale drawings.
      2) Key to the Drawings.
   c. Furnish manufacturer’s descriptive literature of specialty items not manufactured by woodwork manufacturer.

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3. Samples:
    a. Each plastic laminate color indicated on Color List on the Drawings.
    b. Each Solid Surface material indicated on Color List on the Drawings.
    c. Casework Hardware with specified finish.
    d. Casework unit complete with hardware, including locks and accessories, and top. Unit may be incorporated in the Work.

B. Informational Submittals: Proof of woodwork manufacturer qualifications.

1.03 QUALITY ASSURANCE

A. Manufacturer's Qualifications:

1. Successful completion of comparable work on similar size project within 2 years before start of construction on this Project.
2. Quality Standards: AWI, AWMAC, WI Architectural Woodwork Standards.
3. Current member of AWI.

B. Casework: Provide Custom Grade: As defined in AWI, AWMAC, WI Architectural Woodwork Standards, unless otherwise specified.

C. Cabinet Hardware: In accordance with BHMA 156.9 and BHMA 156.11.

D. Work in this section shall be accomplished under the Quality Certification Program of AWI QCC.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Defer delivery to Site until installation and storage areas are complete and dry of wet type construction, and excessive moisture has been out of building for at least 10 days.

B. Protect casework and paneling from damage and dampness. Store in weathertight, well-ventilated areas. Do not subject to extreme changes of temperature or humidity.

1.05 ENVIRONMENTAL REQUIREMENTS

A. For a minimum of 72 hours prior to installation, allow woodwork to come to equilibrium onsite in space where it is to be installed.

B. Humidity: For 24 hours before, during, and after installation, maintain relative humidity between 25 percent and 55 percent.

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C. Temperature: For 24 hours before, during, and after installation, maintain ambient temperature between 65 degrees F and 75 degrees F.

PART 2 PRODUCTS

2.01 CASEWORK MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.

1. Wood Moisture Content: 8 percent to 13 percent.

B. Plywood:

1. APA exterior type conforming to NIST, Product Standard Section, PS 1.
2. Thickness: Minimum 3/4-inch.
3. Grade: No knots or voids present on surfaces.
4. Formaldehyde emissions-free, no volatile organic compound (VOC), synthetic resins.

C. Particleboard or MDF finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of ANSI/NEMA LD 3, Grade VGL, for Test Method 3.3, Method 3.4, Method 3.6, Method 3.8, and Method 3.10.

1. Thickness: Minimum 3/4-inch.
2. Moisture Content: Maximum 8 percent.
3. Formaldehyde emissions-free, no volatile organic compound (VOC), synthetic resins.

D. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.

2.02 CASEWORK FINISH

A. Plastic Laminate:

1. Meet requirements of AWI, AWMAC, WI Architectural Woodwork Standards Section 10.
2. Furnish casework exposed surfaces, including front face, edges, exposed interior, semi-exposed, shelves, and other surfaces specified herein with plastic laminate in colors indicated in Interior Finish Schedule on the Drawings.

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2.03 CASEWORK HARDWARE

A. Hinges: European style hinge, tool-free attachment, three-dimensional adjustment, 120-degree door swing, and nickel-plated steel construction. Meet or exceed ANSI/BHMA A156.9 Grade 2 requirements; 626 satin chrome finish.

1. Manufacturers:
   a. Blum, Inc.
   b. Grass America, Inc.
   c. Stanley.

B. Wire Pulls: 4-inch center-to-center spacing between supports, solid brass, or bronze, 626 satin chrome finish.

1. Manufacturers and Products:
   a. Baldwin; No. 4676.
   b. Stanley; No. 4484.

C. Drawer Slides: Medium-duty type (150-pound load capacity), soft close, ball bearing, rail mount, full extension with clear zinc finish. Meet or exceed ANSI/BHMA A156.9 Grade 1 HD-100 requirements.

1. Manufacturer and Product:
   a. Accuride International Inc.; No. 3932EC.
   b. “Or-equal.”

D. Heavy-Duty Shelf Supports:

1. Wall mounted adjustable shelving support system using heavy-duty 14-gauge steel standards and 16-gauge steel brackets with double slot design and vertical slot adjustability; white finish. Bracket depth as required to suit shelf sizes shown on the Drawings.
2. Provide bookends and other accessories and fasteners for complete system.
3. Manufacturers and Products:
   a. Knape and Vogt; No. 82 Series Standard and No. 182 Series Bracket System.
   b. “Or-equal.”

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2.04 PLASTIC LAMINATE

A. General Use: NEMA LD 3, Grade GP 38; in colors indicated in Interior Finish Schedule on the Drawings.

1. Manufacturers and Products:
   a. (Basis of Design) Wilson Art; Tuf-Surf.
   b. Westinghouse; Micarta.
   c. “Or-equal.”

2.05 SOLID SURFACE (COUNTERS, BACKSPLASHES, AND WINDOW SILLS)

A. Materials:

1. Solid Polymer Components:
   a. Cast, nonporous, filled polymer, not coated, laminated or of composite construction with through body colors meeting ANSI Z124.3 or ANSI Z124.6 having minimum physical and performance properties specified.
   b. Superficial damage to a depth of 0.010-inch (0.25-mm) shall be repairable by sanding and/or polishing.
2. Thickness: 1/2-inch and tripled for 1-1/2-inch edges.
3. Edge Treatment: As shown on the Drawings.
4. Finish: Matte, gloss range 5 to range 20.
5. Color: Shown on Color List, Interior Finish Schedule, and Window and Relight Schedule on the Drawings.

B. Manufacturers and Products:

1. Dupont; Corian.
2. Wilsonart; Solid Surface.
3. “Or-equal.”

2.06 ANCILLARY MATERIALS

A. Adhesives:

1. For Solid Surfacing: As recommended by manufacturer.
2. Woodwork: Phenol-resin or resorcinol-resin.
3. Plastic Laminate: Contact cement; FS A-A-1936.

B. Sealant:

1. For Solid Surfacing: Manufacturer’s Standard kit to produce inconspicuous and nonporous joints.
2. General: As specified in Section 07 92 00, Joint Sealants.

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C. Hardware: Furnish fasteners and miscellaneous hardware required for assembling and anchoring woodwork, including casework.

2.07 FABRICATION

A. Moisture Content:

1. Kiln dry lumber to an average moisture content range as follows:
   a. Interior Work: 5 percent to 10 percent.

B. Casework Construction: AWI, AWMAC, WI Architectural Woodwork Standards Section 10, Custom Grade, flush overlay, and as shown on the Drawings.

C. Casework Finish:

1. Exposed exterior surfaces including, but not limited to, cabinet bottoms, sides, and edges:
   a. Plastic laminate in color as indicated on Interior Finish Schedule and Color List on the Drawings.
2. Exposed interior surfaces including, but not limited to, shelves, divisions, partitions, interior face of ends (sides), backs, bottoms, interior faces of doors and applied drawer fronts:
   a. Plastic laminate in color white.
3. Semi-exposed interior surfaces including, but not limited to, shelves, divisions, interior face of ends (sides), backs, bottoms, drawer sides, subfronts, backs, bottoms, and fronts:
   a. Plastic laminate in color white.
4. Shelf Edgebands: Match plastic laminate color of exterior exposed surfaces.

D. Casework Units: Shop assembled for field installation.

E. Install concealed hinges on doors.

F. Drawer Slides: Use side-mounted, heavy-duty type.

G. Install wire pulls on all doors and drawers.

H. Install casework hardware in accordance with manufacturer’s instructions. Provide items where indicated and as required for a complete installation.

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PART 3 EXECUTION

3.01 PREPARATION

A. Examine grounds, stripping, and blocking for cabinet attachment.

B. Do not proceed to install until conditions are acceptable to installer.

C. Verify surfaces to receive architectural woodwork items are properly prepared.

3.02 CASEWORK INSTALLATION

A. Coordinate installation of, and cut openings for mechanical, electrical, and other items that penetrate casework surfaces and tops.

B. Install casework in true alignment, level, and plumb.

C. Secure units with nails or screws to cleats that have been anchored to building structure or wall framing.

D. Install wall-hung cabinets to rigidly support cabinet weight plus normally expected weight of cabinet contents.

E. Accurately scribe and closely fit faceplates, filler strips, and trim strips to irregularities of adjacent surfaces.

F. Adhere plastic laminate as recommended by laminate manufacturer.

1. Apply with as few cross joints as possible and no longitudinal joints.
2. Scribe neatly to vertical surfaces.

G. Toe Space at Front of Cabinets: Provide by installing front face of cabinets 3 inches in front of base face.

3.03 ARCHITECTURAL WOODWORK INSTALLATION

A. Install horizontal members level and vertical members plumb.

B. Miscellaneous: Furnish fasteners and miscellaneous hardware required for assembling and anchoring woodwork.

C. Plastic Laminate Clad Shelving: Provide in sizes, locations, and color as indicated on the Drawings.

D. No exposed fasteners permitted.

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3.04 SOLID SURFACING INSTALLATION

A. Factory Fabrication:

1. Shop Assembly:
   a. Fabricate components to greatest extent practical to sizes and shapes indicated, in accordance with approved Shop Drawings and manufacturer's printed instructions and technical bulletins.
   b. Form joints between components using manufacturer's standard joint adhesive without conspicuous joints.
      1) Reinforce with strip of solid polymer material, 2 inches wide.
   c. Route and finish component edges with clean, sharp returns.
      1) Route cutouts, radii, and contours to template.
      2) Smooth edges.
      3) Repair or reject defective and inaccurate work.

B. Examination: Examine substrates and conditions, with fabricator present for compliance with requirements for installation tolerances and other conditions affecting performance of work. Field verify all dimensions.

C. Installation: Install components plumb, level, and rigid, scribed to adjacent finishes, in accordance with approved Shop Drawings and product data.

1. Provide product in the largest pieces available.
2. Form Field Joints using Manufacturer's Recommended Adhesive, with Joints Inconspicuous in Finished Work: Exposed joints/seams shall not be allowed.
3. Reinforce field joints with solid surface strips extending a minimum of 1-inch on either side of the seam with the strip being the same thickness as the top.
4. Cut and finish component edges with clean, sharp returns.
5. Route radii and contours to template.
6. Anchor securely to wall or other supports.
7. Align adjacent countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop.
8. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

3.05 ADJUSTING AND CLEANING

A. Adjust hardware and leave in smooth working condition.

B. Adjust doors and drawers to operate without restriction.

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C. Surfaces: Clean and ready for use.

D. Staining or Discoloration of Finish: Restore to original finish or replace unit.

END OF SECTION

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SECTION 07 15 00
AIR AND WATER BARRIERS

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in the section:

1. ASTM International: (ASTM):
   a. E1186, Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems.
   b. E1677, Standard Specification for Air Barrier (AB) Material or System for Low-Rise Framed Building Walls.
   c. E1680, Standard Test Method for Rate of Air Leakage Through Exterior Metal Roof Panel Systems.
   d. E2178, Standard Test Method for Air Permeance of Building Materials.
   e. E2357, Standard Test Method for Determining Air Leakage of Air Barrier Assemblies.
   f. E283, Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
   g. E779, Standard Test Method for Determining Air Leakage Rate by Fan Pressurization.
2. US Army Corps of Engineers (USACE): ALTP, Air Leakage Test Protocol for Measuring Air Leakage in Buildings.

1.02 SUBMITTALS

A. Action Submittals:

1. Shop Drawings: Submit Shop Drawings showing locations and extent of air and water barrier assemblies and details of all typical conditions, intersections with other envelope assemblies and materials, membrane counter-flashings, and details showing how gaps in the construction will be bridged, how inside and outside corners are negotiated, how materials that cover the materials are secured with air-tight condition maintained, and how miscellaneous penetrations such as conduits, pipes, electric boxes and similar items are sealed.
   a. Include VOC content of each material, and applicable legal limit in the jurisdiction of the Project.
   b. Include statement that materials are compatible with adjacent materials proposed for use.
   c. Include required values for field adhesion test on each substrate.

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2. Product Data: Submit material Manufacturer's Product Data, material manufacturer's instructions for evaluating, preparing, and treating substrate, temperature and other limitations of installation conditions, Technical Data, and tested physical and performance properties.
   a. Submit letter from primary air barrier material manufacturer indicating approval of materials that are proposed to be used that are not currently listed in the accessories section of this specification for that manufacturer's material.
   b. Include statement from the primary air barrier material manufacturer that the materials used in their air barrier assembly which will be used to adhere to the underlying substrate are chemically compatible to the substrate material.
3. Provide samples of products specified in other Technical Specifications to identify the materials to be used and compliance with specified requirements of this section.
4. Compatibility: Submit letter from primary material manufacturer stating that materials proposed for use are permanently chemically compatible and adhesively compatible with adjacent materials proposed for use. Submit letter from primary material manufacturer stating that cleaning materials used during installation are chemically compatible with adjacent materials proposed for use.

B. Informational Submittals:

1. Quality Assurance Program: Submit evidence of current Contractor accreditation and Installer certification under the Air Barrier Association of America's (ABAA) Quality Assurance Program (QAP). Submit accreditation number of the Contractor and certification number(s) of the ABAA Certified Installer(s).
2. Provide product data as submitted for other Technical Specifications to identify the materials to be used and compliance with specified requirements of the section.
3. Preinstallation Conference meeting minutes.

1.03 QUALITY ASSURANCE

A. Inspector Qualifications: Certify that the inspectors meet the specified requirements. Air Barrier Subcontractor Qualifications: Air barrier Subcontractor(s) shall be accredited at the time of bidding and during the complete installation, period by the Air Barrier Association of America (ABAA) whose Installer(s) are certified in accordance with the Site Quality Assurance Program used by ABAA.

B. Air barrier Installer(s) shall be certified by BPQI (Building Performance Quality Institute) for the ABAA Quality Assurance Program in accordance

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with the requirements outlined in the QAP program used by ABAA. Installers shall have their photo-identification air barrier certification cards in their possession and available on the Project Site, for inspection upon request.

C. Preinstallation Conference: Prior to starting application of the air barrier system, arrange and attend a preinstallation conference to ensure a clear understanding of the requirements. Give the Contracting Officer 7 days' advance written notice of the time and place of meeting. Ensure that the air barrier inspector, mechanical and electrical subcontractor, flashing and sheet metal subcontractor, and other trades that may perform other types of work penetrating through, on or over the barrier membrane attend this conference. The conference shall address where each subcontractor begins and ends, the sequence of installation, and each subcontractor's responsibility to ensure airtight joints, junctures, penetrations and transitions between materials, products, and assemblies of products specified in the different sections to be installed by the different subcontractors.

D. Mockup: Construct mockup for each type of air and water barrier and each type of backup material to be applied to. Each mockup shall be 4 feet by 4 feet in size and include at least one wall penetration. Demonstrate proposed installation of air and water barrier in field of mockup and at openings, penetrations and masonry veneer anchor ties. Mockups may not be part of the construction.

1.04 APPLICATION

A. Inspection Services are required for Sludge Mixing Building (90-D2BL) and Composting Operations Building (95-C1BL).

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project Site in original packages with seals unbroken, labeled with the material Manufacturer's name, product, date of manufacture, and directions for storage.

B. Store materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by material manufacturer. Protect stored materials from direct sunlight.

C. Handle materials in accordance with material manufacturer's recommendations specified and for products listed in other Technical Specifications that may be part of the complete air and water barrier system.

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1.06 ENVIRONMENTAL CONDITIONS

A. As specified in or as recommended by manufacturer for products listed in other Technical Specifications.

B. Temperature: Install air barrier within range of ambient and substrate temperature, and moisture content recommended by the primary material manufacturer. Do not apply air barrier to a damp or wet substrate.

C. Field Conditions: Do not install air barrier materials in snow, rain, fog, or mist. Do not install air barrier when the temperature of substrate surfaces and surrounding air temperatures are below those recommended by the material manufacturer.

D. Sequencing. Do not install air barrier material before the roof assembly has been sufficiently installed to prevent a buildup of water in the interior of the building.

E. Compatibility. Do not allow air barrier materials to come in contact with chemically incompatible materials.

F. Ultra-violet exposure. Do not expose air barrier materials to sunlight longer than as recommended by the primary material manufacturer.

1.07 WARRANTY

A. Material Warranty: Provide primary material manufacturer’s standard product warranty, for a minimum 3 years from date of Substantial Completion.

B. Subcontractor (approved by ABAA and Manufacturer) Installation Warranty: Provide a 2-year installation warranty from date of Substantial Completion, including all accessories and materials of the air barrier assembly, against failures including loss of air tight seal, loss of watertight seal, loss of attachment, loss of cohesion/adhesion, and failure to cure properly.

1.08 PERFORMANCE REQUIREMENTS

A. General Materials Performance Requirements:

1. Not all materials to be used as part of the total building air barrier system are specified within this specification section. However, whether described herein or in other sections, all materials of the air barrier system shall comply with the following:
    a. Air Permeance of Materials: Materials shall have an air permeance less than or equal to 0.004 cfm per square foot under a

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pressure differential of 1.57 pounds per square foot when testing in accordance with ASTM E2178.

B. Assembly Performance Requirements: The assembly shall accommodate movements of building materials by providing expansion and control joints and flexible connections as required with accessory air seal materials at such locations, changes in substrate and perimeter conditions. Assembly shall be capable of withstanding combined positive and negative design wind, fan and stack pressures on the envelope without damage or displacement, and shall transfer the load to the structure. Assembly shall not displace adjacent materials under full load. Assembly shall be joined in an air and water-tight flexible manner to the barrier material of adjacent assemblies, allowing for the relative movement of assemblies due to thermal and moisture variations and creep, and anticipated seismic movement. For drainage or cavity wall constructions, the air barrier assembly shall perform as a liquid drainage plane flashed to discharge condensation or water penetration to the exterior.

C. Connections to Adjacent Materials:

1. Provide connections to prevent air leakage and vapor migration at the following locations:
   a. Foundation and walls, including penetrations, ties and anchors.
   b. Walls, windows, louvers or doors.
   c. Different wall and roof assemblies, and fixed openings within those assemblies.
   d. Wall and roof connections and penetrations.
   e. Walls, floor and roof across construction, control and expansion joints.
   f. Walls, floors and roof to utility, pipe and duct penetrations.
   g. Seismic and expansion joints.
   h. All other leakage pathways in the building envelope.

D. Air Permeance of Assemblies: Assemblies of materials and components including, but not limited to, sealants and tapes, shall have an average air leakage of 0.04 cfm per square foot or less under a pressure differential of 1.57 pounds per square foot when tested in accordance with ASTM E2357, ASTM E1680, ASTM E1677, or ASTM E283, as applicable to the assembly.

1.09 QUALITY CONTROL

A. Contractor shall provide quality control personnel, procedures, inspection, testing and verification as specified.

B. Coordination of Subcontractor(s): Contractor shall provide coordination between the subcontractors involved in the construction of the air barrier system, coordinate the sequence of construction to ensure continuity of the

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barrier system joints, junctures, penetrations, and transitions between materials and assemblies of materials and products from substructure to walls to roof.

C. Inspection:

1. Contractor shall provide an experienced inspector knowledgeable of air barrier construction to oversee the following:
   a. Sequencing and installation of the air barrier component materials and assemblies.
   b. Proper joining and sealing of the materials and assemblies.
   c. Sealing of penetrations of the barrier materials and assemblies.
   d. Instruct the subcontractors on the above.
   e. The inspector shall also verify the items under Article Field Quality Control, of this section.

D. Inspector Qualifications: The inspector shall have a minimum of 3 years' experience in the installation of air barrier materials and assemblies in similar construction including the experience in joining and sealing various components and sealing of penetrations of the barrier. The inspector shall have experience coordinating and instructing installers involved in the installation, joining, and sealing of the barrier system materials and components.

E. Documentation and Reporting: Document the installation process on daily reports to Contracting Officer. Include information on the installer, substrates, substrate preparation, products used, ambient and substrate temperature, the location of the barrier installation, problems encountered and their resolution, the results of the quality control procedures, and any testing results.

PART 2 PRODUCTS

2.01 AIR BARRIER MATERIALS GENERAL

A. Provide the type of air barrier material and related primers, adhesives, mastics, tapes, spray foam sealants, joint sealants, and other accessories as specified and necessary for a complete air barrier system assembly. This includes products which transition from one barrier product to another called out as self-adhering transition strips, at openings. Ensure compatibility of the materials within a specific barrier membrane type, with each other, and with the materials to which they will be applied. Materials shall conform to Article Performance Requirements, and materials properties specified when tested in accordance with the referenced standards.

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B. Wall, roof, and joint air barrier materials are specified in their related specification sections and shall also meet the air leakage performance requirements specified in this specification section.

2.02 SELF-ADHERED (SHEET) AIR AND WATER BARRIER

A. Self-adhered, vapor permeable, membrane composed of flexible facing material coated completely and uniformly on one side with adhesive material, formed into uniform, flexible sheets, interleaved with disposable release liner that is removed prior to installation. Use regular, high temperature or low-temperature formulation depending on Site conditions, within temperature ranges specified by material manufacturer.

B. Manufacturers and Products:

1. Cosella-Dörken Products Inc; DELTA-VENT SA.
2. GCP Applied Technologies; Perm-A-Barrier VPS.
3. Henry; Blueskin VP160.
4. WR Meadows Inc.; Air-Shield SMP.

C. Accessory Materials: Provide manufacturer’s compliment of accessory materials for complete and continuous air and water barrier installation for substrates required by Project.

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS

A. Before starting the Work, verify that substrate surfaces are in satisfactory condition. Notify Contracting Officer of defects or conditions that will prevent a satisfactory application. Do not start application until defects and conditions have been corrected.

3.02 EXAMINATION

A. Ensure that the following conditions are met:

1. Surfaces are sound, dry, even, and free of oil, grease, dirt, excess mortar or other contaminants that may affect application of air barrier materials.
2. Concrete surfaces are cured and dry, smooth without large voids, spalled areas or sharp protrusions.
3. Verify substrate is visibly dry and free of moisture.
4. Notify the Contracting Officer in writing of anticipated problems or issues with the substrates prior to proceeding.

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3.03 PREPARATION

A. Coordinate Work with that of other trades to ensure that components to be incorporated into the air barrier system are available when needed. Inspect and approve surfaces immediately before application of barrier system materials. Clean, prepare, and treat substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate, unless otherwise recommended by the air barrier manufacturer's application instructions. Remove laitance, loose aggregate, sharp projections, grease, oil, dirt, curing compounds, and other contaminants which could adversely affect the complete bonding of the air barrier membrane materials to substrate surface.

B. Penetrations and Projections: Seal penetrations in accordance with air barrier system manufacturer's requirements before application of air barrier system.

C. Cracks and Joints: Prepare visible cracks and joints in substrate to receive air barrier membrane in accordance with the membrane manufacturer's requirements. Joints shall be prepared and sealed with flexible materials to accommodate joint movement.

D. Priming: Prime surfaces to receive barrier membrane materials as required by the material manufacturer's printed instructions.

E. Materials Integrity: Protect materials during transport and application. Do not dilute primers and other materials, unless specifically recommended by materials manufacturer. Keep containers closed except when removing contents. Do not mix remains of unlike materials. Thoroughly remove residual materials before using application equipment for mixing and transporting materials. Do not permit equipment on the Project Site that has residue of materials used on previous projects. Use cleaners only for cleaning, not for thinning primers or membrane materials.

3.04 APPLICATION

A. Follow manufacturer's printed installation instructions and additional requirements specified.

B. Install self-adhered sheet air and water barrier systems to provide continuity throughout the building envelope in a shingle fashion. Install materials in accordance with manufacturer's recommendations and as follows (unless manufacturer recommends other procedures in writing based on Project conditions or particular requirements of their recommended materials):

1. Apply primer for transition strips at rate recommended by manufacturer for 1 inch beyond terminating edge of transition membrane. Allow primer to set/cure completely before transition strip application.

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2. Allow primer to dry completely before transition strip application. Apply as many coats as necessary for proper adhesion.
3. Position subsequent sheets of transition strips applied above so that membrane overlaps the membrane sheet below by a minimum of 4 inches, unless greater overlap is recommended by manufacturer. Roll into place with roller.
4. Overlap horizontally adjacent pieces of transition strips a minimum of 4 inches, unless greater overlap is recommended by manufacturer. Roll transition strips and seams with roller.
5. Seal around all penetrations with termination mastic/sealant, membrane counter-flashing or other procedure in accordance with material manufacturer’s instructions, ensuring chemical compatibility amongst adjoining materials.
6. Provide transition material at changes in substrate plane (with bead of mastic/sealant, membrane counter-flashing or other material recommended by material manufacturer) under membrane to eliminate all sharp 90 degree inside corners and to make a smooth transition from one plane to another.
7. Seal the barrier membrane in exterior wall assembly continuously to the barrier conditions of the roof, to concrete below-grade structures, to windows, louvers, exterior doors, penetrations, and other intersection conditions using transition membranes and sealants and in accordance with the manufacturer's recommendations.
8. Provide mechanically fastened non-corrosive metal sheet to span gaps in substrate plane and to make a smooth transition from one plane to the other. Barrier membrane shall be continuously supported by substrate.
9. At through-wall flashings, provide an additional 6-inch-wide strip of manufacturer’s recommended membrane counterflashing to seal top of through-wall flashing to membrane. Seal exposed top edge of strip with bead of mastic as recommended by manufacturer.
10. At deflection and control joints, provide backup for the barrier membrane to accommodate anticipated movement.
11. At expansion and seismic joints provide transition to the joint assemblies.
12. Apply a bead or trowel coat of mastic/sealant along membrane seams at reverse lapped seams, rough cuts, and as recommended by the manufacturer.
13. Connect air barrier in exterior wall assembly continuously to the air barrier of the roof, to concrete below-grade structures, to windows, curtain wall, storefront, louvers, exterior doors, other intersection conditions and transitions from wet cavity to dry cavity and seal penetrations using accessory materials in accordance with the material manufacturer’s instructions.

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14. Apply primer for self-adhered sheet air barrier at the rate instructed by the air barrier material manufacturer. Allow primer to set/cure completely before transition strip application.
15. Position subsequent sheets of self-adhered sheet air barrier membrane to overlap the membrane sheet below by a minimum of 2 inches (50 mm), unless greater overlap is recommended by the material manufacturer. Ensure self-adhered sheet air barrier is securely sealed by rolling it smooth on the substrate with a roller, rolling out any “fishmouths,” voids or wrinkles.
16. Do not allow materials to come in contact with chemically incompatible materials.
17. Do not expose transition membrane to sunlight longer than as recommended by the manufacturer.
18. Inspect installation prior to enclosing transition areas and repair damaged areas with like materials as recommended by manufacturer.

3.05 PROTECTION, CLEANING, AND REPAIR

A. Protection and repair is Contactor’s responsibility regardless of the assignment of responsibility for inspection, testing or sample taking and similar services. Protect air barrier assemblies from damage during application and remainder of construction period. Coordinate with installation of materials which cover the barrier, to ensure exposure period does not exceed that recommended by the barrier manufacturer.

B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction and acceptable to the primary barrier material manufacturer. Repair damaged construction, or construction impacted by destructive or other testing and sampling, in a manner to meet specified requirements.

3.06 CORRECTION OF DEFICIENCIES

A. Where any form of deficiency is found, additional measures shall be taken as deemed necessary by Contracting Officer to determine the extent of the deficiency. Corrective action shall be performed as recommended by the barrier membrane material manufacturer in a manner that complies with the full performance requirements specified and as approved by Contracting Officer.

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3.07 FIELD QUALITY CONTROL

A. Inspection and Construction Monitoring:

1. Inspect the Work to ensure compliance with specified requirements and provide daily inspection report during the air barrier installation activity. Verify the following:
   a. Materials comply with the specified requirements.
   b. Materials are not installed in adverse weather conditions nor temperatures beyond the application range specified or recommended by the barrier membrane manufacturer.
   c. All materials are properly stored, handled and protected from damage.
   d. Application equipment is in working order. Metering devices are accurate.
   e. Substrates are in acceptable condition, primed as appropriate, and in compliance with specification prior to application of subsequent materials.
   f. Installer adheres to specified and detailed application parameters.
   g. Ensure proper transitions for change in direction and structural support at gaps.
   h. Ensure continuity of the air barrier system throughout the building enclosure and that all gaps are covered, the covering is structurally sound, and all penetrations are sealed.
   i. Ensure structural support of the barrier system to withstand design air pressures.
   j. Ensure masonry and concrete substrate surfaces are smooth, clean, and free of voids, protrusions and mortar droppings, with mortar joints struck flush.
   k. Ensure laps in sheet materials are at least a 2-inch minimum, shingled in the correct direction to shed water.
   l. Ensure that a roller has been used to enhance adhesion of adhered sheet membrane materials.
   m. Ensure proper connection between assemblies (sealants) for cleaning, preparation and priming of surfaces, structural support, integrity and continuity of seal.
   n. Measure application thickness of liquid applied materials to manufacturer’s requirements for the specific substrate.
   o. Temporary protection measures are in place at the end of each work shift.

END OF SECTION

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SECTION 07 21 00
THERMAL INSULATION

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. ASTM International (ASTM):
   a. C518, Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
   b. C665, Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
   c. D1622, Standard Test Method for Apparent Density of Rigid Cellular Plastics.
   d. E84, Standard Test Method for Surface Burning Characteristics of Building Materials.
   e. E96/E96M, Standard Test Methods for Water Vapor Transmission of Materials.
   f. E2178, Standard Test Method for Air Permeance of Building Materials.

1.02 SUBMITTALS

A. Action Submittals:

1. Product Data: Manufacturer’s product literature identifying products proposed for use.

1.03 DELIVERY, STORAGE, AND HANDLING

A. On packaging clearly identify manufacturer, contents, brand name, applicable standard, and R-value.

B. Store materials off ground and keep them dry. Protect against weather, condensation, and damage.

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PART 2 PRODUCTS

2.01 BATT INSULATION AND FASTENERS

A. Fiberglass or Mineral Wool Batts:

1. ASTM C665, Type 1, with no vapor retarder with R-values as shown on the Drawings.
2. Manufacturers:
   a. CertainTeed.
   b. Owens Corning.
   c. Johns Manville.

B. Fasteners: As recommended by insulation manufacturer.

C. Tape: As recommended by insulation manufacturer.

2.02 SILL SEALER

A. Polyethylene Foam:

1. Size: 3-1/2 inches wide.
2. Manufacturers and Products:
   a. Dow Chemical Company; Styrofoam Sill Seal.
   b. TVM Building Products; TVM Sill Seal.

2.03 SHEET VAPOR RETARDER

A. Polyamide Film: 2-mil-thick.

1. Water Vapor Permeance:
   a. ASTM E96/E96M; Dry Cup Method: 1.0 perm.
   b. ASTM E96/E96M; Wet Cup Method: 10 perms.
2. Fire Hazard Classification: ASTM E84.
   a. Maximum Flame Spread Index: 20.
   b. Maximum Smoke Developed Index: 55.
3. Manufacturer and Product (Basis of Design):
   a. CertainTeed Corp.; MemBrain.
   b. “Or-equal.”

B. Sealant and Tape: As recommended by vapor retarder manufacturer.

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2.04 MASONRY FILL INSULATION

A. Foam-in-Place Insulation:

1. R-Value at 1 Inch Thickness: 4.6, minimum.
2. Foam Density: 0.72 pounds per cubic foot.
3. Surface Burning Characteristics, ASTM E84:
   a. Flame Spread: 25, maximum.
   b. Smoke Developed: 200, maximum.
4. Water Vapor Transmission: 17 perms, maximum.
5. Manufacturers and Products:
   a. cfiFOAM, Inc.; Core Foam Masonry Foam Insulation.
   b. C.P. Chemical Co., Inc.; Tripolymer PRMIU or 105.

2.05 SPRAY FOAM INSULATION

A. General Purpose, Closed Cell, Semi-Rigid, Single-Component Polyurethane Foam:

1. Thermal Resistance (ASTM C518): R-6.5 per inch thickness.
2. Core Density (ASTM D1622): 2.1 pcf.
3. Water Vapor Permeance (E96): 0.44 perm-in.
4. Air Barrier Assembly at 75 Pa (E2178): 0.00 L/sM^2 at 1-inch.
5. Fire Resistance (ASTM E84):
   a. Flame Spread: 5 or less.
   b. Smoke Developed: 350 or less.
6. Manufacturer and Product (Basis of Design):
   a. Gaco Western; Gaco One Pass F1850.
   b. “Or-equal.”

PART 3 EXECUTION

3.01 BATT INSULATION

A. Install in accordance with manufacturer’s instructions and as specified below:

1. Install in widths required by framing spacing with vapor retarder facing warm side.
2. Fit tightly to ensure continuous seal. Tape overlapping flanges of vapor retarder when necessary, using tape as recommended by insulation manufacturer.
3. Where electrical outlets, ducts, pipes, vents, or other utility items occur, place insulation on cold-weather side of obstruction.
4. Protect installed insulation from tears and other damage until covered with finish material.
5. Remove and replace damaged material.

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3.02 SILL SEALER

A. Install under metal tracks resting on concrete slabs-on-grade.

3.03 SHEET VAPOR RETARDER

A. Install in accordance with the following:

1. Apply to wall framing in sheets as large as possible.
2. Lap joints 6 inches.
3. Seal joints with sealant and tape as recommended by vapor retarder manufacturer.
4. Fit tightly and seal around penetrations.
5. Repair minor tears or holes with tape.
6. Replace sheets with tears or holes, which require more than 6-inch length of tape to repair.

3.04 MASONRY FILL INSULATION

A. Foam-in-Place Insulation:

1. Inject foam into ungrouted cells of concrete masonry units through holes drilled in mortar joints at interior face of wall in accordance with manufacturer’s instructions. Locate holes in inconspicuous locations, as approved by Engineer.
2. Upon completion, clean excess foam from face of masonry in accordance with manufacturer’s instructions.
3. Fill and patch holes with mortar in accordance with Section 04 22 00, Concrete Unit Masonry.

3.05 SPRAY FOAM INSULATION

A. Surface Preparation: Free of dirt, grease, oil, loose paint, excessive rust scale, or other foreign material, which would prevent adequate adhesion.

B. Ambient Temperature: Between 25 degrees F and 120 degrees F throughout application process.

C. Application:

1. Apply in accordance with manufacturer’s instructions.
2. Apply spray foam insulation in locations shown on the Drawings.

D. Cleaning: Clean overspray from adjacent surfaces in accordance with manufacturer’s recommendations.

END OF SECTION

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SECTION 07 26 16
BELOWGRADE VAPOR RETARDERS

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Concrete Institute (ACI): 302, Guide for Concrete Floor and Slab Construction.
2. ASTM International (ASTM):
   a. D882, Standard Test Method for Tensile Properties of Thin Plastic Sheeting.
   b. D1709, Standard Test Methods for Impact Resistance of Plastic Film by the Free-Falling Dart Method.
   c. E96/E96M, Standard Test Methods for Water Vapor Transmission of Materials.
   d. E1745, Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.
   e. F1249, Standard Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor.

1.02 SUBMITTALS

A. Action Submittals:

1. Manufacturer’s material specifications and product data.
2. Shop Drawings: Provide plan drawings showing proposed locations of installation and special installation details.

B. Informational Submittals:

1. Manufacturer’s Certificate of Compliance, in accordance with Section 01 43 33, Manufacturers’ Field Services.
2. Manufacturer’s written instructions for preparation, installation/application, repair, protection and maintenance.
3. Manufacturer’s Certification of Proper Installation, in accordance with Section 01 43 33, Manufacturers’ Field Services. Provide photo-documentation of vapor retarder installation demonstrating compliance with specified installation requirements and any repairs prior to placement of concrete.

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1.03 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in labeled packages. Store and handle in strict compliance with manufacturer's instructions. Protect from damage from weather, excessive temperature and construction operations. Remove and dispose of damaged material in accordance with applicable regulations.

PART 2 PRODUCTS

2.01 UNDERSLAB VAPOR RETARDER

A. Meet or exceed ASTM E1745, Class A, with the following properties:

1. Water Vapor Permeance: 0.03 perm maximum when tested in accordance with ASTM E96/E96M or ASTM F1249.
2. Tensile Strength: 45-foot-pounds per inch minimum, when tested in accordance with ASTM D882.
3. Puncture Resistance: 2,200 grams minimum, when tested in accordance with ASTM D1709.
4. Thickness: 10 mils minimum, in accordance with ACI 302.

B. Manufacturers and Products:

1. Fortifiber Building Systems Group; Moistop Ultra 10.
2. Reef Industries, Inc.; Griffolyn 10 mil Green.
3. Stego Industries, LLC; Stego Wrap Class A Vapor Retarder.

2.02 ANCILLARY MATERIALS

A. Fasteners, Tape, Adhesive, or Sealant: As recommended by vapor retarder manufacturer.

B. Pipe Boots: Manufacturer's recommended prefabricated or field fabricated item.

PART 3 EXECUTION

3.01 PREPARATION

A. Examine conditions of substrates and other conditions under which work is to be performed. Do not proceed with work until satisfactory conditions are obtained.

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3.02 INSTALLATION

A. Underslab Vapor Retarder:

1. Apply in accordance with manufacturer’s instructions.
2. After base for slab has been leveled and tamped, apply vapor retarder with roll width parallel to direction of concrete pour.
3. Lap vapor retarder over footings and seal to foundation walls.
4. Overlap joints 6 inches and seal with tape.
5. Seal penetrations with pipe boots.
6. Repair damaged areas with patches of vapor retarder, overlapping damaged area by 6 inches and sealing sides of patch with tape.

3.03 CLEANING

A. Upon completion of vapor retarder installation, remove waste materials and debris resulting from this operation and dispose offsite.

END OF SECTION

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SECTION 07 41 13
METAL ROOF PANELS

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. ASTM International (ASTM):
   a. A792/A792M, Standard Specification for Steel Sheet, 55 Percent Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
   b. C1311, Standard Specification for Solvent Release Sealants.
   c. D523, Standard Test Method for Specular Gloss.
   d. D1970, Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.
   e. E903, Standard Test Method for Solar Absorptance, Reflectance, and Transmittance of Materials Using Integrating Spheres.
   f. E1646, Standard Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference.
   g. E1680, Standard Test Method for Rate of Air Leakage through Exterior Metal Roof Panel Systems.
2. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA): Architectural Sheet Metal Manual.
3. UL: 580, Standard for Safety Tests for Uplift Resistance of Roof Assemblies.

1.02 SYSTEM DESCRIPTION

A. Design Requirements: Provide professional engineering services needed to design roof system and assume engineering responsibility. Roof system design and anchorage shall be completed by a licensed professional structural engineer in the State of Oklahoma.

B. Performance Requirements:

1. Air Infiltration: Air leakage through assembly of not more than 0.06 cfm/square foot of roof area when tested in accordance with ASTM E1680 at the following test pressures.
   a. Test Pressure:
      1) Roof slope less than or equal to 30 degrees: Negative 1.57-pound foot/square feet.

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b. Preload Test-Pressure Difference:
   1) Positive: Greater than or equal to 15-pound foot/square feet and the greater of 75 percent of building live load or 50 percent of building design positive wind pressure difference.
   2) Negative: 50 percent of design wind uplift pressure difference.

2. Water Penetration: No water penetration when tested in accordance to ASTM E1646 at the following test pressures.
   a. Test Pressure:
      1) Roof slope less than or equal to 30 degrees: 2.86-pound foot/square feet.
   b. Preload Test-Pressure Difference:
      1) Positive: Greater than or equal to 15 pound foot/square feet and the greater of 75 percent of building live load or 50 percent of building design positive wind pressure difference.
      2) Negative: 50 percent of design wind uplift pressure difference.
3. Wind Uplift Resistance: Provide metal panel assemblies that comply with design criteria on General Structural Notes as shown on the Drawings.
4. Structural Performance:
   a. Provide metal roof panel assemblies capable of withstanding design loads listed in General Structural Notes as shown on the Drawings.
   b. Deflection Limits: Engineer roof panel assemblies to withstand design loads with vertical deflections no greater than 1/180 of span.
5. Thermal Movement: Provide metal roof panel assemblies that allow for thermal movement resulting from temperature change of 120 degrees F (67 degrees C), ambient and 180 degrees F (100 degrees C), material surface.
6. Solar Reflectance, ASTM E903:
   a. Solar reflectance for roof slopes of 2:12 or less:
      1) Initial: Not less than 0.65.
      2) Maintained: Not less 0.50 for 3 years after installation.
7. Glare Resistance: Specular reflectance of not more than 10 when measured in accordance with ASTM D523 at an angle of 85 degrees.

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1.03 SUBMITTALS

A. Action Submittals:

1. Shop Drawings: Drawings showing thickness and dimensions of parts and accessories, fastening and anchoring methods, details, and locations of seams, joints, and other provisions for thermal movement. Distinguish between factory-assembled and field-assembled work. Include drawings at not less than 1/4-inch to 1-foot scale and details at not less than 3-inch to 1-foot scale.
2. Delegated-Design Submittal: Demonstrate metal roof and wall panels comply with performance requirements and design criteria.
    a. Comprehensive analysis of design loads, including dead loads, live loads, wind loads, snow loads, and thermal movement. Refer to Section 01 88 15, Anchorage and Bracing, and loads provided in General Structural Notes as shown on the Drawings.
    b. Design drawings and structural calculations stamped and signed by licensed professional engineer registered in the State of Oklahoma responsible for their preparation. Include Shop Drawings as specified in this section.
    c. Wind uplift calculations and analysis data in conformance with ASCE 7.
3. Product Data: Provide manufacturer’s literature for each item specified herein.
4. Samples: 12-inch square Samples of specified metal based on initial color selections from manufacturer’s color chart(s). Samples will be reviewed for color and texture only.

B. Informational Submittals:

1. Manufacturer’s printed installation instructions.
2. A letter from roofing manufacturer stating roofer is approved by manufacturer to apply the roof.
3. Preinstallation Conference meeting minutes.
4. Special guarantee.
5. Product Test Reports: For each product, for tests performed by a qualified testing agency.
6. Certificate of Proper Installation per Section 01 43 33, Manufacturer’s Field Services (or alternately, test results or calculations), that ensure item’s and its anchorage’s design criteria meets requirements of Section 01 88 15, Anchorage and Bracing, for loads provided in General Structural Notes as shown on the Drawings.

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1.04 QUALITY ASSURANCE

A. Applicator's Qualifications: Approved and trained by materials manufacturer.

B. Mockups:

1. Before Work of this section begins, fabricate, for acceptance, approximately 3-foot by 2-foot sample roofing panel including fascia and soffit using materials and methods identical to those to be used on Project.
2. Sample panel shall include typical seam, fasteners, eaves, gutters, soffit, and downspouts.
3. Locate mockup where directed by the Engineer.
4. Accepted mockup constitutes minimum Project standards and shall be maintained for comparison with finished Work.
5. Dispose of mockup when directed by the Engineer.

C. Preinstallation Conference:

1. Before starting roof deck installation, conduct a conference with Engineer, roofing applicator, roofing system materials manufacturer, and Subcontractors likely to be on roof, and installers whose work affects metal roof installation.
2. Items to be reviewed and discussed include, but are not limited to, the following items:
    a. Examine roof deck or substrate conditions for compliance with requirements for flatness and tolerance of structural members.
    b. Review structural loading limitations of roof deck or purlins and rafters during roofing installation.
    c. Review flashing details, roof drainage, roof insulation, roof penetrations, roof-mounted mechanical equipment, and other construction and conditions that might affect metal roof panel installation.
    d. Review governing regulations and requirements for insurance, certificates, and testing and inspecting as applicable.
    e. Review temporary protection requirements for metal roof panels during and after installation.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver components and metal roof panels so as not to be damaged or deformed. Package for protection during transportation and handling.

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B. Storage and Handling:

1. Protect against damage and discoloration.
2. Handle panels with nonmarring slings.
3. Do not bend panels.
4. Store panels aboveground on pallets or platforms, with one end elevated for drainage.
5. Protect strippable protective covering from exposure to sunlight except as necessary for metal roof installation.
6. Stack panels to prevent twisting, bending, or abrasion, and to provide ventilation.
7. Protect panels against standing water and condensation between adjacent surfaces.
8. If panels become wet, immediately separate sheets, wipe dry with clean cloth, and separate sheets for air-drying.
9. During storage prevent contact with materials that may cause discoloration or staining.

1.06 COORDINATION

A. Coordinate metal roof installation with flashing and trim as specified in Section 07 62 00, Sheet Metal Flashing and Trim.

B. Coordinate work with construction of decks, walls and other adjoining work.

1.07 SPECIAL GUARANTEE

A. Product: Provide manufacturer’s extended guarantee or warranty, with Owner named as beneficiary, in writing, as Special Guarantee. Special Guarantee shall provide for correction or, at the option of the Owner, removal and replacement of roofing panels, flashing, finish, and accessories found defective during a period of 20 years after the date of Substantial Completion. Duties and obligations for correction or removal and replacement of defective Work shall be as specified the General Conditions.

B. Conditions:

1. Roofing Panels: No rupture, structural failure, or perforation.
2. Finish of Roof and Soffit Panels: No cracking, blistering, flaking, chipping, checking, chalking, peeling, or fading.
3. Roof System Components: Watertight and weathertight with normal usage.

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PART 2 PRODUCTS

2.01 ROOFING PANELS

A. Field formed panels or panels formed on portable equipment are not acceptable.

B. Material: Prefinished galvalume sheet, made of 55 percent aluminum, 1.6 percent silicon, and balance of zinc as described in ASTM A792, 22-gauge minimum.

C. Surface: Smooth finish.

A. Finish: Premium fluoropolymer coating system; minimum 70 percent Kynar 500, 1.0-mil minimum total dry film thickness.

B. Color: As indicated in Exterior Finish Schedule as shown on the Drawings.

C. Standing Seam, Seamed-Joint:

1. Formed with vertical ribs at panel edges and intermediate stiffening ribs symmetrically spaced between vertical ribs designed for sequential field installation by mechanically attaching panels to supports using concealed clips located under one side of panel and engaging opposite edge of adjacent panels and mechanically seaming panels together.
2. Panel Coverage: 16 inches.
3. Panel Height: 2 inches.
4. Manufacturers and Products:
    a. AEP-SPAN; SPAN-SEAM.
    b. Berridge Manufacturing Co.; ZEE-LOC Double Lock.
    c. CENTRIA Architectural Systems; SDP 200.

2.02 METAL SOFFIT PANELS

A. General: Provide factory-formed metal soffit panels designed to be field-assembled by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fastening and factory-applied sealant in side laps; included accessories for a complete, weathertight installation.

B. Match finish, color, material, and profile of metal roof panels.

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C. Flush Profile: Solid panels formed with vertical panel edges and intermediate stiffening ribs symmetrically spaced between panel edges with flush joint between panels.

1. Material: Aluminum-zinc alloy coated sheet 22-gauge minimum metal thickness.
2. Finish: Premium fluoropolymer coating system; minimum 70 percent Kynar 500, 1.0-mil minimum total dry film thickness.
3. Color: As indicated in Exterior Finish Schedule as shown on the Drawings.
4. Panel Coverage: 12 inches.
5. Panel Height: 1.5 inch(es).
6. Manufacturers and Products:
    a. AEP-SPAN; Prestige (R-2) 12 panels.
    b. CENTRIA Architectural Systems; IW-11A.
    c. Berridge Manufacturing Co.; FW-12.

2.03 ACCESSORIES

A. Self-Adhering Underlayment:

1. Ice and water shield, cold applied, self-adhering, polyethylene-faced sheet, consisting of slip-resisting polyethylene-film reinforcing top surface laminated to SBS-modified asphalt adhesive with release-paper backing, 40-mil minimum thickness meeting ASTM D1970.
2. Manufacturers and Products:
    a. Carlisle Coatings and Waterproofing; CCW WIP 300HT Water and Ice Protection.
    b. “Or-equal.”

B. Rigid Roof Insulation:

1. Average Aged R-value for Total Thickness of Rigid Roof Insulation: R-value as shown on the Drawings.
2. Insulation Board:
    a. Polyisocyanurate Foam Board:
        1) ASTM C1289, Type 2, Class 1, with Factory Mutual Class I approval, as manufactured by:
            a) Johns Manville; ENRGY 3.
            b) “Or-equal.”

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C. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide exposed fasteners with heads matching color of metal by means of plastic caps or factory-applied coating.

1. Fasteners for Roof Panels: Self-drilling or self-tapping zinc-plated, hex-head carbon steel screws with stainless steel cap or zinc-aluminum alloy head with EPDM or PVC washer.
2. Fasteners for Flashing and Trim: Self-drilling screws with hex washer head or blind fastener rivets of high-strength aluminum or stainless steel.

D. Holddown Clips: System manufacturer's ASTM A792/A792M standard shape steel.

E. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.

F. Closures: Manufacturer's standard neoprene blocks shaped to fit roof metal profile.

G. Gutters, Downspouts, Flashing, Trim, and Miscellaneous Pieces: Same metal and finish as roofing panels in 22-gauge thickness, and in shapes and dimensions as shown on the Drawings.

H. Sealant:

1. Joint Sealant: Type 5 as specified in Section 07 92 00, Joint Sealants.
2. Silicone Sealant: Type 1 as specified in Section 07 92 00, Joint Sealants.
3. Butyl Sealant: Butyl-rubber based, solvent-release sealant per ASTM C1311.

I. Isolation Paint: As specified in Section 09 90 00, Painting and Coating.

2.04 FABRICATION

A. Fabricate and finish metal roof panels and accessories at factory to the greatest extent possible.

B. Provide panel profile, including major ribs and any intermediate stiffening ribs for full panel length.

C. Panel Length: Roof panels shall be full length from eave to eave, unless otherwise indicated or limited by shipping limitations.

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D. Where indicated, fabricate metal roof panel joints with factory-installed captive gaskets or separator strips that provide a tight seal and prevent metal-to-metal contact.

E. Form and fabricate sheets, battens, strips, cleats, edge treatments, integral flashings, gutters, downspouts, and other components of specified metal roofing panels to profiles, patterns, and drainage arrangement shown, and as required for permanent leakproof construction, and as recommended by SMACNA's "Architectural Sheet Metal Manual."

1. Fabrication of Downspouts and Gutters:
    a. Form downspouts and gutters in maximum lengths as practicable to sizes and shapes as shown on the Drawings.
    b. Telescope end joints 1-1/2 inches and lock longitudinal joints of downspouts.
    c. Where the Drawings indicate downspouts to be routed to storm drain piping, fit downspouts into drainpipe and provide cleanout; neatly caulk or cement joints.

F. Provide for thermal expansion and contraction of Work.

G. Conceal fasteners and methods of expansion where possible. Do not use exposed fasteners on faces of accessories where exposed to view.

H. Finishes:

1. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
2. Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half the range of approved sample. Noticeable variations within same piece are not acceptable. Variations in other component appearances are acceptable if within range of approved samples and are assembled or installed to minimize contrast.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions for compliance with alignment tolerances required by metal roof panel manufacturer. Examine decking to verify joints are supported by blocking or framing, and flatness is within tolerances required by metal roof panel manufacturer.

B. Prior to beginning installation, examine rough-in location for items penetrating metal roof panels and coordinate with seam locations. Locate roof penetrations to avoid panel seams.

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3.02 PREPARATION

A. Deck: Firm, dry, free of foreign materials, and smooth. Report immediately to Engineer cracks, breaks, holes, or other unusual irregularities in surface.

B. Layout Pattern:

1. Lay out to place seams equidistant from corners and aligned with seams on other side of hip.
2. Coordinate Work of this section with flashing, trim, and other construction to provide a permanently leakproof, secure, and noncorroding installation.

3.03 INSTALLATION

A. General:

1. Apply roofing only in dry weather and where weather conditions permit.
2. Install in accordance with manufacturer's written instructions and warranty requirements.
3. Comply with recommendations of the SMACNA "Architectural Sheet Metal Manual."
4. Install metal roofing and soffit system consisting of nonstructural sheet metal panels held to substrate with concealed fasteners.
5. Conceal expansion joint provisions wherever possible in exposed Work; locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for tight installation.
6. Closures and Trim:
   a. Provide eaves, rakes, fascia, gutters, downspouts, and other exposed trim and flashing for a weather-tight roofing and soffit system.
   b. Provide metal closures at peaks, and rake edges.
   c. Flash and seal metal roof panels with weather closures at eaves, rakes, and at perimeter of openings. Fasten with self-tapping screws.
7. Dissimilar Metals:
   a. Separate from each other where electrolysis might occur.
   b. Separate metal panels where contact with corrosive substrates may occur.
   c. Separation is satisfactorily accomplished by coating metals with isolation Paint.
   d. Comply with various metals producers' recommendations for other forms of protection against contamination from corrosive materials or agents.

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8. Lap metal flashing over metal roof panels to allow moisture to run over and off the material.
9. Cutting and Fitting: Neat, square, and true. Saw cut panels, deburr, and use touchup paint immediately as recommended by roofing panel manufacturer. Torch cutting is prohibited.
10. Metal Roof and Soffit Panels, Gutters, Downspouts, and Flashings:
    a. Straight, weather-tight, exposed surfaces free of dents, scratches, abrasions, stains, and other visible defects.
    b. Extend gutter lining under metal roofing 6 inches minimum and terminate in 3/4-inch folded edge secured by cleats.

B. Rigid Roof Insulation:

1. See roof plans for locations. Install thickness necessary for R-value indicated. Use two layers of insulation.
2. Mechanically fasten 100 percent with a Factory Mutual approved fastener in pattern recommended by insulation or mechanical fastener manufacturer.
3. Position boards of first layer so end joints are staggered by minimum of 6 inches and edges are supported by roof deck.
4. Install additional layers with joints staggered or offset from those below.

C. Standing-Seam Metal Roofing:

1. Self-Adhering Underlayment:
    a. Install self-adhering underlayment on rigid roof insulation, unless otherwise recommended by metal roof panel manufacturer.
    b. Apply self-adhering underlayment single-ply lapped shingle fashion, 3 inches at head and 6 inches at sides, in accordance with manufacturer’s instructions.
    c. Install no more than can be covered by metal roofing or other approved protection, in same day.
    d. Use adhesive for temporary anchorage, where possible, to minimize use of mechanical fasteners under metal roof panels.
2. Roof Panels:
    a. Begin at high eaves. Rigidly fasten high eave end of metal roof panels and allow low eave end free movement for thermal expansion and contraction.
    b. Install clips in panel side joints at location, spacing, and with fasteners as recommended by manufacturer for type of substrate and wind loading specified.
    c. At intersections of roof slope with peak, turn up edges of roof panel 1-inch.
    d. Cross Seams: Not allowed. Provide full-length from eave to peak.

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e. Edges:
   1) Extend gutter lining under metal roofing 6 inches minimum and terminate in 3/4-inch folded edge secured by cleats.
   2) Hook lower end of roofing into lock strip to form 3/4-inch wide loose-lock seam.

D. Metal Soffit Panels: Provide full width of soffit. Install perpendicular to support framing. Flash and seal panels with weather closures where metal soffit panels meet walls and at perimeter of openings and joints.

E. Downspouts and Gutters: Anchor downspouts to wall with straps of same material as roof panel. Install gutters as shown on the Drawings.

3.04 CLEANING AND PROTECTION

A. Cleaning:

1. At end of each day, sweep metal clean of foreign materials, especially metal particles and scrap.
2. Peel off strippable film.
3. Where needed, clean metals in conformance with metals industry recommendations or use Basic H organic metal cleaner, Shaklee Products, Hayward, CA.

B. Protection:

1. Protect material from exposure to chlorides, hydrochloric-based and muriatic acids. If contaminated, wash affected areas immediately with 5 percent soda and water solution and rinse with clear water.
2. Avoid walking on roof after completion.

C. Final Cleanup:

1. Remove debris, metal clips, nails, and other materials that could prevent adequate drainage or produce corrosion products through electrolysis.
2. Repair and touch up damage.
3. Replace metal roof panels that have been damaged or have deteriorated beyond successful repair.

END OF SECTION

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SECTION 07 42 00
PREFABRICATED METAL CANOPIES

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. Work in this section includes furnishing and installation of roll-formed aluminum overhead hanger rod style canopies with rear gutter.

B. Related Items and Considerations:

1. All components, connections (including attachments to the building), and accessories shall be designed and detailed by the canopy manufacturer.
2. Determine wall construction, make-up, and thickness.
3. Coordinate with Engineer of Record on all wall conditions required to carry canopy loads.

1.02 REFERENCES

A. American Architectural Manufacturers Association (AAMA): AAMA 2605, Voluntary Specification for High Performance Organic Coatings on Architectural Extrusions and Panels.

1.03 QUALITY ASSURANCE

A. Overall Standard: Structural engineering design documents stamped by a structural engineer registered to practice in the State of Oklahoma.

B. Manufacturer Qualifications: Minimum 5 years' experience in producing canopies of the type specified.

C. Installer Qualifications: Minimum 2 years' experience in erecting canopies of the type specified.

D. Provide all canopy components from a single manufacturer.

1.04 FIELD MEASUREMENT

A. Confirm dimensions prior to preparation of Shop Drawings.

B. Supply manufacturer's standard literature and specifications for canopies.

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C. Submit Shop Drawings showing structural component locations/positions, material dimensions and details of construction and assembly. Demonstrate coordination of canopy with CMU wall coursing and rebar as shown on the Architectural Drawings.

1.05 PERFORMANCE REQUIREMENTS

A. Applicable Building Code:

1. Meet the requirements of the 2018 International Building Code (IBC) as amended by the State of Oklahoma. Structural Performance:
   a. Provide prefabricated metal canopies capable of withstanding the design loads as shown on Design Criteria on the General Structural Drawings.
   b. The prefabricated metal canopies shall be designed to safely resist the positive and negative loads as required for the location and type of project designed according to the requirements of the IBC.

B. Canopy attachment to structure to employ a through bolt and coordinated with CMU structural wall.

1.06 SUBMITTALS

A. Action Submittals:

   a. Product Data: Manufacturer’s catalog data, detail sheets, and specifications.
   b. Shop Drawings: Show design load criteria, material specifications for framing members and connections, framing plan with dimensions and member sizes, connection details showing anchor bolt size and bolt layout, elevations of bracing if applicable, instructions for temporary bracing, details for joining and sealing of canopy and wall cladding, and sections and details for all components and accessories.
   c. Anchorage and bracing drawings and/or catalog information, as required by Section 01 88 15, Anchorage and Bracing, for loads provided in Design Criteria on General Structural Notes on the Drawings.
      1) Signed and sealed by a professional engineer in the State of Oklahoma. Indicate system components, dimensions, attachments, and accessories.
   d. Samples:
      1) Manufacturer’s full range of Kynar colors for initial selection.
      2) 3-inch by 3-inch metal sample with factory finish in specified color for color confirmation.

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B. Information Submittals:

1. Anchorage and bracing calculations as required by Section 01 88 15, Anchorage and Bracing, for loads provided in Design Criteria on General Structural Notes on the Drawings. Submit with Action Submittal for the same item.
   a. Provide stamped calculations by structural engineer registered in State of Oklahoma demonstrating compliance with specified design criteria.
2. Manufacturer's Installation Instructions.
3. Qualifications: Letter certifying manufacturer's required qualifications.
4. Manufacturer's Certificate of Proper Installation.
5. Sample Warranty.

1.07 DELIVERY, STORAGE, HANDLING

A. Deliver and store all canopy components in protected areas. Protect canopy components and accessories from corrosion, deformation, and other damage during delivery, storage, and handling.

1.08 SPECIAL GUARANTEE

A. Provide manufacturer's extended guarantee or warranty with Owner named as beneficiary, in writing, as special guarantee. Special guarantee shall provide for repair or replacement of canopy components that fail in materials or workmanship within 5 years from date of Substantial Completion. Provide 10-year special guarantee for factory paint finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS AND PRODUCTS

A. Basis of Design Manufacturer and Product: Mapes Canopies, Lincoln, Nebraska; Lumishade.

B. Other acceptable manufacturers include:

1. CS Construction Specialties.
2. Perfection Architectural Systems, Inc.

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2.02 MATERIALS

A. Decking shall consist of an interlocking roll-formed 2-1/2 W style pan (minimum 0.032 aluminum).

B. Intermediate framing members shall be extruded aluminum, Alloy 6063-T6, in profile and thickness as required by manufacturer.

C. Hanger rods and attachment hardware shall be factory fished as specified.

1. Provide cantilever brackets where required for spans between hanger rods.

D. Fascia shall be standard 8-inch extruded J style (minimum 0.125 aluminum).

2.03 FINISH AND COLOR

A. Finish:

1. Fluoropolymer Coating: 70 percent PVDF resin-based fluoropolymer, AA C 12C 42R 1, comply with AAMA2 605. Two-coat application.

B. Color: Color as indicated in Color List on the Drawings and as verified through submittal process.

2.04 FABRICATION

A. Ship Canopy in preassembled sections.

B. All connections shall be mechanically assembled utilizing 3/16 fasteners with a minimum shear stress of 350 pounds. Prewelded or factory-welded connections are not acceptable.

1. Prefabricated metal canopy manufacturer’s standard Thru bolt for CMU wall assembly.

C. Decking shall be designed with interlocking roll-formed aluminum members.

D. Concealed Drainage: Water shall drain from covered surfaces into intermediate trough and be directed to the rear gutter for ground level discharge.

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PART 3 EXECUTION

3.01 INSPECTION

A. Confirm that surrounding area is ready for the canopy installation.

B. Installer shall confirm dimensions and elevations to be as shown on Shop Drawings provided by manufacturer.

C. Erection shall be performed by an approved installer and scheduled after all concrete, masonry and roofing in the area is completed.

3.02 INSTALLATION

A. Installation shall be in strict accordance with manufacturer's Shop Drawings. Protect finish during handling and erection.

B. Set plumb, straight, and true to line, adequately braced to maintain position.

C. Canopy shall be installed at location and size shown on the Drawings and approved Shop Drawings.

D. Coat aluminum surfaces in direct contact with ferrous metal or other incompatible materials as specified in Section 09 90 00, Painting and Coating.

E. Seal joint between canopy and building wall for weathertight seal.

3.03 CLEANING

A. Clean surfaces soiled by work as recommended by manufacturer.

B. Remove surplus materials and debris from the Site.

END OF SECTION

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SECTION 07 62 00
SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. ASTM International (ASTM):
   a. A153/A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
   b. A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   c. A924/A924M Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
   d. B32, Standard Specification for Solder Metal.
   e. C920, Standard Specification for Elastomeric Joint Sealants.
   f. C1311, Standard Specification for Solvent Release Sealants.
2. Sheet Metal and Air Conditioning Contractors National Association (SMACNA): 1013, Architectural Sheet Metal Manual.

1.02 QUALITY ASSURANCE

A. Sheet Metal Flashing and Trim Standard: Comply with SMACNA 1793. Conform to dimensions and profiles shown, unless more stringent requirements are indicated.

1.03 SUBMITTALS

A. Action Submittals:

1. Shop Drawings:
   a. Show joints, types and location of fasteners, and special shapes.
   b. Catalog data for stock manufactured items.

1.04 DELIVERY, HANDLING, AND STORAGE

A. Inspect for damage, dampness, and wet storage stains upon delivery to Site.

B. Remove and replace damaged or permanently stained materials that cannot be restored to like-new condition.

C. Carefully handle to avoid damage to surfaces, edges, and ends.

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D. Do not open packages until ready for use.

E. Store materials in dry, weathertight, ventilated areas until immediately before installation.

PART 2 PRODUCTS

2.01 METAL

A. Galvanized Sheet Steel: ASTM A924/A924M, Grade A or ASTM A653/A653M, G90 zinc coating, commercial quality copper bearing steel, thickness 0.032-inch (20 U.S. Standard gauge), unless otherwise shown.

2.02 REGLETS AND COUNTERFLASHING

A. Surface Mounted:

1. Galvanized 26-gauge steel, 0.029-inch thick, with polyvinylidene fluoride (PVDF) finish in color to match adjacent sheet metal or as selected by Contracting Officer.
2. Manufacturers and Products:
   a. Cheney Flashing Co.; Type D reglet and Snap Lock Cap Flashing.
   b. “Or-equal.”

2.03 ANCILLARY MATERIALS

A. Solder: ASTM B32, alloy composition Sn 50.

B. Soldering Flux: ASTM B32, Type RA.

C. Sealing Tape: Polyisobutylene sealing tape.

D. Isolation Paint: As specified in Section 09 90 00, Painting and Coating.

E. Isolation Tape: Butyl or polyisobutylene, internally reinforced, or 20-mil thick minimum polyester.

F. Elastomeric Sealant: ASTM C920, elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

G. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant, polyisobutylene plasticized, heavy bodied for hooked-type expansion joints with limited movement.

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H. Fasteners:

1. Galvanized Steelwork: Steel, galvanized per ASTM A153/A153M or stainless steel fasteners.

2.04 FABRICATION OF FLASHING

A. Field measure prior to fabrication.

B. Fabricate in accordance with SMACNA 1793 that applies to design, dimensions, metal, and other characteristics of item indicated.

C. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.

D. Fabricate sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.

E. Seams: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.

F. Reinforcements and Supports: Provide same material as flashing, unless other material is shown. Steel, where shown or required, shall be galvanized or stainless.

G. Rigid Joints and Seams: Make mechanically strong. Solder galvanized and stainless steel metal joints. Do not use solder to transmit stress.

H. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA recommendations.

I. Expansion Provisions: Where lapped or bayonet-type expansion provisions in the Work cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1-inch deep, filled with butyl sealant concealed within joints.

J. Fabricate sheet metal in 10-foot maximum lengths, unless otherwise indicated.

K. Provide watertight closures at exposed ends of counterflashing.

L. Fabricate corners in one-piece with legs extending 30 inches each way to field joint. Lap, rivet, or solder corner seams watertight. Apply sealant if necessary.

M. Neutralize soldering flux.

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N. Solvent clean sheet metal. Surfaces to be in contact with roofing or otherwise concealed shall be coated with isolation paint.

O. Conceal fasteners and expansion provisions where possible on exposed-to-view sheet metal flashing and trim, unless otherwise indicated.

P. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

1. Thickness: As recommended by SMACNA 1793 and FM Loss Prevention Data Sheet 1-49 for application, but not less than thickness of metal being secured.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify nailing strips, reglets, counterflashing, and blocking are properly located.

B. Verify membrane termination and base flashings are in place, sealed, and secure.

3.02 INSTALLATION

A. Flashing (for Rigid Insulation Cover):

1. General:
   a. Install sheet metal roof flashing and trim to comply with performance requirements and SMACNA 1793.
   b. Provide concealed fasteners where possible, set units true to line, and level as indicated.
2. Isolate metal from wood and concrete and from dissimilar metal with isolation tape or two coats of isolation paint.
3. Use only stainless steel fasteners to connect isolated dissimilar metals.
4. Joints: 10-foot maximum spacing and 2-1/2 feet from corners, butted with 3/16-inch space centered over matching 8-inch-long backing plate with sealing tape in laps.
5. Joints, Fastenings, Reinforcements, and Supports: Sized and located as required to preclude distortion or displacement as a result of thermal expansion and contraction.
6. Conceal fastenings wherever possible.
7. Set flashing and sheet metal to straight, true lines with exposed faces aligned in proper plane without bulges or waves.

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3.03 FINISH

A. Exposed Surfaces of Flashing and Sheet Metalwork: Free of dents, scratches, abrasions, or other visible defects, and clean and ready for painting where applicable.

3.04 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder and sealants.

C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.

D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

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SECTION 07 70 01
ROOF SPECIALTIES AND ACCESSORIES

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. ASTM International (ASTM):
   a. D4586, Standard Specification for Asphalt Roof Cement, Asbestos-Free.
2. FM (Factory Mutual) Global (FM).
3. UL.

1.02 SUBMITTALS

A. Action Submittals:

1. Shop Drawings of each item specified showing materials, details, flashing, anchorage, and relation to adjacent structure.
2. Catalog cuts of each item specified item.

B. Informational Submittals: Manufacturer's Certificate of Compliance per Section 01 61 00, Common Product Requirements, (or alternately, test results or calculations) that assure item's and its anchorage's design criteria meets manufacturer's requirements for specified design loads.

1.03 SEQUENCING AND SCHEDULING

A. Coordination: Schedule and coordinate work of this section with work of Section 07 41 13, Metal Roof Panels, Section 22 40 00, Plumbing Fixtures, Section 07 62 00, Sheet Metal Flashing and Trim, Section 13 34 19, Metal Building Systems.

PART 2 PRODUCTS

2.01 ROOF CURBS

A. Prefabricated Galvanized Steel: Minimum 12-inch-high curb with treated wood nailer, liner panel, and factory installed insulation as required for conditions shown on the Drawings.

B. Metal Gauge and Reinforcement: To suit imposed loads of equipment to be supported.

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C. Fabricate curbs to fit roof slope.

D. Manufacturers and Products:

1. Pate Co.; PC-2.
2. ThyCurb; Model TC-3.
3. RPS Corporation; RC-2A.

2.02 METAL BUILDING ROOF CURBS

A. Prefabricated Galvanized Steel: Minimum 8-inch-high curb with treated wood nailer, liner panel, integral water deflecting cricket, loose cell caps, and factory-installed insulation as required for conditions shown on the Drawings.

B. Metal Gauge and Reinforcement: To suit imposed loads of equipment to be supported.

C. Fabricate curbs with level tops, with flanges surface mounted over metal building roof panels.

D. Fabricate cell caps to conform to profile of standing seam of approved metal building roof panels.

E. Manufacturers and Products:

1. Pate Co.; Model PC-2MB-3.
2. ThyCurb; Model TC-3 MBD.
3. RPS Corporation; RC-7.

2.03 FLEXIBLE BASE PIPE SEALS

A. Prefabricated one-piece aluminum flanged base with stepped, graduated EPDM cap and adjustable stainless steel clamps. Aluminum base shall be capable of bending to match profile of sheet metal roofing panels.

B. Manufacturers and Products:

1. Pate Co.; Dektite.
2. Portals Plus, Inc.; Deck-Mate.

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2.04 ROOF HATCHES

A. Material: Aluminum, 11-gauge with factory-insulated curb and cover.

B. Factory assembled units consisting of:

1. Curb: Double-wall with 1-inch insulation, fully welded corner joints, integral flashing and mounting flanges.
2. Cover: Double-wall with 1-inch insulation, fully welded corners joints, and internally reinforced for 40 psf live load.
3. Furnish EPDM rubber gasketing and corrosion resistant hardware including pintle hinges, hold-open devices, interior padlock hasps, and both interior and exterior handles.

C. Curb Height: 18 inches minimum clearance above roofing membrane.

D. Performance Characteristics: Miami-Dade Product approved, meeting large and small missile impact requirements.

E. Finish and Color:

1. Two coats minimum, factory spray applied, baked-on 70 percent Kynar 500 PVDF Fluoropolymer resin-based paint coating; AAMA 2605.
2. Color: Black.

F. Manufacturers and Products:

1. Size: 3 feet by 2.5 feet:
   a. Bilco; S-50.
   b. Babcock-Davis; B-RHA Series.
   c. JL Industries; RHA-1.

2.05 ROOF ANCHOR

A. Versatile single-point anchor with swivel D-ring, built-in energy absorbing capability, flat base, and clamping mechanism for attachment to standing seam portion of metal roofing panels. For vertical and horizontal lifeline applications and compatible with various fall arrest connecting systems.

B. Capacity: Anchor designed for use by one person with a combined weight of no more than 310 lbs.

C. Tensile strength: 5,000 lb.

D. Complies with OSHA, ANSI A10.32 and ANSI Z359.1-2007.

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E. Durable design to withstand outdoor environment. Internal components constructed of stainless steel. Steel post and base plated with zinc followed by a premium powder coating.

F. Clamping mechanism:

1. Aluminum, self centering for easy installation, designed to pre-install to the base plate.
2. Clamping bolts tighten from above the plate for easy fastening and inspection.
3. Can be used for permanent and temporary installations. Clamps do not penetrate the roof seams.
4. Include mounting hardware.
5. Coordinate clamping mechanism with standing seam spacing.

G. Quantity: As required for designated fall protection system. Locate as required to safely reach all roof fan locations.

H. Personal Fall Arrest System: compatible with roof anchor.

I. Manufacturers and Products:

1. Honeywell Miller; Miller Fusion Roof Anchor Post, X10001.
2. “Or-equal.”

2.06 ROOF THIMBLE

A. Protective transition for exhaust piping that passes through roof to the outside atmosphere. Stainless steel thimble customized to fit to roof curb with length accounting for roof thickness.

B. Conform to NFPA 37 and NFPA 110.

C. High temperature insulation rated for 150 degree F minimum with built in pipe guide eliminating Hot Spots.

D. Manufacturers and Products:

1. InExhaust Innovative Exhaust Solutions, Inc.; Roof Thimble.
2. “Or-equal.”

2.07 ANCILLARY MATERIALS

A. Sealing Tape: Polyisobutylene sealing tape.

B. Isolation Paint: As specified in Section 09 90 00, Painting and Coating.

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C. Coat aluminum surfaces in contact with concrete or dissimilar metals as specified in Section 09 90 00, Painting and Coating.

D. Isolation Tape: Butyl or polyisobutylene, internally reinforced, or 20-mil-thick minimum polyester.

E. Plastic Roof Cement: ASTM D4586, Type II.

F. Fasteners: Stainless steel of type required.

G. High-temperature rated sealant: As recommended by Roof Thimble manufacturer.

1. Manufacturers and Products:
   a. Mil-A-46106B; 100 Series RTV.
   b. “Or-equal.”

PART 3 EXECUTION

3.01 PREPARATION

A. Examine surfaces and structures to receive the Work of this section.

B. Take measurements at Site and fabricate work to suit. No changes shall be made in supporting structure to accommodate this Work.

3.02 INSTALLATION

A. General:

1. Install roof specialties and accessories as detailed in approved shop drawings and in conformance with manufacturer’s instructions, recommendations, and standards.
2. Use appropriate pipe curb assembly, pipe seal, flexible base pipe seal, or vent pipe flashing where pipe, conduit, or cable, etc., penetrate roofing membrane.
3. Factory Finished Units: Place color variations in pieces so no extremes are next to each other.
4. Make Work weathertight and free of expansion and contraction noise.
5. Maintain separation between aluminum surfaces and concrete or dissimilar metals as specified in Section 09 90 00, Painting and Coating.

B. Roof Hatches: Install to operate freely and not rattle when closed or open.

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C. Roof Anchor:

1. Contractor to verify roofing system is capable of supporting roof anchor load and anchorage requirements.
2. Prior to installation, contractor to verify connecting devices and additional components of fall arrest system are compatible and approved by the manufacturer for roof anchor.
3. Depending on fall protection system used in a Restraint or Fall Arrest application, contractor to locate roof anchors accordingly.
    a. For Restraint applications, roof anchors must be located on the roof where they prevent the user from reaching any fall hazard such as roof edge.
    b. Contractor to locate based on requirements of personal fall arrest system. System to be rigged to limit a free fall to the shortest possible distance with 6 feet maximum. Conform with manufacturer's instructions to accurately calculate fall clearance distance.
        1) Ensure that adequate clearance exists in the potential fall path to avoid striking an object.
4. Install roof anchor post perpendicular to the angle of the roof.
5. Do not install roof anchor on unsupported roof structures.

D. Roof Thimble:

1. Install the thimble through the hole so that the exterior flashing is flush against the outside surface, clocking as needed.
2. Ensure that exhaust piping is not in contact with the inner wall of the thimble and is installed to be able to allow installation of the rain cap and clamp.
3. Install sealant at the gap around the perimeter of the thimble body and exterior flashing to cover any gaps and prevent leakage.
4. Ensure that the ventilation holes/slots are not blocked and are free of obstructions.
5. Verify that the type and amount of movement generated by the system are acceptable and do not cause damage to the installed products.

END OF SECTION

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SECTION 07 92 00
JOINT SEALANTS

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. ASTM International (ASTM):
   a. C661, Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer.
   b. C920, Standard Specification for Elastomeric Joint Sealants.
   c. C1193, Standard Guide for Use of Joint Sealants.

1.02 SUBMITTALS

A. Action Submittals:

1. Manufacturer’s Product Data for each material used and surface preparation instructions.
2. Shop Drawings: Indicate where each product is proposed to be used.
3. Samples: Material proposed for use showing color range available. Provide cured sealant samples.

B. Informational Submittals:

1. Installation instructions.
2. Documentation showing applicator qualifications, including representative projects and client contacts.
3. Manufacturer’s Certificate of Compliance, in accordance with Section 01 61 00, Common Product Requirements.
4. Special guarantee.

1.03 QUALITY ASSURANCE

A. Applicator Qualifications: Minimum of 5 years’ experience installing sealants in projects of similar scope.

1.04 ENVIRONMENTAL REQUIREMENTS

A. Ambient Temperature: Between 40 degrees F and 80 degrees F (4 degrees C and 27 degrees C) when sealant is applied. Consult manufacturer when sealant cannot be applied within these temperature ranges.

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1.05 SPECIAL GUARANTEE

A. Product: Furnish manufacturer's extended guarantee or warranty, with Owner named as beneficiary, in writing, as special guarantee. Provide special guarantee for correction or, at the option of the Owner, removal and replacement of Work specified in this section found defective during a period of 5 years after the date of Substantial Completion. Duties and obligations for correction or removal and replacement of defective Work is specified in the General Conditions.

B. Conditions: No adhesive or cohesive failure of sealant.

C. Sealed Joints: Watertight and weathertight with normal usage.

PART 2 PRODUCTS

2.01 SEALANT MATERIALS

A. Characteristics:

1. Uniform, homogeneous.
2. Free from lumps, skins, and coarse particles when mixed.
3. Nonstaining, nonbleeding.
4. Hardness of 15 minimum and 50 maximum, measured by ASTM C661 method.
5. Immersible may be substituted for nonimmersible provided all other specified requirements are met.

B. Color: Unless specifically noted, match color of the principal material adjoining area of application, as selected by Engineer.

C. Type 1—Silicone, Nonsag, Nonimmersible:

1. Silicone base, single-component, moisture curing; ASTM C920, Type S, Grade NS, Class 25.
2. Capable of withstanding movement up to 50 percent of joint width.
3. Manufacturers and Products:
   a. Dow Chemical Co.; DOWSIL 790.
   b. General Electric; SCS2000 Silpruf.
   c. Sika Corp.; Sikasil N Plus US.

D. Type 5—One-part Polyurethane, Immersible:

1. Polyurethane base, single-component, moisture curing; ASTM C920, Type S, Grade NS or Grade P, Class 25.
2. Capable of being continuously immersed in water.

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3. Manufacturers and Products for Nonsag:
   a. Sika Corp.; Sikaflex-1a.
   b. Tremco; Vulkem 116.
4. Manufacturers and Products for Self-leveling:
   a. Master Builders Solutions Construction Systems US; MasterSeal SL-1.
   b. Tremco; Vulkem 45SSL.
   c. Sika Corp.; Sikaflex-1c SL.

E. Type 6—One-part Polyurethane, Nonimmersible:

1. Polyurethane base, single-component, moisture curing; ASTM C920, Type S, Grade NS, Class 25.
2. Manufacturers and Products:
   a. Tremco; Dymonic 100.
   b. Master Builders Solutions Construction Systems US; MasterSeal NP-1.
   c. Sika Corp.; Sikaflex-1a.

F. Type 7—Multipart Polysulfide, Immersible:

1. Polysulfide base, two-component, chemical curing; ASTM C920, Type M, Grade P or Grade NS, Class 25.
2. Capable of being continuously immersed in water.
3. For use above grade and below grade.
4. Manufacturers and Products:
   a. W. R. Meadows; Deck-O-Seal Gun Grade, two-part.
   b. Pecora Corp.; Synthacalk GC2+.

G. Type 10—Sanitary Sealant:

1. Silicone sealant similar to Type 1, above, formulated to resist mold growth and repeated exposure to high humidity while retaining adhesion, flexibility, and color.
2. Manufacturers and Products:
   a. Dow Chemical Co.; DOWSIL 786.
   b. General Electric; SCS1700 Sanitary.

2.02 BACKUP MATERIAL

A. Nongassing, extruded, closed-cell round polyurethane foam or polyethylene foam rod, compatible with sealant used, and as recommended by sealant manufacturer.

B. Size: As shown or as recommended by sealant material manufacturer. Provide for joints greater than 3/16-inch wide.

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C. Manufacturers and Products:

1. Tremco; Closed-cell Backing Rod.
2. W.R. Meadows; Cera-Rod and Kool-Rod.

2.03 ANCILLARY MATERIALS

A. Bond Breaker: Pressure sensitive tape as recommended by sealant manufacturer to suit application.

B. Joint Cleaner: Noncorrosive and nonstaining type, recommended by sealant manufacturer; compatible with joint forming materials.

C. Primer: Nonstaining type recommended by sealant manufacturer to suit application.

PART 3 EXECUTION

3.01 GENERAL

A. Use of more than one material for the same joint is not allowed unless approved by sealant manufacturer.

B. Install joint sealants in accordance with ASTM C1193.

C. Horizontal and Sloping Joints up to 1 Percent Maximum Slope: Use self-leveling (Grade P) joint sealant.

D. Steeper Sloped Joints, Vertical Joints, and Overhead Joints: Use nonsag (Grade NS) joint sealant.

E. Use joint sealant as required for the applicable application and as follows:

Joint Size	Sealant Type
Less than 1"	1, 5, 6, 7, or 10
Less than 2"	1 or 7
Over 2"	Follow manufacturer’s recommendation

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3.02 PREPARATION

A. Verify that joint dimensions, and physical and environmental conditions, are acceptable to receive sealant.

B. Sealed surfaces to be clean, dry, sound, and free of dust, loose mortar, oil, and other foreign materials.

1. Mask adjacent surfaces where necessary to maintain neat edge.
2. Starting of work will be construed as acceptance of subsurfaces.
3. Apply primer to dry surfaces as recommended by sealant manufacturer.

C. Verify joint shaping materials and release tapes are compatible with sealant.

D. Examine joint dimensions and size materials to achieve required width/depth ratios.

E. Follow manufacturer’s instructions for mixing multi-component products.

3.03 INSTALLATION

A. Use joint filler to achieve required joint depths, to allow sealants to perform intended function.

1. Install backup material as recommended by sealant manufacturer.
2. Where possible, provide full length sections without splices; minimize number of splices.
3. Tape sealant may be used as joint filler if approved by sealant manufacturer.

B. Use bond breaker where recommended by sealant manufacturer.

C. Seal joints around window, door and louver frames, expansion joints, control joints, and elsewhere as indicated.

D. Joint Sealant Materials: Follow manufacturer’s recommendation and instructions, filling joint completely from back to top, without voids.

E. Joints: Tool slightly concave after sealant is installed.

1. When tooling white or light color sealant, use a water wet tool.
2. Finish joints free of air pockets, foreign embedded matter, ridges, and sags.

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3.04 CLEANING

A. Clean surfaces next to the sealed joints of smears or other soiling resultant of sealing application.

B. Replace damaged surfaces resulting from joint sealing or cleaning activities.

3.05 JOINT SEALANT SCHEDULE

A. This schedule lists the sealant types acceptable for each joint location. Use as few different sealant types as possible to meet the requirements of Project.

Joint Locations	Sealant Type(s)
Expansion/Contraction and Control Joints At:	
Concrete Walls (except water-holding and belowgrade portions of structures)	1, 5, 6
Concrete Floor Slabs (except for water-holding Structures)	5
Concrete Walls and Slabs immersed in water and/or below grade	7
Slabs Subject to Vehicle and Pedestrian Traffic	5
Masonry Walls	1, 5, 6
Ceramic Tile Floors	1, 5, 10
Ceramic Tile Walls	1, 5, 10
Material Joints At:	
Metal Door, Window, and Louver Frames (Exterior)	1, 5, 6
Metal Door, Window, and Louver Frames (Interior)	1, 5, 6
Wall Penetrations (Exterior)	1, 5, 6
Wall Penetrations (Interior)	1, 5, 6
Floor Penetrations	5, 6
Ceiling Penetrations	1, 5, 6
Roof Penetrations	5
Sheet Metal Flashings	5
Sheet Metal Roofing and Siding	5

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Joint Locations	Sealant Type(s)
Other Joints:	
Threshold Sealant Bed	5
Between Counter Tops and Backsplashes	10
Around Plumbing Fixtures	10

END OF SECTION

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SECTION 08 11 00
METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American National Standards Institute (ANSI):
   a. A250.6, Hardware on Standard Steel Doors (Reinforcement-Application).
   b. A250.8, Recommended Specification for Standard Steel Doors and Frames.
   c. A250.11, Recommended Erection Instructions for Steel Frames.
2. ASTM International (ASTM):
   a. A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   b. A1008/A1008M, Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
3. Builders Hardware Manufacturers Association (BHMA): A156.115, Hardware Preparations in Standard Steel Doors and Frames.
4. National Fire Protection Association (NFPA): 80, Standard for Fire Doors and Other Opening Protectives.
5. UL: Building Materials Directory.

1.02 SUBMITTALS

A. Action Submittals:

1. Applicable information for each type of door and frame, including:
   a. Frame conditions and complete anchorage details, supplemented by suitable schedules covering doors and frames.
   b. Glass opening sizes and locations in doors.
   c. Joints required to accommodate expansion joint movement.
   d. Relate to door numbers used on the Contract Drawings.

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B. Informational Submittals: Certificate of Compliance per Section 01 43 33, Manufacturer's Field Services (or alternately, test results or calculations) that assure items and its anchorages design criteria meets requirements of Section 01 88 15, Anchorage and Bracing, for loads provided in General Structural Notes on the Drawings.

1.03 DESIGN REQUIREMENTS

A. Installed Doors and Frames: Capable of resisting wind load of 34 pounds per square foot.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Properly identify each item with number used on the Contract Drawings.

B. Store doors upright, in protected dry area, at least 1-inch off ground or floor and at least 1/4-inch between individual pieces.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Materials, equipment, and accessories specified in this section shall be products of:

1. Curries Manufacturing.
2. The Ceco Corp.
3. Overly Manufacturing Co.
4. Steelcraft Manufacturing Co.
5. Republic Steel Corp.

2.02 MATERIALS

A. Basic Metal Material: ASTM A1008/A1008M; sheet steel, cold-rolled, stretcher level.

B. Hollow Metal Frames:

1. Products of hollow metal door manufacturer.
2. ANSI 250.8, except as modified herein.
3. Frames for Doors and Relights: 16 gauge for interior and 14 gauge, with thermal break, for exterior, welded type, of cross-section shown.
4. Prepare floor and wall anchors, reinforcement, and cutouts for hardware to meet requirements of BHMA A156.115 and ANSI A250.6.
5. Finished size, shape, and profile of frame members as shown.

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6. Concealed fasteners or welding are preferred to through-the-face fasteners.
7. Identification: Stamp opening number, as shown on the Drawings, on center hinge reinforcement of each frame.

C. Hollow Metal Doors: ANSI A250.8, except as modified herein. BHMA A156.115 and ANSI A250.6 to receive hardware specified in Door and Hardware Schedule.

1. Interior:
   a. Flush Panel Doors: 18 gauge, Level 2, Model 2.
   b. Flush end closure at top of doors.
2. Exterior:
   a. Flush Panel Doors: 16 gauge, Level 3, Model 2.
   b. Double Doors: Overlapping astragals for active leaf, except as noted or detailed otherwise.
   c. Flush end closure at top of doors.
   d. Core Material: Polyurethane.
   e. R-Value: 7.

D. Glazing:

1. Doors: Furnish with formed flush-type glazing strips with butt corner joints to permit selection of secure side in field.
2. Glazing Arrangements: Accommodate glass of type and thickness indicated and as specified in Section 08 80 00, Glazing.

2.03 MISCELLANEOUS ITEMS

A. Filler or Transom Panels: Furnish of same construction and finish as door to include fire-resistive label and sound-retardant construction.

B. Furnish manufacturer’s standard core filler, anchors, fasteners, and other ancillary items.

2.04 FACTORY FINISHING REQUIREMENTS

A. Galvanized with A60 zinc coating in accordance with ASTM A653/A653M (Wipe Coat galvanized coating is not acceptable).

B. Phosphate treat metal for paint adhesion.

C. One shop coat of baked-on rust-inhibiting prime coating compatible with finish coating as scheduled and as specified in Section 09 90 00, Painting and Coating.

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D. Coat inside concealed surfaces of door frames in masonry walls and required to be filled with grout.

PART 3 EXECUTION

3.01 INSTALLATION

A. Frames:

1. Follow ANSI A250.11 and manufacturer's instructions.
   a. Maintain scheduled dimensions, hold head level, and maintain jambs plumb and square.
   b. Secure anchorages and connections to adjacent construction.
   c. Wherever possible, leave frame spreader bars intact until frames are set perfectly square and plumb and anchors are securely attached.

B. Doors:

1. Hollow Metal Doors: ANSI A250.8.
2. Hardware: In accordance with manufacturer's templates and instructions.
   a. Adjust operable parts for correct function.
   b. Remove hardware, with exception of prime coated items, tag, box, and reinstall after finish paint work is completed.
3. Labeled Doors: NFPA Pamphlet No. 80.

3.02 FIELD PAINTING

A. Where prime coat has been damaged, sand smooth and touch up with same primer as applied at shop.

1. Remove rust before painting.
2. Touch Up: Not obvious.
3. Perform immediately after door and frame installation.
4. Meet requirements of specification Section 09 90 00, Painting and Coating.

3.03 PROTECTION

A. Protect installed doors and frames against damage from other construction work.

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3.04 SCHEDULES

A. For tabulation of door and frame characteristics, such as size, type, detail, and finish hardware requirements, see Door and Hardware Schedule on the Drawings. For tabulation of window frame characteristics, such as size, type, and detail requirements, see Window and Relight Schedule on the Drawings.

END OF SECTION

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SECTION 08 30 00
SPECIALTY DOORS

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Iron and Steel Institute (AISI).
2. ASTM International (ASTM):
   a. A36/A36M, Standard Specification for Carbon Structural Steel.
   b. A653, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   c. D3363, Standard Test Method for Film Hardness by Pencil Test.
3. National Electrical Manufacturers' Association (NEMA): 250, Enclosures for Electrical Equipment (1,000 Volts Maximum).
4. National Fire Protection Association (NFPA): 70, National Electrical Code.
5. UL:
   a. Building Materials Directory.
   b. 325, Standard Safety for Door, Drapery, Gate, Louver, and Window Operators and Systems.

1.02 SUBMITTALS

A. Action Submittals:

1. Manufacturer's catalog information, descriptive literature, specifications, and identification of materials of construction.
2. Shop Drawings:
   a. Overhead Coiling Doors:
      1) Shop Drawings showing construction and installation details, and electrical characteristics and control diagrams for motor operators.
      2) Identify each door with same reference as used on the Drawings.
      3) Anchorage and bracing drawings and/or catalog information, as required by Section 01 88 15, Anchorage and Bracing, for loads provided in General Structural Notes on the Drawings.
   b. Access Doors: Provide drawings that show proposed locations, types, and sizes of access doors for the Project.

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3. Samples:
    a. Manufacturer’s full range of factory colors.
    b. Physical samples, with factory finish of selected colors for final color verification.

B. Informational Submittals:

1. Anchorage and bracing calculations as required by Section 01 88 15, Anchorage and Bracing, for loads provided in herein and in General Structural Notes on the Drawings.

1.03 QUALITY ASSURANCE

A. Qualifications: Experienced, factory authorized installer.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver doors with separators and wrapping to protect units from damage during and after installation.

B. Store doors in protected dry area following manufacturer’s requirements.

C. Handle doors according to manufacturer’s instructions.

D. Protect exposed finish surfaces of prefinished items with wrapping.

PART 2 PRODUCTS

2.01 OVERHEAD COILING (ROLLUP) DOORS

A. Manufacturers and Products:

1. CornellCookson, Inc.; Thermiser Max ESD30.
2. Raynor Manufacturing Co.; DuraCoil.
3. “Or approved equal.”

B. Design Requirement:

1. Wind Loading: Complete assembly, each component and anchorage to building to withstand a wind load of 34 pounds per square foot.
2. Cycle Life: Design doors of standard construction for normal use of up to 20 cycles per day maximum, and an overall maximum of 50,000 operating cycles for the life of the door.
3. Insulated Door Slat Material Requirements: Flame Spread Index of 0 and a Smoke Developed Index of 10 as tested per ASTM E84.

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C. Air Infiltration: Maximum air leakage of 1.00 cfm/ft^2 in accordance with DASMA 105 test procedure.

D. Insulated Curtain: Interlocking insulated flat slats of 20-gauge (U.S. Standard) minimum steel with minimum R-value of 8 and backing to match face slat thermally separated from face slat.

E. Hood: Match curtain material and finish; 24 gauge.

F. Slide Guides: ASTM A36/A36M steel, shapes as appropriate for conditions.

G. Brackets, Gears, and Barrel: Manufacturer's standard items.

H. Operation:

1. Motor operated worm and gear to chain drive with pushbutton stations and endless chain or handcrank for emergency operation. Motor, UL 325 listed and rated 460 volts, three-phase.
2. Provide NEMA 250 Type 4X, watertight and corrosion-resistant enclosures for operator controls and stations.
3. Where motor operated doors are located in hazardous areas, as noted in the Area Classification Table on the Electrical Drawings, and as scheduled, provide electric wiring and equipment meeting requirements of NFPA 70 for location hazard classification noted.

I. Finish:

1. Steel Curtain Slats, Guides, Hood, and Brackets: Hot-dip galvanize with G90 zinc coating in accordance with ASTM A653, phosphate treat for paint adhesion, and factory finish using a baked-on polyester powder coating. Coating hardness rated at H or better in accordance with ASTM D3363; minimum 2.5 mils cured film thickness in color as selected from manufacturer's stand range.
2. Other Steel Surfaces: One coat of corrosion-inhibiting prime paint compatible with finish paint specified in Section 09 90 00, Painting and Coating.

J. Special Features:

1. Bottom Bar:
   a. Provide extruded aluminum bottom bar with flexible weatherstripping astragal on exterior doors.
   b. Finish to match curtain slats.
   c. Provide limit switch and automatic stop and reversing feature in astragal.

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2. End Locks and Wind Locks:
    a. Ends of each slat shall have end locks of material compatible with curtain.
    b. Provide wind locks at ends of every other slat minimum on exterior doors.
3. Weather Seals:
    a. Provide rubber, neoprene, or vinyl water seal at hood to prevent airflow around coil on exterior doors.
    b. Provide weather seal sealing strip on guide to close space between guide and curtain on exterior doors.

2.02 ACCESS DOORS

A. Manufacturers:

1. J.L. Industries (Activar Construction Products Group, Inc.).
2. Milcor (Duravent Group).
3. “Or approved equal.”

B. Manufactured Unit: Access doors and frames with anchors to suit wall conditions.

1. Style:
    a. Gypsum Wallboard Locations: Flush access panel with 7/8-inch recessed door.
    b. All other Interior Locations (including tile wall covering): Flush access panel.

C. Size: As shown on the Drawings. If no size indicated, provide smallest standard size permitting ready access and removal of working parts, but not less than 12 inches square.

D. Door and Frame:

1. Gypsum Wallboard Locations: 18-gauge minimum galvanized steel door with one-piece, 16-gauge galvanized steel frame with 3/4-inch minimum exposed flange to cover edge of wall finish.
2. All other Interior Locations: 16-gauge minimum stainless steel door with one-piece 16-gauge stainless steel frame with 3/4-inch minimum exposed flange to cover edge of wall finish.

E. Hinges: Spring-loaded concealed hinges permitting a minimum of 160-degree door travel and door removal.

F. Locks: Flush screwdriver operated.

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G. Finish:

1. Gypsum Wallboard Locations: Primed finish.
2. All other Interior Locations: AISI SS 201, No. 4.

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

A. Install special doors in accordance with the manufacturer’s recommendations and printed instructions.

3.02 OVERHEAD DOOR INSTALLATION

A. Use anchorage devices to securely fasten assembly to wall construction and building frame without distortion or stress.

B. Provide pushbutton operators inside doors.

C. Fit and align assembly including hardware; level and plumb, to provide smooth operation.

D. Coordinate installation of sealant and backing materials at frame perimeter as specified in Section 07 92 00, Joint Sealants.

E. Install perimeter trim and closures.

F. Tolerances:

1. Maintain dimensional tolerances and alignment with adjacent Work.
2. Maximum Variation from Plumb: 1/16-inch.
3. Maximum Variation from Level: 1/16-inch.
4. Longitudinal or Diagonal Warp: Plus or minus 1/8-inch per 10 feet straight edge.

G. Adjusting:

1. Adjust door, hardware and operating assemblies for smooth and noiseless operation.
2. Test smoke activated assemblies for proper activation.

3.03 ACCESS DOOR INSTALLATION

A. Install access panels at cleanouts, valves, or other equipment or spaces requiring adjustment, access or servicing concealed within wall, furred spaces, or ceilings.

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3.04 PRIME COAT TOUCHUP

A. Damaged Prime Coat:

1. Remove rust.
2. Sand smooth.
3. Use same primer as shop.
4. Touch up so it is not obvious.

3.05 CLEANING

1. Leave door and components clean.
2. Remove labels and visible markings.

3.06 PROTECTION

A. Protect installed doors against damage from other construction work.

3.07 SCHEDULE

A. For tabulation of overhead coiling door and frame characteristics, such as size, type, detail, and finish hardware requirements, see Door and Hardware Schedule on the Drawings.

END OF SECTION

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SECTION 08 41 13
ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. The Aluminum Association, Incorporated (AA): Designation System for Aluminum Finishes.
2. American Architectural Manufacturers Association (AAMA): 800, Voluntary Specification and Test Method for Sealants.
3. ASTM International (ASTM):
   a. C509, Standard Specification for Elastomeric Cellular Preformed Gasket and Sealing Material.
   b. D1187, Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal.
   c. E283, Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors under Specified Pressure Differences Across the Specimen.
   d. E330, Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
   e. E331, Standard Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.

1.02 SYSTEM DESCRIPTION

A. Design Requirements:

1. Provide a thermally isolated aluminum framing system that uses straight-in glazing without projecting stops. Position glass near middle of frame.
2. System shall have interior flashing to provide continuous flashing to exterior through pressure relieved horizontal weep holes.
3. Face Clip Design:
   a. Engaged by pushing straight into the clip.
   b. Easily removed for deglazing.
   c. Reusable for reglazing.

B. Performance Requirements: Meet requirements of Article Performance Tests.

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1.03 SUBMITTALS

A. Action Submittals:

1. Shop Drawings:
   a. Details of windows, framing, and anchorage to structure.
   b. Manufacturer’s brochures or catalogs, specifications, recommendations, and standard details illustrating and specifying products proposed for use on this Project.
   c. Show field measurements.
   d. Anchorage and bracing drawings and/or catalog information, as required by Section 01 88 15, Anchorage and Bracing, for loads provided in Design Criteria on Structural Drawings.
2. Samples: At least 3-inch-long Samples of aluminum, with specified factory finish in color scheduled.

B. Informational Submittals:

1. Anchorage and bracing calculations as required by Section 01 88 15, Anchorage and Bracing.
2. Evidence of installer’s qualifications.
3. Certified test reports showing compliance with specified performance tests.
4. Manufacturer’s Certificate of Compliance: In accordance with Section 01 33 00, Submittal Procedures.
5. Sample copy of Guarantee.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Entity specializing in the installation of aluminum glazing systems, with a minimum of 3 years’ experience and approved by the system manufacturer.

B. Preinstallation Meeting: Conduct to discuss and verify project requirements, substrate conditions, and manufacturer’s installation instructions and warranty requirements.

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1.05 SPECIAL GUARANTEE

A. Provide manufacturer's extended guarantee or warranty, with Owner named as beneficiary, in writing, as Special Guarantee. Special Guarantee shall provide for correction, or at option of Owner, removal and replacement of Work specified in this Specification section found defective during a period of 2 years after date of Substantial Completion. Guarantee to cover deterioration because of normal conditions of use. Duties and obligations for correction or removal and replacement of defective Work shall be as specified in General Conditions.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

B. Store materials as recommended by manufacturer, in inside designated areas, free of dust and corrosive fumes, as close as possible to point of installation.

C. Prevent contaminants from contacting aluminum.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Framing systems shall be the products of a single manufacturer.

B. Materials and products specified in this section shall be products of:

1. Basis of Design: Kawneer Co.; Trifab 601 T.
2. Additional Acceptable Manufacturers: Oldcastle Building Envelope.

2.02 BASIC MATERIALS

A. Basic Aluminum Extrusions: ASTM B221; Alloy 6063-T5 aluminum not less than 0.07-inch thick.

B. Framing Members: 6 inches in depth with thermal break and face width of 2 inches. Swing Entrance Doors.

C. Thermal break designed in accordance with AAMA TIR-A8 and tested in accordance with AAMA 505.

D. Glazing Gaskets: Framing manufacturer's standard compression type, replaceable, extruded EPDM rubber, conforming to ASTM C509.

E. Spacers and Setting Blocks: Manufacturer's standard elastomeric type.

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F. Glass and Glazing: As specified in Section 08 80 00, Glazing.

G. Concealed Fastening Devices, Reinforcements, and Other Internal Components: Of aluminum alloy, stainless steel, or corrosion-resistant plated.

H. Screws: Stainless steel, factory finished color to match aluminum finish.

I. Sealants:

1. AAMA 800, to seal metal to metal, nonworking joints.
2. Color to be compatible with adjacent materials.

J. Isolation Tape:

1. Manufacturers and Products:
   a. Tremco; 440.
   b. 3M; EC1202.
   c. Presstite; 579.6.

K. Isolation Paint: Provide as specified in Section 09 90 00, Painting and Coating.

2.03 FINISH

A. Exposed Framing Members: Free of scratches and other serious surface blemishes.

B. Treatment and Color:

1. Factory Finish: Two coats minimum, factory spray applied, baked-on 70 percent Kynar 500 PVDF Fluoropolymer resin-based paint coating; AAMA 2605.
2. Color: As indicated on the Drawings.

2.04 FABRICATION

A. Methods of Fabrication and Assembly: Manufacturer’s discretion, unless otherwise specified.

B. Reinforcement for Surface Hardware: Manufacturer’s standard.

C. Wind Load: Reinforce mullions as necessary to limit deflection to 1/175 of span when wind load on wall is 30 psf in addition to dead loads.

D. Assembly: As far as practicable, do fitting and assembly work in shop.

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PART 3 EXECUTION

3.01 PREPARATION

A. Substrate Conditions: Verify acceptability for product installation in accordance with manufacturer's instructions.

B. Field Measurements: Verify actual opening sizes prior to fabrication.

3.02 INSTALLATION

A. In accordance with manufacturer's installation instructions.

B. Set items straight, level, square, plumb, and at proper elevations and in alignment with other work.

C. Securely anchor units to surrounding structure to resist wind loads.

D. Fasten framing members in place using screws and backing, anchor plugs, or straps.

1. Accurately cut and fit framing and moldings to result in tightly closed flush, hairline weathertight joints.
2. No visible unfinished aluminum.
3. Provide concealed attachments and fasteners.

E. Coat aluminum surfaces in contact with concrete, cement plaster, or stucco with isolation paint, sealant, or isolation tape cut to neat line.

F. Seal all joints.

G. Glazing: As specified in Section 08 80 00, Glazing.

3.03 PERFORMANCE TESTS

A. Air Leakage Through Assembly: Maximum 0.06 cfm per minute per square foot of wall area at 6.24 psf, as measured in accordance with ASTM E283.

B. Resistance to Water Infiltration: No leaks in the complete system when tested in accordance with ASTM E331 at test pressure of 8 psf.

C. Performance Under Uniform Loading:

1. Test in accordance with ASTM E330 for a wind load of 30 psf.
2. Maximum Deflection: Not to exceed 1/175 of member span.
3. When Load is Removed: No permanent deformation or damage.

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D. Thermal Transmittance (U-factor): 0.35 BTU/hour/square foot/F as determined per AAMA 507 or NFRC 100.

E. Condensation Resistance Factor (CRF): Rating no less than 69 for frame and 70 for glass in accordance with AAMA Specification 1503.

3.04 MANUFACTURER'S SERVICES

A. Provide manufacturer's representative at Site in accordance with Section 01 43 33, Manufacturers' Field Services, for preinstallation meeting, installation assistance, inspection and certification of proper installation, and performance testing of specified equipment.

3.05 CLEANING

A. After erection, protect exposed portions from damage by machines, plaster, lime, paint, acid, cement, or other harmful compounds.

B. Remove protective materials and clean with plain water, water with soap, or household detergent.

3.06 PROTECTION

A. Protect adjacent areas and finish surfaces from damage during product installation.

3.07 SCHEDULES

A. For tabulation of window frame characteristics, such as size, type, and detail, see Window Schedule on the Drawings.

END OF SECTION

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SECTION 08 71 00
DOOR HARDWARE

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American National Standards Institute (ANSI):
   a. A156.1, Butts and Hinges.
   b. A156.3, Exit Devices.
   c. A156.4, Door Controls - Closers.
   d. A156.13, Mortise Locks & Latches.
   e. A156.16, Auxiliary Hardware.
   f. A156.18, Materials and Finishes.
2. International Code Council (ICC): A117.1, Accessible and Usable Buildings and Facilities.
3. UL: Fire Protection Equipment List.

1.02 SUBMITTALS

A. Action Submittals:

1. Shop Drawings:
   a. Product Data: Manufacturer’s literature for each item of finish hardware required herein, clearly marked.
   b. Finish Hardware Schedule: Furnish complete and detailed schedule, show product items, numbers, and finishes for hardware for each separate opening.
   c. Provide documentation demonstrating confirmation of Owner’s cylinder and keying requirements.
   d. Special Tools: Provide listing and description of usage.

B. Informational Submittals:

1. Operation and Maintenance Data as specified in Section 01 78 23, Operation and Maintenance Data.
2. Certification of Hardware Consultant.
3. Manufacturer’s Certificate of Proper Installation, in accordance with Section 01 61 00, Common Product Requirements.

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1.03 QUALITY ASSURANCE

A. Qualifications of Supplier: Recognized supplier of architectural finish hardware, with warehousing facilities, who has been furnishing hardware in vicinity of Project for not less than 5 years, and who is, or who employs, architectural hardware consultant.

B. Qualifications of Architectural Hardware Consultant (AHC): Certified by Door and Hardware Institute.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Before delivery, clearly identify and tag each item of hardware with respect to specified description and location of installation.

B. Provide secure storage for finish hardware until installation is made.

1.05 EXTRA MATERIALS

A. Special Tools: Two sets for installation and maintenance of hardware.

PART 2 PRODUCTS

2.01 MATERIALS

A. Provide end products of one manufacturer for each product in order to achieve standardization for appearance, maintenance, and replacement.

B. Finishes: ANSI A156.18.

2.02 FASTENERS

A. Stainless steel.

2.03 BUTT HINGES

A. ANSI A156.1.

B. Quantity per Door Leaf (Minimum):

Door Height	Hinges
Up to 5'-0"	1 pair
5'-1" to 7'-7"	1-1/2 pair
7'-8" to 10'-0"	2 pairs
10'-1" to 12'-6"	2-1/2 pairs

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C. Hinge Height (Minimum):

Door Width	Hinge Height
Up to 3'-0"	4-1/2"
3'-1" to 4'-0"	5"
Over 4'-0"	6"

D. Width: Minimum for clearance of trim and 180-degree swing.

E. Exterior Hinges: Nonremoveable pin.

F. Joint Tolerance: 0.012-inch maximum, gauged in CLOSED position.

G. Finish: Satin stainless steel No. 630.

H. Types and Manufacturers:

No.	Type Description	Stanley	Mc-Kinney	Lawrence	ANSI
H1	Regular weight, two ball-races, full mortise, stainless steel	FBB191-32D	TB2314	BB4101-32D	A5112
H4	Extra heavy-weight, four ball races, full mortise, stainless steel	FBB199-32D	T4B3386	BB5151-A	A5111

2.04 LOCKS AND LATCH SETS

A. Mortise Locks: ANSI A156.13, Series 1000, Grade 1.

1. Materials: Brass or stainless steel.
2. Trim: Wrought or forged lever handles and roses.
3. Core Cylinders: Interchangeable, removable; minimum of six pins.
4. Bolt Throw: 5/8-inch minimum.
5. Lever Backset: 2-3/4 inches.
6. Manufacturers and Products:
   a. Sargent; LNJ.
   b. Schlage; 03.

B. Tactile Warning: Knurl lever handles for touch identification; ICC A117.1, Section 4.29.3.

C. Finish:

1. Satin stainless steel No. 630.
2. Coat exterior levers with Teflon.

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D. Types and Manufacturers:

No.	Type Description	Best	Sargent	Schlage	ANSI
L1	Mortise entrance lock with lever handle	45H7TA3H	8245-LNJ	L9456P-03	F12, F13
L3	Mortise latch with lever handle	45H0N3H	8215-LNJ	L9010-03	F01
L5	Mortise utility room lock with lever handle	45H7D3H	8204-LNJ	L9080-03	F07
L8	Mortise privacy lock with lever handle	45H7L3H	8265-LNJ	L9040-03	F19, F22
L16	Lock by exit device manufacturer; furnish cylinders for keying to other locks as required				

E. Keying:

1. Lock Cylinders: Operate by existing grand master key system that allows for future expansion. Provide to Owner prior to Project completion for Owner's locksmith to perform final keying and installation.
2. Keylocks: As directed by Owner.
3. Keys: Two per lock; tag with schedule information.
4. Master Keys: Four; send by registered mail to Owner.
5. Furnish lock manufacturer's removable core maximum security keying system.

2.05 CONSTRUCTION KEY SYSTEM

A. Removable construction core system for locks.

B. See Article Manufacturer's Services under Part 3, Execution.

2.06 EXIT DEVICES

A. ANSI A156.3.

B. Furnish fire exit devices and mullions at fire-rated doors.

C. Key Lockable, Removable Mullion: Steel construction, by exit device manufacturer.

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D. Trim:

1. Levers: Sargent ETJ; Von Duprin 03.
2. “Or-equal.”

E. Finish:

1. Exit Device: Satin chromium-plated No. 626.
2. Removable Mullion: Steel with prime coat.

F. Types and Manufacturers:

No.	Type Description	Sargent	VonDuprin	ANSI
X1	Rim type, active leaf; with removable mullion for pairs	8813ETJ	99L	Type 1 08

2.07 CLOSERS

A. ANSI A156.4.

B. Size closers in accordance with manufacturer’s standards. Mount regular arm closers on pull side of doors. Mount parallel arm closers on push side of doors. On pair of doors provide closer on active leaf only, unless noted otherwise.

C. Finish: Satin chromium-plated No. 626.

D. Types and Manufacturers:

No.	Type/Description	LCN	Sargent	ANSI
C1	Regular arm	4010 Series	351 Series	C02011
C3	Regular arm with hold-open	4010H Series	351-H Series	C02051
C5	Parallel arm with hold-open	4110H Series	351-PH Series	C02061
C6	Parallel arm with integral stop and hold-open	4110H Cush-N-Stop Series	351-PSHSeries	C02061

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2.08 PUSH-PULLS

A. Manufacturers:

1. Baldwin.
2. “Or-equal.”

B. Solid metal, not plated.

C. Finish: Satin stainless steel No. 630, unless indicated otherwise.

D. Plates: Beveled four edges, square corners.

E. Pulls: Bolted through door.

F. Push Plates: Countersink pull-through bolts and cover with push plate.

G. Types and Manufacturers:

No.	Type Description	Model
P1	8" x 3/4" Pull handle on plate: 0.050" x 4" x 16", and push plate: 0.050" x 8"x 16"	2367 and 2125

2.09 STOPS AND HOLDERS

A. ANSI A156.16.

B. Machine Screws: In threaded anchors at concrete or masonry.

C. Self-Tapping Screws: At stud partitions, wood, or metal mountings.

D. Finish: Satin chromium-plated No. 626.

E. Types and Manufacturers for Each Leaf:

No.	Type Description	BBW or GJ	Baldwin	ANSI
S1	Floor stop	F121X	4086	L02131
S2	Wall bumper	WC9X	4031	L02241
S7	Overhead stop with hold-open	GJ90H Series	Sargent 590H Series	C05541

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2.10 BOLTS

A. ANSI A156.16.

B. Finish: Bright nickel No. 645.

C. Types and Manufacturers:

No.	Type/Description	Stanley	Lawrence	ANSI
B1	Top and bottom flush bolts	393-1/2	280	L04201

2.11 KICKPLATES

A. Solid metal, not plated. Bevel four edges.

B. Width of door leaf less than 1-1/2 inches at single leaf and less than 1 inch at pairs.

C. Finish: Satin stainless steel No. 630.

D. Types and Manufacturers: Ives or Rockwood as follows:

1. K1: 10 inches high by 0.125-inch thick.

2.12 THRESHOLDS

A. Thresholds: One-piece full width of opening; extend beyond jamb where indicated.

B. Provide with stainless steel machine screws in threaded expansion anchors at concrete.

C. Finish: Mill finish aluminum, unless indicated otherwise.

D. Types and Manufacturers:

No.	Type Description	Pemko	Reese
T2	Saddle (serrated, 4" x 1/4")	**270A**	S404A

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2.13 WEATHERSTRIP

A. Finish: Dark bronze anodized aluminum, unless indicated otherwise.

B. Seal Types and Manufacturers:

No.	Type Description	Pemko	Reese
W1	Rubber or vinyl bulb at jambs and head, and at meeting stiles of pairs	S88D	797B
	Door shoe	222DV	DB596DF
	Rain drip	346D	R201D
W2	Rubber or vinyl bulb at jambs and head, and at meeting stiles of pairs	S88D	797B
	Door shoe	222DV	DB596DF

2.14 MISCELLANEOUS ITEMS

A. Provide as indicated in Door and Hardware Schedule:

M1	Nameplate as specified in Section 10 14 00, Signage, in text noted in Door and Hardware Schedule
M2	Nameplate and barrier-free pictorial symbol as specified in Section 10 14 00, Signage, in text noted in Door and Hardware Schedule

2.15 SILENCERS

A. High-grade, durable grey rubber.

B. At metal frame of each hinged door that does not have seals scheduled.

C. Three at single leaves and two at pairs.

2.16 TEMPLATES

A. Fabricate to template hardware applied to metal doors and frames.

B. Ensure that required templates are furnished to various manufacturers for fabrication purposes.

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C. Templates: Make available not more than 10 days after receipt of approved Hardware Schedule.

2.17 EXIT DOORS

A. Always openable from inside by simple turn of lever handle or push on panic bar without use of key or any special knowledge or effort, to include each leaf of door pairs.

PART 3 EXECUTION

3.01 INSTALLATION

A. In accordance with manufacturer's written instructions.

B. Make Work neat and secure, develop full strength of components, and provide proper function.

C. Prevent marring, scratching, or otherwise damaging adjacent finishes during hardware installation.

D. Latchbolts:

1. Install to engage in strikes automatically, whether activated by closers or manually.
2. In no case shall additional manual pressure be required to engage latchbolt in strike.

E. Stops and Holders: Set to allow doors to open as far as possible.

F. Wall Mounted Hardware: Install over solid structural backing or solid blocking in hollow walls.

G. Thresholds:

1. Cope ends neatly to profile of jamb.
2. Set in sealant and seal ends to jambs.

H. Hardware: Adjust for easy, noise-free operation.

I. Replace damaged hardware items.

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3.02 MOUNTING DIMENSIONS

A. Standard Door Hardware Locations: As recommended and published by Door and Hardware Institute, except as noted or detailed otherwise.

B. Door Silencers: Install 3 inches from top and bottom of jamb and 1-inch above strike at single doors, and 3 inches from edges of doors in head for pairs of doors.

3.03 MANUFACTURER'S SERVICES

A. Deliver permanent lock cores to Site.

B. Remove temporary construction cores and insert permanent cores.

C. Inspect each lock set to ensure permanent cores are operating satisfactorily.

D. Deliver to Owner change and control keys for permanent system.

E. Return temporary construction cores to manufacturer.

F. Furnish installer's representative for the following services at Site or classroom as designated by Owner, for minimum person-days listed below, travel time excluded:

1. 1/4 person-day for installation assistance, inspection, and Manufacturer's Certificate of Proper Installation.
2. 1/4 person-day for functional and performance testing.

3.04 PROTECTION

A. Cover and protect exposed surfaces of hardware during installation and until Substantial Completion.

B. Fit, dismantle, and reinstall finish hardware as required for finish painting work.

C. Protect and prevent staining of hardware during construction in accordance with manufacturer's recommendations.

D. Remove protective measures and permanent lock cylinders installed prior to final cleaning.

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3.05 DOOR AND HARDWARE SCHEDULE

A. Door and Hardware Schedule as shown on the Drawings is guide to functional requirements of each opening.

B. Provide finish hardware as scheduled. Sizes omitted shall be as recommended by manufacturer.

3.06 HARDWARE SETS

HDW-1:	All hardware by door manufacturer	
HDW-2:	**Item**	**Type**
	Butt Hinges (quantity as required for door height)	H1
	1 Exit device (rim type) with cylinder for keying to other locks as required	X1/L16
	1 Closer	C6
	1 Metal Kickplate	K1
	1 Threshold	T2
	1 Set Weatherstrip	W1
HDW-3:	**Item**	**Type**
	Butt Hinges (quantity as required for door height)	H1
	1 Exit device (rim type) with cylinder for keying to other locks as required	X1/L16
	1 Closer (active leaf)	C6
	1 Set Bolts (inactive leaf)	B1
	2 Metal Kickplates	K1
	1 Threshold	T2
	1 Set Weatherstrip	W1

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HDW-4:	Item	Type
	Butt Hinges (quantity as required for door height)	H1
	1 Privacy Lock	L8
	1 Closer	C1
	1 Floor Stop	S1
	1 Metal Kickplate	K1
	1 Nameplate	M2
HDW-5:	**Item**	**Type**
	Butt Hinges (quantity as required for door height)	H1
	1 Latch	L1
	1 Closer	C1
	1 Floor Stop	S1
	1 Metal Kickplate	K1
	1 Nameplate	M1
HDW-6:	**Item**	**Type**
	Butt Hinges (quantity as required for door height)	H1
	1 Latch	L5
	1 Closer	C6
	1 Floor Stop	S1
	1 Metal Kickplate	K1
	1 Nameplate	M1
HDW-7:	**Item**	**Type**
	Butt Hinges (quantity as required for door height)	H1
	1 Lock	L5
	1 Closer	C3
	1 Metal Kickplate	K1
	1 Overhead Stop	S7
	1 Nameplate	M1

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HDW-8:	Item	Type
	Butt Hinges (quantity and size as required for door height)	H1
	1 Push Plate	P1
	1 Pull Plate	P1
	1 Closer	C5
	1 Wall Stop	S2
	1 Metal Kickplate	K1
	1 Nameplate	M1
HDW-9:	**Item**	**Type**
	Butt Hinges (quantity as required for door height)	H1
	1 Lock	L1
	1 Closer	C6
	1 Metal Kickplate	K1
	1 Threshold	T2
	1 Set Weatherstrip	W2
HDW-10:	**Item**	**Type**
	Butt Hinges (quantity as required for door height)	H1
	1 Latch	L3
	1 Closer	C1
	1 Floor Stop	S1
	1 Nameplate	M1

END OF SECTION

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SECTION 08 80 00
GLAZING

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. ASTM International (ASTM):
   a. C509, Standard Specification for Elastomeric Cellular Preformed Gasket and Sealing Material.
   b. C864, Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.
   c. C920, Standard Specification for Elastomeric Joint Sealants.
   d. C1048, Standard Specification for Heat-Treated Flat Glass—Kind HS, Kind FT Coated and Uncoated Glass.
   e. C1115, Standard Specification for Dense Elastomeric Silicone Rubber Gaskets and Accessories.
   f. C1193, Standard Guide for Use of Joint Sealants.
   g. C1376, Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass.
   h. E1300, Standard Practice for Determining Load Resistance of Glass in Buildings.
   i. E1886, Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials.
   j. E1996, Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes.
   k. E2190, Standard Specification for Insulating Glass Unit Performance and Evaluation.
2. Consumer Product Safety Commission (CPSC) Code of Federal Regulations (CFR): 16 CFR 1201, Safety Standard for Architectural Glazing Materials.
3. Glass Association of North America (GANA):
   a. Glazing Manual.
   b. Sealant Manual.
4. National Fenestration Rating Council Incorporated (NFRC):
   a. 100, Procedure for Determining Fenestration Product U-Factors.
   b. 200, Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence.

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c. 300, Standard Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems.

5. South Coast Air Quality Management District: SCAQMD Rule 1168-Adhesive and Sealant Applications.

1.02 SUBMITTALS

A. Action Submittals:

1. Shop Drawings:
   a. Complete schedule of glass and glazing material to be used for each purpose.
   b. Indicate sizes, layout, thicknesses, and loading conditions for glass.
2. Product Data:
   a. Catalog cuts of glazing materials and accessories.
   b. Glass: Provide structural, physical, and thermal and solar optical performance characteristics, size limitations, special handling or installation requirements.
   c. Glazing Sealants, Compounds, and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements. Identify available colors where exposed.
   d. Seismic anchorage and bracing drawings and data sheets, as required by Section 01 88 15, Anchorage and Bracing.
3. Samples:
   a. Glass: Two samples 12-inch by 12 inches in size, illustrating each glass units, coloration and design.
   b. Glazing Materials: Submit 3-inch long bead of glazing sealant and gaskets, color as selected.

B. Informational Submittals:

1. Design calculations for glass thicknesses. Signed and sealed by professional engineer registered in state of Oklahoma.
2. Seismic anchorage and bracing calculations as required by Section 01 88 15, Anchorage and Bracing.
3. Manufacturer’s Certificate of Compliance for each type of glazing, in accordance with Section 01 61 00, Common Product Requirements.
4. Details and methods of glazing for each type of glazing condition; include manufacturer’s recommendations for setting, sealing materials, and installing each type of glazing.

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5. Documentation declaring compatibility and adhesion test reports from sealant manufacturer indicating that glazing materials were tested for compatibility and adhesion with glazing sealants and other glazing materials.
6. Documentation of glazer's previous experience and manufacturer's approval.

C. Sustainable Design Submittals:

1. Manufacturer's Certificate: Certify products meet or exceed specified sustainable design requirements.
   a. Materials Resources Certificates:
      1) Recycled material content for recycled content products.
      2) Source for local and regional materials and distance from Site.
   b. Indoor Air Quality Certificates: Volatile organic compound content for each interior adhesive and sealant and related primer.
2. Product Cost Data: Cost of products to verify compliance with Project sustainable design requirements. Exclude cost of labor and equipment to install products.
   a. Provide cost data for the following products:
      1) Products with recycled material content.
      2) Local and regional products.

1.03 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing Work of this section with minimum 3 years' documented experience approved by manufacturer.

B. Preinstallation Meeting: Convene minimum 1-week prior to commencing work of this section.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Storage:

1. Support cases on both sides when stored vertically.
2. After unpacking, place interleaving protection between lites.
3. Keep glass and interleaving dry by storing inside where temperatures are above dewpoint, or if outside storage is necessary, cover glass interleaving with opaque tarpaulins or plastic and inspect periodically. Wet interleaving can stain glass.
4. Avoid exposing stored glass to direct sunlight.

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B. Handling:

1. Stack individual lites on edge and lean them against sturdy uprights at a slope of 5 degrees to 7 degrees from vertical.
2. Cushion bottom edges with soft, firm pads free of dirt, grit, glass chips, or other foreign material.
3. Do not rotate or cartwheel insulating glass units over their corners. Use turning device such as a rolling block if units must be rotated.

1.05 SPECIAL GUARANTEE

A. Provide manufacturer's extended guarantee or warranty, with Owner named as beneficiary, in writing, as Special Guarantee. Special Guarantee shall provide for correction, or at option of Owner, removal and replacement of Work specified in this specification section found defective during a period of 10 years for vertical application insulating glass and 5 years for all other glazing types after date of Substantial Completion. Guarantee to cover deterioration because of normal conditions of use and not because of handling installing and cleaning practices performed contrary to glass manufacturer's published instructions. Duties and obligations for correction or removal and replacement of defective Work shall be as specified in General Conditions.

PART 2 PRODUCTS

2.01 GENERAL

A. Single Source Fabrication Responsibility: Fabrication processes including Low-E and reflective coatings, insulating, and tempering, shall be fabricated by a single fabricator.

B. Performance/Design Criteria:

1. Provide glass and glazing materials for continuity of building enclosure vapor retarder and air barrier:
   a. In conjunction with vapor retarder and air barrier materials.
   b. To utilize inner pane of multiple pane sealed units for continuity of air barrier and vapor retarder seal.
   c. To maintain continuous air barrier and vapor retarder throughout glazed assembly from glass pane to heel bead of glazing sealant.
2. Glass Thickness: Select minimum thickness in accordance with ASTM E1300 to resist specified design loads with the following maximum probability of breakage.
   a. Vertical Glass: Eight lites per 1000 for wind loads with 60 seconds maximum load duration.
   b. Minimum Thickness: 1/4-inch (6 mm) for exterior glass.

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C. Structural Design: Design in accordance with 2018 International Building Code for most critical combination of wind, snow, seismic, and dead loads.

D. Wind Loads: Design and size glass to withstand positive and negative wind loads acting normal to plane of wall, including increased loads at building corners.

1. Design Wind Load: Design pressure of 30 psf.
2. Wind-Borne Debris Loads: Design and size glass located less than 60 feet (18.288 m) abovegrade to withstand the following loads.
   a. Glass Within 30 Feet (9.144 m) of Grade: ASTM E1886 and ASTM E1996; large missile impact test.
   b. Glass Greater than 30 Feet (9.144 m) Abovegrade: ASTM E1886 and ASTM E1996; small missile impact test.
3. Seismic Loads: Design and size components to withstand seismic loads and sway displacement as calculated in accordance with applicable code.
4. Exterior Glass Deflection: Maximum of 1/175 of glass edge length or 3/4 inch (19 mm), whichever is less with full recovery of glazing materials.
5. Interior Glass Deflection: Maximum differential deflection for two adjacent unsupported edges when 50 plf (730 N/m) force is applied to one panel at any point up to 42 inches (1067 mm) above finished floor less than thickness of glass.
6. Thermal and Solar Optical Performance: Measured or calculated in accordance with the following:
   a. U-Values: NFRC 100.
   b. Solar Heat Gain Coefficients: NFRC 200.
   c. Solar Optical Properties: NFRC 300.

2.02 FLOAT GLASS MATERIALS

A. Tempered Glass (SG):

1. ASTM C1048, Type 1 transparent flat, Quality Q3, Kind FT fully tempered, Condition A uncoated, float glass with horizontal tempering.
2. Furnish tempered glass where heat strengthened glass cannot meet specified performance requirements.
3. Conforming to CPSC 16 CFR 1201 Category II.

2.03 FLOAT GLASS PRODUCTS

A. Clear Glass:

1. Tempered (SG) float glass as specified; Class 1 clear.
2. Minimum Thickness: 1/4-inch (6 mm) unless otherwise indicated.

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2.04 INSULATING GLASS PRODUCTS

A. Insulating Glass (IG-C):

1. ASTM E2190 certified by Insulating Glass Certification Council and Insulating Glass Manufacturers Alliance.
2. Total Unit Thickness: 1-inch.
3. Outer Pane: Glass Type Clear Tempered Glass, with Low-E coating on inner surface (No. 2 position).
    a. Low-E Coating: ASTM C1376; pyrolytic or vacuum deposited.
4. Inner Pane: Glass Type Laminated Glass.
5. Air-filled space between lites. Provide argon-filled space between lites if project altitude allows.
6. Visible Light Transmittance: 70 percent minimum.
7. Solar Heat Gain Coefficient: 0.45 maximum.
8. U-Factor Winter: 0.29 maximum.
9. Manufacturer and Product:
    a. Vitro Architectural Glass; Solarban 60.
    b. “Or-equal.”

2.05 GLAZING SEALANTS

A. Elastomeric Glazing Sealants: Materials compatible with adjacent materials including glass, laminated glass core, insulating glass seals, and glazing channels.

1. Silicone Glazing Sealant:
    a. ASTM C920, Type S, Grade NS, Class and Use suitable for glazing application indicated; single component; chemical curing; capable of water immersion without loss of properties, nonbleeding, nonstaining, cured Shore A Hardness Range 15 to Range 25.
    b. Structural Silicone: Furnish high-modulus structural silicone glazing materials where sealant bonds glass to substrate.
    c. Color: As selected.
    d. Sealants and Sealant Primers: Maximum volatile organic compound content in accordance with SCAQMD Rule 1168.
2. Polyurethane Glazing Sealant:
    a. ASTM C920, Type S, Grade NS, Class and Use suitable for glazing application indicated; single component, chemical curing, nonstaining, nonbleeding, Shore A Hardness Range 20 to Range 35.
    b. Color: As selected.
    c. Sealants and Sealant Primers: Maximum volatile organic compound content in accordance with SCAQMD Rule 1168.

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B. Dense Gaskets:

1. Resilient extruded shape to suit glazing channel retaining slot; color as selected.
2. Neoprene: ASTM C864.
3. EPDM: ASTM C864.
4. Silicone: ASTM C1115.

C. Soft Gaskets:

1. ASTM C509 Type II; resilient extruded shape to suit glazing channel retaining slot; black color.
2. Neoprene.
3. EPDM.
4. Silicone.

D. Preformed Glazing Tape:

1. Size to suit application.
2. Preformed butyl compound; 10 to 15 Shore A durometer hardness; coiled on release paper; black color.
3. Butyl Corner Sealant: ASTM C920 single component nonskinning butyl compatible with glazing tape; color to match tape.
4. Sealants and Sealant Primers: Maximum volatile organic compound content in accordance with SCAQMD Rule 1168.
5. Glazing Tape:
   a. Closed cell polyvinyl chloride foam, coiled on release paper over adhesive on two sides, maximum water absorption by volume of 2 percent, designed for compression of 25 percent to affect air barrier and vapor retarder seal.
   b. Adhesives: Maximum volatile organic compound content in accordance with SCAQMD Rule 1168.

2.06 GLAZING ACCESSORIES

A. Setting Blocks: Elastomeric material recommended by glass manufacturer, 80 to 90 Shore A durometer hardness, length of 0.1-inch for each square foot (25 mm for each square meter) of glazing or minimum 4-inch (100 mm) by width of glazing rabbet space minus 1/16-inch (1.5 mm) by height to suit glazing method and pane weight and area.

B. Spacer Shims: Elastomeric material recommended by glass manufacturer, 50 to 60 Shore A durometer hardness, minimum 3-inch (75-mm) long by one half the height of glazing stop by thickness to suit application.

C. Glazing Clips: Manufacturer's standard type.

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PART 3 EXECUTION

3.01 EXAMINATION

A. Verify openings for glazing are correctly sized and within acceptable tolerance.

B. Verify surfaces of glazing channels or recesses are clean, free of obstructions impeding moisture movement, weeps are clear and ready to receive glazing.

3.02 PREPARATION

A. Do not perform glazing work in damp, foggy, or rainy weather, or when temperatures are not within range recommended by GANA “Glazing Manual.”

B. Surfaces:

1. Smooth, even, sound, dry, and clean.
2. Clean contact surfaces with solvent and wipe dry.

C. Priming:

1. Complete and cured.
2. Prime surfaces scheduled to receive sealant.

D. Measure size of frames to receive glass and compute actual glass size allowing for edge clearances.

E. Verify functioning weep system is present.

F. Do not proceed with glazing until unsatisfactory conditions have been corrected.

3.03 GLAZING INSTALLATION

A. General: Follow recommendations of glass manufacturer GANA “Sealant Manual,” GANA “Glazing Manual” and the following:

1. Glazing Sealants: Comply with ASTM C1193.

B. Exterior Dry Method (Gasket Glazing):

1. Cut glazing gasket to length; install on glazing pane. Seal corners by butting tape and sealing junctions with compatible butyl sealant.
2. Place setting blocks at 1/4 points with edge block no more than 6 inches (150 mm) from corners.

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3. Rest glazing on setting blocks and push against fixed stop with sufficient pressure to attain full contact.
4. Install removable stops without displacing glazing spline. Exert pressure for full continuous contact.

C. Exterior Wet/Dry Method (Preformed Tape and Sealant) Installation:

1. Cut glazing tape to length and set against permanent stops, 3/16-inch (5 mm) below sight line. Seal corners by butting tape and dabbing with compatible butyl sealant.
2. Apply heel bead of butyl sealant along intersection of permanent stop with frame ensuring full perimeter seal between glass and frame to complete continuity of air and vapor seal.
3. Place setting blocks at 1/4 points with edge block no more than 6 inches (150 mm) from corners.
4. Rest glazing on setting blocks and push against tape with sufficient pressure to attain full contact at perimeter of pane or glass unit.
5. Fill gap between glazing and stop with elastomeric glazing sealant to depth equal to bite of frame on glazing, but not more than 3/8-inch (9 mm) below sight line.
6. Apply cap bead of elastomeric glazing sealant along void between stop and glazing, to uniform line, flush with sight line. Tool or wipe sealant surface smooth.

D. Interior Wet/Dry Method (Tape and Sealant) Installation:

1. Cut glazing tape to length and install against permanent stops, projecting 1/16-inch (1.6 mm) above sight line.
2. Place setting blocks at 1/4 points with edge block no more than 6 inches (150 mm) from corners.
3. Rest glazing on setting blocks and push against tape to ensure full contact at perimeter of pane or unit.
4. Install removable stops, spacer shims inserted between glazing and applied stops at 24-inch (600-mm) intervals, 1/4-inch (6 mm) below sight line.
5. Fill gaps between pane and applied stop with elastomeric glazing sealant to depth equal to bite on glazing, to uniform and level line.
6. Trim protruding tape edge.

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3.04 FIELD QUALITY CONTROL

A. Hose Test:

1. Use 3/4-inch minimum hose without nozzle. With full stream, flood glazing from bottom to top.
2. Correct leaks disclosed by hose test by reglazing and retesting until eliminated.

3.05 CLEANING

A. Leave glass and glazing in undamaged condition and ready for final cleaning.

B. Remove excess glazing compound from installed glass.

C. Remove labels from glass surface at time of final cleaning.

D. Wash and polish both faces of glass.

E. Clean adjacent surfaces of glass.

3.06 PROTECTION OF COMPLETED WORK

A. Protection:

1. Keep glass free from contamination by materials capable of staining glass.
2. Install tape across lights secured to frames or structure.
3. No tape or marking allowed on glass.

B. Replacements and Repairs: Prior to Substantial Completion, replace broken, defective, or scratched glass and repair damaged compounds.

3.07 SCHEDULE

A. For tabulation of glass requirements refer to Door and Hardware Schedule and Window Schedule on the Drawings.

END OF SECTION

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SECTION 08 90 00
LOUVERS

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. Air Movement and Control Association International, Inc. (AMCA): 500-L, Laboratory Methods of Testing Louvers for Rating.
2. ASTM International (ASTM): D1187/D1187M, Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal.

1.02 DESIGN REQUIREMENTS

A. Installed Louvers: Capable of resisting wind pressure of 34 pounds per square foot.

1.03 SUBMITTALS

A. Action Submittals:

1. Shop Drawings: Large scale details of louvers, anchorage to structure including proposed fasteners and spacing, and relationship to adjoining construction for each louver condition. Demonstrate compliance with specified performance requirements including scheduled minimum louver free area.
   a. Manufacturer’s Literature: Descriptive and performance data of louvers, including standard drawings.
2. Samples:
   a. Manufacturer’s standard finishes and color chart for initial selection.
   b. Metal chips with selected factory finish color coating for verification.

B. Informational Submittals:

1. Factory test data.
2. Certificates of AMCA ratings.
3. Installation instructions.
4. Special Guarantee.

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1.04 SPECIAL GUARANTEE

A. Manufacturer's extended guarantee or warranty, with Owner named as beneficiary, in writing, as Special Guarantee. Special Guarantee shall provide for correction, or at option of Owner, removal and replacement of special fluoropolymer-based finish found defective during a period of 20 years after date of Substantial Completion. Duties and obligations for correction or removal and replacement of defective Work as specified in General Conditions.

1. Conditions:
   a. No peeling, blistering, chipping, cracking, or checking of finish coating.
   b. No chalking, fading, or erosion of finish:
      1) No chalking in excess of 8 numerical ratings in accordance with ASTM D4214.
      2) No change in color or color fade in excess of 5 NBS units in accordance with ASTM D2244 and ASTM D822/D822M.

PART 2 PRODUCTS

2.01 GENERAL

A. Nonacoustical louver sizes are based on percent free area as indicated in the Louver Schedule.

B. Water Penetration Rate: No greater than 0.02-ounce per square foot.

C. Louvers: Rated and tested in accordance with AMCA 500-L.

D. Furnish louvers with interior duct collars.

2.02 FIXED DRAINABLE LOUVER (TYPE DB)

A. Frame: Extruded aluminum channel, 0.081-inch thick, 6 inches deep, interior duct collar, concealed mullions.

B. Blades: Extruded aluminum, minimum 0.081-inch thick, 35-degree to 45-degree pitch angles, with integral front drain gutter, spaced 3 inches to 4 inches on center.

C. Pressure Loss: AMCA certified rating of no greater than 0.10-inch WC.

D. Sizes: As scheduled on the Drawings.

E. Insect Screen: Inside mounted, painted aluminum, 1/2-inch mesh.

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F. Finish: Kynar 500 fluorocarbon coating in color as scheduled on the Drawings.

G. Manufacturers and Products:

1. Greenheck; Model ESD-635.
2. “Or-equal.”

2.03 ACCESSORIES

A. Anchors and Fasteners: Type 304 stainless steel.

B. Flashings: Match louver frame.

C. Isolation Tape: Tremco 440, 3M EC1202, or Presstite 579.6.

D. Isolation Paint: ASTM D1187/D1187, bituminous coating.

E. Insulated Blank-Off Panels:

1. Panels: Urethane core faced on both sides with 0.032-inch stucco embossed 5005-H134 aluminum sheet in finish and color to match louvers.
2. Frames: Alloy 6063-T52 extruded aluminum sections 0.08-inch thick, with mitered corners.
3. Perimeter Gaskets: Closed-cell PVC, to ensure tight fit of panel to louver.
4. Thickness: 2 inches.
5. U-Value: 0.10.

2.04 SOURCE QUALITY CONTROL

A. Factory Performance Tests:

1. Airflow versus pressure loss.
2. Rain penetration data.

PART 3 EXECUTION

3.01 EXAMINATION

A. Check openings to ensure dimensions conform to the Drawings.

B. Ensure openings are free of irregularities that would interfere with installation.

C. Do not install louvers until defects have been corrected.

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3.02 INSTALLATION

A. Install louvers as shown on reviewed Shop Drawings. Coordinate with heating or ventilation ductwork to be connected.

B. Follow procedures in manufacturer’s recommended installation instructions.

C. Install insulated blank-off panels where indicated, completely closing space between ducts and louver frames.

D. Separate aluminum from other metals with isolation tape or paint.

3.03 CLEANING

A. After erection, protect exposed portions from damage by machines, paint, lime, acid, cement, or other harmful compounds.

B. Remove protective materials and clean with plain water, water with soap, or household detergents.

3.04 **SCHEDULE**

A. For tabulation of louver characteristics for each opening numbered on the Drawings, refer to Louver Schedule as shown on the Drawings.

END OF SECTION

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SECTION 09 22 16
NONSTRUCTURAL METAL FRAMING

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards that may be referenced in this section:

1. ASTM International (ASTM):
   a. C645, Standard Specification for Non-Load (Axial) Bearing Steel Studs, Runners (Track), and Rigid Furring Channels for Screw Application of Gypsum Board.
   b. C754, Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum.

1.02 SUBMITTALS

A. Action Submittals:

1. Product data.
2. Shop Drawings:
   a. Anchorage and bracing drawings and/or catalog information, as required by Section 01 88 15, Anchorage and Bracing, for loads shown on General Structural Notes on the Drawings.

B. Informational Submittals:

1. Anchorage and bracing calculations as required by Section 01 88 15, Anchorage and Bracing, for loads shown on General Structural Notes on the Drawings.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Site in manufacturer’s original, unopened, undamaged containers, with labels intact clearly indicating manufacturer and material.

B. Storage:

1. Store materials inside, under cover, stacked flat, off floor.
2. Avoid overloading floor system of storage area.

1.04 DESIGN REQUIREMENTS

A. Partition Walls using Nonstructural Metal Framing: Anchor and brace wall assembly to resist minimum of 5 psf lateral load.

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PART 2 PRODUCTS

2.01 MANUFACTURERS

A. National Gypsum Company; Gold Bond.

B. Dale/Incor.

C. G-P Gypsum Corporation.

D. United States Gypsum Company.

2.02 MATERIALS

A. Furnish materials from a single manufacturer.

B. Studs, Tracks, Furring Channels, and Accessories:

1. ASTM C645.
2. 25-gauge and 20-gauge galvanized steel C-studs with 1-5/8-inch flanges and ancillary items.
3. Sizes as shown on the Drawings.
4. Furnished curved tracks where required for curved wall surfaces.

C. Carrying Channels: Cold-rolled steel, 16-gauge, free of rust, coated with factory-applied rust-inhibitive paint, 1-1/2 inches deep, weighing not less than 475 pounds per 1,000 linear feet.

D. Furring Channels: Roll-formed hat shaped section of 25-gauge galvanized steel with a face width of 1-3/8 inches and a depth of 7/8-inch.

E. Resilient Furring Channels:

1. Roll-formed section of 25-gauge galvanized steel with face width of 1-1/2 inches designed for resilient attachment of gypsum board to framing.
2. Manufacturers and Products:
   a. United States Gypsum; RC-1 channel.
   b. Gold Bond; resilient channels.

PART 3 EXECUTION

3.01 ERECTION

A. Preparation: Provide, install, and maintain necessary scaffold, staging, trestles, planking, and temporary heating, lighting, and ventilation as necessary for duration of gypsum board work.

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B. Field Measurements: Take and record measurements before fabrication of assemblies.

C. Layout: Align partitions as shown on the Drawings.

D. Tracks:

1. Attach metal runner tracks to floor slabs with suitable fasteners located 2 inches from each end and spaced not more than 24 inches OC.
2. Attach tracks to suspended ceiling with toggle or molly bolts spaced 24 inches OC.

E. Studs and Other Framing:

1. ASTM C754.
2. Following manufacturer's printed instructions, position studs vertically, engaging floor and ceiling tracks and spaced as noted on the Drawings.
3. Splices: Not allowed.
4. Place in direct contact with doorframe jambs, abutting partitions, and partition corners. Provide for anchorage of doorframes to studs.
5. Anchor all studs for shelf-walls and those adjacent to window and doorframes, partition intersections, and corners to ceiling and floor runner flanges. Securely anchor studs to jamb and head anchor clips of door or borrowed-light frames by bolt or screw attachment.
6. Over metal door, place horizontally a cut-to-length section of runner, with a web-flanged bend at each end, and secure with one positive attachment per flange. Position a cut-to-length stud (extending to ceiling runner) at vertical panel joints over doorframe header.
7. Locate studs at abutting construction, partition intersections, and partition corners.
8. Spacing: 16 inches OC, unless otherwise required by manufacturer.
9. Doorframes and Cased Openings:
    a. Full height double studs, No. 20-gauge minimum, secured to jamb anchors by bolts, screws, or welds.
    b. Header Track: Secure to frame head anchors and double studs.
    c. Provide double channel stiffeners through studs above frame and extend at least one stud space beyond each jamb.
10. Windows: Similar framing to door openings with stiffeners both above and below.
11. Wall Mounting Accessories: Provide channels, horizontal studding, No. 16-gauge sheet 8 inches by 2 inches greater than stud spacing, or other members within walls as required to provide secure and adequate support.

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F. Furring:

1. Space furring channels the same as studs or as shown.
2. Around columns and beams construct furring as shown using metal studs and furring channels securely tied together and anchored in-place.

G. Leave framing, plumb, aligned, securely anchored, braced, and ready to receive gypsum board.

END OF SECTION

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SECTION 09 29 01
GYPSUM BOARD

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards that may be referenced in this section:

1. American National Standards Institute (ANSI): A118.9, Test Methods and Specifications for Cementitious Backer Units.
2. ASTM International (ASTM):
   a. C475, Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
   b. C665, Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
   c. C840, Standard Specification for Application and Finishing of Gypsum Board.
   d. C1002, Standard Specification for Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases.
   e. C1047, Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.
   f. C1396, Specification for Gypsum Board.
3. Gypsum Association (GA):
   a. 214, Levels of Gypsum Board Finishes.
   b. 216, Recommended Specifications for Application and Finishing of Gypsum Board.

1.02 SUBMITTALS

A. Action Submittals:

1. Product Data: Manufacturer’s list of items and materials proposed for use, with descriptive literature for each system used.
2. Shop Drawings:
   a. Control joint pattern proposed for gypsum board. Provide plan drawing showing each wall and ceiling control joint.
   b. Detailed layout of grid indicating hanger spacing, fastening, and splicing details, change in level details, and access location.
   c. Anchorage and bracing drawings and/or catalog information, as required by Section 01 88 15, Anchorage and Bracing, for loads shown on General Structural Notes on the Drawings.

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B. Informational Submittals:

1. Anchorage and bracing calculations as required by Section 01 88 15, Anchorage and Bracing, for loads shown on General Structural Notes on the Drawings.
2. Manufacturer's recommendation for installation of suspended gypsum board ceiling system.

1.03 QUALITY ASSURANCE

A. Single source responsibility: Use gypsum board and related joint treatment materials from a single manufacturer for each type used.

B. General: Regardless of the minimum specifications herein, utilize materials and applications recommended by manufacturer.

1.04 ENVIRONMENTAL CONDITIONS

A. Temperature: Maintain between 55 degrees F and 70 degrees F for 24 hours before, during, and after application and finishing.

B. Ventilation: Provide ventilation, but protect from drafts during hot, dry weather.

PART 2 PRODUCTS

2.01 MATERIALS

A. Regular Board (GWB): ASTM C1396, Type X, 5/8-inch thick with tapered edges.

B. Water-Resistant Board (WRB): ASTM C1396/C1396M, Type X, 5/8-inch thick with tapered edges.

2.02 TILE BACKING PANELS

A. Cementitious Backer Board (CBB):

1. Aggregated portland cement panel reinforced with vinyl-coated, woven fiberglass mesh embedded in both surfaces meeting ANSI A118.9.
2. Thickness: Type X, 5/8-inch.
3. Manufacturers and Products:
   a. Custom Building Products; Wonderboard.
   b. FinPan, Inc.; Util-A-Crete Concrete Backer Board.
   c. United States Gypsum; Durock.

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2.03 FASTENERS

A. Gypsum Board:

1. Screws: ASTM C1002, self-drilling, self-tapping, bugle head, for use with power-driven tool.
   a. Type S, 1-inch long for gypsum board to sheet metal.
   b. Type W, 1-1/4 inches long for gypsum board to wood.

B. Cementitious Backer Board:

1. Screws: ASTM C1002, self-drilling, self-tapping, bugle head, for use with power-driven tool.
   a. Type S, 1-1/4-inch, Hi-Lo for wood or 22-gauge to 25-gauge steel framing.
   b. Type S-12, 1-1/4-inch, for 14-gauge to 20-gauge steel framing; 1-15/16 inches.
   c. Type S-12, Pilot Point for steel joists.

2.04 JOINT TREATMENT MATERIALS

A. Tape:

1. General Interior Applications: ASTM C475/C475M, perforated paper tape.
2. Cementitious Backer Board: 2-inch wide 10 by 10 open weave glass mesh tape as recommended by manufacturer.

B. Compound:

1. General Interior Applications: ASTM C475/C475M, all-purpose, ready-mixed compound.
2. Water-Resistant GWB: Chemically curing, polyindurate type material as recommended by manufacturer.

2.05 ANCILLARY MATERIALS

A. Adhesives: As recommended by gypsum board manufacturer for intended use. Use adhesives that have VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Sound Attenuation Blankets: ASTM C665, Type I (no facing), thickness as required to fill wall cavity.

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C. Acoustical Sealant:

1. Nonsetting and nonstaining with a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Manufacturers:
   a. DAP.
   b. United States Gypsum.
   c. Tremco.
   d. Ohio Sealants, Inc.

2.06 TRIM ACCESSORIES

A. ASTM C1047, Zinc-Coated Metal.

B. Manufacturers and Products:

1. Corner Bead:
   a. 1-1/4 inches by 1-1/4 inches:
      1) United States Gypsum; Dur-A-Bead.
      2) Gold Bond; standard corner beads.
2. Edge Trim:
   a. United States Gypsum; 200B metal trim.
   b. Gold Bond; No. 200 casing bead.
3. Metal Control Joint:
   a. United States Gypsum; No. 093.
   b. Gold Bond; E-Z strip control joint.

2.07 NONSTRUCTURAL METAL FRAMING MEMBERS

A. As specified in Section 09 22 16, Nonstructural Metal Framing.

2.08 LIGHT-GAUGE METAL FRAMING ACCESSORIES

A. As specified in Section 09 22 16, Nonstructural Metal Framing.

2.09 DRY WALL CEILING SUSPENSION SYSTEM

A. Use system of main runners, cross tees, and furring channels.

B. Furnish manufacturer’s complete suspension in accordance with Design Criteria on General Structural Notes on the Drawings.

C. Manufacturers:

1. Armstrong World Industries, Inc.; Furring Systems/Drywall.
2. USG Interiors, Inc.; Drywall Suspension System.

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2.10 SPRAY TEXTURE

A. Manufacturers and Products:

1. Aggregate Finish:
   a. National Gypsum Company; ProForm Spray Quick.
   b. United States Gypsum Company; Ceiling Spray Texture.

B. Manufacturers and Products:

1. Nonaggregate Finish:
   a. National Gypsum Company; ProForm Perfect Spray EM/HF.
   b. United States Gypsum Co.; SHEETROCK Wall and Ceiling Spray Texture (unaggregated).

PART 3 EXECUTION

3.01 EXAMINATION

A. Inspect surfaces to receive gypsum board and related materials before beginning work and report to Engineer any defects in such work which will adversely affect the quality of work specified herein.

3.02 PREPARATION

A. General: Provide, install, and maintain necessary scaffold, staging, trestles, planking, and temporary heating, lighting, and ventilation as necessary for duration of gypsum board work.

B. Protection: Protect work of other trades.

C. Coordination:

1. Coordinate work with that of other trades. Check specifications and drawings of other trades to determine parts of work requiring coordination.
2. Cut and repair gypsum board systems for installation of omitted work.

D. Surface Preparation: Repair defective surfaces prior to starting work. Prepare as specified for application of specific materials.

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3.03 ERECTION OF DRY WALL CEILING SUSPENSION SYSTEM

A. Follow manufacturer’s printed instructions.

B. Hangers:

1. Space not over 4 feet OC in direction of runners and within 6 inches of ends of runners.
2. Securely attach to structure above and provide for full saddle tie to main runner at indicated height.
3. Connections shall develop full strength of hanger wire.

C. Bracing:

1. Securely brace ceiling areas against sway.
2. Where required by code, install for seismic control.

D. Where ducts interfere with normal spacing of hangers and carrying channels, install additional hangers and channels to properly suspend ceiling.

3.04 ERECTION OF LIGHT-GAUGE NONSTRUCTURAL METAL FRAMING

A. As specified in Section 09 22 16, Nonstructural Metal Framing.

3.05 APPLICATION OF GYPSUM BOARD

A. Inspection and Preparation:

1. Check framing for accurate spacing and alignment.
2. Verify spacing of installed framing does not exceed maximum allowable for thickness of gypsum board to be used.
3. Verify frames are set for thickness of gypsum board to be used.
4. Do not proceed with installation of gypsum board until deficiencies are corrected and surfaces to receive gypsum board are acceptable.
5. Repair protrusions of framing, twisted framing members, or unaligned members before installation of gypsum board is started.

B. General:

1. Meet requirements of ASTM C840 and GA 216.
2. Joints: Use gypsum board of maximum lengths to minimize end joints. Stagger end joints when they occur. Locate end joints as far as possible from center of wall or ceiling. Abut gypsum board without forcing. Neatly fit ends and edges of gypsum board. Do not place butt ends against tapered edges.

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3. Support ends and edges of gypsum board panels on framing or furring members except for face layer of double layer and where ends are back blocked and floated.
4. Use metal edge trim where gypsum board abuts another material, at corners, and where shown or noted on the Drawings.
5. Follow manufacturer's recommendation of good practice.

C. Over Framing:

1. Apply gypsum board first to ceiling and then to walls for single layer horizontal application.
2. Use vertical application for fire-rated walls.
3. Fasten gypsum board securely to framing using double nailing, screw, or adhesive method.

D. Sound-Insulated Partitions:

1. Install sound attenuation blankets where indicated on wall types.
2. Seal with acoustical sealant perimeter edges of gypsum board, joints around penetrations, and other joints as noted.

3.06 INSTALLATION OF CEMENTITIOUS BACKER BOARD (CBB)

A. Follow manufacturer's printed instructions for erection, cutting, attachments, and joint treatment.

B. Verify framing is installed at maximum 16 inches OC, and necessary blocking to support fixtures and accessories has been installed. Where backing plates or straps are used, space out from framing to ensure a smooth finish application. Do not proceed until defects are corrected and are acceptable.

C. Precut boards to required sizes and make necessary cutouts. Fasten with appropriate fasteners. Space fasteners 6 inches OC maximum or as directed by manufacturer. Fit ends closely but not forced together. Maintain 1/4-inch spacing between edge of board and fixture. Caulk all joints and corners that are to receive tiles. Apply 2-inch glass fiber tape over joints and corners embedded with tile setting mortar.

3.07 JOINT SYSTEM FOR GYPSUM WALLBOARD

A. Interior Gypsum Board: Conform to ASTM C840.

B. Required: On exposed gypsum board, under ceramic tile and wall covering, and behind casework.

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C. Prefill: Fill V-grooves formed by abutting rounded edges of gypsum board with prefill joint compound. Fill V-joint flush and remove excess compound beyond groove. Leave clear depression to receive tape. Permit prefill joint compound to harden prior to application of tape.

D. Taping and Finishing Joints:

1. Taping or Embedding Coat: Apply compound in thin, uniform layer to joints and angles to be reinforced. Apply reinforcing tape immediately. Center tape over joint and seat tape into compound. Leave approximately 1/64-inch to 1/32-inch compound under tape to provide bond. Apply skim coat immediately following tape embedment but not to function as fill or second coat. Fold tape and embed in angles to provide true angle. Dry embedding coat prior to application of fill coat.
2. Filling Coat: Apply joint compound over embedding coat. Fill taper flush with surface. Apply fill coat to cover tape. Feather out fill coat beyond tape and previous joint compound line. For joints with no taper, feather out at least 4 inches on either side of tape. Do not apply fill coat on interior angles. Allow fill coat to dry prior to application of finish coat.
3. Finishing Coat: Spread joint compound evenly over and beyond fill coat on joints. Feather to smooth uniform finish. Apply finish coat to taped angles to cover tape and taping compound. Sand final application of compound to provide surface ready for decoration.
4. Filling and Finishing Depressions: Apply joint compound as first coat to fastener depressions. Apply at least two additional coats of compound after first coat is dry. Leave filled and finished depressions level with plane of surface.

E. Finishing Beads and Trim:

1. First Fill Coat: Apply joint compound to bead and trim. Feather out from ground to plane of the surface. Dry compound prior to application of second fill coat.
2. Second Fill Coat: Apply joint compound in same manner as first fill coat. Extend beyond first coat onto face of gypsum board. Dry compound prior to application of finish coat.
3. Finish Coat: Apply joint compound to bead and trim. Extend beyond second fill coat. Feather finish coat from ground to plane of surface. Sand finish coat to provide flat surface ready for decoration.

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3.08 FINAL FINISHES FOR GYPSUM WALLBOARD

A. Levels of Finish: Conform to GA 214.

B. Level 1:

1. Taping or embedding coat only.
2. Use in concealed areas, and where indicated, unless a higher level is required for fire-resistive or sound-rated assemblies.

C. Level 2:

1. Taping, filling, and finishing coats.
2. Use on water-resistant gypsum backing board.

D. Level 3:

1. Taping, filling, and finishing coats.
2. Use on surfaces indicated to have spray texture or ceramic tile.

3.09 SPRAY TEXTURE

A. Application:

1. Apply on gypsum board wall and ceiling surfaces, except behind ceramic tile, following manufacturer’s printed directions for a medium build orange peel texture.
2. Before texture application, finish gypsum board as specified for Level 3.
3. When surfaces are prepared and dry, apply sealer and allow to dry. Mix texture finish material as directed by manufacturer.
4. Use spray equipment of a size and type to assure acceptable results.
5. Apply by spray only at a coverage rate as recommended by manufacturer and in accordance with directions printed on container. Apply material to blend uniformly and cover fully without starved spots or other evidence of thin application. Provide uniform texture without application patterns.

3.10 ADJUST AND CLEAN

A. Clean: Remove droppings or texture overspray from walls, windows, and floor, leaving room clean for following trades.

B. Screw Pop: Repair screw pop by driving new nail approximately 1-1/2 inches from nail pop and reseat nail. When face paper is punctured, drive new nail or screw approximately 1-1/2 inches from defective fastening and remove defective fastening. Fill damaged surface with compound.

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C. Ridging:

1. Do not repair ridging until condition has fully developed, approximately 6 months after installation or one heating season.
   a. Sand ridges to reinforcing tape without cutting through tape.
   b. Fill concave areas on both sides of ridge with topping compound.
   c. After fill is dry, blend in topping compound over repaired area.
2. Fill cracks with compound and finish smooth and flush.

END OF SECTION

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SECTION 09 30 00
TILING

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American National Standards Institute (ANSI):
   a. A108.1A, Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar.
   b. A108.4, Installation of Ceramic Tile with Organic Adhesives or Water Cleanable Tile-Setting Epoxy Adhesive.
   c. A118.4, Latex-Portland Cement Mortar.
   d. A137.1, Ceramic Tile.
2. ASTM International (ASTM):
   a. A497/497M, Standard Specification for Steel Welded Wire Fabric, Deformed, for Concrete.
   b. C144, Standard Specification for Aggregate for Masonry Mortar.
   c. C150, Standard Specification for Portland Cement.
   d. C206, Standard Specification for Finishing Hydrated Lime.
   e. C207, Standard Specification for Hydrated Lime for Masonry Purposes.
   f. C847, Standard Specification for Metal Lath.
   g. C920, Standard Specification for Elastomeric Joint Sealants.
3. Tile Council of North America (TCA): Handbook for Ceramic Tile Installation.

1.02 SUBMITTALS

A. Action Submittals:

1. Product Data: For each type of product.
2. Shop Drawings: Show locations for each type of tile and tile pattern. Show widths, details, and locations of transition strips.
3. Samples:
   a. Two for each color, pattern, and type of tile specified.
   b. Size: Full size of actual tile to be used.
   c. Transition Strips: Two for each type specified.
   d. Mark Samples clearly to indicate color or shade, location in which to be used, and manufacturer’s name.

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B. Informational Submittals:

1. Qualification Data: For installer, submit documentation demonstrating capability and experience in performing installations of the same type and scope as specified by this section.
2. Certification of Compliance: For tile, mortar, grouts, and adhesives.
3. Manufacturer's Instructions: For storage, mixing, application, cleanup, and use of proposed mortars, grouts, and adhesives.
4. Tile Manufacturer's Maintenance Guidelines: For Owner's use in maintaining ceramic tilework specified herein.

1.03 QUALITY ASSURANCE

A. Source Limitations for Tile: Obtain tile of each type from single source or producer.

1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.

B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar and grout component from single manufacturer and each aggregate from single source or producer.

C. Source Limitations for Other Products:

1. Obtain each of the following products specified in this section from a single manufacturer:
   a. Uncoupling membrane.
   b. Transition strips.

D. Installer Qualifications: Minimum 5 years' experience in application of specified products.

E. Perform Work in accordance with TCA Handbook and ANSI A108 Series/A118 Series.

F. Mock-up and Layout:

1. Construct mock-up with vertical portion 4 feet long by 4 feet wide and horizontal potion 8 inches wide, with finish grout. Include all tile types, colors and shapes to simulate design. Mock-up shall include inside and outside wall corners as well as wall to floor joints. The accepted mock-up will serve as a standard of workmanship by which similar work will be evaluated.

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2. Locate where directed by Engineer and do not remove mock-up until directed by Engineer.
3. Build mockups to comply with the following requirements, using materials indicated for the completed work:
   a. Build mockup of each type of floor tile installation.
   b. Build mockup of each type of wall tile installation.
4. Do not begin Work of this section until mockup has been accepted in writing by Owner's representative.
5. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner's representative specifically approves such deviations in writing.
6. Prior to commencing installation of tile, erect layout lines demonstrating proposed tile joint locations and cut tiles for approval by Engineer.

1.04 ENVIRONMENTAL REQUIREMENTS

A. Set and grout tile in portland cement mortar when ambient temperature is at least 50 degrees F and rising. Follow ANSI A108.1A or ANSI A108.1B, as recommended by ANSI A108.1C.

B. Comply with minimum temperature recommendations of manufacturers for bonding and grouting materials other than portland cement mortar.

1.05 EXTRA MATERIALS

A. Furnish extra materials that match, are from same production runs as products installed, and are packaged with protective covering for storage and identified with labels describing contents.

1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.
2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Materials and products specified in this section shall be products of the manufacturers listed below unless otherwise indicated:

1. Tile:
   a. (Basis of Design) American Olean Tile Co.
   b. Dal-Tile Corp.

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2. Mortar and Grout:
   a. (Basis of Design) Mapei.
   b. Custom Building Products.
   c. Laticrete International, Inc.
3. Metal Edge Trim, Transition Strips and Joint Profiles: Schluter Systems.

2.02 MATERIALS

A. Tile: Standard grade, ANSI A137.1.

B. Mosaic Porcelain Tile: ANSI A137.1, Section 5.1, porcelain type with color extending uniformly through body of the tile, smooth cushion edge, nominal face size 2-inches by 2-inches, 1/4-inch thickness.

1. Moisture Absorption: Less than 0.5 percent.
2. Color: As shown in the Color List and Interior Finish Schedule on the Drawings.
3. Factory mount ceramic mosaic tile into sheets of pattern selected.

C. Matte Porcelain Floor Tile: ANSI A137.1, Section 5.1, porcelain type with color extending uniformly through body of the tile, smooth cushion edge, nominal face size 24-inches by 24-inches, 5/16-inch thickness.

1. Moisture Absorption: Less than 0.5 percent.
2. Color: As shown in the Color List and Interior Finish Schedule on the Drawings.

D. Matte Porcelain Wall Tile: ANSI A137.1, Section 5.1, porcelain type with color extending uniformly through body of the tile, smooth cushion edge, nominal face size 12-inches by 24-inches, 5/16-inch thickness.

1. Moisture Absorption: Less than 0.5 percent.
2. Color: As shown in the Color List and Interior Finish Schedule on the Drawings.

E. Trim Shapes and Bases: Type, size, color, and finish to match and coordinate with adjacent floor or wall tiles.

F. Portland Cement Mortar:

1. Portland Cement: ASTM C150, Type 1.
2. Sand: ASTM C144.
3. Hydrated Lime: ASTM C206 or ASTM C207, Type S.
4. Water: Clean and potable.

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5. Mortar Bed Reinforcement:
   a. Either of the following:
      1) Welded Wire Fabric: ASTM A497/497M, size 2-inch by 2-inch mesh, 16/16 wire.
      2) Expanded Metal Reinforcement: ASTM C847, galvanized with minimum weight of 1.8 pounds per square yard.

G. Dry-Set Mortar: ANSI A118.1, TCA Formula 759, gray.

H. Latex-Portland Cement Mortar: Portland cement grout with latex additive, commercial quality, ANSI A118.4.

I. Latex-Portland Cement Grout: Portland cement grout with latex additive, commercial quality, ANSI A118.6.

1. Color: As scheduled in the Color List and Interior Finish Schedule on the Drawings.

J. Silicone Rubber Grout/Sealant: White, fungicidal one-part silicone rubber meeting ASTM C920, Type S, Grade NS, Class 25.

2.03 ANCILLARY MATERIALS

A. Expansion Joints:

1. Sealant: Silicone rubber type, meeting ASTM C920, Type S, Grade P, Class 25, Use T, color to match grout, with Shore A hardness of minimum 25 for joints in horizontal surfaces and minimum 35 in traffic areas.
2. Backup Material: Flexible and compressible type, nonstaining and compatible with sealants used.

B. Sealer: As recommended by tile and grout manufacturers.

C. Shower Pan: Chlorinated polyethylene sheeting meeting ASTM D4068.

1. Manufacturer and Product: Noble Co.; Chloraloy 240.

D. Shower Wall Membrane: ANSI A118.10; composite, sheet membrane made from PVC with non-woven fiber laminated to both sides.

1. Manufacturer and Product: Noble Co.; Wall Seal.

E. Cementitious Backer Board: As specified in Section 09 29 01, Gypsum Board.

F. Tile Cleaner: Neutral tile cleaner solution acceptable to tile manufacturer.

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G. Construction Paper: Heavy-duty, nonstaining kraft paper.

H. Transition Strips:

1. Profiles:
   a. Transition for Tile to Finished Concrete:
      1) Profile with textures, sloped exposed surface, tapered leading edge, integrated trapezoid-perforated anchoring leg, and integrated grout joint spacer.
      2) ADA compliant.
      3) Material and Finish: Sating anodized aluminum (AE).
      4) Height and Ramp Length: As required for installation.
      5) Manufacturer and Product: Schluter; Reno-Ramp.
   b. Transition for Inside Corners and Floor to Wall:
      1) Profile with integrated trapezoid-perforated anchoring leg, connected at a 90-degree angle by a cover-shaped section with 3/8-inch radius that forms the visible surface.
      2) Accessories: Matching end caps.
      3) Material and Finish: Brushed stainless steel.
      4) Manufacturer and Product: Schluter; DILEX-HKU-EB.
   c. Transition (cap) for Tile Edge to Wall:
      1) Bullnose-type profile with symmetrically rounded visible surface with 1/4-inch radius, integrated trapezoid-perforated anchoring leg, and integrated grout joint spacer.
      2) Accessories: Matching end caps.
      3) Material and Finish: Brushed stainless steel.
      4) Manufacturer and Product: Schluter; RONDEC-DB-EB.

PART 3 EXECUTION

3.01 PREPARATION

A. Examine surfaces to receive ceramic tile, setting beds, or accessories prior to tile installation.

B. Correct defects or adverse conditions affecting quality and execution of tile installation.

C. Surfaces to receive tile shall be plumb, level, and true with square corners.

D. Tolerances for Surfaces to Receive Tile:

1. Portland Cement, Dry-Set, Epoxy, and Furan Mortar Methods:
   a. Maximum Variation in Subfloor Surface: 1/4-inch in 10 feet.
   b. Maximum Variation in Vertical and Ceiling Surfaces: 1/4-inch in 8 feet.

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E. Grounds, anchors, plugs, hangers, bucks, electrical and mechanical work, in or behind tile, to be installed prior to proceeding with tilework.

F. Protection: Protect adjoining work surfaces before tilework begins.

G. Make substrate firm, dry, clean, and free of oily or waxy films.

3.02 INSTALLATION

A. Prepare surfaces, fit, set, or bond tile, grout and clean tile in accordance with applicable requirements of ANSI Standards for setting method specified, except as otherwise noted.

B. Workmanship, Cutting, Fitting, and Grout Joint Size:

1. Center and balance areas of tile.
2. Generally start full size tiles at outside corners and leave cut tiles for inside corners.
3. Tile Cutting:
    a. Minimize number of cuts.
    b. No cuts smaller than half size without approval of Engineer.
    c. Make all cuts on the outer edges of the field.
    d. Smooth cut edges. Install tile without jagged or flaked edges.
    e. Do not split tile unless no other alternative is possible.
4. Fit tile closely where edges will be covered by trim, escutcheons, or other similar devices.
5. Maintain heights of tile work in full courses to nearest obtainable dimension where heights are given in feet and inches and are not required to fill vertical spaces exactly.
6. Allowable Lippage: 1/32-inch.
7. Grout Joint Size: 1/8-inch.
8. Install accessories in tile work to be evenly spaced, properly centered with tile joints, and level, plumb, and true to the correct projection. Install accessories at locations and heights shown or designated.

C. Trim: Provide bases, caps, stops, returns, trimmers, and other shapes to finish installation.

D. Setting Wall Tile (Thin-Set Application):

1. On Masonry: Meet TCA Method W202.
2. On Cementitious Backer Board Over Metal Studs: Meet TCA Method W244C.
3. Use latex-portland cement grout.

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E. Setting Floor Tile (Thin-Set Application):

1. On Concrete: Meet TCA Method F113 with latex-portland cement grout.

F. Setting Floor Tile (Conventional Application):

1. On Shower Compartment Floor: Meet TCA Method B415.

G. Transition Strips:

1. At openings without thresholds and similar discontinuous edges of thin-set tile floors.
2. Where ceramic tile floors are adjacent to other flooring material at same level.

H. Profiles: At inside corners, floor to wall transitions, and base tile to wall transitions.

3.03 CLEANING AND SEALING

A. Clean tile surfaces thoroughly on completion of grouting.

B. Remove grout haze, observing tile manufacturer’s recommendations as to use of acid and chemical cleaners.

C. Rinse tilework thoroughly with clean water before and after using chemical cleaners.

D. Polish surface of glazed tilework with soft cloth.

E. After grout has cured for 10 days, clean and seal nonglazed tiles following sealer manufacturer’s instructions and recommendations.

3.04 PROTECTION

A. From Construction Dirt:

1. Apply protective coat of neutral cleaner solution, one part cleaner to one part water, to clean completed tile walls and floors.
2. Cover tile floors with heavy-duty, nonstaining construction paper, masked in-place.
3. Just before substantial completion, remove paper and rinse protective coat of neutral cleaner from tile surfaces.

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B. From Traffic:

1. Prohibit foot and wheel traffic from using newly tiled floors for at least 7 days.
2. Place large, flat boards in walkways and wheelways for 7 days where use of newly tiled floor with cement type grout is unavoidable.

END OF SECTION

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SECTION 09 51 13
ACOUSTICAL PANEL CEILINGS

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards that may be referenced in this section:

1. ASTM International (ASTM):
   a. A641/A641M, Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
   b. C635/C635M, Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings.
   c. C636/C636M, Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.
   d. E1264, Standard Classification for Acoustical Ceiling Products.

1.02 SUBMITTALS

A. Action Submittals:

1. Shop Drawings:
   a. Detailed layout of grid indicating hanger spacing, fastening and splicing details, change in level details, and access location.
   b. Anchorage and bracing drawings and/or catalog information, as required by Section 01 88 15, Anchorage and Bracing, for loads shown on General Structural Notes on the Drawings.
2. Samples:
   a. One 12-inch square of each acoustical unit material to illustrate range of appearance.
   b. One full-size Sample of each suspension system member and molding.
   c. Mark with manufacturer’s name and specific design and technical data.

B. Informational Submittals:

1. Anchorage and bracing calculations as required by Section 01 88 15, Anchorage and Bracing, for loads shown on General Structural Notes on the Drawings.
2. Manufacturer’s recommendation for installation of system.

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1.03 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials with manufacturer's labels indicating brand name, pattern, size, and thickness.

B. Store materials in original protective packaging to prevent soiling, physical damage, or wetting.

1.04 ENVIRONMENTAL REQUIREMENTS

A. Where acoustical materials are to be installed, maintain humidity of 65 percent to 75 percent in area for 25 hours before, during, and 25 hours after installation.

B. Maintain uniform temperature of 55 degrees F to 70 degrees F prior to and during installation of materials.

1.05 EXTRA MATERIAL

A. Provide acoustical units from same production run as installed equal to 1 percent of area.

PART 2 PRODUCTS

2.01 SUSPENSION SYSTEMS

A. Components, Materials, and Accessories: Product of a single manufacturer.

B. ASTM C635/C635M, Heavy Duty:

1. Exposed Tee Grid: Nonrated, heavy-duty, spaced to fit recessed edge lay-in panels.
   a. Manufacturers and Products:
      1) Armstrong; Prelude ML.
      2) "Or-equal."
2. Main and Cross Members:
   a. Double web design, cold-rolled steel, minimum thickness of 0.020-inch, electrozinc-coated and factory-painted low-sheen satin white finish.
   b. Exposed Flange Width: 15/16-inch.
3. Edge Molding:
   a. Minimum 0.020-inch steel, reveal-shaped, with 1/2-inch by 1/2-inch recess.
   b. Flange Width: 15/16-inch minimum.
   c. Finish to match main members.

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4. Hanger Wire: ASTM A641/A641M, minimum 12-gauge, galvanized, soft-annealed, mild steel wire.
5. Wire Ties: ASTM A641/A641M, 18-gauge, galvanized, annealed steel wire.
6. Furnish manufacturer's hold down clips and accessories required for a complete system incorporating Seismic Design Category indicated in General Structural Notes on the Drawings.

2.02 ACOUSTICAL UNITS

A. Recessed Edge Lay-In Panels:

1. Material: Fire-resistive mineral fiber, Class A.
2. In accordance with ASTM E1264, Type III, Form 1.
3. Pattern: Textured, fissured.
4. Noise Reduction Coefficient (NRC): 0.75.
5. Ceiling Attenuation Class (CAC): 35 minimum.
6. Light Reflectance: LR 0.85 or over.
7. Nominal Size: 24 inches by 24 inches by 7/8-inch thick.
8. Edges: Angled tegular.
9. Finish and Color: Painted white.
10. Manufacturers and Products:
    a. Armstrong; Item 1756, Fine Fissured High-NRC.
    b. "Or-equal."

PART 3 EXECUTION

3.01 SEQUENCING

A. Lay out grid.

B. Coordinate with mechanical and electrical equipment in framing and cutting material around ceiling penetrations.

C. Install suspension systems after mechanical work above is complete.

D. Install acoustical units.

3.02 INSTALLATION OF SUSPENDED GRID SYSTEM

A. Hang level and in straight alignment directly from structure in accordance with ASTM C636/C636M and manufacturer's printed instructions.

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B. Hanger Wires:

1. Space maximum 4 feet on center each direction and securely attach to structure above.
2. Install additional hangers at ends of each suspension member and at light fixtures, 6 inches from vertical surfaces.
3. Do not splay wires more than 5 inches in a 4-foot vertical drop.
4. Provide four-way wire splays at 45 degrees from main runner to support structure for every 144 square feet of ceiling area.
5. Wrap wire minimum three times horizontally, turning ends upward.
6. Where hanger wires cannot be hung vertically from structure above because of ducts, pipes, cable trays, or other interferences, provide steel channel trapezes (minimum 2-inch deep, 16-gauge cold-rolled carrying channels) hung on steel rods or 8-gauge wire from structural members above. Hang ceiling wires from these trapezes or similar members supporting ducts or pipes. Do not hang directly from ducts or pipes.
7. Follow suspension system manufacturer’s instructions for modified installation required for Seismic Design Category indicated in General Structural Notes on the Drawings.

C. Edge Molding:

1. Install at intersection of suspended ceiling and vertical surfaces.
2. Miter corners where moldings intersect or install corner caps.
3. Attach to vertical surface with mechanical fasteners.

D. Provide additional channels, hangers, and trapezes as required to support edges of ceiling around and under mechanical and electrical work.

3.03 INSTALLATION OF ACOUSTICAL UNITS

A. Upon completion of suspended grid system and other concealed work, install with pattern running in one direction.

B. Place material to bear all around on suspension members.

3.04 CLEANING

A. Clean soiled or discolored unit surfaces after installation.

B. Touch up scratches, abrasions, voids, and other defects in painted surfaces.

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3.05 SCHEDULE OF CEILING TYPES

A. Areas to Receive Acoustical Ceilings: Indicated on Interior Finish Schedule located on the Drawings by type described below.

B. Acoustical Ceiling Type 1 (ACT):

1. Suspension System: Exposed painted steel tee grid system, 24 inches by 24 inches.
2. Exposed grid with main runners at 48 inches on center and cross tees at 24 inches on center.
3. Lay out grid to provide symmetrical borders as shown and which are not less than half the size of the lay-in panels.
4. Acoustical Units: Recessed edge lay-in panels.

END OF SECTION

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SECTION 09 65 00
RESILIENT FLOORING

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. ASTM International (ASTM):
   a. D2047, Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine.
   b. E648, Test Method for Critical Radiant Flux of Floor Covering Systems Using a Radiant Energy Source.
   c. E662, Test Method for Specific Density of Smoke Generated by Solid Materials.
   d. F970, Test Method for Static Load Limit.
   e. F1861, Standard Specification for Resilient Wall Base.
   f. F2195, Standard Specification for Linoleum Floor Tile.
2. National Fire Protection Association (NFPA):
   a. 253, Test Method for Critical Radiant Flux of Floor Covering Systems Using a Radiant Energy Source.
   b. 258, Test Method for Specific Density of Smoke Generated by Solid Materials.

1.02 SUBMITTALS

A. Action Submittals:

1. Product data and installation instructions.
2. Samples:
   a. Two full-size tiles for each type and color of resilient flooring.
   b. Two 2-1/2-inch-wide strips of base material proposed for use.

B. Informational Submittals:

1. Manufacturer’s certificate of compliance.
2. Operation and Maintenance Data:
   a. As specified in Section 01 78 23, Operation and Maintenance Data.
   b. List of recommended maintenance products, methods, and procedures.

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1.03 DELIVERY, STORAGE, AND HANDLING

A. Store materials in original containers at not less than 70 degrees F ambient temperature for not less than 24 hours immediately before installation.

1.04 ENVIRONMENTAL REQUIREMENTS

A. Maintain ambient temperature in space to receive flooring between 70 degrees F and 90 degrees F for not less than 24 hours before and 48 hours after installation.

B. Maintain minimum temperature of 55 degrees F after flooring is installed, except as specified above.

1.05 EXTRA MATERIALS

A. Furnish additional floor covering materials from same production run as installed material at the rate of 45 square feet for each 1,000 square feet.

1.06 SEQUENCING AND SCHEDULING

A. Do not install floor coverings until concrete slab has cured for 60 days or until primer material in test patches cannot be scraped or peeled from the slab after drying 24 hours.

1.07 SPECIAL GUARANTEE

A. Product: Provide manufacturer’s extended guarantee or warranty, with Owner named as beneficiary, in writing, as Special Guarantee. Special Guarantee shall provide for correction or, at the option of the Owner, removal and replacement of materials found defective during a period of 5 years after the date of Substantial Completion. Duties and obligations for correction or removal and replacement of defective Work shall be as specified the General Conditions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Flooring products of the following manufacturers, meeting these Specifications, may be used on this Project:

1. Armstrong World Industries, Inc.
2. Congoleum Corp.
3. Forbo Flooring System.

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2.02 FLOOR COVERING MATERIALS

A. General: Furnish materials uniform in thickness and size with edges cut accurately and square; uniform color with variations in variegated patterns kept to a minimum.

B. Linoleum Tile (LINO):

1. Performance Requirements:
    a. Meet ASTM F2195.
    b. Static Coefficient of Friction: ASTM D2047.
    c. Static Load Limit: ASTM F970.
    d. Fire Performance:
        1) Flooring Radiant Panel: Class 1, rating per NFPA 253 (ASTM E648).
        2) Smoke Density: Less than 450 per NFPA 258 (ASTM E662).
1. Size: 13.11 inches by 13.11 inches.
2. Gauge: 0.10-inch.
3. Backing Material: Polyester.
4. Color: As indicated on Interior Finish Schedule and Color List on the Drawings.
5. Manufacturer and Product:
    a. (Basis of Design) Forbo Marmoleum; Modular Tile.
    b. “Or-equal.”

2.03 RESILIENT BASE

A. General: ASTM F1861, uniform in 0.125-inch thickness and in as long lengths as practicable to suit conditions of installation.

1. Factory premolded internal and external corners to match base when available.
2. Rubber Base: Type TP, Group 1.
3. Style: Straight.
4. 4 inches high.
5. Color: As indicated on Interior Finish Schedule and Color List on the Drawings.

B. Manufacturers:

1. Armstrong.
2. Johnsonite/Tarkett.
3. Roppe.

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2.04 ACCESSORIES

A. Trim: Furnish in lengths as long as practical to suit conditions of installation.

B. Reducers:

1. Standard rubber or vinyl floor reducer in thickness to suit abutting floor covering by 1-inch wide, tapered or beveled-edge strip.
2. Manufacturers and Products:
   a. Johnsonite; Reducer Series RRS.
   b. Mercer; 633 Tile Reducer.

C. Adhesive: Type and brands of adhesive as recommended by manufacturer of floor covering material for conditions of installation.

D. Primer and Filler: Type and brand recommended by floor covering manufacturer for conditions of installation.

E. Floor Filler:

1. Asphalt mastic as manufactured by:
   a. Armstrong, Lancaster, PA.
   b. “Or-equal.”

F. Concrete underlayment as manufactured by:

1. Ardex Inc., Coraopolis, PA; Ardex K-55.
2. “Or-equal.”

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrate for excessive moisture content and unevenness preventing execution and quality of resilient flooring as specified.

B. Correct defects before installation of resilient flooring.

3.02 PREPARATION

A. Remove dirt, oil, grease, or other foreign matter from surfaces to receive floor covering materials.

B. Fill cracks less than 1/16-inch wide and depression less than 1/8-inch deep with floor filler.

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C. Prime sanded wood surfaces with one brush coat of primer.

D. Prime surfaces, other than wood, if recommended by floor covering manufacturer.

3.03 APPLICATION OF ADHESIVES

A. Mix and apply adhesives in accordance with manufacturer's instructions.

B. Provide safety precautions during mixing and applications as recommended by adhesive manufacturer.

C. Apply uniformly over surfaces:

1. Cover only amount of area that can be covered by flooring material within recommended working time of adhesive.
2. Remove any adhesive that dries or films over.
3. Do not soil walls, bases, or adjacent areas with adhesives.
4. Promptly remove any spillage.

D. Apply adhesives with notched trowel or other suitable tool.

E. Clean trowel and rework notches as necessary to ensure proper application of adhesive.

3.04 INSTALLATION OF TILE MATERIALS

A. Start tile at center of room or space; work toward perimeter.

B. Do not lay tile less than half the width of a field tile except where accepted by Engineer for irregularly shaped rooms or spaces.

C. Cut border tile neatly and accurately to fit within 1/64 inch of abutting surfaces.

D. Use reducer edge strip at exposed tile edges.

E. Fit flooring material neatly and tightly into breaks and recesses, against bases, around pipes and penetrations, under saddles or thresholds, and around permanent cabinets and equipment.

F. Lay tile parallel to room axis in straight courses with cross joints parallel. Lay tile with grain or pattern running in same direction between adjacent tile.

G. Roll flooring with 75-pound to 100-pound roller in both directions.

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3.05 INSTALLATION OF BASE

A. General: Remove defects in wall and floor that would prevent level and true installation of base material.

1. Install base around perimeter of room or space, where shown, and at toe spaces of casework and cabinets.
2. Unroll base material and cut into accurate lengths as desired or as required for minimum number of joints.
3. Match edges at seams or double cut adjoining lengths to give continuous appearance.
4. Install with tight butt joints with no joint widths greater than 1/64-inch.

B. Base:

1. Apply adhesive and firmly adhere to wall surfaces.
2. Press down so bottom cove edge follows floor profile.
3. Ensure top and bottom edges of base are in firm contact with walls and floors.
4. Form internal and external corners by using premolded corners. Other methods, acceptable to Engineer, may be used if premolded corners are not available.
5. Scribe base accurately to abutting materials.

3.06 INSTALLATION OF TRIM MATERIALS

A. Provide reducers where floor covering terminates exposing edge of covering.

B. Center reducer under door, where floor covering terminates at a door opening. Fit end edges to door frames and abutting surfaces and other edges to adjoining materials.

C. Apply adhesives and bond securely to substrates in straight true lines. Meet visible and related features of building construction with a maximum deviation of 1/8-inch in 10 feet.

3.07 CLEANING AND PROTECTION

A. Upon completion of the installation of floor covering and adjacent work, and after materials have set, clean surfaces with a neutral cleaner as recommended by manufacturer for type of floor covering material installed.

B. Repair adjacent surfaces damaged by flooring installation.

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C. Wax Finishing:

1. Provide wax, cleaner, or other finishing material as recommended by floor covering manufacturer for the particular type of flooring material.
2. Apply one coat of nonslip wax or other finish as recommended by floor covering manufacturer; buff to a sheen.

D. Protect completed work from traffic and damage until Substantial Completion by covering with plastic sheet, kraft paper, or plywood panels.

3.08 INSTALLATION SCHEDULE

A. Areas to receive resilient flooring and base are indicated in Interior Finish Schedule on the Drawings.

END OF SECTION

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SECTION 09 90 00
PAINTING AND COATING

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Water Works Association (AWWA):
   a. C203, Coal-Tar Protective Coatings and Linings for Steel Water Pipelines—Enamel and Tape—Hot-Applied.
   b. C209, Cold-Applied Tape Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Water Pipelines.
   c. C213, Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines.
   d. C214, Tape Coating Systems for the Exterior of Steel Water Pipelines.
2. Environmental Protection Agency (EPA).
3. NACE International (NACE): SP0188, Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates.
4. NSF International (NSF): 61, Drinking Water System Components-Health Effects.
5. Occupational Safety and Health Act (OSHA).
6. Research Council on Structural Connections (RCSC): Specification for Structural Joints using High-Strength Bolts.
7. The Society for Protective Coatings (SSPC):
   a. PA 2, Procedure for Determining Conformance to Dry Coating Thickness Requirements.
   b. PA 10, Guide to Safety and Health Requirements for Industrial Painting Projects.
   c. SP 1, Solvent Cleaning.
   d. SP 2, Hand Tool Cleaning.
   e. SP 3, Power Tool Cleaning.
   f. SP 5, White Metal Blast Cleaning.
   g. SP 6, Commercial Blast Cleaning.
   h. SP 7, Joint Surface Preparation Standard Brush-Off Blast Cleaning.
   i. SP 10, Near-White Blast Cleaning.
   j. SP 11, Power Tool Cleaning to Bare Metal.
   k. SP 16, Brush-Off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals.

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l. SP 13, Surface Preparation of Concrete.
m. Guide 15, Field Methods for Retrieval and Analysis of Soluble Salts on Steel and Other Nonporous Substrates.

1.02 DEFINITIONS

A. Terms used in this section:

1. Coverage: Total minimum dry film thickness in mils or square feet per gallon.
2. FRP: Fiberglass Reinforced Plastic.
3. HCl: Hydrochloric Acid.
4. MDFT: Minimum Dry Film Thickness, mils.
5. MDFTPC: Minimum Dry Film Thickness per Coat, mils.
6. Mil: Thousandth of an inch.
7. PPDS: Paint Product Data Sheet.
8. PSDS: Paint System Data Sheet.
9. PVC: Polyvinyl Chloride.
10. SFPG: Square Feet per Gallon.
11. SFPGPC: Square Feet per Gallon per Coat.
12. SP: Surface Preparation.

1.03 SUBMITTALS

A. Action Submittals:

1. Shop Drawings:
   a. Data Sheets:
      1) For each product, furnish a Paint Product Data Sheet (PPDS), the manufacturer’s technical data sheets, and paint colors available (where applicable). The PPDS form is appended to the end of this section.
      2) For each paint system, furnish a Paint System Data Sheet (PSDS). The PSDS form is appended to the end of this section.
      3) Technical and performance information that demonstrates compliance with specification.
      4) Furnish copies of paint system submittals to the coating applicator.
      5) Indiscriminate submittal of only manufacturer’s literature is not acceptable.
   b. Detailed chemical and gradation analysis for each proposed abrasive material.

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2. Samples:
    a. Proposed Abrasive Materials: Minimum 5-pound sample for each type.
    b. Reference Panel:
        1) Surface Preparation:
            a) Prior to start of surface preparation, furnish a 4-inch by 4-inch steel panel for each grade of sandblast specified herein, prepared to specified requirements.
            b) Provide panel representative of the steel used; prevent deterioration of surface quality.
            c) Panel to be reference source for inspection upon approval by Engineer.
        2) Paint:
            a) Unless otherwise specified, before painting work is started, prepare minimum 8-inch by 10-inch sample with type of paint and application specified on similar substrate to which paint is to be applied.
            b) Furnish additional samples as required until colors, finishes, and textures are approved.
            c) Approved samples to be the quality standard for final finishes.
3. Applicator's Qualification: List of references substantiating experience.
4. Factory Applied Coatings: Manufacturer's certification stating factory applied coating system meets or exceeds requirements specified.
5. Manufacturer's written verification that submitted material is suitable for the intended use.
6. If the manufacturer of finish coating differs from that of shop primer, provide finish coating manufacturer's written confirmation that materials are compatible.
7. Manufacturer's written instructions and special details for applying each type of paint.

B. Informational Submittals:

1. Coating manufacturer's Certificate of Compliance, in accordance with Section 01 43 33, Manufacturers' Field Services.
2. Coating for Faying Surfaces: Manufacturer's test results that show the proposed coating meets the slip resistance requirements of the AISC Specification for Structural Joints using ASTM A325 or ASTM A490 bolts.

1.04 QUALITY ASSURANCE

A. Applicator Qualifications: Minimum 5 years' experience in application of specified products.

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B. Regulatory Requirements:

1. Meet federal, state, and local requirements limiting the emission of volatile organic compounds.
2. Perform surface preparation and painting in accordance with recommendations of the following:
   a. Paint manufacturer's instructions.
   b. SSPC PA 10.
   c. Federal, state, and local agencies having jurisdiction.

C. Mockup:

1. Before proceeding with Work under this section, finish one complete space or item of each color scheme required showing selected colors, finish texture, materials, quality of work, and special details.
2. After Engineer approval, sample spaces or items shall serve as a standard for similar work throughout the Project.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Shipping:

1. Where precoated items are to be shipped to the Site, protect coating from damage. Batten coated items to prevent abrasion.
2. Protect shop painted surfaces during shipment and handling by suitable provisions including padding, blocking, and use of canvas or nylon slings.

B. Storage:

1. Store products in a protected area that is heated or cooled to maintain temperatures within the range recommended by paint manufacturer.
2. Primed surfaces shall not be exposed to weather for more than 2 months before being topcoated, or less time if recommended by coating manufacturer.

1.06 PROJECT CONDITIONS

A. Environmental Requirements:

1. Do not apply paint in temperatures or moisture conditions outside of manufacturer's recommended maximum or minimum allowable.
2. Do not perform final abrasive blast cleaning whenever relative humidity exceeds 85 percent, or whenever surface temperature is less than 5 degrees F above dew point of ambient air.

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PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Nationally recognized manufacturers of paints and protective coatings who are regularly engaged in the production of such materials for essentially identical service conditions.

B. Minimum of 5 years' verifiable experience in manufacture of specified product.

C. Each of the following manufacturers is capable of supplying most of the products specified herein:

1. Sherwin Williams.
2. Tnemec.
3. PPG.
4. Carboline.
5. International.

2.02 ABRASIVE MATERIALS

A. Select abrasive type and size to produce surface profile that meets coating manufacturer's recommendations for specific primer and coating system to be applied.

2.03 PAINT MATERIALS

A. General:

1. Manufacturer's highest quality products suitable for intended service.
2. Compatibility: Only compatible materials from a single manufacturer shall be used in the Work. Particular attention shall be directed to compatibility of primers and finish coats.
3. Thinners, Cleaners, Driers, and Other Additives: As recommended by coating manufacturer.

B. Products:

Product	Definition
Acrylic Latex	Single-component, finish as required
Acrylic Latex (Flat)	Flat latex
Acrylic Sealer	Clear acrylic
Alkyd (Semigloss)	Semigloss alkyd

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Product	Definition
Alkyd Enamel	Optimum quality, gloss or semigloss finish as required, medium long oil
Bituminous Paint	Single-component, coal-tar pitch based
Coal-Tar Epoxy	Amine, polyamide, or phenolic epoxy type 70 percent volume solids minimum, suitable for immersion service
Epoxy Filler/Surfacer	100 percent solids epoxy trowel grade filler and surfacer, nonshrinking, suitable for application to concrete and masonry. Approved for potable water contact and conforming to NSF 61, where required
Epoxy Nonskid (Aggregated)	Polyamidoamine or amine converted epoxies aggregated; aggregate may be packaged separately
Epoxy Primer—Ferrous Metal	Anticorrosive, converted epoxy primer containing rust-inhibitive pigments
Epoxy Primer—Other	Epoxy primer, high-build, as recommended by coating manufacturer for specific galvanized metal, copper, or nonferrous metal alloy to be coated
Fusion Bonded Coating	100% solids, thermosetting, fusion bonded, dry powder epoxy, suitable for the intended service
TFE Lube or Grease Lube	Tetrafluoroethylene, liquid coating, or open gear grease as supplied by McMaster-Carr Supply Corporation, Elmhurst, IL
High Build Epoxy	Polyamidoamine epoxy, minimum 69 percent volume solids, capability of 4 MDFT to 8 MDFT per coat
Latex Primer Sealer	Waterborne vinyl acrylic primer/sealer for interior gypsum board and plaster. Capable of providing uniform seal and suitable for use with specified finish coats
NSF Epoxy	Polyamidoamine epoxy, approved for potable water contact and conforming to NSF 61
Epoxy, High Solids	Polyamidoamine epoxy, 80 percent volume solids, minimum, suitable for immersion service
Polyurethane Enamel	Two-component, aliphatic or acrylic based polyurethane; high gloss finish

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Product	Definition
Organic Zinc Rich Primer	Epoxy or moisture cured urethane with 85 percent zinc content in the dry film, meeting the requirements of RCSC Specification for Structural Joints using High Strength Bolts, Class A or Class B, as required.
Water Base Epoxy	Two-component, polyamide epoxy emulsion, finish as required

2.04 MIXING

A. Multiple-Component Coatings:

1. Prepare using each component as packaged by paint manufacturer.
2. No partial batches will be permitted.
3. Do not use multiple-component coatings that have been mixed beyond their pot life.
4. Furnish small quantity kits for touchup painting and for painting other small areas.
5. Mix only components specified and furnished by paint manufacturer.
6. Do not intermix additional components for reasons of color or otherwise, even within the same generic type of coating.

B. Colors: Formulate paints with colorants free of lead, lead compounds, or other materials that might be affected by presence of hydrogen sulfide or other gas likely to be present at Site.

2.05 SHOP FINISHES

A. Shop Blast Cleaning: Reference Paragraph Shop Coating Requirements.

B. Surface Preparation: Provide Engineer minimum 7 days' advance notice to start of shop surface preparation work and coating application work.

C. Shop Coating Requirements:

1. When required by equipment specifications, such equipment shall be primed and finish coated in shop by manufacturer and touched up in field with identical material after installation.

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2. Where manufacturer's standard coating is not suitable for intended service condition, Engineer may approve use of a tie-coat to be used between manufacturer's standard coating and specified field finish. In such cases, tie-coat shall be surface tolerant epoxy as recommended by manufacturer of specified field finish coat. Coordinate details of equipment manufacturer's standard coating with field coating manufacturer.

D. Pipe:

1. Ductile Iron Pipe:
   a. Use SSPC standards as a guide for desired prepared surface. Follow recommendations of pipe and coating manufacturers for means and methods to achieve SSPC-equivalent surface.
   b. The surface preparation and application of the primer shall be performed by pipe manufacturer.
   c. For high performance (epoxy) coatings, follow additional recommendations of pipe and coating manufacturers.
   d. Prior to blast cleaning, grind smooth surface imperfections, including, but not limited to delaminating metal or oxide layers.
2. Steel Pipe:
   a. Surface preparation and application of primer shall be performed by pipe manufacturer.
   b. For pipe with epoxy lining, do not place end cap seals until pipe lining material has sufficiently dried.

PART 3 EXECUTION

3.01 GENERAL

A. Provide Engineer minimum 7 days' advance notice to start of field surface preparation work and coating application work.

B. Perform the Work only in presence of Engineer, unless Engineer grants prior approval to perform the Work in Engineer's absence.

C. Schedule inspection of cleaned surfaces and all coats prior to succeeding coat in advance with Engineer.

3.02 EXAMINATION

A. Factory Finished Items:

1. Schedule inspection with Engineer before repairing damaged factory-finished items delivered to Site.

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2. Repair abraded or otherwise damaged areas on factory-finished items as recommended by coating manufacturer. Carefully blend repaired areas into original finish. If required to match colors, provide full finish coat in field.

B. Surface Preparation Verification: Inspect and provide substrate surfaces prepared in accordance with these Specifications and printed directions and recommendations of paint manufacturer whose product is to be applied. The more stringent requirements shall apply.

3.03 PROTECTION OF ITEMS NOT TO BE PAINTED

A. Remove, mask, or otherwise protect hardware, lighting fixtures, switchplates, aluminum surfaces, machined surfaces, couplings, shafts, bearings, nameplates on machinery, and other surfaces not specified elsewhere to be painted.

B. Provide drop cloths to prevent paint materials from falling on or marring adjacent surfaces.

C. Protect working parts of mechanical and electrical equipment from damage during surface preparation and painting process.

D. Mask openings in motors to prevent paint and other materials from entering.

E. Protect surfaces adjacent to or downwind of Work area from overspray.

3.04 SURFACE PREPARATION

A. Field Abrasive Blasting:

1. Perform blasting for items and equipment where specified and as required to restore damaged surfaces previously shop or field blasted and primed or coated.
2. Refer to coating systems for degree of abrasive blasting required.
3. Where the specified degree of surface preparation differs from manufacturer’s recommendations, the more stringent shall apply.

B. Surface Contamination Testing:

1. A surface contamination analysis test shall be performed every 500 square feet by means of a Chlor Test CSN Salts or approved equivalent.
2. Surface with chloride levels exceeding 3 µg/square centimeter for submerged surfaces and 5 µg/square centimeter for exposed surfaces

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shall be treated with a liquid soluble salt remover equivalent to CHLOR*RID (CHLOR*RID International, Chandler, AZ).

3. Follow manufacturer's recommendations and procedures for the use of this product to remove the surface contamination.

C. Metal Surface Preparation:

1. Where indicated, meet requirements of SSPC Specifications summarized below:
   a. SP 1, Solvent Cleaning: Removal of visible oil, grease, soil, drawing and cutting compounds, and other soluble contaminants by cleaning with solvent.
   b. SP 2, Hand Tool Cleaning: Removal of loose rust, loose mill scale, loose paint, and other loose detrimental foreign matter, using nonpower hand tools.
   c. SP 3, Power Tool Cleaning: Removal of loose rust, loose mill scale, loose paint, and other loose detrimental foreign matter, using power-assisted hand tools.
   d. SP 5, White Metal Blast Cleaning: Removal of visible oil, grease, dust, dirt, mill scale, rust, coatings, oxides, corrosion products, and other foreign matter by blast cleaning.
   e. SP 6, Commercial Blast Cleaning: Removal of visible oil, grease, dust, dirt, mill scale, rust, coatings, oxides, corrosion products, and other foreign matter, except for random staining limited to no more than 33 percent of each unit area of surface which may consist of light shadows, slight streaks, or minor discolorations caused by stains of rust, stains of mill scale, or stains of previously applied coatings.
   f. SP 7, Brush-Off Blast Cleaning: Removal of visible rust, oil, grease, soil, dust, loose mill scale, loose rust, and loose coatings. Tightly adherent mill scale, rust, and coating may remain on surface.
   g. SP 10, Near-White Blast Cleaning: Removal of visible oil, grease, dust, dirt, mill scale, rust, coatings, oxides, corrosion products, and other foreign matter, except for random staining limited to no more than 5 percent of each unit area of surface which may consist of light shadows, slight streaks, or minor discolorations caused by stains of rust, stains of mill scale, or stains of previously applied coatings.
   h. SP 11, Power Tool Cleaning to Bare Metal: Removal of visible oil, grease, dirt, dust, mill scale, rust, paint, oxide, corrosion products, and other foreign matter using power-assisted hand tools capable of producing suitable surface profile. Slight residues of rust and paint may be left in lower portion of pits if original surface is pitted.

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i. SP-16, Brush Blasting of Non-Ferrous Metals: A brush-off blast cleaned non-ferrous metal surface, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, metal oxides (corrosion products), and other foreign matter. Intact, tightly adherent coating is permitted to remain. A coating is considered tightly adherent if it cannot be removed by lifting with a dull putty knife. Bare metal substrates shall have a minimum profile of 19 micrometers (0.75 mil).

2. The words “solvent cleaning,” “hand tool cleaning,” “wire brushing,” and “blast cleaning,” or similar words of equal intent in these Specifications or in paint manufacturer’s specification refer to the applicable SSPC Specification.
3. Where OSHA or EPA regulations preclude standard abrasive blast cleaning, wet or vacu-blast methods may be required. Coating manufacturers’ recommendations for wet blast additives and first coat application shall apply.
4. Ductile Iron Pipe Supplied with Asphaltic Varnish Finish: Remove asphaltic varnish finish prior to performing specified surface preparation.
5. Hand tool clean areas that cannot be cleaned by power tool cleaning.
6. Round or chamfer sharp edges and grind smooth burrs, jagged edges, and surface defects.
7. Welds and Adjacent Areas:
   a. Prepare such that there is:
      1) No undercutting or reverse ridges on weld bead.
      2) No weld spatter on or adjacent to weld or any area to be painted.
      3) No sharp peaks or ridges along weld bead.
   b. Grind embedded pieces of electrode or wire flush with adjacent surface of weld bead.
8. Preblast Cleaning Requirements:
   a. Remove oil, grease, welding fluxes, and other surface contaminants prior to blast cleaning.
   b. Cleaning Methods: Steam, open flame, hot water, or cold water with appropriate detergent additives followed with clean water rinsing.
   c. Clean small isolated areas as above or solvent clean with suitable solvent and clean cloth.
9. Blast Cleaning Requirements:
   a. Type of Equipment and Speed of Travel: Design to obtain specified degree of cleanliness. Minimum surface preparation is as specified herein and takes precedence over coating manufacturer’s recommendations.

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b. Select type and size of abrasive to produce surface profile that meets coating manufacturer's recommendations for particular primer to be used.
c. Use only dry blast cleaning methods.
d. Do not reuse abrasive, except for designed recyclable systems.
e. Meet applicable federal, state, and local air pollution and environmental control regulations for blast cleaning, confined space entry (if required), and disposition of spent aggregate and debris.

10. Post-Blast Cleaning and Other Cleaning Requirements:
    a. Clean surfaces of dust and residual particles from cleaning operations by dry (no oil or water vapor) air blast cleaning or other method prior to painting. Vacuum clean enclosed areas and other areas where dust settling is a problem and wipe with a tack cloth.
    b. Paint surfaces the same day they are blasted. Reblast surfaces that have started to rust before they are painted.

D. Galvanized Metal, Copper, and Nonferrous Metal Alloy Surface Preparation:

1. Remove soil, cement spatter, and other surface dirt with appropriate hand or power tools.
2. Remove passive film with solvent cleaning or brush blast in accordance with SSPC SP 16.
3. Obtain and follow coating manufacturer's recommendations for additional preparation that may be required.

E. Concrete Surface Preparation:

1. Do not begin until 30 days after concrete has been placed.
2. Meet requirements of SSPC SP 13.
3. Remove grease, oil, dirt, salts or other chemicals, loose materials, or other foreign matter by solvent, detergent, or other suitable cleaning methods.
4. Brush-off blast clean to remove loose concrete and laitance, and provide a tooth for binding. Upon approval by Engineer, surface may be cleaned by acid etching method. Approval is subject to producing desired profile equivalent to No. 80 grit flint sandpaper. Acid etching of vertical or overhead surfaces shall not be allowed.
5. Secure coating manufacturer's recommendations for additional preparation, if required, for excessive bug holes exposed after blasting.
6. Unless otherwise required for proper adhesion, ensure surfaces are dry prior to painting.

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F. Plastic and FRP Surface Preparation:

1. Hand sand plastic surfaces to be coated with medium grit sandpaper to provide tooth for coating system.
2. Large areas may be power sanded or brush-off blasted, provided sufficient controls are employed so surface is roughened without removing excess material.

G. Masonry Surface Preparation:

1. Complete and cure masonry construction for 14 days or more before starting surface preparation work.
2. Remove oil, grease, dirt, salts or other chemicals, loose materials, or other foreign matter by solvent, detergent washing, or other suitable cleaning methods.
3. Clean masonry surfaces of mortar and grout spillage and other surface deposits using one of the following:
    a. Nonmetallic fiber brushes and commercial muriatic acid followed by rinsing with clean water.
    b. Brush-off blasting.
    c. Water blasting.
4. Do not damage masonry mortar joints or adjacent surfaces.
5. Leave surfaces clean and, unless otherwise required for proper adhesion, dry prior to painting.
6. Masonry Surfaces to be Painted: Uniform texture and free of surface imperfections that would impair intended finished appearance.
7. Masonry Surfaces to be Clear Coated: Free of discolorations and uniform in texture after cleaning.

H. Wood Surface Preparation:

1. Replace damaged wood surfaces or repair in a manner acceptable to Engineer prior to start of surface preparation.
2. Solvent clean (mineral spirits) knots and other resinous areas and coat with shellac or other knot sealer, prior to painting. Remove pitch by scraping and wipe clean with mineral spirits or turpentine prior to applying knot sealer.
3. Round sharp edges by light sanding prior to priming.
4. Filler:
    a. Synthetic-based wood putty approved by paint manufacturer for paint system.
    b. For natural finishes, color of wood putty shall match color of finished wood.
    c. Fill holes, cracks, and other surface irregularities flush with surrounding surface and sand smooth.

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d. Apply putty before or after prime coat, depending on compatibility and putty manufacturer's recommendations.
e. Use cellulose type putty for stained wood surfaces.

5. Ensure surfaces are clean and dry prior to painting.

I. Gypsum Board Surface Preparation: Typically, new gypsum board surfaces need no special preparation before painting.

1. Surface Finish: Dry, free of dust, dirt, powdery residue, grease, oil, or any other contaminants.

J. Existing Painted Surfaces to be Repainted Surface Preparation:

1. Detergent wash and freshwater rinse.
2. Clean loose, abraded, or damaged coatings to substrate by hand or power tool, SP 2 or SP 3.
3. Feather surrounding intact coating.
4. Apply one spot coat of specified primer to bare areas, overlapping prepared existing coating.
5. Apply one full finish coat of specified primer to entire surface.
6. If an aged, plural-component material is to be topcoated, contact coating manufacturer for additional surface preparation requirements.
7. Application of Cosmetic Coat:
   a. It is assumed that existing coatings have oxidized sufficiently to prevent lifting or peeling when overcoated with paints specified.
   b. Check compatibility by application to a small area prior to starting painting.
   c. If lifting or other problems occur, request disposition from Engineer.
8. Perform blasting as required to restore damaged surfaces. Materials, equipment, procedures shall meet requirements of SSPC.

3.05 SURFACE CLEANING

A. Brush-off Blast Cleaning:

1. Equipment, procedure, and degree of cleaning shall meet requirements of SSPC SP 7.
2. Abrasive: Either wet or dry blasting sand, grit, or nutshell.
3. Select various surface preparation parameters, such as size and hardness of abrasive, nozzle size, air pressure, and nozzle distance from surface such that surface is cleaned without pitting, chipping, or other damage.
4. Verify parameter selection by blast cleaning a trial area that will not be exposed to view.

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5. Engineer will review acceptable trial blast cleaned area and use area as a representative sample of surface preparation.
6. Repair or replace surface damaged by blast cleaning.

B. Acid Etching:

1. After precleaning, spread the following solution by brush or plastic sprinkling can: One part commercial muriatic acid reduced by two parts water by volume. Adding acid to water in these proportions gives an approximate 10 percent solution of HCl.
2. Application:
   a. Rate: Approximately 2 gallons per 100 square feet.
   b. Work acid solution into surface by hard-bristled brushes or brooms until complete wetting and coverage is obtained.
   c. Acid will react vigorously for a few minutes, during which time brushing shall be continued.
   d. After bubbling subsides (10 minutes), hose down remaining slurry with high pressure clean water.
   e. Rinse immediately to avoid formation on the surface of salts that are difficult to remove.
   f. Thoroughly rinse to remove any residual acid surface condition that may impair adhesion.
3. Ensure surface is completely dry before application of coating.
4. Apply acid etching to obtain a “grit sandpaper” surface profile. If not, repeat treatment.

C. Solvent Cleaning:

1. Consists of removal of foreign matter such as oil, grease, soil, drawing and cutting compounds, and any other surface contaminants by using solvents, emulsions, cleaning compounds, steam cleaning, or similar materials and methods that involve a solvent or cleaning action.
2. Meet requirements of SSPC SP 1.

3.06 APPLICATION

A. General:

1. The intention of these Specifications is for new, interior and exterior masonry, concrete, metal, and submerged metal surfaces to be painted, whether specifically mentioned or not, except as specified otherwise. Do not paint exterior concrete surfaces, unless specifically indicated.
2. Extent of Coating (Immersion): Coatings shall be applied to internal vessel and pipe surfaces, nozzle bores, flange gasket sealing surfaces, carbon steel internals, and stainless steel internals, unless otherwise specified.

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3. For coatings subject to immersion, obtain full cure for completed system. Consult coatings manufacturer's written instructions for these requirements. Do not immerse coating until completion of curing cycle.
4. Apply coatings in accordance with these Specifications and paint manufacturers' printed recommendations and special details. The more stringent requirements shall apply. Allow sufficient time between coats to assure thorough drying of previously applied paint.
5. Sand wood lightly between coats to achieve required finish.
6. Vacuum clean surfaces free of loose particles. Use tack cloth just prior to applying next coat.
7. Fusion Bonded Coatings Method Application: Electrostatic, fluidized bed, or flocking.
8. Coat units or surfaces to be bolted together or joined closely to structures or to one another prior to assembly or installation.
9. Water-Resistant Gypsum Board: Use only solvent type paints and coatings.
10. On pipelines, terminate coatings along pipe runs to 1inch inside pipe penetrations.
11. Keep paint materials sealed when not in use.
12. Where more than one coat is applied within a given system, alternate colors to provide a visual reference showing required number of coats have been applied.

B. Galvanized Metal, Copper, and Nonferrous Metal Alloys:

1. Concealed galvanized, copper, and nonferrous metal alloy surfaces (behind building panels or walls) do not require painting, unless specifically indicated herein.
2. Prepare surface and apply primer in accordance with System No. 10 specification.
3. Apply intermediate and finish coats of the coating system appropriate for the exposure.

C. Porous Surfaces, Such As Concrete and Masonry:

1. Filler/Surfacer: Use coating manufacturer's recommended product to fill air holes, bug holes, and other surface voids or defects.
2. Prime Coat: May be thinned to provide maximum penetration and adhesion.
    a. Type and Amount of Thinning: Determined by paint manufacturer and dependent on surface density and type of coating.
3. Surface Specified to Receive Water Base Coating: Damp, but free of running water, just prior to application of coating.

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D. Film Thickness and Coverage:

1. Number of Coats:
   a. Minimum required without regard to coating thickness.
   b. Additional coats may be required to obtain minimum required paint thickness, depending on method of application, differences in manufacturers' products, and atmospheric conditions.
2. Application Thickness:
   a. Do not exceed coating manufacturer's recommendations.
   b. Measure using a wet film thickness gauge to ensure proper coating thickness during application.
3. Film Thickness Measurements and Electrical Inspection of Coated Surfaces:
   a. Perform with properly calibrated instruments.
   b. Recoat and repair as necessary for compliance with specification.
   c. Coats are subject to inspection by Engineer and coating manufacturer's representative.
4. Visually inspect concrete, masonry, nonferrous metal, plastic, and wood surfaces to ensure proper and complete coverage has been attained.
5. Give particular attention to edges, angles, flanges, and other similar areas, where insufficient film thicknesses are likely to be present, and ensure proper millage in these areas.
6. Apply additional coats as required to achieve complete hiding of underlying coats. Hiding shall be so complete that additional coats would not increase the hiding.

3.07 PROTECTIVE COATINGS SYSTEMS AND APPLICATION SCHEDULE

A. Unless otherwise shown or specified, paint surfaces in accordance with the following application schedule. In the event of discrepancies or omissions in the following, request clarification from Engineer before starting work in question.

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B. System No. 2 Submerged Metal:

Surface Prep.	Paint Material	Min. Coats, Cover
SP 5, White Metal Blast Cleaning	Prime in accordance with manufacturer's recommendations	
	Coal-Tar Epoxy -OR- High Build Epoxy	2 coats, 16 MDFT 2 coats, 16 MDFT

1. Use on the following items or areas:
   a. Metal surfaces below a plane 1-foot above maximum liquid surface, metal surfaces above maximum liquid surface that are a part of immersed equipment, concrete embedded surfaces of metallic items, such as wall pipes, pipes, pipe sleeves, access manholes, gate guides and thimbles, and structural steel, and the following specific surfaces:
      1) Interior surfaces of steel piping noted in the Piping Schedule.
      2) Bare ferrous metal piping and pumps inside scum collection.

C. System No. 4 Exposed Metal – Outdoor or Washdown Areas:

Surface Prep.	Paint Material	Min. Coats, Cover
SP 10, Near-White Blast Cleaning	Epoxy Primer—Ferrous Metal	1 coat, 4 MDFT
	High Build Epoxy	1 coat, 4 MDFT
	Polyurethane Enamel	1 coat, 3 MDFT

1. Use on the following items or areas:
   a. Exposed metal surfaces, located outside of structures and exposed to weather, except where otherwise shown or specified.
   b. Piping and pipe appurtenances in Outdoor and Washdown environments as designated in Material Selection Table.
   c. As indicated on Architectural Schedules on the Drawings.
   d. For painted signage on concrete wall inside sludge tank, provide the prime coat and intermediate coat, two coats of epoxy. Polyurethane finish coat not required.

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D. System No. 5 Exposed Metal—Indoor Wet or Dry Areas:

Surface Prep.	Paint Material	Min. Coats, Cover
SP 10, Near-White Blast Cleaning	High Build Epoxy	1 coat, 6 MDFT
	Polyurethane Enamel	1 coat, 3 MDFT

1. Use on the following items or areas:
   a. Exposed metal surfaces, located inside of structures, except where otherwise shown or specified.
   b. Piping, pipe appurtenances, structural framing in outdoor environments as designated Material Selection Table.
   c. As required in the Material Selection Table for System 5 and duplex coating system. Duplex shall receive primer coat per system No 10 if required by coating manufacturer.
   d. As indicated on Architectural Schedules on the Drawings.
   e. Primary Framing of metal buildings as specified in Section 13 34 19, Metal Building Systems.
      1) For Primary Framing, provide tie-coat as needed for field finish coats if required by coating manufacturer for finish coats. Fully coat bolts, primer and finish coat after erection.
   f. Miscellaneous metals and fasteners not specified to be coated elsewhere.

E. System No. 7 Concrete Encased Metal:

Surface Prep.	Paint Material	Min. Coats, Cover
SP 6, Commercial Blast Cleaning	Coal-Tar Epoxy -OR-	2 coats, 16 MDFT
	High Build Epoxy	2 coats, 16 MDFT

1. Use on the following items or areas:
   a. Use on concrete encased ferrous metals including wall pipes, pipe sleeves, access manholes, gate guides, and thimbles; and the following specific surfaces:
      1) Concrete encased ductile iron.

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F. System No. 8 Buried Metal—General:

Surface Prep.	Paint Material	Min. Coats, Cover
SP 10, Near-White Blast Cleaning	Coal-Tar Epoxy -OR- High Build Epoxy	2 coats, 16 MDFT
	Petrolatum Wax Tape Note 2.	AWWA C217

1. Use on the following items or areas:
   a. Buried, belowgrade portions of steel items and ductile iron that do not have a factory supplied coating.
2. For fasteners, metallic pipe fittings, and valves, provide petrolatum wax tape in the field after installation.
3. Fusion bonded epoxy per System No. 29 may be used in lieu of System No. 8 for buried metal.
4. Buried stainless or copper pipe: apply 20 mil PVC tape with 50 percent overlap.

G. System No. 10 Galvanized Metal, Copper, and Nonferrous Metal Alloy Conditioning:

Surface Prep.	Paint Material	Min. Coats, Cover
In accordance with Paragraph Galvanized Metal, Copper, and Nonferrous Metal Alloy Surface Preparation	Epoxy Primer—Other	As recommended by coating manufacturer Remaining coats as required for exposure

1. Use on the following items or areas:
   a. Galvanized surfaces requiring painting.
   b. As indicated on Architectural Schedules on the Drawings.
   c. After application of System No. 10, apply finish coats as required for exposure.

H. System No. 11 Faying Surfaces of Slip Critical Bolted Connections:

Surface Prep.	Paint Material	Min. Coats, Cover
SP 10, Near-White Blast Cleaning	Organic Zinc Rich Primer	1 coat, 3 MDFT

1. Use on faying surfaces of slip critical joints as specified and as shown on the Drawings.

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2. Provide primer in accordance with RCSC Specification for Structural Joints using High-Strength Bolts.

I. System No. 21 Skid-Resistant—Concrete:

Surface Prep.	Paint Material	Min. Coats, Cover
In accordance with Paragraph Concrete Surface Preparation	Epoxy Nonskid (Aggregated)	1 coat, 160 SFPG

1. Use on the following items or areas:
   a. Polymer storage area.

J. System No. 25 Exposed FRP, PVC:

Surface Prep.	Paint Material	Min. Coats, Cover
In accordance with Paragraph Plastic and FRP Surface Preparation	Acrylic Latex Semigloss	2 coats, 320 SFPGPC

1. Use on the following items or areas:
   a. All exposed-to-view PVC and CPVC surfaces, and FRP surfaces without integral UV-resistant gel coat.

K. System No. 27 Aluminum and Dissimilar Metal Insulation:

Surface Prep.	Paint Material	Min. Coats, Cover
Solvent Clean (SP 1)	Prime in accordance with manufacturer's recommendations	
	Bituminous Paint -OR- High Build Epoxy	1 coat, 10 MDFT

1. Use on aluminum surfaces embedded or in contact with concrete and the following items or areas:
   a. Use for dissimilar metal connections where dielectric pads or washers cannot be used.

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L. System No. 29 Fusion Bonded Coating:

Surface Prep.	Paint Material	Min. Coats, Cover
SP 10, Near-White Blast Cleaning	Fusion Bonded Coating 100 percent Solids Epoxy	1 or 2 coats, 7 MDFT

1. For steel pipe and fittings, meet all requirements of AWWA C213.
2. Use on the following items:
   a. Metal fittings in any exposure: buried, submerged, exposed.

M. System No. 29A Fusion Bonded, Steel Dowel Coating:

Surface Prep.	Paint Material	Min. Coats, Cover
SP 10, Near-White Blast Cleaning	Fusion Bonded Coating 100 percent Solids Epoxy	1 or 2 coats, 7 MDFT
TFE Lube, Shop Applied; Grease Lube Alternative, Field Applied Just Prior to Installation	TFE Lube or Grease Lube	1 coat, as required

1. Use on steel expansion joint dowels as specified in Section 03 15 00, Concrete Joints and Accessories.

3.08 ARCHITECTURAL PAINT SYSTEMS AND APPLICATION SCHEDULE

A. Unless otherwise shown or specified, paint surfaces in accordance with the following application schedule. In the event of discrepancies or omissions in the following, request clarification from Engineer before starting work in question.

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B. System No. 106 Galvanized Metal:

Surface Prep.	Paint Material	Min. Coats, Cover
In accordance with Paragraph Galvanized Metal, Copper, and Nonferrous Metal Alloy Surface Preparation	Manufacturer's Recommended Primer	1 coat, as recommended by manufacturer
	Alkyd Enamel (Semigloss)	2 coats, 4 MDFT

1. Use on the following items or areas:
   a. As indicated on Architectural Schedules on the Drawings.

C. System No. 115 Gypsum Board and Plaster, Semigloss:

Surface Prep.	Paint Material	Min. Coats, Cover
In accordance with Paragraph Gypsum Board Surface Preparation	Latex Primer/Sealer	1 coat, 350 SFPG
	Acrylic Latex (Semigloss) or Alkyd (Semigloss)	2 coats, 400 SFPGPC

1. Use on the following items or areas:
   a. As indicated on Architectural Schedules on the Drawings.

D. System No. 116 Gypsum Board and Plaster, Gloss Epoxy:

Surface Prep.	Paint Material	Min. Coats, Cover
In accordance with Paragraph Gypsum Board Surface Preparation	Manufacturer's Recommended Primer	1 coat, 350 SFPG
	Water Base Epoxy (Gloss)	1 coat, 250 SFPG

1. Use on the following items or areas:
   a. As indicated on Architectural Schedules on the Drawings.

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3.09 COLORS

A. Provide as shown in Architectural Schedules on the Drawings, shown for equipment and appurtenances and designated herein, and shown in Piping Schedule on the Drawings.

B. Proprietary identification of colors is for identification only. Selected manufacturer may supply matches.

C. Equipment Colors:

1. Equipment includes the machinery or vessel itself plus the structural supports and fasteners and attached electrical conduits.
2. Paint equipment and piping one color as selected.
3. Paint nonsubmerged portions of equipment the same color as the piping it serves, except as itemized below:
    a. Dangerous Parts of Equipment and Machinery: OSHA Orange.
    b. Fire Protection Equipment and Apparatus: OSHA Red.
    c. Radiation Hazards: OSHA Purple.
    d. Physical hazards in normal operating area and energy lockout devices, including, but not limited to, electrical disconnects for equipment and equipment isolation valves in air and liquid lines under pressure: OSHA Yellow.

D. Pipe Identification Painting:

1. Color code nonsubmerged metal piping, except electrical conduit. Paint fittings and valves the same color as pipe, except equipment isolation valves.
2. Pipe Color Coding: In accordance with Piping Schedule as shown on the Drawings.
3. On exposed stainless steel piping, apply color 24 inches in length along pipe axis at connections to equipment, valves, or branch fittings, at wall boundaries, and at intervals along piping not greater than 9 feet on center.
4. Pipe Supports: Painted light gray, as approved by Owner.
5. Fiberglass reinforced plastic (FRP) pipe, polyvinylidene fluoride (PVDF), and polyvinyl chloride (PVC) pipe located inside of buildings and enclosed structures will not require painting, except as noted or scheduled.

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3.10 FIELD QUALITY CONTROL

A. Testing Equipment:

1. Provide calibrated electronic type dry film thickness gauge to test coating thickness specified in mils.
2. Provide low-voltage wet sponge electrical holiday detector to test completed coating systems, 20 mils dry film thickness or less, except zinc primer, high-build elastomeric coatings, and galvanizing, for pinholes, holidays, and discontinuities, as manufactured by Tinker and Rasor, San Gabriel, CA, Model M-1.
3. Provide high-voltage spark tester to test completed coating systems in excess of 20 mils dry film thickness. Unit as recommended by coating manufacturer.

B. Testing:

1. Thickness and Continuity Testing:
   a. Measure coating thickness specified in mils with a magnetic type, dry film thickness gauge, in accordance with SSPC PA 2. Check each coat for correct millage. Do not make measurement before a minimum of 8 hours after application of coating.
   b. Holiday detect coatings 20 mils thick or less, except zinc primer and galvanizing, with low voltage wet sponge electrical holiday detector in accordance with NACE SP0188.
   c. Holiday detect coatings in excess of 20 mils dry with high voltage spark tester as recommended by coating manufacturer and in accordance with NACE SP0188.
   d. After repaired and recoated areas have dried sufficiently, retest each repaired area. Final tests may also be conducted by Engineer.

C. Inspection: Leave staging and lighting in place until Engineer has inspected surface or coating. Replace staging removed prior to approval by Engineer. Provide additional staging and lighting as requested by Engineer.

D. Unsatisfactory Application:

1. If item has an improper finish color or insufficient film thickness, clean surface and topcoat with specified paint material to obtain specified color and coverage. Obtain specific surface preparation information from coating manufacturer.
2. Evidence of runs, bridges, shiners, laps, or other imperfections is cause for rejection.
3. Repair defects in accordance with written recommendations of coating manufacturer.

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E. Damaged Coatings, Pinholes, and Holidays:

1. Hand or power sand visible areas of chipped, peeled, or abraded paint, and feather edges. Follow with primer and finish coat. Depending on extent of repair and appearance, a finish sanding and topcoat may be required.
2. Remove rust and contaminants from metal surface. Provide surface cleanliness and profile in accordance with surface preparation requirements for specified paint system.
3. Feather edges and repair in accordance with recommendations of paint manufacturer.
4. Apply finish coats, including touchup and damage-repair coats in a manner that will present a uniform texture and color-matched appearance.

3.11 MANUFACTURER'S SERVICES

A. In accordance with Section 01 43 33, Manufacturers' Field Services, coating manufacturer's representative shall be present at Site as follows:

1. On first day of application of any coating system.
2. A minimum of two additional Site inspection visits, each for a minimum of 4 hours, in order to provide Manufacturer's Certificate of Proper Installation.
3. As required to resolve field problems attributable to or associated with manufacturer's product.
4. To verify full cure of coating prior to coated surfaces being placed into immersion service.

3.12 CLEANUP

A. Place cloths and waste that might constitute a fire hazard in closed metal containers or destroy at end of each day.

B. Upon completion of the Work, remove staging, scaffolding, and containers from Site or destroy in a legal manner.

C. Remove paint spots, oil, or stains upon adjacent surfaces and floors and leave entire job clean.

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3.13 SUPPLEMENTS

A. The supplements listed below, following “End of Section,” are a part of this specification:

1. Paint System Data Sheet (PSDS).
2. Paint Product Data Sheet (PPDS).

END OF SECTION

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PAINT SYSTEM DATA SHEET (PSDS)

Complete this PSDS for each coating system, include all components of the system (surface preparation, primer, intermediate coats, and finish coats). Include all components of a given coating system on a single PSDS.

Paint System Number (from Spec.):		
Paint System Title (from Spec.):		
Coating Supplier:		
Representative:		
Surface Preparation:		
Paint Material (Generic)	**Product Name/Number (Proprietary)**	**Min. Coats, Coverage**

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PAINT PRODUCT DATA SHEET (PPDS)

Complete and attach manufacturer's Technical Data Sheet to this PPDS for each product submitted. Provide manufacturer's recommendations for the following parameters at temperature (F)/relative humidity:

Temperature/RH	50/50	70/30	90/25
Induction Time			
Pot Life			
Shelf Life			
Drying Time			
Curing Time			
Min. Recoat Time			
Max. Recoat Time			

Provide manufacturer's recommendations for the following:

Mixing Ratio: _____

Maximum Permissible Thinning: _____

Ambient Temperature Limitations: min.: _____ max.: _____

Surface Temperature Limitations: min.: _____ max.: _____

Surface Profile Requirements: min.: _____ max.: _____

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SECTION 10 14 00
SIGNAGE

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards that may be referenced in this section:

1. American Society of Mechanical Engineers (ASME): A13.1, Scheme for the Identification of Piping Systems.
2. ASTM International (ASTM): A53/A53M, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
3. International Code Council (ICC):
   a. A117.1, Accessible and Usable Buildings and Facilities.
   b. International Fire Code (IFC): Chapter 27, Hazardous Materials-General Provisions.
4. National Fire Protection Association (NFPA):
   a. 704, Standard System for the Identification of the Hazards of Materials for Emergency Response.
   b. HAZ-01, Fire Protection Guide to Hazardous Materials.
5. Occupational Safety and Health Act (OSHA).
6. U.S. Department of Transportation, Federal Highway Administration: Manual on Uniform Traffic Control Devices for Streets and Highways.

1.02 SUBMITTALS

A. Action Submittals:

1. Product Data: Manufacturer’s literature for items specified.
2. Shop Drawings:
   a. Signage: Drawings showing layouts, actual letter sizes and styles, sign and letter colors, sign finishes, and Project-specific mounting details for each required sign.
   b. Sign Layout Plan: Submit layout plan for each facility showing locations where scheduled signs are to be placed.
   c. Pipe Label Layout Plan: Submit layout plan for each facility showing sizes and locations where pipe labels are intended to be placed.
3. Samples: One full size for each type of nameplate, sign, and label specified.

B. Informational Submittals: Manufacturer’s installation instructions.

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PART 2 PRODUCTS

2.01 FACILITY ENTRANCE MARKER

A. Cast-in-Place Concrete: As detailed on the Drawings.

B. Individual Lettering and Numbers:

1. Cast aluminum with pegs for concealed raised mounting on concrete monument.
2. Dark bronze anodized finish, hand tool clean and sharp edges.
3. Lettering Style (Font): Helvetica medium, capitals, and numbers.
4. Message: Verify titles and address with Owner before submittal. Refer to detail on the Drawings.
5. Lettering and Size: Refer to detail on the Drawings.
6. Manufacturers:
   a. A.R.K. Ramos Architectural Signage Systems, Oklahoma City, OK.
   b. Gemini, Inc., Cannon Falls, MN.

C. Logo Plaques:

1. Porcelain enameled steel plaques, full color, sizes as shown on the Drawings, flush mounting on concrete surface.
2. Logo design provided by Owner.

2.02 BUILDING NAME SIGNS (TYPE 1)

A. Fabricated cast aluminum with studs for concealed raised mounting on concrete masonry units or insulated metal wall panels where applicable.

B. Finish: Polished No. 8.

C. Lettering Style: Helvetica medium, capitals.

D. Lettering Height: 12 inches.

E. Lettering Depth: 1-inch minimum.

F. Message: As indicated on the elevations. Verify with Owner before submittal.

G. Manufacturers:

1. A.R.K. Ramos Architectural Signage Systems, Oklahoma City, Ok.
2. Gemini, Inc., Cannon Falls, MN.
3. Impact Architectural Signs Inc., LaGrange, IL.

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2.03 BUILDING NAME SIGN (TYPE 2)

A. Material: Aluminum.

B. Size: 48 inches by 66 inches and minimum 1/4-inch thick.

C. Fasteners: Concealed mechanical fasteners and clip angle as shown on Details.

D. Lettering: Raised, 3 inches high and minimum 1/4-inch thick, concealed fastening.

1. Stainless steel (Type 316) individual letters.
2. Hand-tool, clean, and sharp, polished No. 8 finish.

E. Lettering Style:

1. Helvetica Medium, capitals and numbers, text as listed below:
   a. Composting Operations Building.

2.04 DOOR NAMEPLATES

A. Material: Plastic with square corners.

B. Thickness: 1/8 inch.

C. Height: 2 inches.

D. Finish: Nondirectional matte.

E. Background: Black.

F. Letters: Raised.

1. Size: 1 inch high.
2. Color: White.
3. Style: Helvetica Medium upper case.
4. Message Text: As shown on Door and Hardware Schedule on the Drawings.
5. Braille Text: Domed or rounded as required by ADA regulations, with 3/8-inch minimum clearance on all sides. Contracted (Grade 2).

G. Manufacturers and Products:

1. Best Sign Systems, Montrose, CO; Graphic Blast.
2. Andco Industries Corp., Greensboro, NC; 1400 series.

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2.05 PICTORIAL SYMBOLS

A. Material: Match door nameplates.

B. Conform to ICC A117.1, Section 703.5. Provide Braille text as required by ADA regulation.

C. Manufacturers and Products:

1. Best Sign Systems, Montrose, CO; Graphic Blast.
2. Andco Industries Corp., Greensboro, NC; 1400 series.

2.06 SIGN TYPES

A. Metal Sign (Type B):

1. Material: Baked enamel finished 20-gauge (minimum) steel or 18-gauge (minimum) aluminum signs.
2. Manufacturers:
   a. Seton Identification Products.
   b. Nutheme Illustrated Safety Co.

B. Fiberglass Sign (Type C):

1. Material: Three-ply laminated fiberglass, minimum 1/8 inch thick, with contrasting color core message layer between two clear weather-resistant surface layers.
2. Manufacturers:
   a. Best Sign Systems.
   b. Brady Signmark.

C. Traffic Sign (Type D): Painted aluminum reflectorized signs, standard design meeting requirements of U.S. Department of Transportation, Federal Highway Administration, Manual on Uniform Traffic Control Devices for Streets and Highways.

D. Exit Sign (Type G):

1. Material: Plastic, 1/8 inch minimum thickness.
2. Letters:
   a. 6 inches high, with 3/4 inch stroke.
   b. 2 inches wide, except for letter “I”, with spacing of 3/8 inch.
3. Colors: Red letters and direction arrows on white background.

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E. Painted Sign (Type F):

1. Stenciled.
2. Paint System No. 4 as specified in Section 09 90 00, Painting and Coating.

F. Hazardous Material Sign (Type H):

1. Conform to NFPA 704 and NFPA HAZ-01.
2. Material: Fiberglass 1/8 inch thick.
3. Background, Letters, and Numbers: Die-cut vinyl with pressure sensitive adhesive.
4. Manufacturers:
   a. Brady Signmark.
   b. Emed Co., Inc.

2.07 IDENTIFICATION LABELS

A. Pipe Labels:

1. Snap-on, reversible type with lettering and directional arrows, sized for outside diameter of pipe and insulation.
2. Provided with ties or straps for pipes of 6 inches and over diameter.
3. Designed to firmly grip pipe so labels remain fixed in vertical pipe runs.
4. Material: Heavy-duty vinyl or polyester, suitable for exterior use, long lasting, and resistance to moisture, grease, and oils.
5. Letters and Arrows: Black on OSHA safety yellow background.
6. Color Field and Letter Height: Meet ASME A13.1.
7. Message: Piping system name as indicated on Piping Schedule.
8. Manufacturers and Products:
   a. Brady Signmark; B-915 BradySnap-On and Strap-On Pipe Markers.
   b. Seton Identification Products; Ultra-mark Pipe Markers.

B. Equipment Labels:

1. Applies to equipment with assigned tag numbers, where specified.
2. Letters: Black bold face, 3/4 inch minimum high.
3. Background: OSHA safety yellow.
4. Materials:
   a. Aluminum or stainless steel with a baked-on finish suitable for use on wet, oily, exposed, abrasive, and corrosive areas.
   b. Fiberglass with encased lettering.
5. Furnish 1-inch margin with holes at each end of label, for mounting. On fiberglass labels, furnish grommets at each hole.

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6. Size:
    a. 2 inches minimum and 3 inches maximum high, by 14 inches minimum and 18 inches maximum long.
    b. Furnish same size base dimensions for all labels.
7. Message: Equipment names and tag numbers as used in sections where equipment is specified.
8. Manufacturers:
    a. Brady Signmark.
    b. Seton Identification Products.

2.08 ANCILLARY MATERIALS

A. Fasteners: Stainless steel screws or bolts of appropriate sizes.

B. Pipe Posts: 2-1/2-inch galvanized steel pipe meeting ASTM A53/A53M, Type S, Grade B.

C. Chain: Type 304 stainless steel, No. 16 single jack chain or No. 2 double loop coil chain.

PART 3 EXECUTION

3.01 INSTALLATION—GENERAL

A. In accordance with manufacturer's recommendations.

B. Mount securely, plumb, and level.

3.02 BUILDING NAME SIGNS

A. Mount with concealed mechanical fasteners and clip angle as shown on the Drawings. Locate where shown on the Drawings or as directed by Engineer.

3.03 DOOR NAMEPLATES AND PICTORIAL SYMBOLS

A. Attach to doors or walls adjacent to doors with Phillips head screws or self-sticking removable adhesive. See Door and Hardware Schedule on the Drawings for locations and messages.

B. Mount with bottom of lowest tactile character on sign 48 inches minimum above ground surface and bottom of highest tactile character on sign 60 inches maximum above ground surface in accordance with ICC A117.1, Section 703.4.

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3.04 SIGNS

A. General:

1. Fasten to walls or posts, or hang as scheduled.
2. Anchor in place for easy removal and reinstallation with ordinary hand tools.

B. Information, Exit, and Safety Signs:

1. Install facing traffic. Locate for high visibility with minimum restriction of working area around walkways and equipment.

C. Traffic Signs: Mount each sign on scheduled support using two 1/4-inch stainless steel bolts through sign and post. Install facing traffic at locations and in manner shown in U.S. Department of Transportation, Federal Highway Administration Manual on Uniform Traffic Control Devices for Streets and Highways.

D. Hazardous Material Sign:

1. Install where required by NFPA No. 704 and IFC, Chapter 27.
2. Install at entrances to spaces where hazardous materials are stored, dispensed, used, or handled, and on sides of stationary tanks.
3. Specific Materials:

Sign Schedule—Hazardous Material Signs

Mark	Material	Health Hazard (Blue)	Flammability Hazard (Red)	Instability Hazard (Yellow)	Special Hazard (White)	Location	Mounting Method	Height to Top
H-1	Polymer	0	0	0		Wall	Bolts	5'-6"

3.05 IDENTIFICATION LABELS

A. Pipe Labels:

1. Locate at connections to equipment, valves, or branching fittings at wall boundaries.
2. At intervals along piping not greater than 18 feet on center with at least one label applied to each exposed horizontal and vertical run of pipe.
3. At exposed piping not normally in view, such as above suspended ceilings and in closets and cabinets.
4. Supplementary Labels: Provide to Owner those listed on Piping Schedule that do not receive arrows.
5. Apply to pipe after painting in vicinity is complete, or as approved by Engineer.
6. Install in accordance with manufacturer’s instructions.

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B. Equipment Labels:

1. Locate and install on equipment or concrete equipment base.
2. Anchor to equipment or base for easy removal and replacement with ordinary hand tools.

3.06 SUPPLEMENT

A. The supplement listed below, following “End of Section,” is a part of this specification:

1. Sign Schedule: Tabulation of characteristics and mounting information for each sign on Project. Provide items as scheduled. Meet requirements of Occupational Safety and Health Act (OSHA).

END OF SECTION

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Sign Schedule

Sign								Lettering					
		Size			Mounting								
Sign Type[1]	Detail Reference[2]	Width	Height	Color	Location	Method	Height to Top	Height	Style	Color	Message	Faces	Other Requirements
C	1014-002	20"	14"	Yellow	Hanging	Chain	5'-6"	1" min.	Helvetica	Black	CAUTION Equipment Starts Automatically	1	Locate at all equipment that may start automatically (including but not limited to pumps)
C	1014-002	20"	14"	Yellow	Wall	Bolts	5'-6"	1" min.	Helvetica	Black	CAUTION Electrical Equipment Authorized Personnel Only	1	Provide at Electrical Room Door
C	1014-001	20"	14"	White	Wall	Bolts	3'-6"	1" min.	Helvetica	Black	DANGER Nonpotable Water Not for Drinking	1	Provide at interior W2 hose valves
B	1014-001	20"	14"	White	Pipe Post	Bolts	3'-6"	1" min.	Helvetica	Black	DANGER Nonpotable Water Not for Drinking	1	Provide at exterior W2 hose valves
H	1014-006	10" min.	10" min.	*	Wall	Screws	5'-6"	4"	Block	Black	*	1	*See format detail and Article Signs; provide at all locations where hazardous materials are stored and used

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Sign Schedule

Sign								Lettering					
		Size			Mounting								
Sign Type[1]	Detail Reference[2]	Width	Height	Color	Location	Method	Height to Top	Height	Style	Color	Message	Faces	Other Requirements
F	N/A	As required		N/A	Wall	Painted	As directed by Engineer	6" min.	Block	OSHA Safety Yellow	*Message to be confirmed by Owner before beginning work	1	Provide at CONC walls at Sludge Tank as directed by Engineer.

[1]Letters refer to Sign Types specified in this section.
[2]Numbers refer to Design Details that show sign layout.
[3]Verify requirements for this sign with Regulations in state where Project is located.

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SECTION 10 28 00
TOILET AND BATH ACCESSORIES

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. Americans with Disabilities Act (ADA).
2. National Fire Protection Association (NFPA): 701, Standard Methods of Fire Tests for Flame Propagation of Textiles and Films.

1.02 DESIGN REQUIREMENTS

A. Design grab bars, shower seats, and attachments to resist minimum 250-pound (0.22-kN) concentrated load applied at any point in any direction.

1.03 SUBMITTALS

A. Action Submittals:

1. Product Data:
   a. Manufacturer’s literature clearly indicating:
      1) Engineer’s identification mark, size, and description of components.
      2) Base material with surface finish inside and out.
      3) Hardware and locks and attachment devices.
   b. Shop Drawings:
      1) Description of rough-in framing.
      2) Details of blocking and anchorage required.
      3) Mounting height to operable parts, demonstrate compliance with ADA.

B. Informational Submittals:

1. Distributor’s List: List of local distributors for supplies required for accessories installed.
2. Cleaning instructions.

1.04 QUALITY ASSURANCE

A. Flame Resistant Fabric: Passes when tested in accordance with NFPA 701, Test 1 or Test 2.

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PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Materials and products specified in this section shall be products of:

1. Bobrick Washroom Equipment, Inc.
2. Bradley Corp.

2.02 TOILET AND BATH ACCESSORIES

A. Furnish accessory items listed where indicated by mark or note on the Drawings.

Item	Mark	Bobrick	Bradley
Surf. Mounted Dual Roll Toilet Paper Dispenser	TPD-1	No. B-2740	No. 5241-50
Wall Mounted Liquid Soap Dispenser	SD-2	No. B-4112	No. 6542
Mirror, Size on the Drawings	MIR	No. B-290	No. 780
Recessed Paper Towel Dispenser and Receptacle	PTD-1	No. B-3944	No. 234
Surf. Mounted Paper Towel Dispenser	PTD-2	No. B-262	No. 250-15
Surf. Mounted Napkin Disposal	ND	No. B-270	No. 4781-15
Recessed Seat Cover Dispenser	SCD-1	No. B-301	No. 584
Mop and Broom Holder (24")	M&BH	No. B-223 x 24	No. 9953
Robe Hook	RH	No. B-6727	No. 9124
Grab Bars (straight) (36")	GB-1	No. B-6806-36	No. 812-001-36
Grab Bars (straight) (42")	GB-2	No. B-6806-42	No. 812-001-42
Grab Bars (straight), 18" for Vertical Mounting	GB-3	No. B-6806-18	No. 812-001-18
Grab Bars (shower, corner type)	GB-6	No. B-6861	No. 812-036 /037 Modified (15"x30")
Towel Bar (24")	TB	No. B-6737x24	No. 9054
Recessed Soap Dish	SD	No. B-4380	
Shower Curtain Rod	SCR	No. B-207	No. 9538

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Item	Mark	Bobrick	Bradley
Flame Resistant and Antibacterial Shower Curtain with Hooks	SC	No. B-204-2/204-1	No. 9537/9536
Fold-Up Shower Seat (L-shaped)	SHS	No. B-518/517	No. 956/9561

B. Finish:

1. Satin stainless steel.
2. Manufacturer’s or brand name on face of units is not acceptable.

C. Anchors: Furnish anchors, fasteners, or other devices necessary for a complete, secure installation.

1. Fasteners: Tamper-proof screws or bolts.

D. Supplies: Furnish fill supplies, such as paper goods, soap, and napkins, as recommended by accessory manufacturer.

PART 3 EXECUTION

3.01 PREPARATION

A. Coordinate support framing and backing as necessary for proper installation of accessories.

B. Coordinate the Work with placement of internal wall reinforcement and to receive anchor attachments.

3.02 INSTALLATION

A. Mounting Heights and Locations: Locate where mark is shown on the Drawings at height required by accessibility regulations and as indicated on the Drawings. Coordinate installation of accessories such that collocated accessories are maintained at an accessible position.

B. Follow manufacturer’s instruction and recommendations.

C. Install and securely anchor accessories in their proper locations, plumb and level, and without distortion.

D. Remove protective masking and clean surfaces, leaving them free of soil and imperfections.

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E. Fill units with necessary supplies within 10 days before Substantial Completion.

F. Deliver to Owner keys and devices required to fill and service units.

3.03 CLEANING

A. Clean and repair existing toilet accessories which remain or are to be reinstalled.

END OF SECTION

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SECTION 10 44 00
FIRE PROTECTION SPECIALTIES AND SAFETY EQUIPMENT

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. Factory Mutual (FM).
2. National Fire Protection Association (NFPA):
   a. 10, Standard for Portable Fire Extinguishers.
   b. 30, Flammable and Combustible Liquids Code.
3. Occupational Safety and Health Administration (OSHA).
4. UL: Fire Protection Equipment Directory.

1.02 PERFORMANCE REQUIREMENTS

A. Conform to NFPA 10 and 2018 International Building Code (IBC).

B. Provide extinguishers classified and labeled by UL for purpose specified and indicated.

C. Provide fire rated fire extinguisher cabinets classified and labeled by UL for purpose specified and indicated.

1.03 SUBMITTALS

A. Action Submittals:

1. Shop Drawings:
   a. Fire Extinguisher and Extinguisher Cabinet Layout Plan: Submit layout plan for each facility showing types, sizes, and locations where scheduled fire extinguishers and extinguisher cabinets are to be placed.
   b. Fire Extinguishers: Manufacturer’s product data for each item, including sizes, ratings, UL listings, color and finish, operational features, or other certifications, and mounting information.
   c. Extinguisher Cabinets: Indicate type of cabinet, cabinet physical dimensions, rough-in measurements for semi-recessed cabinets, wall bracket mounted measurements, location, mounting methods and anchorage details, relationship of cabinet box and trim to surrounding construction, door type and hardware, trim style, and panel style.
   d. Product Data: Submit for all other specified items.

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B. Informational Submittals:

1. Manufacturer’s Installation Instructions:
   a. Special criteria and wall opening coordination requirements.
   b. Manufacturer’s installation details for fire-rated cabinets.
2. Operation and Maintenance Data: Submit test, refill or recharge schedules and recertification requirements.

1.04 ENVIRONMENTAL REQUIREMENTS

A. Section 01 61 00, Common Product Requirements: Environmental conditions affecting products onsite.

B. Do not install extinguishers when ambient temperatures are capable of freezing extinguisher ingredients.

PART 2 PRODUCTS

2.01 PORTABLE FIRE EXTINGUISHERS

A. Manufacturers:

1. JL Industries.
2. Larsen’s Manufacturing Co.
3. Nystrom Products Co.

B. General:

1. Conform to NFPA 10 for fire extinguishers.
2. Furnish fire extinguishers and cabinets from one manufacturer.
3. UL listed, charged and ready for service.

C. Multipurpose Hand Extinguisher (F. Ext-1):

1. Tri-class dry chemical extinguishing agent.
2. Pressurized, red enameled steel shell cylinder.
3. Activated by top squeeze handle.
4. Agent propelled through hose or opening at top of unit.
5. For use on A, B, and C class fires.
6. Minimum UL Rating: 4A-60B:C, 10-pound capacity.

D. Carbon Dioxide Hand Extinguisher (F. Ext-2):

1. Carbon dioxide.
2. Pressurized, red enameled steel shell cylinder.
3. Activated by top squeeze handle.
4. Agent propelled through hose and spreader nozzle.

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5. For use on B and C class fires.
6. Minimum UL Rating: 10B:C, 15-pound capacity.

2.02 FIRE EXTINGUISHER CABINETS

A. Semi-Recessed Fire Extinguisher Cabinet (FEC):

1. Door and Trim Construction: No. 4 stainless steel. Flush cabinet door with continuous hinge.
2. Trim Style: Semi-recessed with rolled edge; 4-inch maximum projection from face of finished wall including handle. Rough opening depth no greater than 3-5/8 inches.
3. Tub: Constructed of cold rolled steel with white powder coat finish.
4. Door Style: Glazed with clear acrylic and provided with manufacturer's safety cam lock design.
5. Manufacturers and Products:
   a. JL Industries; Ambassador 1017 G10.
   b. Larsen's Manufacturing Co.; Architectural Series Model 2409-6R.

2.03 FIRST-AID CABINETS AND SUPPLIES (FAC)

A. Manufacturers:

1. Afassco, Inc.
2. Johnson & Johnson.
3. Zee Medical Products Co., Inc.

B. Cases:

1. Enameled metal or break-resistant plastic.
2. Carrying handles.
3. Made to hang on wall.

C. Supplies: Quantities to serve 10 people.

2.04 ACCESSORIES

A. Extinguisher Brackets: For hand extinguishers not located in cabinets, furnish heavy-duty, formed steel with white enamel finished brackets with clip-together strap for wall mounting.

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B. Graphic Identification: Provide graphic identification marking for each fire extinguisher type. OSHA approved pictorial markings to indicate the extinguisher uses and nonuses on a single label.

C. Fasteners: Furnish necessary screws, bolts, brackets, and other fastenings of suitable type and size to secure items of fire and safety equipment in position.

1. Metal expansion shields for machine screws at concrete.
2. Interior: Rust-resistant.
3. Exterior: Stainless steel.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify cabinets are correctly sized for fire extinguisher type.

B. Verify rough openings for cabinet are correctly sized and located.

3.02 INSTALLATION

A. Install where indicated or directed and in accordance with manufacturer's recommendations.

B. Install cabinets plumb and level in wall openings.

C. Secure cabinets and brackets rigidly to structure.

D. Provide adequate backing for mounting surfaces.

E. Place extinguishers and accessories in cabinets or on wall brackets as indicated on the Drawings.

F. Position cabinet signage as required by authorities having jurisdiction.

3.03 PORTABLE FIRE EXTINGUISHERS AND CABINETS

A. Provide at locations shown or as directed by Engineer.

B. Mount hangers or wall brackets securely in position, following manufacturer's recommendations.

C. Install wall brackets and cabinets so that top of fire extinguisher and cabinet handle is maximum 48 inches from finished floor.

D. Fire-Rated Cabinets: Install in accordance with cabinet manufacturer's requirements and details.

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3.04 FIRST-AID CABINETS AND SUPPLIES (FAC)

A. Provide at locations shown on the Drawings or as directed by Engineer. Mount with top no higher than 48 inches above finished floor.

END OF SECTION

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SECTION 10 51 00
LOCKERS

PART 1 GENERAL

1.01 SUBMITTALS

A. Action Submittals:

1. Shop Drawings: Provide plan, section and elevation drawings showing proposed locker, including accessible locker, and bench installation.
2. Manufacturer’s literature describing products proposed for use.
3. Samples:
   a. Color charts illustrating colors available.
   b. Two samples, each 2-inch by 3-inch minimum size, in selected color for final color verification.

B. Informational Submittals:

1. Anchorage and bracing calculations as required by Section 01 88 15, Anchorage and Bracing.
2. Installation and anchorage instructions.

PART 2 PRODUCTS

2.01 LOCKERS

A. Type: Standard, single-tier, single-door type made of cold-rolled sheet metal.

1. Locker sides, backs, tops, bottoms, and shelves; minimum 24-gauge steel.
2. Doors and frames; minimum 16-gauge steel.

B. Size: 18 inches by 18 inches by 72 inches.

C. Top: 20-gauge flat top.

D. Bottom: Flat for mounting on raised base.

E. Doors: Standard, with louvers top and bottom.

F. Recess Trim: Manufacturer’s standard 18-gauge recess trim.

G. Filler Panels: Manufacturer’s standard, 24-gauge, to suit locker arrangement shown on the Drawings.

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H. Hinges and Door Strikes: Manufacturer’s standard continuous type.

I. Locks: Padlock attachment.

J. Shelves: One hat shelf with rolled front.

K. Coat Hooks: Three single-prong wall hooks in each compartment.

L. Number Plates: Noncorrosive with black numerals, numbered consecutively as indicated on the Drawings.

M. Finish: Powder-coat, over bonding and rust-resisting phosphate undercoat.

N. Color: As indicated in Interior Finish Schedule.

O. Provide one accessible compliant locker meeting requirements of 2018 International Building Code, Chapter 11. Standard locker items to be located to meet code requirements.

1. Handles: Located a maximum of 48 inches above finish floor and operable with one hand and shall not require tight grasping, pinching, or twisting of the wrist. The force required to activate the handle shall be 5 pounds maximum.
2. Storage and Hooks: Capable of being accessed within a reach limit of 15 inches to 48 inches above finish floor.

P. Anchor Bolts: Minimum 1/2-inch diameter (unless a larger minimum size is shown on the Drawings) Type 316 stainless steel; total number and final size as required by equipment manufacturer and by Contractor’s anchorage and bracing design per Section 01 88 15, Anchorage and Bracing. Anchor bolts shall be as specified in Section 05 50 00, Metal Fabrications.

Q. Manufacturers:

1. Lyon Workspace Products.
2. (Basis of Design) Penco Products, Inc.
3. Republic Storage Systems Company.

2.02 ACCESSIBLE LOCKER BENCH

A. Accessible in accordance with 2018 International Building Code, Chapter 11.

B. Tops:

1. High-density polyethylene (HDPE) formed under pressure into single component section, with homogenous color throughout.
2. 20 inches wide by minimum 1-1/2 inches thick by 42 inches long.

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3. Top of Bench Height: 17 inches above finish floor.
4. Manufacturer’s standard plastic sealer finish.
5. Color: As indicated on Finish Schedule and in Color List on the Drawings.

C. Pedestals:

1. Aluminum.
2. Heavy-duty tubes welded to top and bottom flanges.
3. Floor anchored. Anchor bolts minimum 1/2-inch diameter (unless a larger minimum size is shown on the Drawings) Type 316 stainless steel; total number and final size as required by equipment manufacturer and by Contractor’s anchorage and bracing design per Section 01 88 15, Anchorage and Bracing. Anchor bolts shall be as specified in Section 05 50 00, Metal Fabrications.
4. Spacing as recommended by manufacturer, but not to exceed 3 feet on center.
5. Finish and Color: Manufacturer’s standard finish; color as shown on the Drawings.

D. Manufacturers:

1. (Basis of Design) ASI, Inc.
2. Lyon Workspace Products.
3. School Lockers, Inc.

PART 3 EXECUTION

3.01 LOCKER INSTALLATION

A. Securely attach to wall, base, and to each other as recommended by manufacturer. Accurately place anchor bolts using templates furnished by equipment manufacturer and as specified in Section 05 50 00, Metal Fabrications.

B. Align and level lockers with shims where necessary to compensate for irregularities in the base.

C. Install trim, adjust doors and latches for proper operation, and leave lockers level, plumb, neat, rigid, and free from soil and imperfections.

D. Locate ADA accessible locker where shown on the Drawings.

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3.02 ACCESSIBLE LOCKER BENCH INSTALLATION

A. Attach pedestals to top with fasteners supplied by manufacturer and secure to floor with anchors recommended by manufacturer. Accurately place anchor bolts using templates furnished by equipment manufacturer and as specified in Section 05 50 00, Metal Fabrications.

END OF SECTION

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SECTION 11 31 00
APPLIANCES

PART 1 GENERAL

1.01 SUBMITTALS

A. Action Submittals: Manufacturer's product data demonstrating compliance with specified requirements.

1. Manufacturer's literature including specifications, operating and cleaning instructions, and color chart. Identify each unit with Engineer's item number.

PART 2 PRODUCTS

2.01 MANUFACTURED UNITS

A. Refrigerator, A-1: Refrigerator with bottom freezer, no-frost, 18.6-cubic-foot capacity, with automatic ice maker, rollers, and energy saving feature.

1. Counter depth with french doors.
2. Maximum Size: 70 inches high, 33 inches wide, and 31 inches deep.
3. ENERGY STAR qualified.
4. Finish: As selected by Owner.
5. Americans with Disabilities Act (ADA), ICC A117.1 Compliant: Capable of being operable with one hand and not require tight grasping, pinching, or twisting of the writs. Required force of less than 5 pounds to activate.
6. Manufacturer and Product:
   a. General Electric; GWE19JSLSS.
   b. "Or-equal."

B. Microwave Oven, A-2: Countertop model with minimum 2.2 cubic-foot capacity, 1,100 watt cooking power, and turntable cooking system.

1. Approximate Size: 14 inches high by 24 inches wide by 20 inches deep.
2. ENERGY STAR qualified.
3. Finish: Stainless steel.
4. Americans with Disabilities Act (ADA), ICC A117.1 Compliant: Capable of being operable with one hand and not require tight grasping, pinching, or twisting of the writs. Required force of less than 5 pounds to activate.

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5. Manufacturer and Product:
    a. General Electric; PES7227SLSS.
    b. “Or-equal.”

C. Dishwasher, A-3: Undercounter dishwasher with three cycles.

1. Maximum Size: 32.5 inches high by 17.75 inches wide by 22.5 inches deep.
2. ENERGY STAR qualified.
3. Finish: As selected by Owner.
4. Americans with Disabilities Act (ADA), ICC A117.1 Compliant: Capable of being operable with one hand and not require tight grasping, pinching, or twisting of the writs. Required force of less than 5 pounds to activate.
5. Manufacturer and Product:
    a. General Electric; PDT145SSLSS.
    b. “Or-equal.”

PART 3 EXECUTION

3.01 INSTALLATION

A. Following manufacturers’ instructions and recommendations, install and connect appliances in the proper location and leave them ready for use.

B. Remove all protective maskings and clean surfaces, leaving them free of soil and imperfections.

END OF SECTION

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SECTION 11 82 30
PORTABLE TROMMEL SCREEN TRAILER

PART 1 GENERAL

1.01 SUMMARY

A. This section includes furnishing, delivering, and placing into service one new portable trommel screen trailer unit.

B. The screens work environment shall be similar to fertilizer plants, chemical industries, and agricultural facilities. The screen shall be a corrosion resistant configuration capable of long-term facility operations.

1.02 DEFINITIONS

A. Operational and Material Terms:

1. Aperture: The precise dimension and shape (e.g., square, round, hex) of the openings in the screen mesh.
2. Blinding: The clogging of screen apertures caused by wet, sticky material coating the holes.
3. Bulk Density: The mass of the material divided by its total volume, expressed in lbs/yd^3 or kg/m^3.
4. Fines: The undersized material that successfully falls through the drum apertures.
5. Moisture Content: The percentage of water weight contained within the raw processing material. This percentage is the inverse when compared to wastewater operations. Example: A 20 percent total solids in wastewater means that 80 percent of the mass is water weight.
6. Oversize (Overs): The material larger than the aperture size that exits through the end of the drum.
7. Pegging: The wedging of hard, jagged particles tightly into the screen apertures, blocking flow.

B. Performance and Mobility Terms:

1. Acceptance Test: The formal, onsite operational trial used to verify the machine meets all performance metrics before final payment.
2. Design Capacity: The maximum continuous production rate the unit is engineered to safely achieve.
3. Kingpin/Pintle Hook: The specific heavy-duty coupling device used to secure the trailer chassis to the towing vehicle.
4. Landing Gear: The adjustable, heavy-duty mechanical jacks used to support and level the trailer when unhitched.

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5. Throughput Capacity: The actual volume or weight of material processed by the unit per hour.

C. Screen Unit Component Terms:

1. Clearing Brush: A heavy-duty, rotating nylon brush mounted externally to clean the drum and prevent clogging.
2. Feed Hopper: The intake bin that receives raw material and regulates its flow into the drum.
3. Fines Conveyor: The discharge belt that collects and stockpiles material passing through the screen openings.
4. Infeed Conveyor: The variable-speed belt transferring raw material from the hopper into the drum.
5. Overs Conveyor: The discharge belt that collects and stockpiles material too large to pass through the screen.
6. Screen Mesh: The replaceable punch plate or woven wire media wrapped around the drum frame.
7. Trommel Drum: A rotating, cylindrical sieve that tumbles material to separate it by size.

1.03 SUBMITTALS

A. Action Submittals:

1. Manufacturer’s data, including the following:
   a. Catalog information with descriptive literature, specifications, and identification of materials of construction.
   b. Screen physical parameters including the drum size, total screening area, drive wheel construction, and ground-adjustable self-cleaning brush mechanisms.
   c. Screening capacity ratings including cubic yard of throughput volume.
   d. Product data sheets for the overall units configuration and layout.
   e. A list of spare parts required and supplied for the preventative maintenance service contract.

B. Informational Submittals:

1. Manufacturer’s Certificate of Compliance, in accordance with Section 01 61 00, Common Product Requirements.
2. Prior to delivery provide manufacturer’s instructions for materials requiring special shipping, storage, or handling requirements.
3. Routine maintenance requirements.
4. Suggested spare parts list to maintain the equipment in service for a period of 1 year and for 5 years. Include a list of special tools required for checking, testing, parts replacement, and maintenance.

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5. Operation and maintenance data as specified in Section 01 78 23, Operation and Maintenance Data.

1.04 QUALITY ASSURANCE

A. All equipment supplied under this specification must meet the performance criteria outlined herein. To satisfy quality assurance requirements, a vendor must either possess pre-approved status or successfully complete the post-delivery operational acceptance test.

B. Vendors who have successfully demonstrated their equipment during the buyer's official field trials prior to the release of this specification are granted pre-approved status.

C. An operational acceptance test shall operate the unit continuously for a minimum of 2 hours. The machine must maintain the target throughput capacity of define herein using the onsite material. Fines and oversize material streams shall be sampled to achieve a minimum 90 percent separation efficiency without excessive blinding or pegging.

D. The vendor is responsible for all costs associated with their technical staff during the test. The Owner shall supply the materials and loader operators.

E. The vendor shall coordinate with the Owner to ensure all operators and equipment maintenance staff are onsite during the operational acceptance test.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Loaders shall be packaged and shipped to the facility for possible temporary storage. Weatherproofing and sealing shall have a shrink wrap encapsulation with appropriate ventilation and access panels. Include any means required for temporary storage up to 18 months in an unprotected outdoor environment.

B. Deliver equipment fully assembled, serviced, and ready for operations.

C. Delivery and acceptance shall have an Owner, Owner’s Representative, or Engineer onsite prior to bill of lading, delivery acceptance, or similar being approved.

D. Delivery: In accordance with Section 01 61 00, Common Product Requirements.

1.06 WARRANTY

A. Provide a full manufacturer’s warranty covering the entire machine for a minimum period of 24 months or 3,000 operating hours, whichever occurs

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first, starting from the official date of machine commissioning at the Project Site.

B. Spare parts identified within this specification shall not be used to address warranty repairs.

C. Provide alternate proposal cost on the Proposal Form for manufacturer's extended guarantee or warranty, with Owner named as beneficiary, in writing, as special guarantee.

D. Provide alternate proposal costs for an extended warranty of 48 months or 6,000 operating hours in lieu of standard 24 months, 3,000 hours warranty.

1.07 MAINTENANCE AND SERVICE AGREEMENTS

A. The vendor must include a comprehensive, multi-year service agreement as a part of the equipment quote. This agreement must define the preventative maintenance schedule, repair response times, and technical support availability required to maintain the trommel screen trailer unit at peak operational efficiency.

B. The proposed service agreement must include scheduled preventative maintenance visits performed by factory-certified technicians at 250, 500, 750, 1,000, and 1,250 engine hour intervals. The agreement must cover all proprietary lubricants, hydraulic oils, and OEM filters required during these scheduled service intervals.

C. In the event of a breakdown, a qualified field service technician must arrive onsite within 48 hours of notification. Every service visit must also include a mandatory visual and mechanical inspection of the trommel drum, screen mesh, clearing brushes, and conveyor belts, followed by a detailed written condition report. The Owner shall monitor the equipment hour-meter, maintain operational logs, and notify the service representative when support is required.

D. The service agreement shall cover an initial term of 2 years from the date of final equipment acceptance.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturer and Product:

1. McCloskey International; Series 621 RE.
2. "Or-equal."

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2.02 SERVICE CONDITIONS

A. Material Type: Finished compost from a municipal wastewater treatment composting facility. Compost is produced from biosolids and woodchips.

B. Compost Bulk Density: 800 pounds to 900 pounds per cubic yard.

C. Compost Moisture Content: 30 percent to 50 percent (IE. 50 percent to 70 percent TS).

D. Operational Hours: 8 hours per day, 5 days per week.

E. Design Feed Rate: 80 cubic yards per hour.

F. Desired Screen Cut Size: 3/8-inch woven wire square mesh.

G. Environment: Outside, uncovered, high-moisture, and corrosive.

2.03 MATERIALS OF CONSTRUCTION

A. All screening unit materials of construction shall be suitable for a corrosive environment.

B. The drum shell construction shall be heavy-walled steel barrel frame.

C. The conveyor belting and components shall be heavy-duty, premium-grade multi-ply rubber. Three-ply or four-ply belts are appliable to the application and light-duty, two-ply or generic PVC belts are prohibited.

2.04 TROMMEL SCREEN UNIT

A. Heavy-duty, high-throughput mobile trommel screen integrated with a hydraulic radial conveyor and rapid-setup chassis.

B. The unit shall be configured on a heavy-duty wheeled chassis, complete with road-rated tires and an integrated ABS braking system to facilitate safe, compliant transport.

C. Unit Capacities:

1. Hydraulic Tank: 250 U.S. gallons.
2. Diesel Tank: 320 U.S. gallons.
3. Hopper Capacity: 6.5 cubic yards.

D. Physical Dimensions and Construction:

1. Engine: 170-hp, minimum.

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2. Maximum Loading Height: 10 feet 6 inches.
3. Conveyor Belt Sizes: 42-inch width for feed, fines, and radial conveyors. Integrated hydraulic folding stockpiling conveyors.
4. Trommel Drum:
    a. Dimensions: 6 feet by 21 feet.
    b. Screening Area: 296 square feet.
    c. Trommel Speed: Adjustable.
    d. Screen Mesh Size: 3/8 inch
5. Anti-Blinding Mechanism: Self-adjustable nylon drum cleaning brush.

2.05 SAFETY FEATURES

A. Standard safety features include external belt alignment mechanisms and remote grease banks to eliminate “live-machine” maintenance hazards, alongside comprehensive guarding of all pinch and nip points.

B. All critical bearing grease points are manifolded to centralized, ground-level access blocks. Operators never need to climb the chassis or remove guards for routine lubrication.

C. High-visibility, heavy-duty mesh guards fully enclose all rotating components, pulleys, and conveyor return idlers to prevent accidental entanglement.

D. Striking, mushroom-head E-stop buttons are strategically located at all primary operator stations, ground levels, and near the remote-control receiver.

E. An integrated siren and flashing beacon trigger a mandatory 10-second delay prior to any component movement, alerting nearby personnel.

F. To prevent catastrophic failure, the electronic control unit (ECU) monitors system vitals and triggers an immediate, automatic engine shutdown if any of the following occur:

    1. Low oil pressure, high-water temperature, air filter blockage, fuel contamination, or low hydraulic tank level.

2.06 SPARE PARTS

A. Provide the spare parts scheduled herein. In addition, the Contractor shall cross-reference the manufacturer’s operation and maintenance manual and include all additional parts, filters, gaskets, and hardware required to perform the specified preventative maintenance intervals.

B. The omission of a specific part or consumable from the written list in this specification does not relieve the Contractor from the obligation to provide it, if it is required by the manufacturer to complete the scheduled service.

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C. Review service agreement section. Provide a complete 2-year supply of factory-certified filter elements for the trommel screen unit including:

1. Four engine oil filter elements.
2. Four primary fuel filter elements/water separators.
3. Four secondary/main fuel filter elements.
4. Two outer and inner heavy-duty engine air cleaner elements.
5. Two hydraulic return line filter elements and high-pressure-line elements.
6. Two crankcase ventilation filters.
7. Hardware kit including drum tensioning bolts, mesh clamps, wedge kits, and all wearable hardware that would require replacement.
8. Consumables.

D. Coordinate with onsite staff for spare part storage location. The anticipated location for these components is in the maintenance building where the older sludge tank blower room equipment is removed in this Contract.

PART 3 EXECUTION

3.01 DELIVERY

A. In accordance with Section 01 61 00, Common Product Requirements.

B. Deliver unit to Site and store at a location approved by onsite personnel. The unit shall be tarp covered, wrapped, or protected from outside elements until composting facility startup has begun.

C. Upon delivery to the Site, coordinate with the Owner and onsite staff to the appropriate delivery location of the unit.

3.02 FIELD QUALITY CONTROL

A. Functional Test: Run trommel unit with Owner’s operators to demonstrate capabilities. This functional test shall take place once the composting facility is in startup or preliminarily operational.

3.03 MANUFACTURER’S SERVICES

A. See Section 01 43 33, Manufacturers’ Field Services, and Section 01 91 14, Equipment Testing and Facility Startup.

END OF SECTION

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SECTION 12 49 00
ROLLER SHADES

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American International (ASTM): G21, Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.
2. National Fire Protection Association (NFPA):
   a. 70, National Electrical Code.
   b. 701, Fire Tests for Flame-Resistant Textiles and Films.

1.02 SUBMITTALS

A. Action Submittals:

1. Product Data:
   a. Manufacturer’s data sheets on each product clearly marked for products used on this Project, including:
      1) Preparation instructions and recommendations.
      2) Styles, material descriptions, dimensions of individual components, profiles, features, finishes, and operating instructions.
      3) Storage and handling requirements and recommendations.
      4) Mounting details and installation methods.
2. Shop Drawings: Plans, elevations, sections, product details, installation details, operational clearances, and relationship to adjacent work.
   a. Window Treatment Schedule: For all roller shades. Use same room designations as indicated on the Drawings and include opening sizes and key to typical mounting details.
3. Color Samples: Shade cloth sample and aluminum finish sample as specified.

B. Informational Submittals:

1. Maintenance Data: Methods for maintaining roller shades, precautions regarding cleaning materials and methods, instructions for operating hardware and controls.
2. Warranty: Provide manufacturer’s sample warranty.

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1.03 QUALITY ASSURANCE

A. Manufacturer Qualifications: Obtain roller shades through one source from a single manufacturer with a minimum of 5 years' experience in manufacturing products comparable to those specified in this section.

B. Installer Qualifications: Installer trained and certified by the manufacturer with a minimum of 3 years' experience in installing products comparable to those specified in this section.

C. Fire-Test-Response Characteristics: Passes NFPA 701 small and large-scale vertical burn.

D. Anti-Microbial Characteristics: 'No Growth' in accordance with ASTM G21 results for fungi ATCC 9642, ATCC 9644, and ATCC 9645.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver shades in factory-labeled packages, marked with manufacturer and product name, fire-test-response characteristics, and location of installation using same room designations indicated on the Drawings and in the Window Schedule as shown on the Drawings.

1.05 PROJECT CONDITIONS

A. Environmental Limitations: Install roller shades after finish work including painting is complete and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1.06 WARRANTY

A. Roller Shade Hardware and Shade Cloth: Manufacturer's standard nondepreciating 25-year limited warranty.

B. Roller Shade Installation: 1-year from date of Substantial Completion.

PART 2 PRODUCTS

2.01 ROLLER SHADES

A. Manufacturers:

1. Basis of Design: MechoSystems.
2. "Or-equal."

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B. Applications:

1. Roller Shade Scope:
   a. Shade Type: Manual operating, chain drive, roller shades in exterior windows as scheduled.

C. Shade Cloth:

1. Visually Transparent Single-Fabric Shade Cloth: Single thickness, nonraveling 0.030-inch thick vinyl fabric, woven from 0.018-inch diameter extruded vinyl yarn consisting of 25 percent polyester and 75 percent PVC.
   a. Dense Basket Weave: 1500 series, 0 percent to 3 percent visually linear-weave pattern.
   b. Color: As shown in the Color List on the Drawings.
   c. Manufacturer and Product:
      1) Basis of Design: MechoSystems; ThermoVeil Group.
      2) “Or-equal.”

D. Shade Band: Construction of shade band includes the fabric, the hem weight, hem-pocket, shade roller tube, and the attachment of the shade band to the roller tube. Sewn hems and open hem pockets are not acceptable.

E. Shade Fabrication:

1. Fabricate units to completely fill openings from head to sill and jamb-to-jamb, unless specifically indicated otherwise.
2. Fabricate shade cloth to hang flat without buckling or distortion. Fabricate with heat-sealed trimmed edges to hang straight without curling or raveling. Fabricate unguided shade cloth to roll true and straight without shifting sideways more than 1/8-inch in either direction per 8 feet of shade height due to warp distortion or weave design. Fabricate hem using bottom hem weights.

2.02 ROLLER SHADE COMPONENTS

A. Access and Material Requirements:

1. Provide shade hardware allowing for the removal of shade roller tube from brackets without removing hardware from opening and without requiring end or center supports to be removed.
2. Provide shade hardware that allows for removal and remounting of the shade bands without having to remove the shade tube, drive, or operating support brackets.

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B. Manual Operated Chain Drive Hardware and Brackets:

1. Provide for universal, regular, and offset drive capacity, allowing drive chain to fall at front, rear or nonoffset for all shade drive end brackets. Universal offset shall be adjustable for future change.
2. Provide hardware capable for installation of a removable fascia, for both regular and/or reverse roll, which shall be installed without exposed fastening devices of any kind.
3. Provide shade hardware system that allows for removable regular and/or reverse roll fascias to be mounted continuously across two or more shade bands without requiring exposed fasteners of any kind.
4. Provide positive mechanical engagement of drive mechanism to shade roller tube. Friction fit connectors for drive mechanism connection to shade roller tube are not acceptable.
5. Provide shade hardware constructed of minimum 1/8-inch thick plated steel or heavier as required to support 150 percent of the full weight of each shade.
6. Drive Bracket/Brake Assembly:
   a. MechoShade Drive Bracket Model M5 shall be fully integrated with all MechoShade accessories, including, but not limited to SnapLoc fascia, room darkening side/sill channels, center supports and connectors for multi-banded shades.
   b. M5 drive sprocket and brake assembly shall rotate and be supported on a welded 3/8-inch (9.525-mm) steel pin.
   c. The brake shall be an overrunning clutch design, which disengages to 90 percent during the raising and lowering of a shade. The brake shall withstand a pull force of 50 pounds (22 kg) in the stopped position.
   d. The braking mechanism shall be applied to an oil-impregnated hub on to which the brake system is mounted. The oil impregnated hub design includes an articulated brake assembly, which assures a smooth, nonjerky operation in raising and lowering the shades. The assembly shall be permanently lubricated. Products that require externally applied lubrication and/or not permanently lubricated are not acceptable.
   e. The entire M5 assembly shall be fully mounted on the steel support bracket, and fully independent of the shade tube assembly, which may be removed and reinstalled without effecting the roller shade limit adjustments.
7. Drive Chain: No. 10 qualified stainless steel chain rated to 90-pound minimum breaking strength. Nickel plate chain shall not be accepted.

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2.03 ACCESSORIES

A. Fascia:

1. Continuous removable extruded aluminum fascia that attaches to shade mounting brackets without the use of adhesives, magnetic strips, or exposed fasteners.
2. Fascia shall fully conceal brackets, shade roller, and fabric on the tube.
3. Provide bracket/fascia end caps where mounting conditions expose outside of roller shade brackets.
4. Notching of fascia for manual chain not acceptable.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. Notify Engineer of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the Project conditions.

3.03 INSTALLATION

A. Install roller shades level, plumb, square, and true according to manufacturer's written instructions, and located so shade band is not closer than 2 inches to interior face of glass. Allow proper clearances for window operation hardware.

B. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

C. Clean roller shade surfaces after installation, according to manufacturer's written instructions.

3.04 TRAINING

A. Installer to train Owner's maintenance personnel to adjust, operate, and maintain roller shade systems.

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3.05 PROTECTION

A. Protect installed products until completion of Project.

B. Touch-up, repair, or replace damaged products before Substantial Completion.

3.06 INSTALLATION SCHEDULE

A. Install roller shades where indicated in Window Schedule as shown on the Drawings.

END OF SECTION

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SECTION 12 50 00
FURNITURE

PART 1 GENERAL

1.01 SUBMITTALS

A. Action Submittals:

1. List of items to be furnished, marked with Contract Document item numbers (for example, F-3).
2. Samples:
   a. Manufacturer’s color chart for initial color selection.
   b. One Sample each, 2 inches by 2 inches minimum, for finishes selected for final color verification.
   c. One Sample each, 2-inch by 5-inch dye lot fabric Sample each of fabrics selected for final color verification.

B. Informational Submittals: Manufacturer’s recommendations for care, cleaning, and maintenance of upholstery and wood finishes.

1.02 QUALITY ASSURANCE

A. Qualifications:

1. Fabricators and Installers: Experienced and regularly engaged in fabrication and installation of furniture.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Packing and Shipping:

1. Prepare and protect products for shipment in accordance with manufacturer’s recommendations and ship as follows:
   a. Each item tagged with Contract Document item number.

B. Delay delivery until construction operations are complete.

C. Carefully store and handle items of furniture until delivery to the Site can be made.

D. Preserve furniture in its original factory condition.

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PART 2 PRODUCTS

2.01 MANUFACTURERS' NAMES AND ADDRESSES

A. The following list of manufacturers is for convenience of Contractor and is not intended to be all-inclusive:

Name	Address
All-Steel, Inc.	Allsteel Drive Aurora, IL 60507 1-800/323-0112
Howe Furniture Corp.	12 Cambridge Dr. Trumbull, CT 06611 203/374-7833
KI, Krueger International	1300 Bellevue St. P.O. Box 8100 Green Bay, WI 54308-8100 414/468-8100
Steelcase, Inc.	901-44th St., SE Grand Rapids, MI 49508 616/247-2710 1-800/227-2960

2.02 FURNITURE AND ACCESSORIES

A. Desk, Double Pedestal (F-1):

1. Steelcase, Inc.; No. 32021.
   a. Size: 60 inches long by 30 inches wide by 29-3/8 inches high.
   b. Finish: As selected by Owner.
2. All-Steel, Inc.; No. 2001-127.
   a. Size: 60 inches long by 30 inches wide by 29 inches high.
   b. Finish: As selected by Owner.

B. Table (F-2):

1. Steelcase, Inc.; No. 3224.
   a. Size: 60 inches long by 30 inches wide by 29-3/8 inches high.
   b. Finish: As selected by Owner.
2. All-Steel, Inc., No. 2041-003.
   a. Size: 60 inches long by 30 inches wide by 29 inches high.
   b. Finish: As selected by Owner.

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C. Conference Table (F-3):

1. Howe Furniture Corp.; Tempest.
   a. Size: 96 inches long by 48 inches wide by 28-3/4 inches high.
   b. Finish: As selected by Owner.
2. KI; Tributaire Conference Table.
   a. Size: 96 inches long by 48 inches wide by 29 inches high.
   b. Finish: As selected by Owner.

D. Bookcase (F-4):

1. Steelcase, Inc.; No. 2294-T, with two adjustable shelves.
   a. Size: 36 inches wide by 15 inches deep by 42 inches high.
   b. Finish: As selected by Owner.
2. All-Steel, Inc.; No. 3475-100, with two adjustable shelves.
   a. Size: 36 inches wide by 12 inches deep by 42 inches high.
   b. Finish: As selected by Owner.

E. Desk Chair (F-5):

1. Steelcase, Inc.; No. 454-382M, with dual-wheel casters.
   a. Finish: As selected by Owner.
2. All-Steel, Inc.; No. 686-000, with dual-wheel casters.
   a. Finish: As selected by Owner.

F. Side Chair (F-6):

1. Steelcase, Inc.; No. 474-410M.
   a. Finish: As selected by Owner.
2. All-Steel, Inc.; No. 756-010.
   a. Finish: As selected by Owner.

G. Conference Armchair (F-7):

1. Steelcase, Inc.; FL-X Mesh Back.
   a. Finish: As selected by Owner.
2. All-Steel, Inc.; No. C613-800.
   a. Finish: As selected by Owner.

H. Conference Stack Chair (F-8):

1. Steelcase, Inc.; No. 472-410.
   a. Finish: As selected by Owner.
2. KI; MXU/-CH/U.
   a. Finish: As selected by Owner.

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PART 3 EXECUTION

3.01 PREPARATION

A. Examination: Ensure that construction work is complete, areas are clean, and relative humidity is below 60 percent.

B. Measure areas to be sure items will fit as shown. Notify Engineer if they do not.

C. Unpack each item and inspect for damage.

3.02 INSTALLATION

A. Place furniture and accessories in accordance with Floor Plan Drawings.

1. Flexibility in location related only to location of furnishings over or abutting telephone and electrical floor outlets.
2. Do not allow furniture items to rock when set in place.

B. Allow no telephone or electrical outlets in aisleways as a result of misplacement of furnishings. Inform Engineer of situation where such placement results in aisleways or path clearances less than 30 inches wide.

C. Remove protective masking and clean surfaces, leaving them free of soil and imperfections and ready for use.

3.03 INSPECTION

A. Inform Engineer at least 24 hours before furniture is ready to inspect.

B. Protect installed furniture until inspection and Substantial Completion.

END OF SECTION

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SECTION 13 34 19
METAL BUILDING SYSTEMS

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Architectural Manufacturers' Association (AAMA):
   a. 101, Standard Specifications for Windows, Doors, and Unit Skylights.
   b. 605, Voluntary Specification for High Performance Organic Coatings on Architectural Extrusions and Panels.
   c. 606.1, Voluntary Guide Specifications and Inspection Methods for Integral Color Anodic Finishes for Architectural Aluminum.
2. American Institute of Steel Construction (AISC):
   a. 360, Specification for Structural Steel Buildings.
   b. RCSC Specification for Structural Joints Using ASTM A325 or A490 Bolts.
   c. Design Guide 3: Serviceability Design Considerations for Steel Buildings.
3. American Iron and Steel Institute (AISI): Specification for the Design of Cold-Formed Steel Structural Members.
4. American Welding Society (AWS): D1.1/D1.1M, Structural Welding Code - Steel.
5. ASTM International (ASTM):
   a. A36/A36M, Standard Specification for Carbon Structural Steel.
   b. A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 pounds per square inch Tensile Strength.
   c. A325, Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
   d. A490/A490M, Standard Specification for Structural Bolts, Alloy Steel, Heat-Treated, 150 ksi Minimum Tensile Strength.
   e. A529/A529M, Standard Specification for High-Strength Carbon-Manganese Steel of Structural Quality.
   f. A572/A572M, Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.
   g. A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   h. A792/A792M, Standard Specification for Steel Sheet, 55 percent Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.

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i. A992/A992M, Standard Specification for Steel for Structural Shapes.
j. C991, Standard Specification for Flexible Fibrous Glass Insulation for Metal Buildings.
k. E84, Standard Test Method for Surface Burning Characteristics of Building Materials.
l. E96/E96M, Standard Test Methods for Water Vapor Transmission of Materials.
m. E2190, Standard Specification for Insulating Glass Unit Performance and Evaluation.
n. E1514, Standard Specification for Structural Standing Seam Steel Roof Panel Systems.
o. F1554, Standard Specification for Anchor Bolts, Steel, 36-ksi, 55-ksi, and 105-ksi Yield Strength.

6. International Accreditation Service, Inc. (IAS): Quality Certification Program.
7. International Code Council (ICC): International Building Code (IBC).
8. Metal Building Manufacturer's Association (MBMA): Metal Building Systems Manual.
9. Steel Door Institute (SDI): A250.8, Standard Steel Doors and Frames.
10. Steel Joist Institute (SJI):
    a. Standard Specifications and Load Tables:
        1) Open-Web Steel Joists, K-Series.
        2) Long Span Steel Joists, LH-Series, and Deep Long Span Steel Joists, DLH-Series.
        3) Super Longspan Steel Joists, SLH-Series.
        4) Joist Girders.
11. Recommended Code of Standard Practice for Steel Joists and Joist Girders.
12. UL: 580, Tests for Uplift Resistance of Roof Assemblies.

1.02 SYSTEM DESCRIPTION

A. Complete building package using manufacturer's standard components and components specified in other sections.

B. Primary Framing System: Clear span rigid frame or modular rigid frame supported with intermediate columns as shown on the Drawings

C. Lateral Support System in Longitudinal Direction: Cross bracing, and Portal frames located as shown on the Drawings.

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D. Include: Insulated metal wall and roof panels, sheet metal roof and wall panels as specified herein.

E. Include: Doors and other accessories as specified in other sections.

1.03 DESIGN REQUIREMENTS

A. Applicable Building Code: The 2018 International Building Code (IBC), as amended by the State of Oklahoma and local agencies.

B. Refer to design criteria on the Drawing General Structural Notes.

C. Minimum Roof Live Load: 20 pounds per square foot.

D. Building system dead load.

E. Mechanical and Electrical Equipment Loads:

1. Purlins and Secondary Framing: As indicated on the Drawings, minimum 5 pounds per square foot collateral load.
2. Primary Frames: As indicated on the Drawings, minimum 5 pounds per square foot collateral load.

F. Deflection Criteria:

1. In accordance with AISC Design Guide 3 recommendations. Conformance is required to deflection criteria as stated in the Appendix.
2. Applies to primary and secondary framing members, bracing members, roof panels, and wall cladding.

G. Design Standards:

1. AISC 360.
2. AISC RCSC Specification for Structural Joints Using ASTM A325 or ASTM A490 Bolts.
3. AISI Specification for the Design of Cold-Formed Steel Structural Members.
4. AWS D1.1/D1.1M.

H. Consider prying action of bolts for bolted moment-resistant connections in primary framing.

I. Design column bases as pinned, unless specifically indicated otherwise.

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1.04 CONTRACTOR/METAL BUILDING MANUFACTURER COORDINATION

A. Submit metal building Shop Drawings and obtain approval prior to forming foundation concrete or fabricating foundation reinforcing steel. Confirm size of concrete column pilasters for steel column baseplates and its associated anchor bolt template.

B. Verify interface of building components with foundation and coordinate required foundation revisions with Engineer.

1.05 SUBMITTALS

A. Action Submittals:

1. Shop Drawings:
    a. Manufacturer’s literature and technical data.
    b. Drawings Stamped by Designer:
        1) Drawings shall be specifically prepared for this Project.
        2) Mark out details that do not apply to Project.
        3) Show design load criteria, material specifications for framing members and connections, roof framing plan with dimensions and member sizes, baseplate details showing anchor bolt size and bolt layout, elevations of wall framing and bracing, instructions for temporary bracing, framing around roof and wall openings, details for joining and sealing of roof panels and wall cladding, and sections and details for all components and accessories.
    c. Anchorage and bracing drawings and catalog information, as required by Section 01 88 15, Anchorage and Bracing, for loads provided in Section 01 61 00, Common Product Requirements.
    d. Painting System: Specifications; include paint manufacturer’s name, product trade name, and preparation for shop and field coats.
2. Samples:
    a. Manufacturer’s standard color chart for initial color selection.
    b. Minimum 2-inch by 3-inch metal for final color verification.

B. Informational Submittals:

1. Structural Calculations Stamped by Designer:
    a. Complete analysis and design of structural components and connections in accordance with design requirements indicated.
    b. Summary of building column reactions to foundation level for load cases.
    c. Mark out calculations that do not apply to Project.

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2. Anchorage and bracing calculations as required by Section 01 88 15, Anchorage and Bracing, for loads provided in Section 01 61 00, Common Product Requirements. Submit with Action Submittal for the same item.
3. Manufacturer's written instructions for shipping, handling, storage, protection, and erection or installation of building and components.
4. Manufacturer:
   a. IAS Quality Certification: IAS certificate showing name and address of manufacturer, effective date, and category of certification.
5. Erector:
   a. IAS Quality Certification: IAS certificate showing name and address of erector, effective date, and category of certification, or, in lieu of IAS certification, documentation of past 5 years' experience record to include project name, location, date of completion, building manufacturer, and name and phone number of Owner's contact person.
   b. Certification of approval by manufacturer.
6. Manufacturer's Certificate of Proper Installation, in accordance with Section 01 43 33, Manufacturers' Field Services.

1.06 QUALITY ASSURANCE

A. Qualifications:

1. Designer: Registered professional engineer valid in same state as Project.
2. Manufacturer:
   a. IAS Quality Certification: Metal Building Systems (MB).
3. Erector:
   a. IAS Quality Certification as Certified Steel Erector (CSE), or 5 years of experience in erection of metal building systems in lieu of IAS certification.
   b. Approval by manufacturer.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect building components and accessories from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Deliver to Site with parts individually tagged.

C. Store on wood blocking or pallets, flat and off ground, to keep clean and to prevent damage or permanent distortion. Support bundles so there is no danger of tipping, sliding, rolling, shifting, or material damage. Cover with tarpaulins or other suitable weathertight ventilated covering.

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D. Protect finish of metal panels by application of removable plastic film or other suitable material placed between panels. Do not allow panels to come in contact with other material that would result in scratching, denting, staining or other damage to panel finish.

1.08 SPECIAL GUARANTEE

A. Furnish manufacturer's extended guarantee or warranty, with Owner named as beneficiary, in writing, as special guarantee. Special guarantee shall provide for correction, or at the option of Owner, removal and replacement of Work specified in this specification section found defective during a minimum period of 20 years and as stated below after date of Substantial Completion. Duties and obligations for correction or removal and replacement of defective Work as specified in the General Conditions.

B. Conditions:

1. Finish on metal roof, wall panels, flashing, and trim will not chalk, crack, check, blister, peel, flake, chip, or lose adhesion for 20 years.
2. Roofing will remain weathertight for 20 years.

PART 2 PRODUCTS

2.01 BUILDING SYSTEM MANUFACTURERS

A. Products manufactured or supplied by the following, and meeting these Specifications, may be used on this Project:

1. American Buildings Company, Columbus, GA.
2. Behlen Manufacturing Co., Columbus, NE.
3. Bigbee Steel Buildings, Inc., Muscle Shoals, AL.
4. Butler Manufacturing Co., Kansas City, MO.
5. CBC Steel Buildings, Lathrop, CA.
6. Ceco Corp., Columbus, MS.
7. Chief Industries, Inc., Rensselaer, IN.
8. Garco Building Systems, Airway Heights, WA.
9. Inland Buildings, Cullman, AL.
10. Kirby Building Systems, Inc., Columbus, GA.
11. NCI Building Systems, Inc., Houston, TX.
12. Nucor Building Systems, Waterloo, IN.
13. Ruffin Building Systems, Oak Grove, LA.
14. Star Building Systems, a Robertson Ceco Co., Oklahoma City, OK.
15. United Structures of America, Inc., Houston, TX.
16. Varco-Pruden Buildings, Memphis, TN.
17. Whirlwind Building Systems, Houston, TX.

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2.02 COMPONENTS

A. Structural Framing and Bracing:

1. Primary Framing: ASTM A36/A36M, ASTM A529/A529M, ASTM A572/A572M, or ASTM A992 with 3/16-inch minimum thickness and factory primer compatible with finish coating per System 5 in Section 09 90 00, Painting and Coating.
2. Open-Web Metal Joists: Factory primer compatible with finish coating per System 5 in Section 09 90 00, Painting and Coating.
3. Secondary Framing:
    a. Open Web Steel Joists:
        1) General: Design and fabricate steel joists and bridging to meet requirements of SJI Standard Specifications and Load Tables.
        2) Chord Members: Rolled double angle sections only.
        3) Factory primer in accordance with SJI Standard Specifications compatible with finish coating per System 5 in Section 09 90 00, Painting and Coating.
    b. Steel for cold-formed galvanized channel and z-sections shall be ASTM A653/A653M, Structural Steel (SS) Grade 33 or High-Strength Low-Alloy Steel (HSLAS) Grade 50 Type A or Type B, with G60 galvanized coating and minimum design thickness equal to 0.0346-inch. Field finish coat per System 5 in Section 09 90 00, Painting and Coating.
4. Bracing:
    a. ASTM A36/A36M or ASTM F1554, Grade 36, for threaded rod, or ASTM A36/A36M for rolled shapes.
    b. Do not use wire rope or cable for permanent bracing.
5. Bolted Connections:
    a. Primary Framing: ASTM A325 or ASTM A490/A490M high-strength bolted connections.
    b. Secondary Framing: ASTM A307 or ASTM A325.

B. Sheet Metal Roof and Wall Panels:

1. Material:
    a. ASTM A654/A653M or ASTM A792/A792M preformed ribbed steel panels, Grade 50, minimum.
    b. Minimum 24-gauge galvanized steel with roll-formed corrugations for structural stiffness and appearance.
    c. Exterior Finish: Factory-applied, 70 percent fluoropolymer coating, dry film thickness of 1.0 mil including primer, in color shown in the Exterior Finish Schedule on the Drawings.

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d. Interior Finish:
   1) Factory applied polyester, DFT 1.0 mil minimum.
   2) Field finish coating underside of sheet metal roof and interior side of wall panels per System 5 in Section 09 90 00, Painting and Coating.
   3) Color: White.

2. Standing Seam Sheet Metal Roofing:
   a. ASTM E1514 structural standing seam steel roof panel system.
   b. Standing Seam: Formed with vertical ribs at panel edges and two intermediate stiffening striations symmetrically spaced between vertical ribs designed for sequential field installation by mechanically attaching panels to supports using concealed clips located under one side of panel and engaging opposite edge of adjacent panels and mechanically seaming panels together.
   c. Panel Coverage: 24 inches.
   d. Panel Height: 3 inches.
   e. Tested and certified to meet UL 580, Class 90 wind uplift rating.
   f. Manufacturer and Product:
      1) Basis of Design: Nucor; CFR Standing Seam Roof Panel.
3. Sheet Metal Wall Panel System:
   a. One piece from eave to sill, with base trim at sill.
   b. 36-inch wide panels with 1-1/2-inch high vertical panel edges and intermediate stiffening ribs symmetrically spaced between panel edges with flush joints between panels.
   c. Manufacturer and Product:
      1) Basis of Design: Nucor; Classic Wall.

C. Insulated Metal Roof Panels:

1. Materials and Configuration: Factory-assembled insulated preformed metal panels with manufacturer’s standard concealed fasteners, tongue and groove interlock and standing seam system.
   a. Core: Insulating polyisocyanurate foam bonded to face sheets.
   b. Thickness: As required for thermal value specified.
   c. Thermal Value: Minimum R-Value of 20.
   d. Width: 42-inch maximum.
   e. Interior and Exterior Skin: 24-gauge, embossed sheet metal panels with minor ribs between 2-inch high standing seams meeting ASTM E72.
   f. Exterior Finish: Factory-applied, 70 percent fluoropolymer coating, dry film thickness of 1.0 mil including primer, in color shown in the Exterior Finish Schedule on the Drawings.
   g. Interior Finish: Factory applied polyester, DFT 1.0 mil minimum, color white.

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2. Insulated Roof Panel System:
   a. Panels shall be installed with concealed anchor clips and fasteners to purlins to allow for thermal movement over 120-degree ambient temperature range. Provide panels in longest length available.
   b. The side joint shall consist of a 2-inch vertical sidelap, mechanically seamed, with fasteners and thermally broken attachment clip completely concealed within the side joint.
   c. Tested and certified to meet UL 580, in accordance with Wind Design Criteria on General Structural Notes on the Drawings.
   d. Basis of Design:
      1) Manufacturer and Product: Nucor; High Rib, HR3.

D. Insulated Metal Wall Panels:

1. Materials and Configuration:
   a. Factory-assembled insulated preformed metal panels with manufacturer's standard concealed fasteners, and gasketed seam system of double tongue and groove interlocking joint.
   b. Core: Insulating polyisocyanurate foam bonded to face sheets.
   c. Thickness: As required for thermal value specified.
   d. Thermal Value: Minimum R-Value of 15.
   e. Width: 40-inch maximum.
   f. Exterior Profile: Longitudinal striations 1/32-inch deep.
   g. Interior and Exterior Skin: 22-gauge exterior and 26-gauge interior, light embossed, sheet metal panels meeting ASTM E72.
   h. Exterior Finish: Factory-applied, 70 percent fluoropolymer coating, dry film thickness of 1.0 mil including primer, in color shown in the Exterior Finish Schedule on the Drawings.
   i. Interior Finish: Factory applied polyester, DFT 1.0 mil minimum, color white.
2. Insulated Wall Panel System:
   a. One piece from eave to sill, with base trim at sill. Where indicated, provide one piece from eave to panel transition shown on the Drawings.
   b. Sidelaps: Double interlocking joint with concealed fasteners to girts or subgirts.
   c. Basis of Design:
      1) Manufacturer and Product: Nucor; Double Mesa Profile.

2.03 ACCESSORIES

A. Trim: Factory-formed and factory-painted ridge cap, rake trim, simple eave trim, panel side trim, corner trim, door trim, and other trim as necessary.

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B. Hollow Metal Doors, Frames, and Hardware: As specified in Section 08 11 00, Metal Doors and Frames.

C. Furnish hardware as shown in the Door and Hardware Schedule on the Drawings for each opening and as specified in Section 08 71 00, Door Hardware.

D. Overhead Doors: As specified in Section 08 30 00, Specialty Doors.

E. Gutter Fascia and Downspouts:

1. Material: ASTM A653/A653M, 26-gauge galvanized steel.
2. Gutter Fascia:
   a. Prefinish.
   b. Furnish hangers with factory-applied paint.
3. Preformed Corner Closures: Furnish to match configuration of gable fascia.
4. Downspouts:
   a. Configuration: Nominal 4-inch corrugated rectangular box with minimum 11 square inches of cross-section area.
   b. Factory finish to match wall panels.

F. Miscellaneous: Furnish fasteners, metal-backed neoprene washers, weatherstripping, sealants, roof jacks, roof curbs, gaskets, and other items as required for a complete installation.

1. Provide sealants in accordance with Section 07 92 00, Joint Sealants.
2. Provide flexible base pipe seal in accordance with Section 07 70 01, Roof Specialties and Accessories.

2.04 FABRICATION

A. Factory Fabricate: To manufacturer’s written standards, MBMA Metal Building Systems Manual, and AISC Specification for Structural Steel Buildings.

B. Building Parts: Accurate and true to dimension to facilitate building erection without cutting, fitting, or other alterations.

C. Welded Connections: In accordance with AWS D1.1/D1.1M.

D. Shop Primer for Primary Framing: Clean and apply one coat of manufacturer’s standard primer in accordance with MBMA Metal Building Systems Manual.

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PART 3 EXECUTION

3.01 EXAMINATION

A. Examine supporting concrete foundation and anchor bolt placement for compliance with requirements for installation tolerances and other conditions affecting performance of metal building.

3.02 BUILDING ERECTION

A. Erect building system in accordance with manufacturer's standards and instructions.

B. Provide temporary bracing in accordance with MBMA standards and as required for safe installation.

C. Structural Framing:

1. Do not field cut or alter primary or secondary framing members.
2. Installation and Tolerances: In accordance with MBMA Metal Building Systems Manual.

D. Roof and Wall Panels:

1. Field cutting of panels by torch is not permitted.
2. Attach panels to structural supports to maintain a weathertight seal while allowing for thermal and structural movement.
    a. Install exposed fasteners in true vertical and horizontal alignment.
    b. Field seam side laps of standing seam roof panels using electrically operated seaming machine.
    c. Use proper tools to install screw fasteners to compress neoprene washer without damaging washer or stripping metal.
3. Install manufacturer's standard joint sealants, gaskets, and closure strips as required for weathertight installation.
4. Install roof curbs for roof top equipment.
5. Field Cutting and Patching: Perform in manner not to impair appearance, weathertightness, or structural capacity of panel system.

3.03 INSTALLATION OF METAL ROOFING AND WALL SYSTEMS

A. General:

1. Apply roofing only in dry weather and where weather conditions permit.
2. Install in accordance with manufacturer's written instructions and warranty requirements.

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3. Comply with recommendations of the SMACNA “Architectural Sheet Metal Manual.”
4. Layout Pattern:
    a. Lay out to place seams equidistant from corners.
    b. Coordinate Work of this section with flashing, trim, and other construction to provide a permanently leakproof, secure, and noncorroding installation.
5. Conceal expansion joint provisions wherever possible in exposed Work; locate so as to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.
6. Closure and Trim:
    a. Provide ridges, eaves, rakes, fascia, gutters, downspouts, and other exposed trim and flashing for a weathertight roofing and wall system.
    b. Provide metal closures at eaves, peaks, rake edges.
    c. Flash and seal metal roof panels with weather closures at eaves, rakes, and at perimeter of openings. Fasten with self-tapping screws.
7. Install high eave caps as the metal roof panel work proceeds.
8. Dissimilar Metals:
    a. Separate from each other where electrolysis might occur.
    b. Separate metal panels where contact with corrosive substrates may occur.
    c. Separation is satisfactorily accomplished by coating metals with isolation paint.
    d. Comply with various metal procedures’ recommendations for other forms of protection against contamination from corrosive materials or agents.
9. Lap metal flashing over metal roof panels to allow moisture to run over and off the material.
10. Cutting and Fitting: Neat, square, and true. Saw cut panels using nonabrasive blade tool, deburr, and use touchup paint immediately as recommended by roofing panel manufacturer. Touch cutting is prohibited.
11. Metal Roof Panels, Wall Panels, Gutters, Downspouts, and Flashings: Straight, weathertight, exposed surfaces free of dents, scratches, abrasions, stains, and other visible defects.

B. Insulated Metal Roof Panels:

1. Attach panels to structural supports to maintain a weathertight seal while allowing for thermal and structural movement.
    a. Install seams in true vertical and horizontal alignment.
    b. Field seam side laps of standing seam roof panels using electrically operated seaming machine.

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c. Follow insulated metal roof panel manufacturer's instructions for weather-tight installation.
d. Use proper tools to install screw fasteners to compress neoprene washer without damaging washer or stripping metal.

2. Roof Panel Layout Pattern: Lay out with seams equidistant from corners.
3. Install manufacturer's standard joint sealants, gaskets, and closure strips as required for weathertight installation.
4. Install pipe boots, roof flashing, and wall trim for weather-tight seal around all pipe and conduit penetrations.
5. Field Cutting and Patching: Perform in manner not to impair appearance, weathertightness, or structural capacity of panel system.

C. Insulated Metal Wall Panels:

1. Insulated Metal Wall Panel Layout:
   a. Begin at base of wall.
   b. Overlap and secure panels to framing members with concealed fasteners, in accordance with manufacturer's instructions.
   c. Align bottom edge for a straight true line. Flash and seal panels with weather closures where wall panels meet walls, along lower panel edges and at perimeter of all openings and joints. At panel endlap, overlap panels a minimum of 6 inches and seal with manufacturer's recommended sealant or butyl mastic tape.
   d. Provide exposed trim and flashings for a weathertight siding system.

D. Sheet Metal Roof Panels:

1. Begin at eaves. Rigidly fasten eave end of metal roof panels and allow ridge end free movement for thermal expansion and contraction.
2. Install clips in panel side joints at location, spacing, and with fasteners as recommended by manufacturer for type of substrate and wind loading specified.
3. At intersections of roof slope with peak, turn up edges of roof panel 1-inch.
4. Seal joints where necessary for weathertightness.
5. Install pipe boots, roof flashing, roof curbs, and wall trim for weather-tight seal around all roof hatch, mechanical equipment curbs, pipe and conduit penetrations.

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E. Sheet Metal Wall Panels:

1. Begin at base of canopy.
2. Overlap and secure panels to framing members with exposed fasteners, in accordance with manufacturer's instructions.
3. Align bottom edge for a straight true line. Flash and seal panels with weather closures where wall panels meet walls, along lower panel edges and at perimeter of all opening and joints. At panel endlap, overlap panels a minimum of 6 inches and seal with manufacturer's recommended sealant or butyl mastic tape.
4. Provide exposed trim and flashing for a weathertight siding system.

F. Gutters and Downspouts:

1. Install gutters and downspouts as indicated on the Drawings.
2. Anchor downspouts to wall with straps of same material as wall panel.
3. Telescope end joints 1/2-inch and lock longitudinal joints of downspouts. Neatly caulk joints.
4. Provide elbows at bottom where downspouts transition to downspout boots or empty onto paving, grade or splashblocks.

3.04 REPAIR, CLEANING, AND PAINTING

A. Immediately following erection, remove unused material, screws, fasteners, and other debris from completed installation. Use caution in removing metal cuttings from surface of prefinished metal panels.

B. Replace damaged, dented, buckled, or discolored metal panels.

C. Repair damaged painted and galvanized surfaces as specified in Section 09 90 00, Painting and Coating.

D. Finish Painting on Primary and Secondary Framing: As specified in Section 09 90 00, Painting and Coating.

3.05 FIELD QUALITY CONTROL

A. Special inspection will be provided by Owner where indicated on the Drawings.

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3.06 MANUFACTURER'S SERVICES

A. Provide manufacturer's representative at Site in accordance with Section 01 43 33, Manufacturers' Field Services, for installation assistance, inspection, and certification of proper installation.

END OF SECTION

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