Cedar Hills Regional Landfill Pilot-Scale Micro-Electrolysis

Contract KC001738

Volume 2 of 3

Technical Specifications

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King County

Department of Natural Resources and Parks
Solid Waste Division

TABLE OF CONTENTS
CEDAR HILLS REGIONAL LANDFILL PILOT-SCALE MICRO-ELECTROLYSIS

VOLUME 1

DIVISION 00 - BIDDING REQUIREMENTS, FORMS AND TERMS AND CONDITIONS

00 01 10	TABLE OF CONTENTS
00 10 00	INVITATION TO BID
00 20 00	INSTRUCTIONS TO BIDDERS
00 22 00	REQUIREMENTS FOR NON-DISCRIMINATION, EQUAL EMPLOYMENT OPPORTUNITY, SMALL CONTRACTORS AND SUPPLIERS, AND APPRENTICESHIP
00 40 00	FORM OF BID
00 40 00-A	FORM OF BID - BIDDING SCHEDULE
00 43 13	BID GUARANTY BOND
00 43 43	WAGE RATES
00 45 13	QUALIFICATION INFORMATION
00 45 13-A	RESPONSIBILITY DETAIL FORM
00 50 00	AGREEMENT
00 52 00	FORMS AND DOCUMENTS
00 61 00	PERFORMANCE AND PAYMENT BOND
00 62 00	INSURANCE REQUIREMENTS
00 72 00	GENERAL TERMS AND CONDITIONS
00 90 00	ADDENDA

VOLUME 2

FACILITY CONSTRUCTION SUBGROUP

DIVISION 01 – GENERAL REQUIREMENTS

01 09 05	REFERENCE STANDARDS
01 10 00	SUMMARY OF WORK
01 10 00A	PILOT-SCALE MICRO-ELECTROLYSIS SYSTEM DESIGN CRITERIA
01 10 00B	PILOT-SCALE MICRO-ELECTROLYSIS SYSTEM MAJOR EQUIPMENT SCHEDULE
01 10 00C	REDUCED IRON POWDER
01 14 00	WORK RESTRICTIONS
01 15 00	SUSTAINABLE INFRASTRUCTURE SCORECARD
01 16 00	LABOR MANAGEMENT PLAN
01 29 00	MEASUREMENT AND PAYMENT PROCEDURES
01 30 00	ADMINISTRATIVE REQUIREMENTS
01 32 00	PROJECT SCHEDULING
01 33 00	SUBMITTAL PROCEDURES
01 35 00	HEALTH AND SAFETY
01 41 00	REGULATORY REQUIREMENTS
01 41 00A	CONCRETE FOUNDATION PERMIT

TABLE OF CONTENTS (CONT.)

01 43 00 QUALITY ASSURANCE AND CONTROL
01 50 00 TEMPORARY FACILITIES AND UTILITIES
01 55 00 TRAFFIC CONTROL
01 60 00 PRODUCT REQUIREMENTS
01 74 19 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL
01 78 00 CLOSEOUT PROCEDURES

DIVISION 02 — EXISTING CONDITIONS
02 31 40 HAZARDOUS MATERIALS AND DANGEROUS WASTE

DIVISION 03 — CONCRETE
03 20 00 CONCRETE REINFORCING
03 30 00 CAST-IN-PLACE CONCRETE

DIVISION 04-09 — NOT USED

DIVISION 10 — SPECIALTIES
10 73 16 CANOPIES

DIVISION 11-25 — NOT USED

FACILITY SERVICES SUBGROUP:

DIVISION 26 — ELECTRICAL
26 05 00 COMMON WORK RESULTS FOR ELECTRICAL
26 05 23 CONTROL-VOLTAGE ELECTRICAL POWER CABLES
26 22 13 LOW-VOLTAGE DISTRIBUTION TRANSFORMERS
26 24 16 PANELBOARDS
26 27 26 WIRING DEVICES
26 28 13 FUSES
26 28 16 ENCLOSED SWITCHES AND CIRCUIT BREAKERS
26 29 13.03 MANUAL AND MAGNETIC MOTOR CONTROLLERS
26 29 23 VARIABLE-FREQUENCY MOTOR CONTROLLERS
26 51 19 LED LIGHTING

DIVISION 27-39 — NOT USED

PROCESS EQUIPMENT SUBGROUP:

DIVISION 40 — PROCESS INTERCONNECTIONS

40 20 00 PROCESS PIPING
40 20 00A PIPING MATERIAL CLASSES
40 63 43 PROGRAMABLE LOGIC SYSTEM

DIVISION 41-42 — NOT USED

DIVISION 43 — PROCESS GAS AND LIQUID HANDLING, PURIFICATION AND STORAGE EQUIPMENT
43 22 16 LIQUID AGITATORS
43 22 16A AGITATOR DATASHEET
43 42 41 MICRO-ELECTROLYSIS SYSTEM
43 42 41A EQUIPMENT REQUIREMENTS

DIVISION 44-49 — NOT USED

VOLUME 3

CONTRACT DRAWINGS

SECTION 01 09 05
REFERENCE STANDARDS

PART 1 GENERAL

1.01 SUMMARY

A. Section includes:

1. Specification Format and Content Explanation.
2. Industry Standards.
3. Governing Regulations/Authorities.

1.02 SPECIFICATION FORMAT AND CONTENT EXPLANATION

A. Specification Format: These Specifications are organized into Divisions and Sections based on the Construction Specifications Institute's latest MasterFormat™ numbering system.

B. Specification Content: These Specifications use certain conventions in the use of language and the intended meaning of certain terms, words, and phrases when used in particular situations or circumstances. These conventions are explained as follows:

1. Abbreviated Language: Language used in Specifications and other Contract Documents are the abbreviated type. Words and meanings shall be interpreted as appropriate. Words that are implied, but not stated, shall be interpolated as the sense required. Singular words will be interpreted as plural and plural words interpreted as singular where applicable and the context of the Contract Documents so indicates.
2. Imperative and streamlined language is used generally in the Specifications. Requirements expressed in the imperative mood are to be performed by the Contractor. At certain locations in the text, for clarity, subjective language is used to describe responsibilities that must be fulfilled indirectly by the Contractor or by others when so noted.
    a. The words "shall be" shall be included by inference wherever a colon (:) is used within a sentence or phrase.

1.03 INDUSTRY STANDARDS

A. Applicability of Standards: Except where the Contract Documents include more stringent requirements, referenced construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

B. Publication Dates: Unless noted otherwise, comply with the standard in effect as of the date of the Bid Proposal.

C. Copies of Standards: Each entity engaged in construction on the Project is required to be familiar with referenced industry standards applicable to that entity's construction activity. Copies of referenced standards are not bound with the Contract Documents.

1. Where copies of standards are needed for performance of a required construction activity, the Contractor shall obtain copies directly from the publication source.

D. Abbreviations and Names: Trade association names and titles of general standards are frequently abbreviated. The following acronyms or abbreviations, as referenced in Contract Documents, are defined to mean the associated names. Names and addresses are subject to change and are believed to be, but are not assured to be, accurate and up to date as of the date of the Contract Documents.

1. AASHTO American Association of State Highway & Transportation Officials
<http://www.transportation.org/>
555 12th Street NW, Suite 1000
Washington, DC 20004 (202) 624-5800

2. ACI American Concrete Institute
<https://www.concrete.org/>
38800 Country Club Dr.
Farmington Hills, MI 48333-9094 (248) 848-3800

3. AI Asphalt Institute
<http://www.asphaltinstitute.org/>
2696 Research Park Drive
Lexington, KY 40511-8480 (859) 288-4960

4. A.I.A. American Insurance Associates
<http://americaninsassoc.com/>
103 Fourth St STE 320-A
Castle Rock, CO 80104 (303) 663-1555

5. AIHA American Industrial Hygiene Association
<www.aiha.org/>
3120 Fairview Park Drive, Suite 360
Falls Church, VA 22042 (703) 849-8888

6. AISC American Institute of Steel Construction

7. AISI American Iron and Steel Institute
<www.steel.org/>
25 Massachusetts Ave., NW, Suite 800
Washington, DC 20001 (202) 452-7100

8. AMPP The Association for Materials Protection and Performance.
<https://www.ampp.org/about/>
15835 Park Ten Place
Houston, TX 77084 1-800-797-6223

9. ANSI	American National Standards Institute <www.ansi.org/> 1899 L Street, NW, 11th Floor Washington, DC 20036	(202) 293-8020
10. ASCE	American Society of Civil Engineers	
11. ASTM	ASTM International <www.astm.org/> 100 Barr Harbor Drive PO Box C700 West Conshohocken, PA 19428-2959	(610) 832-9500
12. AWS	American Welding Society <www.aws.org/> 8669 NW 36 Street #130> Miami, FL 33166-6672	(800) 443-9353
13. AWWA	American Water Works Association <www.awwa.org/> 6666 W. Quincy Avenue Denver, CO 80235	(303) 794-7711
14. CRSI	Concrete Reinforcing Steel Institute <www.csri.org/> 933 North Plum Grove Road Schaumburg, IL 60173-4758	(847) 517-1200
15. FM	FM Global Research <www.fmglobal.com/> 601 108th Avenue NE Suite 1400 Bellevue, WA 98004	(425) 455-5333
16. GSI	Geosynthetic-Institute <http://www.geosynthetic-institute.org/> 475 Kedron Avenue Folsom, PA 19033	(610) 522-8440
17. IBC	International Building Council	
18. ICC	International Code Council <www.iccsafe.org/> 500 New Jersey Avenue, NW, 6th Floor Washington, DC 20001	(888) 422-7233
19. NAPA	National Asphalt Pavement Association <www.asphaltpavement.org/> 6406 Ivy Lane, Suite 350 Greenbelt, MD 20770-1441	(888) 468-6499
20. NCMA	National Concrete Masonry Association <www.ncma.org/> 13750 Sunrise Valley Drive Herndon, VA 20171-4662	(703) 713-1900

21. NEC National Electric Code (from NFPA)
<www.nfpa.org/>
National Fire Protection Association
1 Batterymarch Park
Quincy, MA 02169-7471 (800) 344-3555

22. NEMA National Electrical Manufacturers Association
<www.nema.org/>
1300 North 17th Street N #900
Arlington, VA 22209 (703) 841-3200

23. NPCA National Paint and Coatings Association
<www.paint.org/>
901 New York Ave. NW
Washington, DC 20005 (202) 462-6272

24. PCA Portland Cement Association
<www.cement.org/>
200 Massachusetts Ave NW, Suite 200
Washington, D.C. 20001 (202) 408-9494

25. PDI Plumbing and Drainage Institute
<www.pdionline.org/>
800 Turnpike Street, Suite 300
North Andover, MA 01845 (978) 557-0720

26. PLIB Pacific Lumber Inspection Bureau
<www.plib.org>
1010 South 336th Street, Suite 210
Federal Way, WA 98003 (253) 835-3344

27. UL Underwriters Laboratories
<www.ul.com/>
14301 SE 1st Street, Suite 140
Vancouver, WA 98684 (877) 854-3577

E. Federal Government Agencies: Names and titles of federal government standard or Specification producing agencies are often abbreviated. The following acronyms or abbreviations referenced in the Contract Documents indicate names of standard or Specification producing agencies of the federal government. Names and addresses are subject to change and are believed to be, but are not assured to be, accurate and up to date as of the date of the Contract Documents.

1. COE Corps of Engineers
(United States Department of the Army)
<www.usace.army.mil/>
441 G Street NW
Washington, DC 20314-1000 (202) 761-0011

2. CFR Code of Federal Regulations
<www.gpo.gov/>
Available from the Government Printing Office
732 N. Capitol Street NW
Washington, DC 20401 (205) 512-1800
(Material is usually first published in the “Federal Register”)

3. CS Commercial Standard
(United States Department of Commerce)
Government Printing Office
1401 Constitution Ave NW
Washington, DC 20230 (205) 482-2000

4. DOT Department of Transportation
<www.dot.gov/>
1200 New Jersey Avenue, SE
Washington, DC 20590 (855) 368-4200

5. EPA Environmental Protection Agency
<www.epa.gov/>
1200 Pennsylvania NW
Washington, DC 20460 (202) 272-0167

6. FS Federal Specification (from GSA)
<www.gsa.gov/>
Specifications Unit (WFSIS)
One Constitution Square
1800 F Street, NW
Washington, DC 20405 (866) 606-8220

7. OSHA Occupational Safety and Health Administration
<www.osha.gov/>
United States Department of Labor
Occupational Safety & Health Administration
200 Constitution Avenue NW, Room Number N3626
Washington, DC 20210 (800) 321-6742

8. PS Product Standard of NBS
(United States Department of Commerce)
Government Printing Office
1401 Constitution Ave NW
Washington, DC 20230 (205) 482-2000

F. State Government Agencies: Names and titles of state government standard or Specification producing agencies are often abbreviated. The following acronyms or abbreviations referenced in the Contract Documents indicate names of standard or Specification producing agencies of the state government. Names and addresses are subject to change and are believed to be, but are not assured to be, accurate and up to date as of the date of the Contract Documents.

1. Ecology Washington State Department of Ecology
<https://ecology.wa.gov/>
300 Desmond Drive SE
Lacey, WA 98503 (360) 407-6000

2. WISHA Washington Industrial Safety and Health Act
<http://www.lni.wa.gov/Safety/>

3. WSDOT Washington State Department of Transportation
<www.wsdot.wa.gov/>
310 Maple Park Avenue SE
P.O. Box 47300
Olympia, WA 98504 (360) 705-7000

G. Local Government Agencies: Names and titles of local government standard producing agencies are often abbreviated. The following acronyms or abbreviations referenced in the Contract Documents indicate names of standard producing agencies of local government. Names and addresses are subject to change and are believed to be, but are not assured to be, accurate and up to date as of the date of the Contract Documents.

1. King County King County Building Dept https://kingcounty.gov/en/dept/local-services/certificates-permits-licenses/permits
919 SW Grady Way, Suite 300
Renton WA, 98057
(206) 296-6600

2. KCSWD King County Solid Waste Division
<http://your.kingcounty.gov/solidwaste/index.asp>
201 S. Jackson Street, Suite 701
Seattle, WA 98104 (206) 477-4466

3. PHSKC Public Health – Seattle and King County
<www.kingcounty.gov/health>
401 5th Avenue, Suite 1100
Seattle, WA 98104 (206) 296-4600

4. PSCAA Puget Sound Clean Air Agency
<https://pscleanair.gov>
1904 Third Avenue, Suite 105
Seattle, WA 98101 (206) 343-8800

1.04 GOVERNING AUTHORITIES/STANDARDS

A. The King County Project Representative has contacted authorities having jurisdiction (AHJs) where necessary to obtain information necessary for preparation of Contract Documents. Contractor shall notify the King County Project Representative prior to contacting AHJs directly for information and decisions having a bearing on the Work.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION – NOT USED

END OF SECTION 01 09 05

SECTION 01 10 00
SUMMARY OF WORK

PART 1 GENERAL

1.01 SUMMARY

A. This Section summarizes the Work required for construction of the Cedar Hills Regional Landfill (CHRLF) Micro-Electrolysis (ME) Pilot Study in King County, Washington.

1.02 CONTRACT DOCUMENTS

A. Contract Documents include, but are not limited to:

1. Volume 1: Division 00 – Bidding Requirements, Forms, and the Owner's General Terms and Conditions.
2. Volume 2:
    a. Division 01 – General Requirements
    b. Division 02 – Existing Conditions
    c. Division 03 – Concrete
    d. Division 10 – Specialties
    e. Division 26 – Electrical
    f. Division 40 – Process Interconnections
    g. Division 43 – Process Liquid Handling and Storage Equipment
3. Volume 3:
    a. Pilot-Scale Micro-Electrolysis System Design Criteria Table
    b. Pilot-Scale Micro-Electrolysis System Major Equipment Schedule
    c. Site Layout Drawings
    d. Piping and Instrumentation Diagrams
    e. Structural Drawings
    f. UW Bench-Scale Reactor Specifications and Mixing Analysis
    g. ME Reactor and Platform Model
    h. Media Data Sheets

1.03 PROJECT DESCRIPTION

A. The pilot-scale ME project, which targets arsenic in industrial wastewater from the methane processing plant located at CHRLF, is part of the overall leachate and lagoon improvements project at CHRLF. The pilot-scale ME technology and treatment system has been selected to pretreat the industrial wastewater stream from the methane processing plant prior to the stream entering the leachate lagoon pretreatment system. The experimental ME technology was developed by the University of Washington (UW) and designed at current scale by WSP USA (WSP). CHRLF discharges industrial wastewater collected at the landfill to the King County

publicly owned treatment works (POTW) in Renton, Washington, under Waste Discharge Permit No. 7842-04 (discharge permit), issued to the County by the King County Industrial Waste (KCIW) program. The Work includes but is not limited to the following features:

1. Obtain all permits necessary to perform the Work.
2. Furnish and installation of ME reactor and platform foundation slab and stairway foundation slab, including all required anchoring.
3. Furnish and installation of pilot-scale ME treatment system equipment, interconnecting piping and valves, and instrumentation.
4. Furnish initial bulk chemicals and media.
5. Installation of site utility hookups to existing onsite power, including underground and above-grade connection points for the pilot system and associated installations.
6. Hydrostatic and leak testing.
7. Pre-commissioning, commissioning, inspections, and final system testing.

B. Equipment and Drawings provide the necessary details to describe the scope of work (Work) and are provided in the Volume 3 Contract Documents.

1.04 NOTICES TO PROCEED, WORK AND MILESTONES

A. The Contractor shall complete the Work as described by the Contract Documents within the Contract Time.

B. The Owner will provide the Contractor with a written Notice to Proceed (NTP) before commencement of Work. Contract Time shall start on the date established in NTP.

1. Milestone 1, Substantial completion of all Work described in the Contract Documents shall be achieved within 180 calendar days after NTP.
2. Milestone 2, Final Acceptance, is to be achieved within seventy (70) calendar days after issuance of the Certificate of Substantial Completion.

1.05 CODES AND REGULATIONS

A. Work shall meet the requirements of applicable laws, statutes, regulations, ordinances, and safety regulations of Federal, State, and county jurisdictions and as may be further referenced in the Contract Documents.

B. Comply with provisions of Federal, State, and local statutes, ordinances, and regulations dealing with the prevention of environmental pollution of natural resources that affect the project.

C. In accordance with Paragraph 1.07 B, the Owner's independent testing and inspection services will verify compliance with all required codes and regulations.

1.06 WORK BY OWNER AND OTHERS

A. Permits:

1. The Owner-obtained permits associated with the Work are listed in Section 01 41 00 – Regulatory Requirements.
2. The Contractor shall secure and pay for demolition permits (if required) and all other temporary and permanent permits, certifications, tests, inspections,

connection, or "hook-up" charges, and other legal or usual charges or fees required by government agencies and private utilities having jurisdiction over the Work either directly or under contract. The Contractor shall determine prior to bidding what these charges, if any, will be.

B. Owner's Testing and Inspection Services:

1. The Owner contracts with testing and inspection agencies and/or uses in-house testing services to verify the Contractor is in compliance with Contract Documents.
2. The Owner's testing and inspection agencies provide services for the Owner exclusively, except as indicated in this Section and in Section 01 43 00 – Quality Assurance and Control.
3. If the law or ordinance of any public authority requires any Work to be tested, approved, or inspected, in addition to the testing required by Section 01 43 00, the Contractor shall arrange for and pay all costs related to such testing, inspections, and/or approvals.
4. Contractor Responsibilities:
    a. The Contractor is required to perform, at no additional cost to the Owner, its own quality control program, including testing, inspection, and special inspections, as necessary to verify compliance with Contract Documents including source quality control testing as required.
        1) The Contractor is prohibited from employing the same testing and inspection agency or agencies employed by the Owner.
    b. The Contractor shall pay for testing of Work that is subject to corrective action, or that was otherwise untested, or not observed, or has other problem(s) attributable to the Contractor's performance of the Work.
    c. The Contractor shall pay for additional testing beyond that required by the Contract Documents to facilitate the performance of its means and methods.

C. Hazardous Materials and Dangerous Waste:

1. The Owner provides and pays for collection of samples for laboratory and chemical analysis, storage and processing of samples, and analysis of samples in accordance with Section 02 31 40 – Hazardous Materials and Dangerous Waste.
2. Contractor Responsibilities:
    a. At Owner's direction, Contractor shall collect, handle, provide for possible temporary storage, and dispose of potential hazardous materials and dangerous waste.
    b. Provide and pay for the cleanup and mitigation of spills caused by the Contractor or its Subcontractors, with no additional cost to the Owner.

D. Other Construction Work:

1. Known construction work by the Owner or others is anticipated to occur within or adjacent to the Construction limits concurrently with Contractor's Work, as noted below.

a. Possible repairs and maintenance to Owner's existing facilities, such electrical and communications systems, and landfill gas and leachate control systems. Contractor shall provide reasonable access to other contractors and King County staff who are performing such repairs and maintenance.

b. Interim Facilities Relocation project.

c. Leachate Lagoon Improvements project.

d. Area 9 Demolition and Excavation project.

2. As additional projects are known, they will be conveyed to the Contractor by the Project Representative.

1.07 QUALITY ASSURANCE AND CONTROL

A. The Contractor shall perform the Work in accordance with Section 01 43 00.

B. The Contractor shall be responsible for Construction Quality Control (CQC). The Contractor shall engage and pay for the services of qualified staff or a qualified subcontractor to perform CQC for monitoring and documenting the quality of the Work in accordance with the Contract Documents.

C. The Project Representative (or Construction Manager) will provide Inspection Test Plan (ITP). The Project Representative (or Construction Manager) will be responsible for observing and documenting periodic verification, checking, or testing to confirm that the quality of the Work is in accordance with the Contract Documents.

D. Unless otherwise specified, the Contractor shall complete CQC inspection, sampling, testing or any other action, as considered necessary by the Contractor to ensure that the Work has been completed in accordance with the Contract Documents. Notwithstanding the results of the Contractor's CQC program, compliance of the Work with the Contract Documents shall be defined by the results of the Project Representative's (or Construction Manager's) ITP.

E. Any Work that does not satisfy the requirements of the Contract Documents, shall be made good in accordance with the requirements of the Contract Documents or as directed by the Construction Manager, Owner, or Owner's approved representative at the sole expense of the Contractor.

1.08 SITE CONDITIONS

A. Contractor's Staging Area: Areas will be set aside on the project property, as indicated on the Contract Drawings, for the Contractor's use as a staging area for workers, equipment, and materials. Contractor shall restore the staging area to its original condition at the conclusion of Work.

B. Disposal of Waste Material per Section 01 74 19 Waste Management and Disposal.

C. Fire Prevention and Protection: The Contractor shall perform all work in a fire-safe manner and comply with applicable local and State fire prevention regulations. The Contractor shall implement adequate fire prevention measures and ensure that all employees, agents, and subcontractors observe these measures. The Contractor shall coordinate hours of Work with fire prevention measures.

1.09 WARRANTY

A. The Work shall be warranted in accordance with Division 00 and Section 01 78 00 – Closeout Procedures.

1.10 CONTRACT DOCUMENTS AND AVAILABLE INFORMATION

A. Refer to Section 1.02 for Contract Documents

1. Documents designated “Available Information” provided by the Owner are not part of the Contract Documents. Available Information documents are provided by the Owner for the Contractor’s information gathering and assessment activities.

a. Available Information is not warranted by any party.

b. Verify any information using the Contractor’s own procedures, processes, and means.

c. Reliance on the Available Information for decision-making associated with the Project will be at the Contractor’s risk.

d. Available Information is offered for download at the E-Procurement Supplier Portal.

B. Prior to issuance of the NTP for commencing the Work, revised Contract Documents will be issued to the Contractor, if applicable.

1.11 AVAILABLE INFORMATION

A. The following documents are designated Available Information:

1. Inspection and Test Plan (ITP).

2. Contract Documents for Area 8 Stage 1 Closure and Area 9 Phase 1 Excavation.

1.12 PROJECT UTILITY SOURCES

A. Refer to Section 01 50 00 – Temporary Facilities and Utilities for information on temporary water service, electrical power, telecommunications, and wastewater.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION – NOT USED

END OF SECTION 01 10 00

Table 3: Pilot-Scale Micro-Electrolysis System Design Criteria
Cedar Hills Regional Landfill, Maple Valley, Washington

Unit Process	Purpose	Design Parameters	Equipment	Operating Conditions	Existing Data Gaps[1]
Primary					
Influent Diversion	Reroute portion of CHRGE wastewater to system.	Air-actuated solenoid valves were designed to divert a small portion of the waste stream to automatically start and stop filling the influent tank.	Diversion control valves. Air compressor/receiver.	Incremental fill from CHRGE sump. Emergency bypass to prevent tank overfilling. Valve operation controlled by level indicator in influent tank. Valve actuated by continuously supplied compressed air.	None.
Influent Flow Collection and Equalization	Equalization and storage.	Tank was sized to accommodate two days worth of untreated CHRGE water. The intent is to limit pilot system operation disturbances caused by sporadic CHRGE operations and resulting flows.	Level switches tied to control valves. HDPE Tank. Agitator pH instrumentation. Level transmitter. Immersion heater. Transfer pump.	Incremental fill from CHRGE sump. Level monitored/alarmed based on level indication. Batch operations. Agitator protected by level indicator. Pump controlled by operator and level indicator in ME reactor.	None.
ME Reactor Tank	ME reaction containment.	316 SS cone-bottom tank. ~60-gallon pilot scale reactor. Flanged top and bottom (sidewall to cone) Closed to atmosphere.	60-gallon cone-bottom tank. Inlet nozzles. Outlet nozzles.	Batch fill ME reactor with manual start influent transfer pump until ME reactor level switch is triggered.	None.
ME Reactor Agitator	ME reaction mixing.	Achieve uniform mixing. 30 - 60 minute reaction time per cycle.	350 RPM vertical 4-blade center mounted 316 SS agitator with: 1 hp 1800 rpm motor; NPS 4 150# ANSI Flange; Double carbon/silicon carbide/viton mechanical seal.	Operator manually starts the agitator once the ME reactor is filled, media is dosed, and headspace is purged. Once the desired pH is achieved, the operator will allow the agitator to run for 30 - 60 minutes. Operator will manually turn off the agitator.	Reaction time could take between 30 and 60 minutes. ME pilot system operations and analytical sampling will determine optimal reaction time for ME pilot. The use of intermittent mixing may be implemented after further study.
ME Reactor Instrumentation	Control ME reactor processes and provide analytical data.	Provide monitoring of pH for sulfuric acid dosing control. Control influent transfer pump, agitator operation, and acid dosage through level indication. Prevent pressure buildup above 12 psi. Provide ORP data.	ph instrumentation x3. ORP measurement x2. Pressure indication instrumentation x1. Pressure control valve x1. Vibrating fork level switch x1.	pH instruments are placed at different column elevations. The average reading will control the sulfuric acid dosing pump operations. ORP measurements are automatically reported to the PLC. pH and ORP probes must be submerged in solutions or buffer at the end of daily operations. ORP probe needs to be rigorously cleaned and calibrated routinely. The pressure indicator sends a signal to the pressure control valve to open before reactor pressure reaches 12 psi. Level switch disables influent transfer pump and enables both agitation, and sulfuric acid dosing.	pH/ORP probe submersion method to be determined. Probes may either need removed from the reactor and put into solution or the reactor may be kept full overnight. Proper cleaning and calibration of ORP probes to be further investigated. Monitoring parameters and any potential correlations need to be identified. Fe analysis as a surrogate for ME treatment and related instrumentation to be considered.
ME Reactor Effluent	Decant water from ME reactor to enter the effluent system.	Media retention when removing water from the reactor during standard operation.	Decant ports x3.	After agitation has ceased and the media settling time has passed, the operator is to manually open the decant valves one at a time. The top decant valve should be closed once water elevation has fallen below the first valve. The same procedure is to be observed for the lower decant valves from highest to lowest.	Media settling duration is to be determined during pilot startup. The method of identifying settling duration is to be determined.
Post-Treatment	Filtration (media retention). pH adjustment.	Filtration for polishing and media retention prior to entering the pH adjust tank. Target pH of 5.5 SU. Well mixed tank.	Bag filter (1-10-micron). HDPE tank. Agitator. Transfer pump. pH instrumentation. Level transmitter. Immersion heater.	Decant through bag filter upstream of pH adjust tank to remove any media in decant stream. Target pH of 5.5 SU to limit iron precipitation. Transfer pretreated CHRGE water to frac tank via manual pumping started by the operator and terminated by effluent tank level controls.	Frequency of effluent tank discharge to be determined in field from typical daily ME reactor batches.
Sludge/Solids					
ME Reactor Solids	Collection and transfer, dewatering, and disposal of exhausted media.	20 - 50 g/L of solids. ~3 batches per solids dose. ~10 lbs. of solids per 3 batched of CHRGE water treated. Moisture content of ~40%.	Exhausted media and supernatant collection/dewatering tank w/ fabric/filter bottom. Supernatant recycling pump.	After the last batch, drain ME reactor. Disconnect the drainage hose and effluent tank hose from the air diaphragm effluent pump. Attach the dewatering hose and solids dewatering tank hose to the air diaphragm effluent pump. Allow solids to drain/dewater in dewatering bin. Dispose of solids accordingly. Recycle supernatant to frac tank.	Confirm life of media during ME pilot operations. Solids dewatering process.
Chemical Feed Systems					
Sulfuric Acid	Reduce pH in ME reactor.	Target pH 3.5 to 4.5 SU in ME reactor using 0.25M H_2SO_4 solution. UW provided influent titration data. Target ~0.001–0.0025M H_2SO_4 in ME reactor.	pH instrumentation and transmitter. Chemical metering skid. PID controller. Chemical containment.	PID controlled to maintain pH in ME reactor throughout reaction.	None.
Sodium Hydroxide	pH adjustment prior to discharge.	Target pH 5.5 SU using 33% sodium hydroxide by weight. UW provided effluent titration data. Target ~0.015M NaOH in effluent.	pH instrumentation and transmitter. Chemical metering skid. PID controller. Chemical containment.	PID controlled to achieve target pH in pH adjust tank prior to transfer.	None.
CO_2	Reactor headspace purging before and after ME reaction.	Deoxygenation of ME reactor. Headspace clearing to scrub volatiles post ME reaction.	Pressurized CO_2 tank. Pressure relief valve.	Prior to reaction, remove all oxygen from the reactor headspace prior to atmosphere. Post-reaction, remove all volatiles from headspace. Activate GAC scrubber, and monitoring, prior to atmospheric discharge.	Amount of CO_2 needed to fully purge the upscaled ME reactor headspace. Time of CO_2 discharge to purge headspace. Efficacy of CO_2 purging volatile gasses.

Table 3: Pilot-Scale Micro-Electrolysis System Design Criteria (cont'd)
Cedar Hills Regional Landfill, Maple Valley, Washington

Unit Process	Purpose	Design Parameters	Equipment	Operating Conditions	Existing Data Gaps[1]
Media					
ZVI	Anode in ME reaction process.	2:1 ratio ZVI:GAC (13.3 g/L solids). Assumed the media will be hazardous and must be disposed of accordingly.	Volumetric solids handling and feed system.	Solids reuse through 3 cycles.	Usage will be updated and optimized during start-up. Corroded iron may precipitate and co-precipitate arsenic. May have surface complexation with arsenic.
GAC (Treatment Process)	Cathode in ME reaction process.	2:1 ratio ZVI:GAC (6.7 g/L solids). Assumed the media will be hazardous and must be disposed of accordingly.	Volumetric solids handling and feed system.	Solids reuse through 3 cycles.	Usage will be updated and optimized during start-up. +2% by weight after each cycle.
GAC (Air Scrubbing)	Scrub the headspace of the influent tank, ME reactor and effluent tank.	Scrub the headspace of all closed tanks to ensure operator safety and comply with all emission regulations. Two GAC Columns will be used in parallel for different air sources. Multiple columns in series are not necessary for the air type and concentrations anticipated.	Two active 55-gallon GAC columns, (utilizing a motor and blower).	Active air scrubber. Two 55-gallon GAC columns in parallel. Pre-column and post-column monitoring to detect leaking.	Life span of the GAC air scrubbing system will likely be determined in the field. Hazardous material designation must be determined prior to disposal.

Notes:
1. Items subject to change during pilot testing or outstanding experimentation for UW to explore. To be confirmed upon completion of arsenic speciation studies by UW and WSP as well as during start-up and operations.

Abbreviations

CHRGE = Cedar Hills Renewable Gas to Energy
CO_2 = carbon dioxide
FOG = fats, oil and grease
g/L = grams per liter
GAC = granular activated carbon
H_2SO_4 = sulfuric acid
HDPE = high density polyethylene
L = liter
lbs. = pounds
ME = micro-electrolysis
mV = millivolt
NaOH = sodium hydroxide
ORP = oxidation reduction potential
PID = proportional-integral-derivative
SU = standard units
UW = University of Washington
WSP = WSP USA Environment & Infrastructure Inc.
ZVI = zero-valent iron

Pilot-Scale Micro-Electrolysis System Major Equipment Schedule[1, 2]

Cedar Hills Regional Landfill, Maple Valley, WA

Unit Op.	Tag No.	Equipment	Quantity	Capacity	Dimensions	Weight[3]	Materials of Construction	Vendor / Supplier	Make	Mfr. Model	Item No.	Electrical[4]					Notes
												Voltage	Amperage	Motor Power (hp)	VFD (Y/N)	Motor Requirements	
Influent																	
	SV-100 SV-110	Diversion valve	2	-	2"	30 lbs	316 SS	Valworx	Valworx	555232A	5552	-	-	-	-	-	-
	AC-1200/ AR-1200	Air Compressor/Air Receiver	1	80 gal - 25.8 cfm	2' x 6.5' x 4'	700 lbs	Cast Iron	Grainger	Ingersoll Rand	247PD7.5-V	786FG1	200-208V	25.3	7.5	-	-	-
	AD-1200	Air Dryer	1	30 cfm @250 psi	15 1/2" x 18 1/4"	26.1 lbs	Polycarbonate	Grainger	SpeedAire	2YNL6	2YNL6	-	-	-	-	-	-
	LIT-100	Ultrasonic Level Indicators	1	-	-	-	EPDM	Endress + Hauser	Ultrasonic measurement Time-of-Flight Prosonic	-	-	14-35V	-	-	-	-	-
	AE-100	pH Sensor	1	-	0.87" x 5.91"	NA	PPS and Glass	Endress+Hauser	Memosens	Digital pH Sensor	CPF81E	-	-	-	-	-	-
	-	Instrumentation Cables - pH (Potentiometric)	1	-	0.25 " x <328'	NA	TPE and Aluminum	Endress+Hauser	Memosens	Digital Cable	CKY10	-	-	-	-	-	-
	YI-102	Immersion Heater	1	4,000 W	2" dia x 17.5" length	7 lbs	Copper	Grainger	TEMPCO	2VXU4	TSP02086	240V AC	-	-	N	-	-
		Thermostat - Local Control	1	-	-	0.5 l bs	Copper	Grainger	TEMPCO	36VE75	TST-101-137	-	-	-	-	-	-
	TK-100	Influent Tank	1	500 gal	48" dia x 73" h	104 lbs	HDPE	National Tank Outlet	NORWESCO	40148	X1038961	-	-	-	-	-	-
	AG-100	Influent Tank Agitator	1	3,000 gal	60" l, 3/4" shaft dia., 13"x13" propeller	96 lbs	316 SS	Grainger	Dayton	32V141	32V141	115/230V AC	-	3/4	-	-	-
	-	Influent Tank Mixer Mounting	1	500 gal	80"	50 lbs	Steel	Peabody	Peabody	204-31728	204-31728	-	-	-	-	-	-
	P-100	Influent Discharge Pump	1	24 gpm @ 60 ft tdh	9" x 14" x 9"	30	316 SS	Grainger	Goulds	4UB54	100MS1C5E4	208-230/460V AC	7.5/3.8	0.5	N	60 Hz	-
ME Reactor																	
	RE-400	ME Reactor	1	60 gal	17" dia x 87" h	408 lbs	316 SS	ABM Equipment	-	-	-	-	-	-	-	-	-
	RE-400	ME Reactor Platform	1	NA	146" l x 69" w x 139" h	1600 lbs	304 SS	ABM Equipment	-	-	-	-					-
	AG-400	ME Reactor Agitator	1	60 gal	67" l x 9.5" dia.	243 lbs	316 SS	Chemineer	50DTN-1	50DTN-1	36b179a5-29f5-4f28-bff0-2acbdf1b0996	230/460 V	-	1	Y	60 Hz	-
	LSH-400	Level Switch	1	-	3/4" NPT	-	-	Grainger	FLOWLINE	12U435	LZ12-1405	-	-	-	-	-	-
	CY-1000, CY-1100	Volumetric Solids Feeder	2	2.5 cf	17" x 30"	186 lbs	316 SS	ABM Equipment	Shenck	Dual Drive Dry Material Feeder	604M	90V DC	-	1/2	Y	60 Hz	Included in ME Reactor
	BN-1000	GAC Bin	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Included in ME Reactor
	BN-1100	ZVI Bin	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Included in ME Reactor
	AIT-435	pH and ORP Transmitter	1	-	9.4" x 7.6" x 6.4"	NA	NA	Endress+Hauser	Liquiline	8-channel transmitter	CM448	110 V AC	-	-	-	-	-
	AE-435 AE-440 AE-460	pH Sensor	3	-	0.87" x 5.91"	NA	PPS and Glass	Endress+Hauser	Memosens	Digital pH Sensor	CPF81E	-	-	-	-	-	-
	AE-405 AE-410	ORP Sensor	2	-	0.87" x 5.91"	NA	PPS and Glass	Endress+Hauser	Memosens	Digital ORP Sensor	CPF82E	-	-	-	-	-	-
	-	Instrumentation Cables - pH (Potentiometric)	3	-	0.25 " x <328'	NA	TPE and Aluminum	Endress+Hauser	Memosens	Digital Cable	CKY10	-	-	-	-	-	-
	-	Instrumentation Cables - ORP (Sensor ORP/Redox)	2	-	0.25 " x <328'	NA	TPE and Aluminum	Endress+Hauser	Memosens	Digital Cable	CKY10	-	-	-	-	-	-
	P-500	Sulfuric Acid Dosing Pump	2	96 gpd	5.5" x 12" x 11"	17 lbs	CSPE/PTFE	Grainger	Pulsatron	LPG5SA-KTC3-G19	6KYH0	115/230V AC	-	1/5	Y	60 Hz	-
	TK-500	Sulfuric Acid Tote (0.25M)	1	5.3 gal	12" dia x 18" h	50 lbs	Polyethylene	Grainger	Lab Chem	8PWZ7	LC256405	-	-	-	-	-	-
	-	Acid Chemical Containment	1	70 gal	33" dia x 42" h	78 lbs	Polyethylene	Grainger	ENPAC	8002-YE	31DL71	-	-	-	-	-	-
	TK-300	CO2 Storage Tank	1	1800 PSI Service Pressure	9" dia x 50" h	50 lbs	Aluminum	All Safe Global	All Safe Global	50LBALVLV	50LBALVLV	-	-	-	-	-	-
	PRV-300	Gas Flow Meter and Regulator	1	80 psi; 80 scfh	-	-	Brass/Neophrene	Grainger	VICTOR	482W21	0781-3642	-	-	-	-	-	-
	PIT-400	Pressure Indicator	1	900 psi			Die-cast aluminum, AISI 316L	Endress+Hauser	Cerebar	Digital Pressure Transmitter	PMC71	11.5 - 45 VDC	4 - 20 mA				-
	PCV-400	Pressure Control Valve	1	-	18" x 15"	26.4 lbs	316 SS	Applied Control	Baumann	NPS 1/2 24000S 32 Size 32 DVC6200 Factory Mtgs	NPS 1/2 24000S 32 Size 32 DVC6200 Factory Mtgs	-	-	-	-	-	-
	-	Zero Valent Iron (ZVI)	1	-	10" dia x 14"W x 10"H	20 lbs	Iron	IPW Industries	IPW Industries	1240 - AW	ASIN: B0814249XX	-	-	-	-	-	-
	-	Granular Activated Carbon (GAC)	1	-	-	25 lbs	Carbon	Hoganas	Hoganas	Reduced Iron Powder	CR15	-	-	-	-	-	-
	-	Pressurized Spray Nozzle	2	-	3/8"	NA	316 SS	BTE	BTE	TF	TF16	-	-	-	-	-	-
Effluent																	
	P-700	Effluent Tank Pump	1	15 gpm	10-1/16" x 6-3/16" x 10-29/32"	5.6 lbs	Polypropylene	Aro	Non-Metallic	PD07P	PD07P-XXS-XXX	-	-	-	-	-	-
	BF-700	Bag Filter	1	40 gpm	8" dia x 22" h	51 lbs	Aluminum	Pentek	Pentek	156571-75	55KD90	-	-	-	-	-	-
	TK-700	Effluent Tank	1	500 gal	48" dia x 73" h	104 lbs	HDPE	National Tank Outlet	NORWESCO	40148	X1038961	-	-	-	-	-	-
	LIT-710	Ultrasonic Level Indicators	1	-	-	-	EPDM	Endress + Hauser	Ultrasonic measurement Time-of-Flight Prosonic	-	-	14-35V	-	-	-	-	-
	YI-702	Immersion Heater	1	4,000 W	2" dia x 17.5" length	7 lbs	Copper	Grainger	TEMPCO	2VXU4	TSP02086	240V AC	-	-	N	-	-
		Thermostat - Local Control	1	-	-	0.5 l bs	Copper	Grainger	TEMPCO	36VE75	TST-101-137	-	-	-	-	-	-
	AG-700	Effluent Tank Agitator	1	3,000 gal	60"	96 lbs	316 SS	Grainger	Dayton	32V141	32V141	115/230V AC	-	3/4	-	-	-
	-	Effluent Tank Mixer Mounting	1	500 gal	80"	50 lbs	Steel	Peabody	Peabody	204-31728	204-31728	-	-	-	-	-	-
	AE-700	pH Sensor	2	-	0.87" x 5.91"	NA	PPS and Glass	Endress+Hauser	Memosens	Digital pH Sensor	CPF81E	-	-	-	-	-	-
	-	Instrumentation Cables - pH (Potentiometric)	1	-	0.25 " x <328'	NA	TPE and Aluminum	Endress+Hauser	Memosens	Digital Cable	CKY10	-	-	-	-	-	-
	P-600	Sodium Hydroxide Dosing Pump	2	96 gpd	5.5" x 12" x 11"	17 lbs	CSPE/PTFE	Grainger	Pulsatron	LPG5SA-KTC3-G19	6KYH0	115/230V AC	-	1/5	Y	60 Hz	-
	TK-600	Sodium Hydroxde Tote	1	5.3 gal	12" x 12"	50 lbs	Plastic	Grainger	Lab Chem	LC241155	9DT58	-	-	-	-	-	-
	-	Base Chemical Containment	1	17 gal	30.5" x 29.5" x 6"	5 lbs	Polyethylene	Grainger	BLACK DIAMOND	5141-BD	35LT85	-	-	-	-	-	-
	P-710	Effluent Tank Transfer Pump	1	24 gpm @ 60 ft tdh	9" x 14" x 9"	30	316 SS	Grainger	Goulds	4UB54	100MS1C5E4	208-230/460V AC	7.5/3.8	0.5	N	60 Hz	-

Pilot-Scale Micro-Electrolysis System Major Equipment Schedule[1, 2] (cont'd)

Cedar Hills Regional Landfill, Maple Valley, WA

Unit Op.	Tag No.	Equipment	Quantity	Capacity	Dimensions	Weight[3]	Materials of Construction	Vendor / Supplier	Make	Mfr. Model	Item No.	Electrical[4]					Notes
												Voltage	Amperage	Motor Power (hp)	VFD (Y/N)	Motor Requirements	
Misc.																	
	-	PLC/ SCADA/ HMI/ Computer	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	TK-800, BL-800	GAC Air Scrubber and Blower	1	90 acfm	24" dia x 56" h	250 lbs	Epoxy Lined Carbon Steel	Carbtrol	Carbtrol	G-1B90	-	120/230V	-	1/3	N	-	-
	TK-900, BL-900	GAC Air Scrubber and Blower	1	90 acfm	24" dia x 56" h	250 lbs	Epoxy Lined Carbon Steel	Carbtrol	Carbtrol	G-1B90	-	120/230V	-	1/3	N	-	-
	-	GAC Platform	1	30 gal	52 " x 27"	35 lbs	Polyethylene	Grainger	Eagle	35U061	1632D	-	-	-	-	-	-
	TK-400	Solids De-watering Tank	1	1 cu. yd	3' x 3' x 3'	860 lbs	Carbon Steel w/ Epoxy Coating	Process Park	GeoCat	GEDHO2	GEDHO2	-	-	-	-	-	-
	P-400	Solids De-watering Transfer Pump	1	24 gpm @ 60 ft tdh	9" x 14" x 9"	30	316 SS	Grainger	Goulds	4UB54	100MS1C5E4	208-230/460V AC	7.5/3.8	0.5	N	60 Hz	-
	TK-200	Clean Water Tank	1	275 gal	47" x 39" x 45"	150 lbs	Polyethylene	Grainger	Grainger Approved	GC275	21YK53	-	-	-	-	-	-
	YI-201	Immersion Heater	1	4,000 W	2" dia x 17.5" length	7 lbs	Copper	Grainger	TEMPCO	2VXU4	TSP02086	240V AC	-	-	N	-	-
		Thermostat - Local Control	1	-	-	0.5 l bs	Copper	Grainger	TEMPCO	36VE75	TST-101-137	-	-	-	-	-	-
	P-200	Clean Water Discharge Pump	1	24 gpm @ 60 ft tdh	9" x 14" x 9"	30	316 SS	Grainger	Goulds	4UB54	100MS1C5E4	208-230/460V AC	7.5/3.8	0.5	N	60 Hz	-
	-	Spill Containment - Straight	8	-	60" x 7.25" x 4"	1 lb	Polyurethane, Vinyl	Grainger	PIG	PLR258	30PW76	-	-	-	-	-	-
	-	Spill Containment - Corner	4	-	9.5" x 7.25" x 4"	1 lb	Polyurethane, Vinyl	Grainger	PIG	PLR263	30PW77	-	-	-	-	-	-
	-	Harsh Chemicals Spill Kit	1	55 gal	21" dia	70 lbs	-	Grainger	CONDOR	35ZR88	35ZR88	-	-	-	-	-	-
	-	Eyewash Station	1	15 gal	20" x 41"	51 lbs	SS	Grainger	GUARDIAN EQUIPMENT	G1562HTR	38NJ18	120V AC	3.33	-	-	-	-
	-	Lab Bench	1	-	48" x 24"	24 lbs	Plastic	Grainger	NATIONAL PUBLIC SEATING	BT2448	793EH8	-	-	-	-	-	-
	-	Pilot Concrete Pad	1	-	44' x 14' x 8"'	31,046 lbs	Concrete	-	-	-	-	-	-	-	-	-	-
	-	HACH 9385100 DR 900 Colorimeter	1	-	-	1 lb	-	Amazon	HACH	9385100	6630-01-623-0976	-	-	-	-	-	-
	-	Canopy	1	NA	42' x 12' x 15' (Eave)	-	Steel	Silverline	-	-	-	-	-	-	-	-	-

Notes:

1.All equipment must be as noted or equivalent.

Piping and valving was not included in this preliminary equipment list and cost estimate. Shelf spares for imperative process equipment are not included in this list. Equipment spares will be determined for the final design package.

2. Red values represent iterms that are not available through Grainger or a similar type of supplier.

3. All process tank weights are empty weights provided by vendor.

4. Electrical requirement will dictate equipment selection as the electrical package was tailored to this specific equipment.

5. "Or equals" may be substituted if engineer-approved

Abbreviations

- = Non Measurable or Not Applicable
AC = alternating current
cf = cubic feet
cfm = cubic feet per minute
CO_2 = carbon dioxide
CSPE = chlorosulfonated polyethylene
DC = direct current
dia = diameter
GAC = granular activated carbon
gal = gallons
gpd = gallons per day
gpm = gallons per minute
h = height
HDPE = high density polyethylene
HMI = human-machine interface
hp = horsepower
lbs = pounds
l = length
M = moles / liter
ME = micro-electrolysis
Mfr. = manufacturer
N = no
NA = not applicable
NPT = National Pipe Tapered
Op. = Operations
ORP = oxidation-reduction potential
oz = ounces
psi = pounds per square inch
PTFE = polytetra fluoroethylene
SCADA = supervisory control and data acquisition
SS = stainless steel
TDH = total dynamic head
UV =ultra violet
V = volts
VFD = variable-frequency drive
w = width

PUBLISHED CR-15 PARTICLE SIZE DISTRIBUTION SPECS



Provided by The University of Washington: 7/3/2023

CR-15

Reduced iron powder

Reduced iron powder is manufactured from selected iron oxides through high temperature metallurgical reduction processes. The powder particles are irregular in shape with a sponge-like porous structure so that it provides lower bulk density and higher surface area compared to conventional iron powders.

For more information on Höganäs products, please contact your local sales representative.

Technical information

Grade			**CR-15**
Physical			
Apparent density (g/cm^3)			1.5
Sieve Analysis (% retained)	mesh	µm	
	+20	+850	0
	+40	+425	9.1
	+60	+250	22.2
	+100	+150	38.8
	+200	+75	28.4
	-200	-75	1.5
Chemical (%)			
Fe			98.2
H_2-loss			0.74
Acid-insolube			0.20

Note: above are typical values.

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ADDITIONAL CR-15 PARTICLE SIZE DISTRIBUTION SPECS

Höganäs

Issued by Bo Hu

Provided by The University of Washington: 7/3/2023

Reduced Iron Powder

CR-15

Reduced iron powder is manufactured from selected iron oxides through high temperature metallurgical reduction processes. The powder particles are irregular in shape with a sponge-like porous structure so that it provides lower bulk density and higher surface area compared to conventional iron powders.

Technical Information

Grade	CR-15
Physical property	
Apparent density, g/cm^3	1.5
Particle size distribution	
%<20 mesh	100
%<100 mesh	<35
%<325 mesh	<5
Chemical property	
%Fe	>98
%H_2loss	1.0
%Acid-insoluble	0.2

North American Höganäs Co.
111 Höganäs Way, Hollsopple, PA 15935 USA

Tel: 814-479-3500
Fax: 814-479-2636

Provided by The University of Washington: 7/3/2023

Charcoal activated, NORIT® GAC 1240 12-40 mesh

Supplier: Thermo Scientific Chemicals

Synonyms: Activated carbon, Carbon activated, Activated charcoal



Formula: C
MW: 12.01 g/mol
Melting Pt: 3652 °C
Storage Temperature: Ambient

MDL Number: MFCD00133992
CAS Number: 7440-44-0

Specification Test Results

Appearance	Black Granular solid
Water	≤2 % (As packed)
Particle size	≤5 % (> 12 mesh)
Particle size	≤4 % (< 40 mesh)
Molasses number	≥230
Abrasion number	≥75
Iodine number	≥1000 mg/g

ORDER

VWR Catalog Number	Unit	Your Price	Quantity	Size	Packaging	Supplier No.
TS39571-0010	Each (1kg)	$177.10		1 kg	Glass bottle	39571-0010
TS39571-2500	Each (250g)	$72.89		250 g	Glass bottle	39571-2500

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- State issued document with your organization's Federal Tax ID Number
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- City or County issued Business License
- State Department of Health Services License
- Any other ID issued by the State that includes the business name & address

* ATTN: California Customers may require additional documentation as part of the CA Health & Safety Code. Products that fall under this regulation will be placed on a received. VWR will not lift restrictions for residential shipping addresses.

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SECTION 01 14 00
WORK RESTRICTIONS

PART 1 GENERAL

1.01 SUMMARY

A. Section includes the following:

1. Contractor responsibilities to not disrupt, or interfere with, concurrent Owner's landfilling operations.
2. Use of Site.
3. Work prohibitions and restrictions.
4. Prescribed work hours.
5. Access to Site.
6. Protection of existing facilities.

1.02 REFERENCES

A. The publications listed herein form a part of this Specification to the extent referenced. During implementation, the most recent version of the publication shall be used in all cases.

B. King County Code (KCC).

C. Community Workforce Agreement (CWA).

D. Revised Code of Washington (RCW) – Chapter 70.107 – Noise Control.

E. Washington Administrative Code (WAC):

1. 173-350 – Solid waste handling standards.
2. 173-351 – Criteria for municipal solid waste landfills.
3. 173-60 – Maximum environmental noise levels.
4. 296-155 – Safety standards for construction work.
5. 296-24-960 – Working on or near exposed energized parts.

1.03 DEFINITIONS

A. Limits of Construction (also referred to as the "Site"):

1. The boundary beyond which no construction is allowed.
2. The Limits of Construction are as indicated on the Drawings.

B. Staging Areas:

1. Those areas where the Contractor and its subcontractors and suppliers shall store and stage all equipment, offices, parking, materials and supplies to perform and complete the Work under this Contract.
2. Limited area for staging is available on Site. Contractor shall utilize just-in-time delivery whenever possible.

1.04 SUBMITTALS

A. Prior to mobilization, the Contractor shall prepare and submit to the Owner a list of all major equipment to be used on the Work Site throughout the Contract which will include the following minimum items:

1. List of equipment that may generate more than 85 dBA.
2. Make, model and age, plus anticipated noise level based on manufacturer's data.
3. Contractor's proposed noise reduction plans.

B. The Owner reserves the right to reject the use of specific equipment which produces sound at levels above 85 dBA.

C. Prior to mobilization, the Contractor shall prepare and submit to the Owner a Work Restrictions Coordination Plan specifically acknowledging and addressing how the Contractor will comply with each of the requirements of this Specification. This Plan shall incorporate the draft baseline project schedule, a check-marked copy of this specification section acknowledging each requirement of this Specification, and a draft gas service interruption Work Plan.

1.05 PERFORMANCE

A. Contractor is responsible for ensuring that their activities do not disrupt, or interfere with, Owner's concurrent landfilling operations:

1. King County personnel shall be able to access all portions of the Site at all times for monitoring and maintenance.
2. Contractor shall frequently consult with the Project Representative in implementation of the Traffic Control Plan as the Work progresses, to ensure Owner's operations and access are not disrupted or interfered with.
3. Contractor shall provide the Project Representative with written notice not less than seven (7) days in advance of any work activities by the Contractor which could interfere or disrupt Owner's operations or access.
4. In the event of an actual or potential disruption to the Owner's operations, as determined by and at the sole discretion of the Owner, the Project Representative and the Contractor shall work together to expeditiously and without delay, develop an alternative work plan that is satisfactory to the Owner.
5. The Contractor shall provide flaggers and signage for any work requiring flaggers inside the Limits of Construction, or as directed by the Project Representative.

B. Work Restrictions:

1. The Contractor shall only enter and exit the delineated Project Site through the designated entrance as indicated on the Drawings.
    a. Access to the scale facility is prohibited and no crossing of the Owner's scales is allowed.
    b. Any alternative entering and exiting arrangements desired by the Contractor shall be submitted in writing to the Project Representative not less than seven (7) days prior to Contractor's need. Such requests may be approved at the sole discretion of the Project Representative.

c. The Contractor shall mobilize all equipment and trucks only through Contractor Gate as indicated on the Drawings.

d. Limit vehicle speed as described in the Traffic Control Plan or as posted on Site, whichever is less.

2. Schedule, coordinate, and conduct work periods to comply with requirements of permits and the authorities having jurisdiction.

3. King County transfer trailer operating hours will generally be as follows and are subject to change:

a. From 6:30 AM to 6:00 PM Monday through Friday.

4. Noise Production:

a. Comply with State of Washington statutory prohibitions and rules regarding construction-generated noise production including but not limited to Chapter 70.107 RCW, and WAC 173-60.

b. Comply with KCC regarding noise (KCC Chapter 12.86).

c. Review noise production conditions with the Project Representative periodically to make necessary adjustments to mitigate noise impacts.

5. Work Area Limitations:

a. The Contractor's work areas shall not unnecessarily impair the use of the on-site roads, parking areas, and access gates.

b. Any work activities which could disrupt traffic flow shall be identified in the baseline project schedule, and appropriate traffic controls shall be provided for safe completion of the Work and concurrent landfill operations.

c. Site Roads: Work conducted within or adjacent to Site roads shall comply with the following requirements:

1) The Work area shall be limited to maintain at least one (1) operating traffic lane at all times.

C. Prescribed Work Hours:

1. Within the Limits of Construction indicated on the Drawings:

a. Daily hours of 6:30 a.m. to 6:00 p.m. weekdays, providing the work complies with all ordinances and permits.

b. Provide the Project Representative six (6) weeks advance written notice of Contractor's intended work areas and/or change in work hours. Owner requires this information to schedule Construction Quality Assurance field activities and to alert the permitting agencies and Cedar Hills Regional Landfill customers to the planned hours of construction activity.

c. Work activities that require inspection by any agencies other than the Owner, shall be scheduled and coordinated through the Project Representative for the hours between 8:00 a.m. to 4:00 p.m. on weekdays, unless prior approval from the affected agency is obtained in advance.

d. Work outside the daily hours of 6:30 a.m. to 6:00 p.m. weekdays and work on Saturday, Sunday and holidays shall be coordinated with the Project Representative at least seventy-two (72) hours in advance of the off-hour work to allow coordination of inspection coverage of the work.

2. Within the Cedar Hills Regional Landfill:

   a. Access to Cedar Hills Regional Landfill shall be available Monday through Friday unless alternative arrangements are made with the Project Representative.

   b. Contractor shall not leave trucks on access roads or at the entrance road to the Cedar Hills Regional Landfill overnight.

D. Staging Areas:

1. Locations:

   a. Limited area for staging is available on Site. Contractor shall utilize just-in-time delivery whenever possible.

   b. Parking of personal vehicles at the Owner-provided area is not allowed.

   c. Contractor trailers shall be kept offsite unless otherwise directed by the Project Representative.

2. Contractor's use of the staging areas shall not disrupt or interfere with the operation or access to the landfill.

3. Contractor shall not utilize the entrance road or scale facility area for unloading, staging and storage of any items, materials, and equipment, unless otherwise authorized (in writing) by the Project Representative.

E. Work Area Separation:

1. The Contractor shall post appropriate signs delineating the work areas in a format acceptable to the Project Representative.

   a. Maintain posted signs in good serviceable condition.

   b. Replace damaged or missing signs promptly.

   c. Refer to Section 01 50 00 – Temporary Facilities and Utilities.

2. Remove and store protective and exclusionary devices inside designated staging areas indicated on the Drawings when directed by the Project Representative.

F. Parking:

1. Comply with the provisions of the Traffic Control Plan.

2. The Contractor is responsible to park Contractor vehicles within the Site at designated staging locations so as to not disrupt or interfere with access to, or operation of, the landfill. A maximum of three (3) contractor vehicles (including those of subcontractors and delivery vehicles) are permitted on site at any one time. Parking of personal vehicles at the Owner-provided area is not allowed and shall be parked at an offsite location(s) secured by the Contractor.

3. Failure of the Contractor to abide by the requirements of onsite parking may result in Contractor and subcontractor vehicles being immediately towed, refused access in the future, or otherwise restricted access as determined appropriate by the Project Representative; the Contractor shall not be entitled to additional compensation on the basis of vehicle removal and exclusion restrictions imposed by the Project Representative.

G. Locating and Protection of Existing Facilities:

1. The Contractor is responsible for locating and protecting all existing utilities, structures, and improvements.
2. Review and field verify the available Information and Drawings prior to performing Work adjacent, above, or otherwise potentially affecting underground conditions, obstructions, utilities, structures, and improvements.
3. Immediately notify the Project Representative of conditions which are not as indicated within the Available Information and Contract Drawings.
4. Take all necessary steps to plan and execute work so as not to damage or disrupt existing facilities and utilities.
5. Follow procedures of Chapter 19.122 RCW.
6. Mark and record location of existing underground utilities, structures, and improvements within Construction Limits prior to commencing Work activities.
7. Report any damage to existing facilities and utilities caused by Contractor's operations immediately to the Project Representative.
8. Repair, restore or replace any underground utilities, structures or improvements which are damaged or rendered unusable by actions caused by or arising from the performance of Work by the Contractor or its subcontractors in accordance with the Owner's General Terms and Conditions – Correction of Work or Damaged Property at no cost to the Owner.

H. Intermittent use of Site by Third Parties:

1. Contractor shall coordinate its Work with supply and service vehicles in support of on-going landfill operations.

I. Work, including staging, is not allowed within the Cedar Hills Regional Landfill buffer.

J. Site Restoration:

1. All areas, items, utilities or structures damaged or destroyed by the Contractor or its subcontractors and suppliers during the construction of this Project, whether inside or outside of the Construction Limits, shall be restored by the Contractor to the satisfaction of the Project Representative, and in accordance with the requirements of this Section, prior to the Certificate of Substantial Completion.
2. Damage to roadway surfaces from the direct or indirect result of the Contractor's operation shall be repaired by the Contractor to the satisfaction of the Project Representative at no additional cost to the Owner.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION

3.01 NOISE

A. The Contractor shall comply with noise requirements of the State of Washington, KCC Chapter 12.86 or the requirements below; whichever are more stringent. Measurement of noise levels for the purpose of checking compliance with this requirement shall be done in accordance with the requirements of the applicable noise bylaw.

B. At no time during specified working hours shall the noise generated by the work, exceed the applicable regulatory limits, or, where no regulatory limits apply, “continuous” noise levels shall not exceed 85 dBA at the nearest property line, where “continuous” noise level is defined as the noise level exceeded for more than 3 minutes in any 15 minute period.

C. Should the Contractor wish to work outside the limits of the noise regulations, it shall submit to the Project Representative an alternative work plan for review and comment. The work plan shall indicate the types of equipment that will be required to operate outside the specified limits, proposed locations of the equipment and a description of any noise control measures that will be implemented. The Contractor shall then apply to the governing authority for a variance to the noise limit should they wish to work outside of the applicable limits.

D. The Contractor shall cooperate with the Project Representative in choosing a location for stationary equipment to minimize noise to the public.

E. The potential for noise impact to the commercial, industrial, and residential properties adjacent to Cedar Hills Regional Landfill and access roads has been predicted based upon anticipated construction activities and equipment. Noise monitoring may be conducted in the surrounding neighborhood by the Owner throughout the project. If measurements indicate that the required noise levels are not being met, the Contractor shall identify and implement noise control measures necessary to comply with applicable regulations and these contractual requirements.

3.02 EQUIPMENT NOISE LIMITS

A. Except for any equipment specifically accepted by the Project Representative, the maximum acceptable noise level produced by any individual machine shall be 85 dBA when measured at a distance of 45 FT from the equipment.

B. The Contractor shall equip and maintain devices on truck tailgates to minimize banging noise.

C. The Work Site shall be laid out to minimize the requirement for trucks and mobile equipment to back up. Back-up alarms shall be broadband-type alarms (i.e., quackers) and not pulsed, tone type alarms (i.e., beepers), adjusted to be clearly audible above the ambient noise level, as required by OSHA but shall be no louder than necessary. Where after-hours work is required and approved, OSHA approved alternatives to the use of back-up alarms may be required.

D. The Project Representative reserves the right to test any equipment on the Work Site at any time to determine if equipment noise emission exceeded the Contract limits. The Contractor shall make any equipment, with operator, available for testing, at or near its working location, at no additional cost to the Owner.

E. In the event that any equipment does not satisfy the Contract noise level limits, the equipment shall be replaced by a quieter machine or it shall be modified, for example, by providing better exhaust silencing or reducing its governed engine speed or building a sound enclosure and the alternate or modified machine may then be re-tested. The cost of testing Contractor equipment that exceeds Contract noise limits, including costs for retesting Contractor equipment, shall be at the Contractor's expense.

3.03 MAINTENANCE AND USE OF EQUIPMENT

A. Regular maintenance of equipment shall be undertaken to reduce noise and emissions produced by that equipment. This includes, but is not limited to, regular greasing of treads, chassis and pivot points, replacement of worn parts, brake checks, mechanical overhauls, attention to exhaust and emission control systems and any special acoustical fixtures.

B. All equipment used on the Work Site shall be equipped with, and operated with, all applicable covers, hoods, shields, and guards in place and latched shut, and all exhaust and emission control systems in place and fully operational. Air-powered equipment such as rock drills and jackhammers shall be equipped with effective mufflers on the air exhaust. The manufacturer's recommendation shall be followed.

C. Equipment, which is not in use shall be shut down, and not left idling for periods longer than three (3) minutes to reduce noise and negative impacts on air quality.

D. Brakes on trucks shall be adjusted and maintained to avoid objectionable brake "squeal" or noise. Engine brakes shall not be used anywhere on the Work Site or on any access roads, except in an emergency.

E. Operators of excavating equipment shall use minimum power consistent with reasonable operation of equipment, and shall avoid banging buckets on truck bodies, or other objects.

F. The Contractor shall maintain the truck tailgate damping devices in good working order at all times.

END OF SECTION 01 14 00

SECTION 01 15 00
SUSTAINABLE INFRASTRUCTURE SCORECARD

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes a description of the King County Sustainable Infrastructure Scorecard (KCSIS) design requirements.

1.02 PAYMENT

A. The Owner will not compensate the Contractor for Changes in Contract Time or Contract Price associated with the required sustainability documentation.

B. Contractor's lack of familiarity regarding their role and responsibilities for achieving project sustainability objectives shall not be a basis for additional compensation.

1.03 REFERENCES

A. Comply with the requirements of Section 01 09 05 – Reference Standards and as listed herein. The following is a list of standards referenced in this Section:

1. The King County Green Building and Sustainable Infrastructure Guidelines:

   a. Guidelines for complying with the King County Green Building and Sustainable Development Ordinance. This document was developed by the King County Solid Waste Division Green Tools Team with the guidance of the King County County-wide Green Building Team intended for non- Leadership in Energy and Environmental Design (LEED®) Eligible Capital Projects where the scope of project or type of structure limits the ability to achieve LEED Certification.

2. LEED – Rating System, LEED for Building Design and Construction.

3. LEED – Reference Package for New Construction & Major Renovations.

1.04 DEFINITIONS

A. KCSIS: The non-LEED Eligible Capital Projects checklist and scorecard developed for the King County Green Building and Sustainable Development Ordinance Guidelines which should be used on all King County projects where the project's scope or type limits the ability to achieve LEED certification.

1. KCSIS is provided to help track requirements for non-LEED eligible projects.

2. KCSIS was developed using concepts that are the basis of the LEED rating system.

3. KCSIS focuses on seven (7) key areas in addition to an innovations section. Each section lists credits within three columns:

   a. The "Yes" (Y) column denotes credits that are likely to be achieved.

   b. The "No" (N) column denotes credits that are applicable to the project but that are not likely to be achieved.

   c. The "Not Applicable" (N/A) column denotes credits that are not applicable to a particular project and will not be attempted.

B. KCSIS Coordination Manager: The Contractor's designated person responsible for quality of KCSIS and sustainability objectives and documentation.

C. KCSIS Prerequisite: One (1) of eight (8) fundamental requirements of the King County Green Building and Sustainable Development Ordinance Guidelines, none of which results in award of a KCSIS Credit.

D. KCSIS Credit: One (1) of eighty-seven (87) possible performance goals of the King County Green Building and Sustainable Development Ordinance Guidelines.

E. Available KCSIS Credit: An achievable performance goal for the Project and recognized by the King County Green Building and Sustainable Development Ordinance Guidelines.

F. Unavailable KCSIS Credit: A KCSIS Credit which is not suited to the project, as determined by the Owner's sustainability consultant.

G. Biobased Product: As defined in the 2002 Farm Bill, a product determined by the Secretary to be a commercial or industrial product (other than food or feed) that is composed, in whole or in significant part, of biological products or renewable domestic agricultural materials (including plant, animal, and marine materials) or forestry materials.

H. Biobased Content: The weight of the biobased material divided by the total weight of the product and expressed as a percentage by weight.

I. Certificates of Chain-of-Custody: Certificates signed by manufacturers certifying that wood used to make products has been tracked through its extraction and fabrication to ensure that was obtained from forests certified by a specified certification program.

J. Light Pollution: Light that extends beyond its source such that the additional light is wasted in an unwanted area or in an area where it inhibits view of the night sky.

K. Recycled Content Materials: Products that contain pre-consumer or post-consumer materials as all or part of their feedstock.

L. Post-Consumer Recycled Content: The percentage by weight of constituent materials that have been recovered or otherwise diverted from the solid-waste stream after consumer use.

M. Pre-Consumer Recycled Content: Materials that have been recovered or otherwise diverted from the solid-waste stream during the manufacturing process.

    1. Pre-consumer content must be material that would not have otherwise entered the waste stream as per Section 5 of the FTC Act, Part 260 "Guidelines for the Use of Environmental Marketing Claims": <www.ftc.gov/bcp/grnrule/guides980427>.

N. Regional Materials: Materials that are extracted, harvested, recovered, and manufactured within a radius of five hundred (500) miles from the Project Site.

O. Salvaged or Reused Materials: Materials extracted from existing buildings in order to be reused in other buildings without being manufactured.

P. Volatile Organic Compounds (VOC): Any compound of carbon, excluding carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates, and ammonium carbonate, which participates in atmospheric photochemical reactions. Compounds that have negligible photochemical reactivity, listed in United States (U.S.) Environmental Protection Agency's (EPA) 40 CFR 51.100(s), are also excluded from this regulatory definition.

1.05 PERFORMANCE

A. This Project is required to complete KCSIS.

B. To minimize the environmental impacts of the construction and operation, the Contractor during the Project shall implement the following procedures, either individually or in combination.

1. Select products that minimize consumption of non-renewable resources, consume reduced amounts of energy, and minimize amounts of pollution to produce, and employ recycled and/or recyclable materials. To help purchasers incorporate environmental considerations into purchasing decisions, it is the intent of this Project to conform to EPA Five Guiding Principles on environmentally preferable purchasing. The five principles are as follows:

    a. Include environmental considerations as part of the normal purchasing process.

    b. Emphasize pollution prevention early in the purchasing process.

    c. Examine multiple environmental attributes throughout a product's or service's life cycle.

    d. Compare relevant environmental impacts when selecting products and services.

    e. Collect and base purchasing decisions on accurate and meaningful information about environmental performance.

2. Products and processes that achieve the above objectives to the extent currently possible and practical have been selected and included in these Contract Documents. The Contractor is responsible to maintain and support these objectives in developing means and methods for performing the Work of this Contract and in proposing product substitutions and/or changes to specified processes.

1.06 QUALITY CONTROL

A. Perform Work in accordance with Section 01 43 00 – Quality Assurance and Control.

B. Preconstruction Meeting in accordance with Section 01 30 00 – Administrative Requirements.

1.07 SYSTEM DESCRIPTION

A. The Contractor shall be responsible for assisting the Owner in meeting the sustainability objectives identified in this Section.

B. Identify a member of the Contractor's organization to perform as the KCSIS Coordination Manager.

1. Responsibilities include:

a. Provide calculations for volumes, quantities, rates, percentages, and other numerical measures for performance of specific environmental requirements per this Section.

b. Complete KCSIS forms provided at the Preconstruction Meeting.

c. Deadlines for submittals of KCSIS forms vary and will be discussed at the Weekly Project Meetings to assist the Contractor in performance of the documentation duties.

d. Coordinate with suppliers, vendors, subcontractors, and others.

e. Collect documentation and submit to the Project Representative.

f. Make adjustments, corrections, clarifications, and other corrective actions.

g. Report at weekly progress meetings submittals received the past week related to KCSIS.

C. Prepare submittals:

1. General: Additional KCSIS submittal requirements are included in other Sections of the Specifications.

2. Sustainable Design Submittals:

a. Salvaged or Reused Materials: Provide documentation that lists each salvaged or reused material, the source or vendor of the material, the purchase price, and the replacement cost if greater than the purchase price.

b. Recycled Content: Submittals for materials with recycled content must include the following documentation.

1) Cost of each material or product, excluding cost of labor and equipment for installation.

2) Manufacturer's product data, product literature, or a letter from the manufacturer verifying the percentage of post-consumer and pre-consumer recycled content (by weight) of each material or product.

3) An electronic spreadsheet that tabulates the Project's total materials cost and combined recycled content value (defined as the sum of the post-consumer recycled content value plus one-half of the pre-consumer recycled content value) expressed as a percentage of total materials cost. It should indicate, on an ongoing basis, line items for each material, including cost, pre-consumer recycled content, post-consumer recycled content, and combined recycled content value.

3. Regional Materials: Submittals for all products or materials expected to contribute to the regional calculation for materials sourced within five hundred (500) miles must include the following documentation.

a. Cost of each material or product, excluding cost of labor and equipment for installation.

b. Location of product manufacture and distance from point of manufacturer to the Project Site.

c. Location of point of extraction, harvest, or recovery for each raw material in each product and distance from the point of extraction, harvest, or recovery to the Project Site.

d. Manufacturer's product data, product literature, or a letter from the manufacturer verifying the location and distance from the Project Site to the point of manufacture for each regional material.

e. Manufacturer's product data, product literature, or a letter from the manufacturer verifying the location and distance from the Project Site to the point of extraction, harvest, or recovery for each regional material or product, including, at a minimum, gravel and fill, planting materials, and concrete.

f. An electronic spreadsheet that tabulates the Project's total materials cost and regional materials value, expressed as a percentage of total materials cost. It should indicate on an ongoing basis, line items for each material, including cost, location of manufacture, distance from manufacturing plant to the Project Site, location of raw material extraction, and distance from extraction point to the Project Site.

4. Project Materials Cost Data: Provide a spreadsheet in an electronic file indicating the total cost for the Project and the total cost of building materials, excluding labor costs, used for the Project, as follows:

a. Identify each reused or salvaged material, its cost, and its replacement value.

b. Identify each recycled-content material, its post-consumer and pre-consumer recycled content as a percentage the product's weight, its cost, its combined recycled content value (defined as the sum of the post-consumer recycled content value plus one-half of the pre-consumer recycled content value), and the total combined recycled content value for all materials as a percentage of total materials costs.

c. Identify each regional material, its cost, its manufacturing location, the distance of this location from the Project Site, the source location for each raw material component of the material, the distance of these extraction locations from the Project Site, and the total value of regional materials as a percentage of total materials costs.

d. Identify each wood-based material, its cost, the total wood-based materials cost, each FSC Certified wood material, its cost, and the total value of FSC Certified wood as a percentage of total wood-based materials costs.

D. Provide final versions of the above spreadsheets to the Project Representative within the Request for Substantial Completion. The individual Sections of the Specifications indicate submittal requirements to be performed by the Contractor.

E. The Contractor is not required to perform any direct communication or reporting to the U.S. Green Building Council, the King County Solid Waste Division Green Tools Team, or King County Green Building Team.

1. The Contractor is required to provide documentation required for the KCSIS certification application to the Project Representative.

2. The Contractor is required to provide at a minimum the submittals identified in the individual Sections.
3. The Contractor will be instructed to provide certain assurances, statements, measurements, and other information on the required forms to substantiate the sustainability goals of the Project.
4. Forms required to be filled out by the Contractor will be included in the KCSIS certification application.
5. The Contractor is required to be familiar with the LEED Rating System and the KCSIS and have experience or access to experience for performing the required documentation.

F. This Project will apply in accordance with the King County Green Building Initiative under the KCSIS Rating system.
   1. The rating system includes a scorecard for evaluating projects.
   2. Documentation is required of the Contractor in the process of demonstrating compliance.
   3. This system consists of six (6) environmental categories containing fifty-four (54) credits, an Equity and Social Justice category containing twenty-seven (27) credits, a category for enhanced performance containing six (6) credits, and a required category containing eight (8) prerequisites for a total of ninety-five (95) total prerequisites and credits.
      a. Each prerequisite and credit identifies the intent, requirements, and submittals to achieve a specific goal.
      b. Points are awarded for accomplishments in each credit area.
      c. Credits, when added together, form the basis for a performance award in the form of certification level for the Project.
   4. Four (4) award levels of achievement are possible: “Bronze,” “Silver,” “Gold” and “Platinum.”
      a. The award is based on the review of the KCSIS.
      b. Significant Contractor participation is required to complete the KCSIS.

G. There are two (2) documents available from the U.S. Green Building Council to explain the LEED Green Building Rating System which is the basis of the King County Green Building Initiative and the KCSIS Rating system as applicable to this Project. There is one (1) document available from King County that provides additional guidance for the Scorecard.
   1. These documents may be obtained from the U.S. Green Building Council website at https://new.usgbc.org/leed:
      a. LEED Rating System, v4 for Building Design and Construction.
      b. LEED Reference Package for New Construction & Major Renovations.
   2. Green Building and Sustainable Infrastructure Guidelines is available from the King County website at http://your.kingcounty.gov/solidwaste/greenbuilding/scorecard.asp

H. KCSIS Certification:

1. The Owner supports every available KCSIS Credit. Some credits may not be available to the Project.
2. These unavailable credits are identified on the baseline KCSIS which will be provided at the Preconstruction Meeting.
3. The Project must satisfy every applicable prerequisite. Additionally, the Project must achieve the specific number of credit points defined in the KCSIS.
    a. The Contractor may not of its own volition, or interpretation, fail to perform a reasonable and identifiable sustainability objective.
4. The Project Representative is responsible for administration of the KCSIS responsibilities performed by the Contractor.

PART 2 PRODUCTS

2.01 PRODUCT ENVIRONMENTAL REQUIREMENTS

A. Do not burn rubbish, organic matter, etc. or any material on the Site.

B. Herbicides and Pest Control: Herbicides shall not be permitted, and pest control measures shall utilize EPA-registered biopesticides only.

C. Salvaged or Reused materials: There shall be no substitutions for specified salvaged and reused materials and products.

D. Recycled Content of Materials:

1. Provide building materials with recycled content such that post-consumer recycled content value plus half the pre-consumer recycled content value constitutes a minimum of thirty (30) percent of the cost of materials used for the Project. The Contractor shall make all attempts to maximize the procurement of materials with recycled content.
    a. The post-consumer recycled content value of a material shall be determined by dividing the weight of post-consumer recycled content by the total weight of the material and multiplying by the cost of the material.
    b. The pre-consumer recycled content value of a material shall be determined by dividing the weight of pre-consumer recycled content by the total weight of the material and multiplying by the cost of the material.
    c. Do not include mechanical and electrical components in the calculations.
    d. Do not include labor and delivery costs in the calculations.
    e. Recycled content of materials shall be defined according to the Federal Trade Commission's "Guide for the Use of Environmental Marketing Claims," 16 CFR 260.7 (e).
    f. Utilize all onsite existing paving materials that are scheduled for demolition as granulated fill, and include the cost of this material had it been purchased in the calculations for recycled content value.

E. Regional Materials: Provide a minimum of ten (10) percent of building materials by cost that are manufactured and extracted/harvested within a five hundred (500) mile radius of the Project Site, exclusive of labor and delivery costs. The Contractor shall make all attempts to maximize the procurement of materials within this specified five hundred (500) mile radius.

F. Adhesives and Sealants:

1. All adhesives and sealants, regardless of where they are used, must comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA method 24):

    a. Concrete Curing Compound: 60 g/L

    b. Concrete Sealer: 10 g/L

    c. Concrete Form Release Agents: 0g/L

    d. Portland Cement Plaster: 20 g/L

    e. Multipurpose Construction Adhesives: 70 g/L

    f. General Contact Adhesive: 80 g/L

    g. Pipe Thread Sealant: 50 g/L

    h. Plastic Cement Welding Compounds: 250 g/L

    i. ABS Welding Compounds: 400 g/L

    j. Adhesive Primer for Plastic: 250 g/L

PART 3 EXECUTION – NOT USED

END OF SECTION 01 15 00

SECTION 01 29 00
MEASUREMENT AND PAYMENT PROCEDURES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: This Section specifies administrative and procedural requirements governing the Contractor's Applications for Payment, the preparation of a baseline Schedule of Values, and criteria for progress payments under a Lump Sum contract framework.

B. Scope Definition: All work required to fully complete the Project in compliance with the Contract Documents shall be compensated through the established Lump Sum Contract Price. No independent item measurements will be recorded except to establish the baseline percentage of work completed.

1.02 BASELINE SCHEDULE OF VALUES (SOV)

A. Submittal Timing: The Contractor shall submit a detailed, line-item Schedule of Values to the King County Project Representative within 14 calendar days of the Notice to Proceed (NTP), or at the Pre-Construction Conference, whichever occurs first.

B. Format: Schedule line items shall follow the Construction Specifications Institute (CSI) Master Format structural divisions matching the project manual.

C. Breakdown Requirements:

1. Break down large lump sum line items into discrete, identifiable tasks or physical components to facilitate progress evaluation.
2. Mobilization, Demobilization, Submittals/As-Builts, Operations & Maintenance (O&M) Manuals, and Project Closeout must be listed as explicit, individual line items.

D. Overhead and Profit: Proportionally allocate overhead, bond costs, insurance premiums, and profit across all operational work-item components. "Front-loading" values onto early milestones is strictly prohibited and constitutes grounds for rejection of the SOV by King County.

1.03 PROGRESS PAYMENT PROCEDURES

A. Application Schedule: The Contractor shall submit a preliminary "pencil copy" Application for Payment to King County on or before the 25th day of each calendar month for work projected through the end of that month.

B. Review Cycle: The King County Project Representative will review the pencil copy within 5 working days. Upon validation and mutual agreement, the Contractor shall submit the formalized, signed Application for Payment.

C. Payment Terms: King County will process approved applications and issue payments within 30 days of receiving a properly executed, finalized Application for Payment.

PART 2 PART 2 – PRODUCTS (NOT USED)

PART 3 PART 3 – EXECUTION

3.01 MEASUREMENT METHODOLOGY

A. Lump Sum Verification: Progress measurements for lump sum items are based exclusively on the estimated percentage of physical work completed and accepted in the field by King County.
B. Joint Assessments: Monthly progress assessments must be performed jointly by the Contractor's project superintendent and the King County Project Representative immediately prior to submitting the pencil copy application.
C. Material on Hand (Stored Materials): At King County's sole discretion, progress payments may be authorized for non-perishable materials fabricated specifically for the project and securely stored on-site or in an approved bonded warehouse. Claims must be accompanied by original paid invoices, transfer of title documents, and proof of separate insurance.

3.02 DEFINITION OF PAYMENT ITEMS

A. Progress allocations within the Schedule of Values are governed by the following operational definitions:
    1. Mobilization & Demobilization:
        a. Capped at a maximum percentage specified in the Invitation to Bid (typically 5% to 10% of the total contract price).
        b. Paid incrementally: 50% upon verified mobilization and setup of field facilities, and 50% upon complete demobilization, site cleanup, and removal of equipment.
    2. Civil, Structural, and Mechanical Systems: Paid strictly as a percentage of construction milestones completed (e.g., excavation, foundation pour, framing, final assembly installation).
    3. Testing, Commissioning, and Facility Integration: Paid upon successful functional testing and submission of certified reports satisfying King County Quality Assurance standards.
    4. Project Closeout Documents: Retains a distinct, mandatory allocation within the SOV (minimum 2% to 5% of the contract total) which is withheld from release until King County approves all Record Drawings (As-Builts), warranties, and O&M deliverables.

3.03 RETAINAGE AND DEDUCTIONS

A. Statutory Retainage: King County will withhold 5% retainage from all progress payments in accordance with Chapter 60.28 of the Revised Code of Washington (RCW) to protect laborers, subcontractors, and material providers.

B. Deficient Work Deductions: King County reserves the right to withhold payments or reduce progress percentages for any work found to be defective, non-compliant with specifications, or lagging behind the approved baseline schedule recovery plans.

END OF SECTION

SECTION 01 30 00
ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY

A. Section includes the following:

1. Approvals.
2. Project coordination.
3. Preconstruction meeting.
4. Pre-installation meetings.
5. Weekly project meetings.
6. Request for Information (RFI) meetings.
7. Documents and submittals.

1.02 APPROVALS

A. All approvals described in the Contract Documents shall be made in writing by the Project Representative. Written documents include the following:

1. Change Orders.
2. Field Directives.
3. Emails.

1.03 PROJECT COORDINATION

A. General: Coordinate construction activities to assure efficient and orderly performance of the Work and avoidance of interference with Owner's landfill operations.

B. Coordinate construction activities with utility service providers required for performance of the Work.

C. Be responsible for completion, and administration of required forms.

1. The Owner will provide required and suggested forms and formats during and after the Preconstruction Meeting.

D. Forms not prescribed by the Owner may be of the Contractor's own design, subject to the following.

1. Contractor-designed forms shall use Arial typeface, eleven (11) point type size, and shall be printed double-sided, if applicable.
2. Submit forms for review and approval by the Project Representative prior to use.

1.04 PRECONSTRUCTION MEETING

A. Schedule:

1. The Project Representative will schedule the Preconstruction Meeting(s).

    a. Initial Preconstruction Meeting will be held within twenty (20) calendar days following Notice to Proceed.

B. The Project Representative will provide an agenda for the Preconstruction Meeting(s) and provide a list of those items required for the Contractor to submit or present at the Preconstruction Meeting.

C. Purpose:

1. Establish lines of communication at the project working level.
2. Discuss and review administrative requirements of the Contract.
3. Discuss and review the Stormwater Pollution Prevention Plan (SWPPP). The SWPPP shall be prepared by the Contractor, prior to the preconstruction meeting.
4. Review forms required to be used by the Contractor in administration of the Work.
5. Review and discuss design intent, user, and concurrent operations issues, and permitting issues including requirements of authorities having jurisdiction (AHJs).
6. Review and discuss Contract Documents including Drawings and Specifications.
7. Review and discuss requirements for Contractor to maintain and submit Project Record Documents on a weekly basis per Section 01 78 00 – Closeout Procedures.
8. Review and discuss facility and Site access, flagging activities, security, procedural issues, and protocol for interacting with Landfill Operations Representatives.
9. Discuss administration and performance of landfill security responsibilities.
10. Coordinate safety activities, including performance of the required Contractor's Health and Safety Plan.
11. Review and discuss Milestones, Substantial Completions, and Punch list Procedures as described in the Owner's General Terms and Conditions.
12. Coordinate mobilization activities.

D. Notification:

1. The Project Manager will notify the Contractor and required attendees not less than two (2) calendar days in advance of the proposed meeting time.

E. Required Attendees:

1. Construction Manager.
2. Project Representative.
3. Technical Representatives designated by the Project Representative.
4. Landfill Operations Representatives.

5. Design Team (also referred to as Engineer) Representatives.
6. Contractor representatives, including at a minimum the following:
    a. Project Manager.
    b. Superintendent.
    c. Safety officer.
7. Significant subcontractors pertinent to the agenda.

F. Project Representative will prepare and distribute the notes from the Preconstruction Meeting.

1.05 PRE-INSTALLATION MEETINGS

A. Pre-installation meetings will be scheduled for various portions of the Work as the Work progresses.

B. The agenda of each pre-installation meeting shall include the following:

1. Project conditions, including anticipated temperature and weather conditions, readiness of the substrate for installation; and project-specific issues affecting the Work of this Section.
2. Installation schedule, sequencing, and coordination with Work of other trades.
3. Installation procedures.
4. Quality assurance procedures; specifically, Contractor accommodation of Project Representative and CQA Representative, inspections of the Work of the relevant Section, and other quality expectations.

C. The following is a partial list of systems, assemblies and products for which pre-installation meetings are required:

1. Concrete slabs/foundations.
2. Pilot-scale ME treatment system.
3. Connections to existing utilities.
4. Others as determined by the Project Representative.

1.06 WEEKLY PROJECT MEETINGS

A. The Project Representative will prepare, coordinate, convene, arrange, and direct Weekly Project Meetings.

B. Purpose:

1. Maintain and improve lines of communication.
2. Demonstrate performance of administrative requirements of the Contract.
3. Complete and maintain forms required to be used by the Contractor in administration of the Work.
4. Review and discuss the Weekly Look Ahead Schedule.
5. Review and discuss design intent, user and concurrent operations issues, work quality issues, and permitting issues including requirements of AHJs.

6. Review and discuss specific questions regarding Contract Documents including Drawings and Specifications.
7. Review and discuss strategies to maintain and improve facility and Site access, traffic control, flagging activities, security, noise management, stormwater management, procedural issues, and interfacing with Landfill Operations.
8. Review and improve ongoing safety activities including performance of the required Health and Safety Plan.
9. Review Contractor's progress maintaining Project Record Documents.

C. The Contractor shall follow the direction of the Project Representative in preparation for weekly meetings, including:
   1. Ensure the Contractor's project manager, superintendent, safety officer, representatives of subcontractors, and others are present in accordance with provisions of this Section.
   2. Ensure required attendees are prepared and familiar with the Project and the Project Schedule.
   3. Coordinate the time and place of the weekly meetings with the Project Representative.
   4. Ensure the Project Representative has been consulted in advance of the meeting with respect to the proposed attendees, and their relationship to the Project.
   5. Submit the Weekly Look Ahead Schedule at least twenty-four (24) HRS in advance of the Weekly Project Meeting.
   6. Submit Weekly Reports:
      a. Include a narrative describing the Work accomplished the preceding week.
      b. Identify the completion of milestones, and work activities.
      c. Indicate problems and resolution of problems occurring during the week.
      d. Progress on KCSIS submittals and documentation.

D. Attendance at Weekly Project Meetings:
   1. Construction Manager.
   2. Project Representative.
   3. Landfill Operations Representative(s).
   4. Design Team(s) Representative(s).
   5. Contractor representatives including at a minimum:
      a. Project Manager,
      b. Superintendent,
      c. Safety Officer, and
      d. Others as requested by the Project Representative.
   6. Subcontractors and vendors pertinent to the agenda.
   7. Representatives of AHJs, as needed.

E. Agenda for Weekly Project Meetings:

1. Be prepared to discuss the following, to the extent deemed appropriate by the Project Representative:

    a. Safety Report by the Contractor-designated safety representative.

    b. Weekend work request, if any is requested, by the Contractor for the coming week.

    c. Temporary Erosion and Sediment Control (TESC) discharge request, in the event discharge is needed or anticipated within the coming week.

    d. Review and approve minutes (or record) of previous Weekly Project Meeting.

    e. Review work progress during the preceding week.

    f. Note field observations, problems, and decisions.

    g. Identify problems that impede planned progress.

    h. Coordinate activities to the Project Representative's satisfaction, to permit the Project Schedule to be maintained, or improved.

    i. Review offsite fabrication processes and status.

    j. Develop corrective measures, and procedures to maintain or improve the Project Schedule.

    k. Discuss progress of preparation and maintenance of administrative documents required in accordance with this Section.

    l. Discuss updates to the Monthly Update Schedule in accordance with Section 01 32 00 – Project Scheduling.

    m. Review planned work identified in the Weekly Look Ahead Schedule in accordance with Section 01 32 00 – Project Scheduling.

    n. Review impacts of Changes on the Project Schedule.

    o. Discuss status, and action related to Changes.

    p. Discuss additional scope, costs, schedule impacts, deviations, substitutions, and other Changes.

    q. Review safety measures, including compliance with the required Health and Safety Plan, and cooperation with governmental agencies, and AHJs.

    r. Review Apprenticeship and Subcontractor Opportunities.

    s. Maintenance and improvement of quality, work standards, and competence.

    t. Resolution of construction non-conformities.

    u. Review of status logs of submittals, RFIs, and Change Orders.

    v. Review of Sustainability Scorecard progress and documentation.

F. The Project Representative or designee will prepare and distribute minutes from each Weekly Project Meeting.

1.07 DOCUMENTS

A. For documents created by the Contractor and/or its subcontractors:

1. Text: Submit electronically in Microsoft Word, current version.
2. Tables: Submit electronically in Microsoft Excel, current version.
3. Schedules: Submit electronically in native format (Primavera or Approved Equal software) along with an Adobe Portable Document Format (PDF) version.
4. Figures and pictures: Submit electronically as PDF or JPG files.
5. Cut sheets from catalogs and similar items: Scan and submit as PDF.
6. Drawings: Submit as PDF files and provide AutoCAD version of files and xmls.
7. Obtain prior approval from the Owner to submit an electronic version in a format other than those specified in this Section.

B. Environmental Quality Monitoring:

1. For information such as sediment quality data and water quality data, submit the data in a Microsoft Excel file (current version), or
2. Use a format compatible with the Washington State Department of Ecology's SEDQUAL Database format.

C. Security and Reliability:

1. The Contractor is required to provide, upon request by Project Representative, its own back up of electronic files that have been submitted.

D. Electronic Document Control System:

1. The Contractor is required to transmit and receive documents electronically, utilizing the Document Control System (DCS) provided by Owner.
2. Internet connection will be required for Contractor personnel to utilize the DCS.
3. The DCS system document storage capacity does not relieve Contractor's responsibilities to maintain and protect separate electronic and hardcopy versions of Record Documents.

1.08 SUBMITTALS

A. Contractor Staffing and Organization Chart:

1. Submit an Organization Chart to the Project Representative showing the Contractor's personnel and key points of contact with the Owner within three (3) weeks following Notice to Proceed.
2. Submit a list of Contractor's personnel and Subcontractors to the Project Representative. The list shall include Contractor and Subcontractor responsibilities and contact information and shall be submitted within three (3) weeks following Notice to Proceed.
    a. Include the Project Manager, Project Superintendent, and Safety Officer.
    b. Provide telephone numbers with voice mail service, and email addresses monitored daily for each designee of the Contractor.
    c. Indicate emergency and after-hours contacts, and the means of reaching these people.
    d. Post copies of the list in the construction trailers.

e. Revise the list as approved by the Project Representative whenever changes in staffing occur.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION – NOT USED

END OF SECTION 01 30 00

SECTION 01 32 00
PROJECT SCHEDULING

PART 1 GENERAL

1.01 SUMMARY

A. Section includes the creation, submittal, and maintenance of a project construction schedule.

1.02 DEFINITIONS

A. Baseline Schedule: The complete Project Schedule reviewed and commented on by the Owner prior to the commencement of work. Baseline Schedule will be used to determine the progress of work as compared to the updated Project Schedule.

B. Float Time: Time between the earliest start date, and the latest start date of an activity, or succession of dependent activities.

C. Weekly Look Ahead Schedule: Annotated, detailed version of the Monthly Update Schedule.

D. Monthly Update Schedule: Actual current Project Schedule reflecting actual progress to date, changes to the Baseline Schedule, and Changes to the Work.

E. Project Schedule: The approved Baseline Schedule, inclusive of any subsequent approved Changes.

1.03 PERFORMANCE

A. Responsibilities

1. Perform scheduling responsibilities required in this Section.
2. Be responsible for completion and administration of required forms.

B. Scheduling of Work:

1. The scheduling requirements identified in this Section are in addition to the requirements of the Owner's General Terms and Conditions.
    a. Failure of the Contractor to provide suitable and sufficient information may result in the Project Representative denying or delaying an Application for Payment.
2. Scheduling of construction activities and preparation of construction activities is the responsibility of the Contractor.
3. Use the Critical Path Method (CPM) of scheduling.
4. Level of Detail Required:
    a. Show a continuous flow of Work from the date of Contract Execution to Final Acceptance.
    b. Do not exceed duration of thirty (30) days for any single activity, unless otherwise approved by the Project Representative.
    c. Use Notices to Proceed as constraints only.

d. Use start-start, and finish-start relationships, and milestone activities. No beginning or ending constraints shall be used. No summary activities shall have logic links.

e. Show predecessor and successor activities for each activity in column format in the schedule. Each activity shall have at a minimum, one predecessor and one successor, except for the starting and completing milestone activities.

f. Group all activities and milestones within appropriate Work Breakdown Structure (WBS) categories, at a minimum the following:

1) Project Milestones.

2) Pre-construction.

3) Construction.

4) Project Closeout.

5) Change Orders/Contract Modifications.

g. All activities must have a unique name. Activities shall not describe work to be done by more than one entity or subcontractor.

h. Include a separate activity and time for procurement of critical activities. Examples of procurement activities include but are not limited to: Materials/equipment submittal preparation, submittal and approval of material/equipment fabrication and delivery, and material/equipment onsite.

i. Do not use lead or lag logic unless otherwise approved by the Project Representative.

5. Phase of Work:

a. Identify activities within the Notices to Proceed in accordance with Section 01 10 00 – Summary of Work.

6. Software:

a. Use a Primavera, MS Project, or approved equal scheduling product acceptable to the Owner.

b. Scheduling software shall use (if applicable) Retained Logic, not Progress Override, as the schedule calculation.

7. Cost Loading:

a. Cost load every activity when cost loading is required for a schedule submittal in accordance with provisions of this Section.

b. Include progress schedule and reporting activities.

c. Include mobilization and demobilization activities.

8. Baseline Schedule:

a. Incorporate Construction Manger’s comments into the Preliminary Construction Schedule.

b. The Baseline Schedule provides precedence diagram and cash flow projections and demonstrates cost-loading, resource-loading, activity-coding, and a defined critical path.

c. Provide a schedule which accurately describes completion of the Work within the Contract Time.

d. Cost load each activity.

e. Resource load each activity.

f. Assign an activity code for each activity. Activity codes should be relevant to location, stationing, scope of work, trade, and type of work.

g. No progress billing will be paid on the non-cost loaded, non-resource loaded, non-activity-coded Preliminary Construction Schedule.

h. When reviewed by the Project Representative, and after the Project Representative's comments have been resolved, the Baseline Schedule constitutes the Project Schedule for monitoring, and completion of the Work in performance of the Contract.

9. Monthly Update Schedule:

   a. Include an updated Gantt or Pert diagram, narrative summary, PDF, and native schedule data files (.xer, .mpp, etc.) to the Project Representative for review and analysis.

   b. Narrative Summary: Briefly describe the progress of the Work and describe how the Work is progressing toward its scheduled completion.

   c. Identify milestones completed, major equipment deliveries, and problems arising during the month.

   d. Identify impacts on the schedule.

   e. Project the Work anticipated during the coming month; include major deliveries and submittals.

   f. Progress all activities which should have started, are in progress, or should have finished during the update period. No activities shall have a start date equal to the data date and not be in progress.

10. Float Time:

    a. Float Time is for the Contract and is not for the exclusive use of either the Contractor or the Owner.

    b. Float should be used in priority of who demonstrates a reasonable need to utilize Float Time first, whether this is the Owner, or the Contractor.

    c. Contractor's use of Float Time requires Project Representative approval.

11. Weekly Look Ahead Schedule:

    a. Annotated version of the Monthly Update Schedule that reflects work tasks to be completed in the next six (6) week period and coordinated with the work results in the preceding two (2) week period.

    b. Provide this schedule with greater detail than the CPM schedule.

    c. Prepare this schedule in a format that includes references to the appropriate CPM schedule activity numbers, and the WBS.

    d. Include effects of identified Changes.

C. Delays and Recovery:

1. If, at any time during the Project, Contractor fails to complete an activity by its latest scheduled completion date, Contractor shall submit within two (2) working days a written statement as to how and when Contractor will reorganize its work force to return to current construction schedule.

2. Whenever it becomes apparent from progress evaluation and/or updated schedule data that milestone completion dates and/or Contract completion dates will not be met, the Contractor shall take some or all of the following actions:

   a. Increase construction staffing in such quantities and crafts to substantially eliminate backlog of work.

   b. Increase number of working hours per shift, shifts per workday, workdays per work week, or amount of construction equipment, or combination of foregoing to substantially eliminate backlog of work. The increase of work effort shall be subject to allowable Cedar Hills Regional Landfill working hours and days as well as approval of the King County Project Representative.

   c. Reschedule work items to substantially eliminate the backlog of work.

3. Under no circumstance will addition of equipment or construction forces, increasing working hours or any other method, manner, or procedure to return to current Construction Progress Schedule be considered justification for Contract modification or treated as an acceleration.

1.04 SUBMITTALS

A. Baseline Schedule:

1. Submit preliminary baseline schedule within fourteen (14) calendar days after the Notice to Proceed.

2. Provide both PDF and the native schedule data file.

3. Schedule shall be formatted so that activity relationships, time periods and descriptions are legible. Time scale shall be adjusted to smallest time increment possible to be able to review the scheduled activities.

4. Submit final baseline schedule five (5) working days after receipt of comments on the preliminary baseline schedule.

B. Monthly Update Schedules:

1. Submit with each Application for Payment.

2. Submit an electronic version in both PDF and the native schedule data file software.

C. Submit an electronic version, in both PDF and the native schedule file software, of the Weekly Look Ahead Schedule twenty-four (24) HRS in advance of Weekly Progress Meetings.

1.05 QUALITY CONTROL

A. Dates imposed on the Project by the Baseline Schedule are not binding on the Owner, and do not limit or restrain the Owner in its activities for administration of the Contract.

B. Written Narratives:

1. Provide when requested by the Project Representative.
2. Show Contractor's determination of durations for CPM activities, and near-critical activities.
3. Show crew strength, composition, experience level, number of shifts, hours per shift, and workdays per calendar week.
4. Show production curves for major commodities, including below grade pipe, concrete, piping, wire, and cable.
5. Show construction equipment requirements.
6. Show supplier and delivery requirements.

C. Network Diagrams: Include the following detailed information, in accordance with the CPM technique, when network diagrams are required by provisions of this Section:

1. Number.
2. Description of activities, coordinated with the WBS and the Schedule of Values.
3. Activity duration.
4. Early start and late start.
5. Early finish and late finish.
6. Predecessor activities.
7. Successor activities.
8. Total Float Time.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION

3.01 CONTRACT BASELINE SCHEDULE

A. A network diagram (CPM) schedule shall be required for this Contract.

B. Submit schedule per the timelines and requirements detailed above.

END OF SECTION 01 32 00

SECTION 01 33 00
SUBMITTAL PROCEDURES

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes the administrative and procedural requirements for submittals, specifically:

1. Submittal procedures, requirements, and variations from the Contract Documents.
2. Progress schedules.
3. Proposed products list.
4. Shop drawings.
5. Product data and samples.
6. Manufacturer's instructions and certificates.
7. Test reports.
8. Operation and Maintenance Manuals.

1.2 SUBMITTAL PROCEDURES

A. Contractor shall make all submittals in accordance with this procedure and the requirements of the Contract Documents.

B. Contractor shall certify all submittals for accuracy, completeness, and compliance with contract requirements. Contractor shall indicate approval on each submittal as evidence of coordination and review.

C. Submittals provided without evidence of the Contractor's approval will not be reviewed.

D. Where construction or erection procedures require design and calculations, the Contractor shall provide a Professional Engineer licensed in the State of Washington to perform these services, affix seal, and provide signature. The Professional Engineer shall provide proof of Professional Liability Errors and Omissions Insurance in accordance with Owner’s Insurance Requirements.

E. The review of submittals by the Engineer will be limited to general design requirements only and shall in no way relieve the Contractor from responsibility for errors or omissions contained therein.

F. Acceptance of submittals shall not relieve the Contractor from responsibility for the safety of their method or equipment or from responsibility for complying with the requirements of all applicable codes and of this Contract, except with respect to specifically approved variations.

G. Work done prior to submittal review shall be at the Contractor's risk.

H. Delays, resequencing, or other impact to Work resulting from Contractor's submission of unchecked or unreviewed, incomplete, inaccurate or erroneous, or nonconforming submittals, which will require Contractor's resubmission of a submittal

review, shall not constitute a basis of claim for adjustment in Contract Price or Contract Time.

I. Project Representative reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

J. Provide a "priority list" when submitting several submittals at one time.

K. Submittal sequencing should coincide with the Contractor's Submittal Schedule and scheduled progression of work.

1. Generally, the Contractor shall submit no later than sixty (60) calendar days before the product, material, assembly, system or other element of the Work covered by the submittal must be ordered so it is delivered to the Project Site when needed, in accordance with the Contractor's latest Project Schedule.

L. Contractor will allow time for review coordination with regulatory agencies as specifically called out in the Contract Documents.

1.3 SUBMITTAL SCHEDULE

A. Prepare a Submittal Schedule, based on the submittal summary listed at the end of this section, which provides columns for the following information in tabular format:

1. Unique submittal number numbered sequentially.
2. Submittal description.
3. Applicable Section and/or Article.
4. Planned submittal date.
5. Actual submittal date.
6. Required submittal approval date.
7. Actual submittal return date.
8. Disposition.
9. Notes or comments.

B. Provide an electronic copy of the Submittal Schedule in Microsoft Excel format.

C. Submittal Schedule shall be submitted within twenty-one (21) days of Notice to Proceed.

D. Submittals requiring further action or re-submittal will be added to the Submittal Schedule and tracked by the Contractor. Resubmittals are to have the original number with an alphabetic suffix (i.e., SUB-01 first revision becomes SUB-01A).

E. Submit an updated Submittal Schedule monthly with each Application for Payment.

F. In the event of a discrepancy between the Contract Documents and the Submittal Schedule, the Contract Documents shall take precedence.

G. Submittal Registry. Preliminary list is presented below. Other submittals may be required as listed in each specification. This list should be supplemented based on Drawings and Specifications.

Project Documentation Submittals	
Document Required	**Reference Specification**
List of Major Equipment	01 14 00
Work Restrictions Coordination Plan	01 14 00
Labor Management Plan	01 16 00
Stormwater Pollution Prevention Plan	01 30 00
Site Health and Safety Plan	01 30 00
Contractor Staffing and Organization Chart	01 30 00
List of Contractor Personnel and Subcontractors	01 30 00
Baseline Schedule	01 32 00
Monthly Update Schedule	01 32 00
Weekly Look Ahead Schedule	01 32 00
Network Diagrams	01 32 00
Written Narrative (Provided on Request)	01 32 00
Submittal Schedule	01 33 00
Certification of Regulatory Requirements	01 41 00
Traffic Control Plan	01 55 00
C&D Materials Management Report	01 74 19
C&D Materials Management Plan	01 74 19
Final Affidavit of Amounts Paid	01 78 00
As-Built Drawings	01 78 00
Final Record Documents	01 78 00
Final Application for Payment	01 78 00
Contingency Response Plan	02 31 40
Pollution Prevention Site Plan	02 31 40
Spill Prevention and Cleanup Report	02 31 40

Equipment Submittals			
Discipline	**Equipment**	**Submittal Category**	**Documents Required**
Process/Mechanical	All	Product Information	- Shop Drawings - Product Data/Cutsheet - Manufacturer's Installation, Operation and Maintenance Instructions
Structural	All	Product Information	- Shop Drawings - Concrete mix
Electrical	All	Product Information	- Shop Drawings - Material Lists - Product Data

1.4 SUBMITTAL REQUIREMENTS

A. Identify each submittal and resubmittal by showing the following information:

1. Name and address of submitter, name and telephone number of the individual who may be contacted for additional information.
2. Project name as it appears in the Contract Documents.
3. Contractor, subcontractor, or supplier name and address.
4. Drawing sheet and detail number(s) and specifications section number to which the submittal applies.
5. When applicable, the name, address, and telephone number of the local manufacturer's representative.
6. Submit only pertinent catalog pages and mark each copy of standard printed data to identify pertinent products. All options, models or other unnecessary information shall be clearly lined/crossed out or the pertinent information highlighted. Submittals received that do not clearly show the material being submitted shall be returned to the Contractor un-reviewed.
7. Address no more than one topic or related topics under a single identification number.

B. Submittal Format:

1. The Contractor is required to transmit and receive documents electronically.
2. Make all Shop Drawing prints in blue or black line on white background.
   a. Size shall be 22 IN x 34 IN, 8-1/2 IN x 11 IN, or 11 IN x 17 IN.
   b. Make all Shop Drawings accurate to a scale sufficiently large to show the pertinent features of the item and its method of connection.
3. Transmit each submittal with a sequentially numbered identification. Resubmittals are to have the original number with an alphabetic suffix.
4. Submittals received from sources other than the Contractor will be returned without action.
5. Record relevant information, deviations, and requests for data, including minor variations and limitations from the Contract Documents.
6. In the event of the need to "Revise and Resubmit" a submittal, resubmit the same in acceptable form/content, clearly identifying deviations from previous submittal content.

1.5 SUBMITTAL INFORMATION

A. Shop Drawings:

1. Submit for review to check for conformance with information given and the design concept expressed in the Contract Documents.
2. Indicate any special utility, electrical characteristics, and/or utility connection requirements.

B. Product Data:

1. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information unique to this project.
2. For manufactured products other than the brand name specified in the Contract, submit a Substitution Request Form per Specification Section 01 60 00 and obtain approval in writing from the Project Representative prior to ordering.
3. Indicate any product utility, electrical characteristics, and/or utility connection requirements.

C. Samples:

1. Submit samples as specified in individual Specification Sections and in accordance with the Contract Documents.
2. Clearly label samples, identifying the system, assembly, material, or product for which it is submitted using the names or terminology for the system, assembly, material, or product in the Contract Documents. Labels shall include, at a minimum, referenced Specification Section, material description, date of shipment, and name of person/entity shipping the sample.
3. Provide three (3) duplicate samples or sets of samples unless noted otherwise in the Contract Documents.
4. Include with samples a statement of the availability of each product, and compliance with applicable standards.
5. Submit a full set of choices when the selection will be from a range of products.
    a. Demonstrate finishes including color, sheen, texture, and other physical attributes including toughness, resistance to damage from scratching, crushing and wear. Provide samples from the range of materials that are being proposed.

D. Manufacturer’s Instructions:

1. When specified in individual Specification Sections, submit manufacturers' printed instructions for delivery, storage, assembly, installation, adjusting, and finishing before the item is delivered to Project Site.
2. Identify any conflicts between manufacturers' instructions and Contract Documents.

E. Manufacturer’s Certificates:

1. When specified in individual Specification Sections, submit manufacturers' certificate for review.
2. Demonstrate that the material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
3. Certificates may be based on recent or previous test results on the material or product.

F. Submit Test Reports as required in individual Specification Sections.

G. Submit all other items as specified in individual Specification Sections.

H. Submit Operation and Maintenance (O&M) Manuals for all functional equipment.

1. Provide one (1) digital copy of each O&M Manual for review. Once reviewed and returned with no corrections required one (1) final electronic copy.
2. Each O&M Manual shall include, at a minimum:
    a. Fly sheet indicating: project name; Owner's name; manufacturer's name, address, and telephone number; and local supplier / representative's name, address, and telephone number.
    b. Detailed index indicating submittal contents, with major headings related to tabbed dividers.
    c. Assembly drawings.
    d. Parts list and/or bill of materials, complete with manufacturer's part/ serial numbers and contact information for parts supply.
    e. Wiring diagrams.
    f. Lubrication instructions, including type and frequency.
    g. Preventative and periodic maintenance summary.
    h. Operating instructions.
    i. Overhaul and parts replacement instructions.
    j. Serial numbers.
    k. Source for parts.
    l. Testing and troubleshooting procedures.
    m. Performance curves (as applicable)
    n. Factory test data.
    o. List of recommended spare parts (with serial numbers).
    p. List of expendable parts (i.e., air or oil filters).
    q. Safety Data Sheet on all associated chemicals and products.
    r. Warranty.

1.6 SUBMITTAL REVIEW

A. Ensure all submittals are provided far enough in advance of scheduled installation to provide time for review and approval, allowing for any necessary revision and resubmittal, and for orders and delivery.

B. Only those items required by the Contract Documents will be reviewed. Information submitted by the Contractor that is not required will be returned marked "Information Only."

C. In the event a single submittal contains both required and non-required information, only the required information is subject to review.

D. Submittals will be checked for conformance with the design concept of the project and compliance with the information given in the Contract Documents.

E. Review of drawings or data prepared by a Professional Engineer licensed in the State of Washington will be limited to the submittal's effect on the integrity of the completed project.

F. Submittals will be marked to indicate the result of the review, as follows:

1. “APPROVED – NO EXCEPTION TAKEN" – Revision of Shop Drawing or data will not be required.
2. "APPROVED – AS NOTED" – Contractor shall revise the Shop Drawing or data as indicated. Resubmittal is not required.
3. “DISAPPROVED – COMMENTS ATTACHED, REVISE AND RESUBMIT” – Submittal does not conform to Contract Documents. Contractor shall revise and resubmit for review and approval.
4. "REJECTED" - Submittal does not conform to Contract Documents. Contractor shall resubmit in a form that conforms to Contract Documents for review and approval.

G. Copies marked "NO EXCEPTION TAKEN” or “APPROVED – AS NOTED" authorizes the Contractor to proceed with construction or fabrication covered by those shop drawings or data sheets with corrections, if any, incorporated.

H. No revision in any way shall be made to a submittal marked "NO EXCEPTION TAKEN" without resubmitting for review.

I. When prints of Drawings have been marked "RESUBMIT," the Contractor shall make the necessary corrections and resubmit. Every revision shall be shown by number, date, and subject in a revision block, and in addition, each revised Shop Drawing shall have its latest revision clearly indicated by clouding (in red) around the revised areas. Resubmittals without these indications will be considered nonconforming.

1.7 VARIATIONS FROM CONTRACT REQUIREMENTS

A. Variations from the Contract Documents shall be specifically and separately approved by the Project Representative.

B. If working Drawings show variations from the Contract requirements, Contractor shall describe such variations in writing and submit for approval.

C. For product options and substitutions see Section 01 60 00 – Product Requirements.

1.8 PROGRESS SCHEDULES

A. Progress Schedules shall comply with Section 01 32 00 – Project Scheduling.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION – NOT USED

END OF SECTION 01 33 00

SECTION 01 35 00
HEALTH AND SAFETY

PART 1 GENERAL

1.01 SUMMARY

A. Section includes: Special safety and health requirements for Work on the Cedar Hills Regional Landfill.

B. Construction of this project is being performed on, within, and adjacent to buried waste and refuse.

1. As these buried materials decompose anaerobically, they generate landfill gas (LFG), which normally consists of carbon dioxide (CO2), methane (CH4), and lesser amounts of hydrogen sulfide (H2S) and other gases, dependent on the composition of the buried materials.

2. Hazardous conditions due to LFG include, but are not limited to, fires, explosions, oxygen deficiency, and toxic environments.

3. Leachate (i.e., contaminated liquid that has come in contact with refuse and contains waste degradation products) may be present in excavations.

C. LFG has the potential to create hazardous conditions if not controlled or recognized. Some of the hazards include:

1. Fires that may start spontaneously from exposed and/or decomposing refuse.

2. Fires and explosions that may occur from the presence of methane gas.

3. Gases that may have toxic effects or create an oxygen deficiency in trenches, vaults, conduits, and structures.

4. Hydrogen sulfide, a highly toxic and flammable gas, which may be present.

D. Exposure to leachate is potentially hazardous to human health because of toxic and/or carcinogenic compounds that may be present in the leachate.

1.02 REFERENCES

A. Comply with the requirements of Section 01 09 05 – Reference Standards and as listed herein. The following is a list of standards referenced in this Section:

1. Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

2. Federal Water Pollution Control Act (FWPCA).

3. Occupational Safety and Health Act (OSHA) Hazardous Waste Operations and Emergency Response (HAZWOPER) - 29 Code of Federal Regulations (CFR) 1910.120.

4. National Institute of Occupational Safety and Health (NIOSH) / OSHA / United States Coat Guard (USCG) / United States Environmental Protection Agency (EPA): Occupational Safety and Health Guidance Publication 85-115: Manual for Hazardous Waste Site Activities, October 1985.

5. Puget Sound Clean Air Agency (PSCAA) Regulations.

6. Revised Code of Washington (RCW):
    a. 49.17 – Washington Industrial Safety and Health Act.
    b. 70.105 - Hazardous Waste Disposal Act.
    c. 70.105D - Hazardous Waste Cleanup-Model Toxic Control Act.
7. Toxic Substance Control Act (TSCA).
8. Washington Administrative Code (WAC).
    a. Chapter 173-160: Minimum standards for construction and maintenance of wells.
    b. Chapter 173-303: Dangerous Waste Regulations.
    c. Chapter 173-351: Criteria for Municipal Solid Waste Landfills.
    d. Chapter 296-24: Safety Standards for General Safety and Health.
    e. Chapter 296-62: General Occupational Health Standards.
    f. Chapter 296-155: Safety Standards for Construction Work.
    g. Chapter 296-842: Respirators.
9. Solid Waste Association of North America (SWANA) National Landfill Gas Committee.

1.03 SUBMITTALS

A. Submit a Site Health and Safety Plan (HASP) in accordance with Part 3.02 at least five (5) days prior to commencing Work at the Site or within ten (10) days following the Notice to Proceed, whichever comes first.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION

3.01 GENERAL

A. The Owner may order a work stoppage at any time when unsafe conditions are present with no allowance to increase the Contract Price or the Contract Time. The Contractor shall remedy unsafe conditions promptly and resume Work when approved to do so by the Project Representative.

B. The Contractor shall comply with health and safety rules, regulations, ordinances promulgated by the Local, State, and Federal Government, the various construction permits, and other sections of the Contract Documents.

C. In addition to complying with health and safety rules, regulations, and ordinances promulgated by the Local, State, and Federal Government, the various construction permits, and other Sections of the Contract Documents, the Contractor shall inform its employees and subcontractors and their employees of the potential danger in working on and near solid waste landfills.

D. The Contractor shall be familiar with the Health and Safety section of the Landfill Gas Field Practices and Procedures as prepared by the Solid Waste Association of North America (SWANA) National Landfill Gas Committee. The most current version of this

document is dated August 2011. Copies may be obtained by writing SWANA at P.O. Box 7219, Silver Springs, Maryland 20910; telephoning (301) 585-2898; or visiting their website at SWANA.org.

E. Contractor shall perform whatever Work is necessary for safety and be solely and completely responsible for conditions of the Site within the Construction Limits, including safety of all persons (including employees of King County, any Site visitors, and Contractor) and property during the Contract period. This requirement applies continuously and is not limited to normal working hours.

F. The Project Representative's review of the Contractor's performance is not intended to include a review or approval of the adequacy of the Contractor's safety supervisor, the safety program or any safety measures taken in, on, or near the construction Site.

G. The Contractor shall provide for the protection of employees and all others from fire, explosion, or asphyxiation caused by any gases encountered during construction and landfill leachate emitted from, and present within, the existing solid waste landfill.

H. The Contractor shall provide at all times proper facilities for safe access to the Work by authorized government officials.

I. Accidents causing death, injures, or damage must be reported immediately to the Project Representative by telephone or messenger. In addition, promptly report in writing to the Project Representative all accidents whatsoever arising out of, or in connection with, the performance of the Work whether on, or adjacent to, the Site, giving full details and statements of witnesses.

J. If a claim is made by anyone against the Contractor or any subcontractor on account of any accident, the Contractor shall promptly report the facts in writing within 24 HRS after occurrence, to the Project Representative, giving full details of the claim.

K. Implement all Owner requirements dealing with Employee Drug and Alcohol Testing.

3.02 SITE HEALTH AND SAFETY PLAN

A. Develop, implement, and maintain for the duration of this Contract, a Site Health and Safety Plan prepared under the supervision of, and signed by, a Certified Industrial Hygienist that will effectively incorporate and implement all required County, State, and Federal safety provisions.

1. The Site Health and Safety Plan shall be consistent with all applicable Local, State and Federal health standards and guidelines, including, but not limited to, OSHA, the Washington Industrial Safety and Health Act, WAC, RCW, NIOSH, the American Conference of Governmental Industrial Hygienists, and the EPA. Where these are in conflict, the more stringent requirements shall be followed.

2. The Site Health and Safety Plan shall be sufficient to protect onsite and offsite personnel from potential physical, chemical, and/or biological hazards particular to the Site.

3. The Contractor shall provide a written Site Health and Safety Plan for the construction at least five (5) days prior to commencing Work at the Site or within ten (10) days after receiving a Notice to Proceed, whichever comes first.

4. At least one (1) copy of the written Site Health and Safety Plan shall be maintained at the Site and posted in a conspicuous location. The Site Health and Safety Plan shall be made accessible by the Contractor to any requesting party.
5. The Contractor shall assign an individual to serve as a Site Safety and Health Officer at the Site at all times during Work that is responsible, and authorized, to supervise and enforce compliance with the Site Health and Safety Plan in accordance with this Section.

B. Preparation of the written Site Health and Safety Plan is the Contractor's responsibility and no statement made in these provisions relieves the Contractor of responsibility for information included and implementation of the Site Health and Safety Plan.

C. The Contractor's written Site Health and Safety Plan shall include, but not be limited to:

1. A list of names of key personnel and alternates responsible for Site safety and health, including the Site Health and Safety Officer.
2. A list of chemical and physical hazards (such as methane exposure), safety data sheets (SDSs), allowable OSHA exposure levels, threshold limit values, other regulatory exposure levels, and the emergency response should an exposure or injury occur.
3. Frequency and types of air monitoring, personnel monitoring, and environmental sampling techniques and instrumentation to be used, including methods of maintenance and calibration of monitoring and sampling equipment to be used.
4. Personal protective equipment to be used by employees for each of the Site tasks and operations and criteria for upgrading level of worker protection from Level D to Levels C and B.
5. A list of safety and monitoring equipment at the Site and locations where equipment is stored or maintained.
6. An emergency evacuation plan for immediate removal to a hospital or a doctor's care any person who may be injured on the Site including routes to medical treatment, and emergency telephone numbers including hospital, ambulance, fire, sheriff/police, poison control, the Site Health and Safety Officer, and others as deemed necessary.
7. Employee training assignments.
8. Medical surveillance requirements.
9. Decontamination procedures.
10. Confined space entry procedures.
11. A spill containment program for handling contaminated liquids.
12. Copies of individual 40-hour HAZWOPER and 8-hour annual HAZWOPER refresher certificates for every employee that is to Work in contact with landfill material.
13. Documentation of participation in ongoing respiratory protection program, as per Part E of WAC 296-842, including results of fit testing conducted within the past six (6) months.

D. The Contractor shall inform all workers and the public visiting the Site of the potential for the presence of methane and other landfill gasses emanating from the natural decomposition of refuse buried at or near the Site and the importance of safety precautions to ensure the safety of workers and the public. The Contractor shall instruct all workers and maintain the strict control of construction activity to protect and maintain the integrity of the closed portion of the landfill.

E. Failure on the part of the Contractor to follow the Site Health and Safety Plan or to continue any Work in an unsafe manner may result in suspension of the Work by the County. The Contractor shall not be entitled to extra compensation on the Contract Price for health and safety related suspensions, nor shall the Contract Time be extended.

3.03 CONTRACTOR SAFETY EQUIPMENT

A. The Contractor shall maintain at the Site, safety equipment applicable to the Work as prescribed by the governing safety authorities in quantities that are adequate for the construction worker, as well as the Project Representative's team and all articles necessary for giving first aid to the injured.

B. The Contractor shall keep Automated External Defibrillators (AEDs) and First-Aid Kits readily available at all times in conspicuous and known locations.

C. The Contractor shall train all personnel in the use of the appropriate safety equipment that would be utilized during their work. It is the responsibility of the Site Safety and Health Officer, or person(s) in authority, to ascertain that all safety equipment is being used when appropriate.

D. The Contractor shall inform all workers and visitors of the location of safety equipment on a daily basis.

3.04 SITE HEALTH AND SAFETY OFFICER

A. The Contractor shall provide a person designated as the Site Health and Safety Officer, who is thoroughly trained in rescue procedures, the use of safety equipment and gas detectors, and the potential hazards that may be present at municipal solid waste landfills. The person must be present at all times while Work is being performed and implement the written Site Health and Safety Plan and conduct testing.

B. The Contractor's Site Health and Safety Officer shall be delegated the authority to order any person or worker on the landfill Site to follow the safety rules. Failure to observe these rules is sufficient cause for removal of the person or worker(s) from the project.

C. The Site Health and Safety Officer shall have taken a course satisfying the training requirements of 29 CFR 1910.120 for Hazardous Waste Site Operations. A copy of the Site Safety and Health Officer's 40-hour OSHA Hazmat Certificate shall be submitted to the Engineer, within ten (10) days after receipt of Notice to Proceed.

D. The Site Health and Safety Officer is responsible for determining the extent to which any safety equipment must be utilized, depending on conditions encountered at the Site.

END OF SECTION 01 35 00

SECTION 01 41 00
REGULATORY REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY

A. Section includes the following:

1. Compliance with codes, laws, regulations, and rules.
2. Fees.
3. Permits.

1.02 REFERENCES

A. The following is a partial list of Codes and Regulations central to the Project:

1. King County Surface Water Design Manual. King County, Washington. 2021
2. 2024 Department of Ecology Stormwater Management Manual for Western Washington
3. King County Code (KCC)
    a. KCC – Title 10 Solid Waste
    b. KCC – Title 12 Public Peace, Safety, and Morals
    c. KCC – Title 16 Building and Construction Standards
4. International Building Code including the following amendments:
    a. Washington State Amendments
5. Puget Sound Clean Air Agency (PSCAA) Regulations I, II, and III
6. Resource Conservation and Recovery Act (RCRA)
7. Revised Code of Washington (RCW) 70.94 and 90.48
8. Washington Administrative Code (WAC)
    a. WAC 173-201A – Water Quality Standards for Surface Waters of the State of Washington
    b. WAC 173-303 – Dangerous Waste Regulations
    c. WAC 173-350 – Solid Waste Handling Standards
    d. WAC 173-351 – Criteria for Municipal Solid Waste Landfills

B. A list of industry standards and governing regulations and authorities is provided in Section 01 09 05 – Reference Standards.

1.03 PERFORMANCE

A. The Contractor shall be fully informed of all regulations which impact the Work, specifically the following permits paid for and obtained by Owner listed below:

1. Concrete Foundation Construction Permit, Cedar Hills Regional Landfill NONB26-0007, August 6, 2026.

B. In event of conflict between standards, codes, and regulations:

1. Inform the Project Representative at the earliest opportunity.
2. The Project Representative will determine the appropriate direction and communicate with the Contractor.

C. Permit Milestones: Coordinate permit responsibilities and tasks with preparation and maintenance of schedules and other administrative activities.

1. Provide (apply and pay for) the following permits:
   a. Any permits required for temporary facilities or utilities.
   b. All other permits not specifically listed as obtained by the Owner.
2. Fulfill the obligations and conditions in each permit affecting the Work.

1.04 SUBMITTALS

A. Certification is to include Owner statement(s) that Work was performed as agreed, that restoration work was performed, and that Work was completed in a satisfactory manner.

B. Certification is to include Owner statements that the Owner has no claims for damages on account of construction restoration activities.

C. Submit when requested by the Project Representative.

D. Permits not provided by the Owner.

E. Provide copies of permits to the Project Representative within three (3) days of the date of issuance by the permitting agencies.

F. Provide copies of permit cards that include progress notations made by inspectors acknowledging completeness of Work, for those permits requiring several inspections.

G. Provide electronic and hard copies of permit approvals to the Project Representative when these become available.

1.05 ADDITIONAL REQUIREMENTS

A. Work performed under permits must be inspected by the authority having jurisdiction prior to being considered part of the Work.

B. Contractor shall be responsible for the satisfactory completion of all Work required, obtaining regulatory approval, and sign-off of permits applied to this Contract.

C. Permit Posting:

1. Post all permits at the Site in a protected location.
2. Use transparent plastic pockets mounted on wood for storage.
3. Post project permits in one (1) location.
4. Do not post permits in unprotected or exterior locations.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION – NOT USED

END OF SECTION 01 41 00

Department of Local Services
Permits
919 SW Grady Way, Suite 300
Renton, WA 98057

CONSTRUCTION PERMIT

Permit type, Subtype:	Non-Building, Utility
Title:	(ART) KC SWD CHRLF LEACHATE TREATMENT - MICRO ELECTROLYSIS
Description:	CONSTRUCT A REINFORCED CONCRETE FOUNDATION PAD (APPROX 44' X 14') AT CHRLF TO SUPPORT A FUTURE WASTEWATER TREATMENT SYSTEM - WORK INCLUDES INSTALLATION OF STEEL REINFORCEMENT AND PLACEMENT OF AN 8-INCH CONCRETE SLAB ON A COMPACTED GRANULAR BASE - THIS PERMIT PHASE IS LIMITED TO AT-GRADE FOUNDATION CONSTRUCTION ONLY - TANK PLATFORM AND LARGE CANOPY TO BE SUBMITTED AS A SEPARATE PERMIT
List of Parcels:	2123069016
Site Address:	16645 228TH AVE SE 98038
Valuation:	$2,651,652.00
Applicant Name:	SAID SEDDIKI
Applicant Address:	201 S JACKSON ST SEATTLE, WA 98401

Permit Number:	**NONB26-0007**
Date Issued:	08/06/2026
Expiration Date:	8/5/2028
Permit Status:	Permit Issued

Comments and Conditions

1. Work Subject to Approved Plans and Conditions. Work Authorized by this permit is subject to the approved plans and corrections shown thereon and the attached conditions of permit approval. Failure to comply with all conditions once construction is begun may necessitate an immediate work stoppage until such time as compliance with the stipulated conditions is attained.

2. Posting on the job site. This permit must be posted on the job site at all times in a visible and readily accessible location.

3. Inspections Scheduling, Estimated Arrival Times* & Results. (*Building only)

Online: https://inspection.mybuildingpermit.com/ **IVR:** 206-971-9780 **Text:** 1-844-413-2653
For IVR Codes/Instructions: https://kingcounty.gov/en/dept/local-services/buildings-property/inspections/building-inspections

Inspection cutoff: 3:00 pm for next day inspections. Fire Inspection and land use requests will be confirmed and scheduled by a return phone call.

4. Expiration. Please note the expiration date on this permit located in the upper right corner. Permit extension requests may be considered in accordance with current King County Code.. Work must be substantially commenced within two years of permit issuance. Extensions beyond the third year shall only be granted to allow completion of the structure.

5. Compliance with State and Federal laws and the Endangered Species Act. The applicant is responsible for making a diligent inquiry regarding the need for concurrent state or federal permits to engage in the Work requested under this permit, and to obtain the required permits prior to issuance of this permit. It is understood that the granting of this permit shall not be construed as satisfying the requirements of other applicable Federal, State or Local laws or regulations. In addition this permit does not authorize the violation of regulations. In addition, the granting of this permit does not authorize the violation such "take" restrictions would be violated by work done pursuant to this permit, and is precluded by Federal law from undertaking work authorized by this permit if that work would violate the "take" restrictions set forth at 16 U.S.C. 8, 50 C.F.R. §17.21, 50 C.F.R. §223 and 50 C.F.R §224.

King County

Department of Local Services
Permits

919 SW Grady Way, Suite 300
Renton, WA 98057

Permit: NONB26-0007

INSPECTIONS

See reverse side for scheduling and accessing inspection results

Approved plans, documents and this Inspection Record Card must be at the job site for all requested inspections

EROSION CONTROL PROVISIONS SHALL BE IN PLACE PRIOR TO AND DURING CONSTRUCTION

Approvals: (Inspection codes for use with the DLS Permits voice Inspection Line)

1. Site Preparation (215)	**2. Drainage BMP (150)**	**3. Critical Areas (350)**	**4. Final Site (355)**
By: _____	By: _____	By: _____	By: _____
5. Foundation (087)	**6. Under Floor (300)**	**7. Exterior Shear (200)**	**8. Framing (090)**
By: _____	By: _____	By: _____	By: _____
9. Insulation Inspection (060)	**10. HVAC (282)**	**11. Fire Inspection (266)**	**12. Final Building* (075)**
By: _____	By: _____	By: _____	By: _____

Notes:

_____

_____

_____

_____

All Permits:

a) Responsibility for the building's compliance with the provisions of the applicable King County Codes and for maintenance of the building rests exclusively with the permit applicants and their agents and the property owners.

b) King County inspection of the building and real property are spot checks designed to foster and encourage compliance with the applicable codes. Neither the approvals above nor the issuance of a Certificate of Occupancy guarantees or assures compliance with all applicable codes.

c) The owner's copy of any applicable manufacturer's installation instructions shall be available to the inspector at the time of the inspection.

***SINGLE FAMILY PERMITS**

Permission to occupy structures for residential use is authorized upon final building inspection approval.

COMMERCIAL / MULTI-FAMILY PERMITS:

No occupancy of commercial or multi-family structures is permitted until a separate **"Certificate of Occupancy"** has been issued.

SECTION 01 43 00
QUALITY ASSURANCE AND CONTROL

PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies administrative and procedural requirements for quality control measures by the Contractor and references quality assurance duties which have combined responsibilities as outlined in the Inspection and Test Plan (ITP) provided as available information.

1.02 GENERAL

A. The Contractor shall be fully responsible for the quality of its work.

B. Quality control services include inspections, tests and related actions including reports performed by independent agencies, government authorities, and the Contractor. They do not include Contract enforcement activities performed by the Project Representative.

C. Inspection and testing services are required to verify compliance with requirements specified or indicated. These services do not relieve the Contractor of responsibility for compliance with Contract Document requirements.

D. Quality control requirements for individual construction activities are shown in the Sections that specify those activities.

E. Inspections, tests, and related actions specified are not intended to limit the Contractor's quality control procedures that facilitate compliance with Contract Document requirements.

F. Requirements for the Contractor to provide quality control services required by the Project Representative or authorities having jurisdiction are not limited by provisions of this Section.

1.03 DEFINITIONS

A. Construction Quality Control (CQC): Refers to those actions taken by the Contractor (including those parties charged with the manufacture, supply, fabrication, delivery, and installation) to demonstrate and quantify the characteristics of the product. The results of the CQC program are compared to the Contract Documents and any other contractual or regulatory requirements. During each aspect of the Work, the Contractor shall provide quality control to ensure and document that the materials and workmanship conform to the Contract Documents.

B. ITP: Refers to those actions (including inspections, verifications, audits, testing and evaluation), taken by the Project Representative on behalf of King County, intended to provide adequate confidence that the materials and workmanship provided by the Contractor conform to the Contract Documents and any applicable regulatory requirements.

1.04 SAMPLES AND CERTIFICATION

A. Samples:

1. Contractor shall supply samples when required by the Contract Documents or the Project Representative.
2. Samples or test specimens shall be prepared and specified furnished with information as to their source in such quantities and size as may be required for proper examination and tests, with all freight charges prepaid.
3. Samples shall be submitted in ample time to permit the making of proper tests, analysis, examination, rejections, and resubmissions prior to shipping or installation or continue construction or nominated by the Contract Documents.
4. Samples of materials shall be submitted to and retained by the Project Representative for reference and comparison purposes.

B. Certification:

1. Producers and associations which have instituted accepted systems of quality control and have been accepted by accepted associations may submit certifications of compliance in lieu of further testing.
2. Materials from which samples have been taken shall not be incorporated in the work or accepted as part of the work until the samples testing results have been accepted in writing by the Project Representative.

1.05 CONTRACTOR'S RESPONSIBILITY

A. The Contractor shall submit to the Project Representative daily reports of all activities as required by individual Specification Sections.

B. The Contractor shall provide inspections, tests, and similar quality control services, as described in the Owner's General Terms and Conditions and as specified in individual Specification Sections and required by governing authorities.

C. The Contractor shall employ and pay an independent agency to perform quality control services as specified in the Contract Documents. No separate payment shall be made for quality control services specified by the Contract Documents. Additional inspection and tests required because of defective work or ill-timed notices shall be performed at Contractor's expense, and/or reimbursable to the Owner if inspection and/or tests are performed by the Project Representative.

D. Coordination:

1. The Contractor and each agency engaged by the Contractor to perform inspections, tests, and similar services shall coordinate the sequence of activities to accommodate required services with a minimal delay.
    a. The Contractor shall coordinate activities with the Project Representative or inspection agencies hired by the Project Representative to avoid delays to the Work and avoid the necessity of removing and replacing construction to accommodate inspections and tests.
    b. The Contractor is responsible for scheduling and coordinating all observations, tests, taking samples, and similar activities.

E. Access:

1. The Contractor shall furnish free access to various parts of the Work and assist the Project Representative in performance of their duties at no additional cost to the Owner.

F. Data:

1. The Contractor shall furnish all samples, records, drawings, certificates, and similar data as may be required to assure compliance with the Contract Documents.

G. Retesting:

1. The Contractor is responsible for the cost of the Project Representative's retesting where results of required inspections, tests, or similar services prove unsatisfactory and do not indicate compliance with the Contract Documents.
    a. Cost of retesting construction revised or replaced by the Contractor shall be at the Contractor's cost, where required tests were performed on original construction.
2. Project Representative will separately track and accumulate all such extra work. The costs incurred by the Project Representative will be reported and will be deducted from the subsequent payments to the Contractor.
    a. The Contractor may request copies of the Construction Manager's documentation of the cost of extra Work, but the amounts are not subject to negotiation or reduction.
    b. The Contractor shall not be entitled to a change in Contract Time or Contract Price due to delays caused by testing or rejected work or materials.

H. Associated Services:

1. The Contractor shall cooperate with the Project Representative, or their agents performing required observations, tests, and similar services and provide reasonable auxiliary services as requested. Auxiliary services required include but are not limited to:
    a. Providing access to the Work and furnishing incidental labor and facilities necessary to facilitate observations and tests.
    b. Taking adequate quantities of representative samples of materials at locations directed by the Project Representative.
    c. Providing facilities for storage of test samples.
    d. Security and protection of samples and test equipment at the Site

1.06 PROJECT REPRESENTATIVE'S RESPONSIBILITIES

A. The Project Representative will engage a testing agency or other entity for testing and observation of a part of the Work.

B. The Contractor shall not employ the entity engaged by the Project Representative for testing and observation, unless otherwise approved by the Project Representative.

1.07 DEFECTIVE WORK

A. Contractor shall remove, replace, and retest any work found defective or not complying with requirements of Contract Documents, at no additional cost to the Owner.

B. Work will be observed as it progresses, but failure to detect any defective work or materials shall not relieve the Contractor of its responsibilities, prevent later rejection when such defect is discovered, or obligate the Project Representative to accept non-conforming, deficient, or defective work.

C. All observation and testing required because of defective work or ill-timed notices shall be performed at the Contractor's expense.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION

3.01 REPAIR AND PROTECTION

A. General:

1. Upon completion of observation, testing, sample taking, and similar services, the Contractor shall repair damaged construction and restore substrates and finishes to eliminate deficiencies, including deficiencies in visual qualities of exposed finishes at no additional cost to Owner.

B. Protect construction exposed by or for CQC and ITP activities.

C. Repair and protection are the Contractor’s responsibility, regardless of the assignment of responsibility for observation, testing, or similar services.

END OF SECTION 01 43 00

SECTION 01 50 00
TEMPORARY FACILITIES AND UTILITIES

PART 1 GENERAL

1.01 SUMMARY

A. Requirements for Temporary Utilities, Construction Facilities, Temporary Controls, Removal of Utilities, Facilities and Controls and Mobilization and Demobilization.

1.02 GENERAL

A. Where onsite space for temporary facilities is limited, the Project Representative will make the allocation of the available space.

B. The area shown on the Drawings for Contractor's staging/parking area will be shared with the Contractors of other Projects under construction at Site. Should the Contractor require space in addition to that allocated, the Contractor shall arrange for storage of materials and equipment in locations off the Site at no additional cost.

C. Limit operations and storage of equipment and materials to the areas designated on the Drawings. Maintain the area during construction without obstructing operations of any existing municipal solid waste landfill operations or access roads to the Site as set forth in the Contract Documents. Proceed with the Work in an orderly manner, maintaining the construction Site free of debris and unnecessary equipment or materials. Store materials such as well casing or pipe and geosynthetics on pallets or racks, off the ground, and store in a manner to allow access for inspection.

1.03 TEMPORARY ELECTRICITY

A. Provide temporary electric power, if required, for use during construction.

B. Provide main service disconnect and over-current protection at convenient location.

1.04 TEMPORARY LIGHTING FOR CONSTRUCTION PURPOSES

A. Contractor shall provide temporary lighting at least to meet all applicable safety requirements to allow erection, application or installation of materials and equipment, and observation or inspection of the Work.

B. If night Work is allowed Contractor shall provide lighting as required.

C. Contractor shall provide branch wiring from power source to distribution boxes with lighting conductors, pigtails, and lamps as required.

D. Maintain lighting and provide routine repairs.

1.05 TEMPORARY HEATING

A. Contractor shall provide and pay for heating devices and heat as needed to maintain specified conditions for construction operations.

1.06 TEMPORARY WATER SERVICE

A. The Contractor is responsible for providing potable water for use in the Work. Contractor shall provide and pay for a suitable source of potable water to complete the Work and for use by construction personnel and representatives of King County. The Contractor shall maintain an adequate supply of potable water onsite at the field

trailers for the duration of the Work. The Contractor may acquire a temporary, onsite hydrant if allowable by the King County Water District No. 90.

1.07 TEMPORARY SANITARY FACILITIES

A. Provide and maintain all required sanitary facilities and enclosures, and litter containers for the Work including recycling collection and containers. Use of the existing King County facilities shall not be permitted. Facilities shall be provided for the duration for the Work and shall be installed at time of Project mobilization. Place secure facilities on flat surface at convenient locations. At the end of the job such facilities and enclosures shall be removed completely.

1.08 VEHICULAR ACCESS

A. Vehicular access shall be restricted as indicated on the Drawings.

B. Provide unimpeded access for emergency vehicles. Maintain 20 FT width driveways with turning space between and around combustible materials.

C. Provide and maintain access to fire hydrants and control valves free of obstructions.

D. Provide means of removing mud from vehicle wheels before entering public roads and streets, as required.

1.09 PARKING

A. Parking onsite shall be limited to the areas shown on the Drawings and as specified by the Project Representative.

B. Maintenance:

1. Maintain traffic and parking areas in a sound condition, free of excavated material, construction equipment, products, mud, snow, and ice.

2. Maintain existing paved areas used for construction; promptly repair breaks, potholes, low areas, standing water, and other deficiencies, to maintain paving and drainage in original, or specified, condition.

1.10 PROGRESS CLEANING AND WASTE REMOVAL

A. Maintain areas free of waste materials, debris, and rubbish. Maintain Site in a clean and orderly condition.

B. Collect and remove waste materials, debris, and rubbish from Site weekly. Direct disposal of waste into the active landfill is not permitted.

C. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

1.11 TRAFFIC REGULATION

A. Traffic control shall be provided in accordance with Section 01 55 00 – Traffic Control, and the following requirements:

1. Barriers:

a. Provide barriers to prevent unauthorized entry to construction areas and to protect existing facilities and adjacent properties from damage from construction operations and demolition.

b. Provide barricades and covered walkways required by governing authorities for public rights-of-way.

c. Protect non-owned vehicular traffic, stored materials, Site, and structures from damage.

1.12 SECURITY AND PROTECTION

A. Temporary Fire Protection: Install and maintain temporary fire protection facilities of the types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 10 “Standard for Portable Fire Extinguishers,” and NFPA 241 “Standard for Safeguarding Construction, Alterations and Demolition Operations”:

1. Locate fire extinguishers where convenient and effective for their intended purpose.

2. Store combustible materials in containers in fire-safe locations.

3. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire protection facilities, stairways, and other access routes for fighting fires. Prohibit smoking in hazardous fire exposure areas. Smoking shall only be permitted on Site at the location(s) designated by the Project Representative.

4. Provide supervision of welding operations, combustion type temporary heating units and similar sources of fire ignition.

B. Barricades, Warning Signs and Lights: Comply with standards and code requirements for erection of structurally adequate barricades. Paint with appropriate colors, graphics, and warning signs to inform personnel and the public of the hazard being protected against. Where appropriate and needed provide lighting, including flashing red or amber lights. Provide temporary fencing and precast concrete barriers where shown on Drawings.

C. Security Enclosure and Lockup: Where Contractor’s materials and equipment must be stored, and are of value or attractive for theft, provide a secure lockup. Enforce discipline in connection with the installation and release of materials to minimize the opportunity for theft and vandalism.

D. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations, minimize the possibility that air, wetlands, waterways, and subsoil might be contaminated or polluted, or that other undesirable effects might result. Avoid use of tools and equipment which produce harmful noise. Restrict use of noise making tools and equipment to hours that comply with all relevant noise requirements and minimize complaints from persons or firms near the Site.

E. Protection of Site: Prohibit construction traffic from entering landscaped areas and wetlands, unless approved by the Project Representative.

F. Security Program:

1. Protect Work, existing premises, and County's operations from theft, vandalism, and unauthorized entry.

2. Initiate program in coordination with County's existing security system at Project mobilization.

3. Maintain program throughout construction period until County acceptance precludes the need for Contractor security.

G. Entry Control:

1. Restrict entrance of persons and vehicles into Project Site and existing facilities.
2. Allow entrance only to authorized persons with proper identification.
3. Maintain log of Workers and visitors, make available to King County on request.
4. King County will control entrance of persons and vehicles related to its operations.

1.13 SURFACE WATER CONTROL

A. Provide surface water drainage controls.

B. Maintain excavations free of water. Provide, operate, and maintain pumping equipment as required.

C. Maintain grading in Contractor areas: Construction areas, staging areas, parking areas, material stockpiles, and processing areas to prevent ponding in excess of 2-inch in depth or running water. Provide water barriers as required to protect Site from soil erosion.

1.14 DUST CONTROL

A. Provide street sweeping and dust control, as necessary.

1.15 NOISE CONTROL

A. Provide methods, means, and facilities to minimize noise produced by construction operations in accordance with Section 01 14 00 – Work Restrictions.

1.16 PEST AND RODENT CONTROL

A. Provide methods, means, and facilities to prevent pests, rodents, and insects from invading the premises and damaging the Work.

1.17 POLLUTION CONTROL

A. Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations.

1.18 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Clean and repair damage caused by installation or use of temporary Work.

B. Restore existing facilities used during construction to original condition. Restore permanent facilities used during construction to specified condition.

1.19 QUALITY CONTROL

A. Contractor shall perform the Work in accordance with Section 01 43 00 – Quality Assurance and Control.

B. Temporary facility installation shall meet the construction safety requirements of Occupational Safety and Health Administration (OSHA), state, and other governing agencies. Comply with industry standards and applicable laws and regulations of authorities having jurisdiction (AHJs), including but not limited to:

1. Health and safety regulations.
2. Utility company regulations.
3. Police, Fire Department and Rescue Squad rules.
4. Environmental protection regulations.
5. Standard Specifications and Standard Plans as referenced and modified herein.

C. Inspections: If required by local ordinance or code, arrange for AHJs to inspect and test each temporary utility before use. Obtain required certifications and permits.

1.20 MOBILIZATION AND DEMOBILIZATION

A. Mobilization consists of preparatory Work and operations, including but not limited to, those necessary for the movement of personnel, Project safety, including adequate personnel, equipment, supplies, and incidentals to the Project Site; for the establishment of facilities necessary for Work on the Project; for premiums on bond and insurance for the Project and for other Work and operations Contractor must perform or costs Contractor must incur before beginning Work on the Project, which are not covered in other bid items.

B. Demobilization consists of Work and operations including, but not limited to, those necessary for movement of personnel, equipment, supplies, incidentals, and office offsite. Demobilization includes cleaning of the Site.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION – NOT USED

END OF SECTION 01 50 00

SECTION 01 55 00
TRAFFIC CONTROL

PART 1 GENERAL

1.01 SUMMARY

A. General requirements for the supply and execution of Traffic Control necessary to complete the Work including but not limited to: Construction parking control; flagging, signs, and other traffic control devices; haul routes; and removal of traffic control devices.

1.02 REFERENCES

A. The publications listed herein form a part of this Specification to the extent referenced. The publications are cited in the text by basic designation only. During implementation, the most recent version of the publication and test method shall be used in all cases.

1. Occupational Safety and Health Administration (OSHA):
    a. Construction Safety and Health Regulation 29 CFR, Part 1926, Subpart G, Signs, Signals, and Barricades.
    b. Construction Safety and Health Regulation 29 CFR, Part 1926, Subpart P, Excavations, Trenching, and Shoring.
2. Manual on Uniform Traffic Control Devices (MUTCD).
3. Modifications to MUTCD for Streets and Highways for the State of Washington.
4. Washington Administrative Code (WAC):
    a. 296-155, Department of Labor and Industries, Safety Standards for Construction Work.

1.03 SUBMITTALS

A. Prior to commencing work, the Contractor shall submit a Traffic Control Plan for review by the Project Representative.

B. Traffic Control Plan shall be reviewed by the Project Representative and King County Operations for coordination with the current operations.

C. All flaggers and spotters shall possess a current flagging card. A copy of the flagger's cards shall be provided to the Project Representative prior to commencing work.

1.04 GENERAL

A. Keep all roads, sidewalks, and parking areas not part of this Project usable at all times, unless otherwise approved by the Project Manager.

B. The Contractor shall coordinate all work to avoid conflict with King County's operations on the Site. The Contractor shall supply all equipment and labor necessary to achieve this, and acceptable to the Project Representative.

C. The Contractor shall provide flaggers, signs, and other traffic control devices not otherwise specified as being furnished by King County. The Contractor shall erect and maintain all construction signs, warning signs, detour signs, and other traffic control devices necessary to warn and protect the public and King County personnel at all times from injury or damage resulting from the Contractor's operations. No work shall be done on or adjacent to the above locations until all necessary signs and traffic control devices are in place.

D. Flaggers, signs, and other traffic control devices shall be used for the safety of the public, the Contractor's employees, King County's personnel, and to facilitate landfill operations.

E. Upon failure of the Contractor to immediately provide flaggers; erect, maintain, and remove signs; or provide, erect, maintain, and remove other traffic control devices when ordered to do so by the Project Representative. The Project Representative may, without further notice to the Contractor, perform any of the above and deduct all costs from the Contractor's payments.

F. The Contractor shall be responsible for providing adequate flaggers, signs, and other traffic control devices for the protection of the work and King County Operations at all times regardless of whether or not the Project Representative orders the flaggers, signs, and other traffic control devices. The Contractor shall be liable for injuries and damages to persons and property suffered by reason of the Contractor's operations or any negligence in connection therewith.

G. Contractor shall advise the Project Representative a minimum of two (2) weeks prior to implementing any road closures or diversions.

1.05 CONFORMANCE TO ESTABLISHED STANDARDS

A. The Contractor shall provide all necessary barricades, lights, signs, signals, etc., for the protection of the workers and the public, as established by the OSHA Construction Safety and Health Regulation 29 CFR, Part 1926, Subpart G, Signs, Signals, and Barricades, and in Subpart P-Excavations, trenching, and shoring.

B. Flagging, signs, and all other traffic control devices furnished or provided shall conform to the standards established in the latest adopted edition of MUTCD published by the United States Department of Transportation and the Modifications to the MUTCD for Streets and Highways for the State of Washington.

1.06 TRAFFIC CONTROL PLAN

A. The Contractor shall prepare a Traffic Control Plan describing their method of performing in accordance with the requirements of the Contract Documents.

B. The Contractor shall submit the Traffic Control Plan within fourteen (14) days of Notice to Proceed. The Contractor shall not begin work onsite until the Project Representative has approved the Traffic Control Plan.

C. The Traffic Control Plan shall accommodate all elements of the work required for completion.

D. The Traffic Control Plan shall specifically highlight the impact of the Work, if any, on King County's landfill operations. Impacts shall include, but not be limited to, road closures, partial road closures and when construction traffic will be required to operate on the same haul roads as King County Operations.

E. If the Contractor's traffic control methods vary from those shown on the Drawings, the Contractor shall propose a modification by showing the necessary construction signs, flaggers, and other traffic control devices required for the project.

F. The Traffic Control Plan shall include procedures for deliveries to the Site, including but not limited to, Site access restrictions, Contractor escort of delivery vehicles when on the Site, and sign in and sign out procedures.

G. The Contractor shall obtain all necessary approvals of traffic control plans required by local jurisdictions.

PART 2 PRODUCTS

2.01 FLAGGING, SIGNS, AND ALL OTHER TRAFFIC CONTROL DEVICES

A. Traffic Control Labor:

1. The Contractor shall furnish all personnel for flagging, escorting, and for the setup and removal of all traffic control devices and signs.
2. Contractor shall furnish temporary traffic control devices and construction signs necessary to control traffic during construction operations.
3. Flaggers and spotters shall have a current certification (flagging card) acceptable to the Washington State Department of Labor and Industries (WAC 296-155-305). Workers engaged in flagging or traffic control shall wear reflective vests and hard hats.

B. Construction Signs:

1. The Contractor shall provide the posts or supports and erect and maintain the signs in a clean, neat, and presentable condition until the necessity for them has ceased.
2. All non-applicable signs shall be removed or completely covered with either metal or plywood during periods when they are not needed. When the need for any of these signs has ceased, the Contractor, upon approval of the Project Representative, shall take down these signs, posts, or supports. All posts or supports shall be removed from the project and shall remain the property of the Contractor.
3. Signs, posts, or supports that are lost, stolen, damaged, destroyed, or those that the Project Representative deems to be unacceptable, while their use is required on the project, shall be replaced by the Contractor without additional compensation.

PART 3 EXECUTION

3.01 CONSTRUCTION PARKING CONTROL

A. Contractor employees shall only park Contractor vehicles in the area designated on the Drawings. Contractor employees' personal vehicles shall be parked offsite at location(s) secured by the Contractor.

1. Contractor shall maintain vehicular access to and through parking areas.
2. Contractor shall prevent parking on, or adjacent to, access roads or in non-designated areas.

3.02 HAUL ROUTES

A. Flaggers shall be required for all work that disrupts King County hauling operations including work on and adjacent to the West Perimeter Road will require 2-person flagging.

B. Confine construction traffic to designated haul routes.

C. Provide traffic control at critical areas of haul routes to regulate traffic and to minimize interference with landfill operations.

3.03 REMOVAL

A. Remove equipment and devices when no longer required. Restore surfaces to original condition.

END OF SECTION 01 55 00

SECTION 01 60 00
PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY

A. This Section describes product requirements for quality control, storage and protection, and substitution procedures.

1.02 PRODUCTS

A. Products are to include new material, machinery, components, equipment, fixtures, and systems forming the Work. The term does not include machinery and equipment used for preparation, fabrication, conveying and erection of the Work.

B. Materials and equipment existing at the Site shall only be used as specifically permitted by the Contract Documents and Project Representative.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to the Project Site in the manufacturer's original container, with labels intact and legible:

1. Maintain packaged materials with seals unbroken and labels intact until time of use.

2. Promptly remove damaged material and unsuitable items from the Project Site, and promptly replace with material meeting the requirements of the Contract Documents, at the Contractor’s sole expense.

B. Project Representative may reject as non-complying such material and products that do not bear identification satisfactory to Project Representative as to manufacturer, grade, quality, and other pertinent information.

C. Transport and handle products in accordance with manufacturer's instructions and the requirements of this Section.

D. Promptly inspect shipments to assure that products comply with requirements, quantities are correct, and products are undamaged.

E. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.

F. Store and protect products in accordance with manufacturer's instructions, with seals and labels intact and legible. Store sensitive products in weather-tight, climate-controlled enclosures.

G. For exterior storage of fabricated products, place on sloped supports, above ground.

H. Provide offsite storage and protection when the Project Site does not permit onsite storage or protection.

I. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to avoid condensation.

J. Store loose granular materials on solid flat surfaces in a well-drained area.

K. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

L. Arrange storage of products to permit access for inspection. Periodically inspect to assure products are undamaged and are maintained under specified conditions.

1.04 REPAIRS AND REPLACEMENTS

A. In event of any damage, the Contractor shall promptly make replacements and repairs to the acceptance of Project Representative and at the Contractor's sole expense.

B. Additional time required to secure replacements and to make repairs will not be considered by Project Representative to justify a change to the Contract Time or Contract Price.

1.05 ALTERNATIVE PRODUCTS

A. The Contract is based on standards of quality established in the Contract Documents:

1. In agreeing to the terms and conditions of the Contract, Contractor has accepted a responsibility to verify that the specified products will be available and to place orders for all required materials in such a timely manner as is needed to meet the construction schedule.

2. King County has agreed to the substitution of materials or methods called for in the Contract Documents, except as they may specifically otherwise state in writing.

B. Materials and/or methods specified by name:

1. Where materials and/or methods are specified by naming one single manufacturer and/or model number, without stating that equal products will be considered, only the material and/or method named is approved for incorporation into the Work.

2. Should Contractor demonstrate to the acceptance of Project Representative that a specified material or method was ordered in a timely manner and will not be available in time for incorporation into this Work, Contractor shall submit to Project Representative such data on proposed substitute materials and/or methods as is needed to help Project Representative determine suitability of the proposed substitution.

C. Where materials and/or methods are specified by name and/or model number, followed by the words "or approved equal" or similar wording:

1. The material and/or method specified by name establishes the required standard of quality.

2. Materials and/or methods proposed by Contractor to be used in lieu of materials and/or methods so specified by name shall in all ways equal or exceed the qualities of the named materials and/or methods.

3. Contractor shall demonstrate to King County, in accordance with the requirements of the Owner's General Terms and Conditions, that the proposed substitution is equal in every way.

4. Do not assume that materials, equipment, or methods will be accepted as equal unless the item has been specifically accepted in writing for this Work by the Project Representative.

D. The following products do not require further acceptance except for interface within the Work:

1. Products specified by reference to standard Specifications such as ASTM and similar standards; and

2. Products specified by manufacturer's name and catalog model number.

E. The decision of Project Representative shall be final.

1.06 DELAYS

A. Delays in construction arising by virtue of the unavailability of a specified material and/or method will not be considered by Project Representative as justifying a change of the Contract Time.

1.07 SUBSTITUTIONS

A. Project Representative will consider requests for Substitutions only within the thirty (30) days that follow the date of Notice to Proceed.

B. Substitution requests greater than thirty (30) days after the date of Notice to Proceed may be considered when a product becomes unavailable through no fault of Contractor.

C. Document each request using the attached Substitution Request Form and Certification Form. Include all relevant data substantiating compliance of proposed substitution with Contract Documents.

D. A request constitutes a representation that Contractor:

1. Has investigated proposed product and determined that it meets or exceeds the level of quality of the specified product.

2. Will provide at least the same warranty for the substitution as for the specified product.

3. Will coordinate the installation and make changes to other Work, which may be required to complete the Work, at the Contractor’s sole expense.

4. Waives claims for additional costs or time extension, which may subsequently become apparent.

5. Will reimburse King County for review or redesign services associated with re-approval by authorities.

E. Substitutions will not be considered when they are indicated or implied on the Shop Drawings or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.

F. Substitution Submittal Procedure:

1. All substitution submittals shall be accompanied with the attached Substitution Request Form completely filled out. Limit each request to one proposed substitution.

2. Submit Shop Drawings, product data, and certified test results attesting to the proposed product equivalence. Clearly indicate with red arrows on the supporting data the proposed substitution and accessories.
3. Project Representative will be allowed a reasonable time, but not less than two (2) weeks, within which to evaluate the proposed substitute. Project Representative will be the sole judge of the acceptability of the proposed substitute. Project Representative will notify Contractor, in writing, of decision to accept or reject request.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION – NOT USED

END OF SECTION 01 60 00

SUBSTITUTION REQUEST FORM

TO: _____

PROJECT NAME: _____

We hereby submit for consideration, the following product instead of the specified item for the above project:

Section _____ Paragraph _____ Specified Item _____

Proposed Substitution: _____

Attach complete dimensional information, engineering calculations, and technical data including laboratory tests, if applicable.

Include complete information on changes to Drawings and/or Specifications which proposed substitution will require for its proper installation.

Submit with request all necessary samples and substantiating data to provide equal quality, performance, and appearance to that which is specified. Clearly mark manufacturer's literature to indicate equality in performance. Differences in quality of materials and construction shall be indicated.

The undersigned states that the following paragraphs, unless modified on attachments, are correct:

1. The proposed substitution does not affect dimensions shown on drawings.
2. The undersigned will pay for changes to the design, including engineering design, detailing and construction costs caused by the requested substitution.
3. The proposed substitution will have no adverse effect on other trades, the construction schedule, or specified warranty requirements.
4. Maintenance and service parts will be locally available for the proposed substitution.
5. The proposed substitution will have no effect on applicable codes.
6. The manufacturer's guarantee or warranties of proposed product is equivalent to, or exceeds, that of the specified product.

List of names and location of three similar projects on which product was used, date of installation, and Engineer's name and phone number.

_____

_____

_____

_____

_____

CERTIFICATION OF EQUAL PERFORMANCE AND ASSUMPTION OF LIABILITY FOR EQUAL PERFORMANCE

UNDERSIGNED ATTESTS THAT FUNCTION AND QUALITY ARE EQUAL TO OR SUPERIOR TO SPECIFIED ITEMS

Submitted By:

Signature Title

Firm

Address

City / State Zip

Telephone Date

Engineer's Stamp

Above signature and stamp must be by person having authority to legally bind the firm to the above terms.

FOR USE BY THE PROJECT REPRESENTATIVE:

Accepted

Accepted as Noted

Not Accepted

Received Too Late

By

Date

Remarks

SECTION 01 74 19
CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies the requirements for managing construction and demolition (C&D) materials and King County's requirements to divert C&D materials from landfill disposal.

1. Purpose is to establish that, during the course of Work, diligent means are employed to pursue practical and economically feasible waste management and recycling options.
2. Requirement is to divert a minimum of 85 percent of the total weight of non-hazardous C&D materials for reuse or recycling.
3. The Contractor shall include measures at the Project Site to minimize and divert C&D waste from landfill disposal by all parties to the Contract.
4. Resources: King County Solid Waste Division website for general information on the County's C&D Recycling Program, program contact, and online resources.

B. Separate reports and plans, which are required in accordance with this Section, shall be prepared for the Cedar Hills Regional Landfill Micro-Electrolysis Pilot System.

1.02 DEFINITIONS

A. Construction and Demolition (C&D) Materials: All non-hazardous materials resulting from construction, renovation, remodeling, alterations, repair, and demolition of buildings, roads, or other structures. Includes material and debris that is recycled, reused, salvaged, or disposed of as C&D waste. Land-clearing debris, excavated soils and related vegetation are not considered C&D materials that can contribute to materials diversion.

B. C&D Materials Management Report (Report): Report documenting execution and status of C&D material included in the C&D Materials Management Plan.

C. C&D Materials Management Plan (Plan): Project specific plan for the collection/handling, disposition (recycling, reuse, salvage, disposal), transportation and tracking of C&D material diversion and C&D waste disposal.

D. C&D Waste: All non-hazardous excess building materials with no recoverable value resulting from construction, demolition, remodeling, renovation, alternation, or repair operations. These solid waste materials, trash, or garbage cannot be recycled, reused, salvaged, or returned, and shall be disposed of in a landfill. Land-clearing debris, excavated soils and related vegetation are not considered C&D waste that can contribute to waste diversion. Non-recyclable C&D materials shall be placed in a separate waste container from Mixed C&D Recycling.

E. Deconstruction and Salvage Assessment: A document summarizing the building components of an existing building that, if removed, have potential to be reused.

F. Designated Facilities: A C&D material recovery facility or a privately owned C&D waste transfer station that has a signed agreement with King County that permits it to accept mixed C&D and waste C&D from jobsites located within the County's jurisdiction.

G. Disposal: Removal off-Site of C&D waste for deposit in a landfill in accordance with King County Code Title 10.30.020.

H. Diversion: The reuse, recycle, or beneficial use of C&D materials.

I. Material Recovery Facility: A general term used to describe a material processing facility. Mechanical, hand-separation, or a combination of both procedures, are used to recover recyclable materials.

J. Mixed C&D Recycling: The process of collecting mixed recyclable materials in one container at the Project Site. The container shall be taken to a designated material recovery facility where materials are separated for recycling.

K. Recycle: The process of transforming or remanufacturing waste materials into useable or marketable materials for use other than landfill disposal or incineration. This can be conducted on site (as in the griding of asphalt cement concrete or Portland cement concrete and subsequent reuse on site) but does not include combustion of solid waste or preparation of a fuel from solid waste.

L. Reuse: Making use of a material without altering its chemical composition.

M. Salvage: Recovery of C&D building materials and components from a building or building Site for Onsite reuse, off-Site sale, or donation to a third-party.

N. Source-Separated C&D Recycling: The process of separating recyclable materials in separate containers as they are generated on the Project Site. The separated materials are hauled directly to a recycling facility providing recycling services for 100 percent diversion.

1.03 PERFORMANCE REQUIREMENTS

A. C&D materials shall be diverted from the landfill whenever practicable in accordance with both King County's Strategic Climate Action Plan (Performance Measure GHG 20) and the following diversion options listed from most sustainable to least: (1) reuse in place; (2) reuse on site; (3) reuse; (4) source-separated C&D recycle; (5) mixed C&D recycle; and (6) disposal – includes alternative daily cover.

B. All generators, handlers, and collectors of mixed and non-recyclable C&D materials shall deliver or ensure delivery of C&D materials to designated C&D material recovery facilities or transfer stations listed at: www.greentools.us. Loads of recyclable C&D materials shall contain no more than 10% non-recyclable C&D materials.

C. Material from demolition projects shall be recycled or reused whenever practicable (State of Washington RCW 39.04.135).

D. Washington State regulations (State of Washington WAC 173-345-040) require a separate collection container be provided for waste at Project Site(s) that conduct recycling. Disposal shall comply with King County Code Title 10.30 and utilize designated C&D facilities.

E. The following C&D waste disposal bans apply to generators, handlers, collectors, and privately and publicly owned facilities designated by King County to manage C&D waste, as authorized under King County Code Title 10.30:

1. Concrete, asphalt paving, and bricks unpainted, without a hazardous constituent, and not attached to other materials.
2. Metal, ferrous and nonferrous: includes composite, multi-metal products or products with nonmetal contaminants but metal content must be more than 90 percent by weight of the material.
3. Cardboard: includes with tape, staples, and other fasteners and is dry and free of contamination such as paint, grease, grime, or dirt.
4. Unpainted new construction gypsum scrap that is dry and does not have adhering spackling compound or excessive water damage that would prevent recycling.
5. Unpainted/Untreated Wood: excludes particle board and laminated veneer wood.
6. Exceptions: Bans do not apply where C&D wastes are painted, have dangerous waste or asbestos containing constituents, are glued, nailed, or otherwise connected to other material types, are present only in very small quantities, or are generated during disaster emergency situations where C&D materials from disasters needs to be removed quickly and recycling options are not available.
7. In addition to the C&D materials banned from disposal by King County and the City of Seattle, the following materials may have viable recycling markets and should be diverted for recycling whenever possible: carpet, carpet pad, window glass, and field office material, including office paper, aluminum cans, glass, plastic, and batteries.

F. Diversion Rates:

1. King County: Disposal for all County capital projects shall comply with King County Code Title 18.17.050.B.2, which provides, in part, that diversion rates for C&D materials achieve a minimum of 85 percent diversion and shall achieve zero waste of resources with economic value beginning in 2030. Disposal shall comply with King County Code Title 10.30 using County designated facilities.
2. Projects using the County's Sustainable Infrastructure Scorecard achieve points by achieving diversion rates of 85 percent under credit CM 1.1-1.3.

1.04 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with hauling, diversion, and disposal regulations of authorities having jurisdiction.

B. Weekly Review: Discuss C&D materials management at least weekly during standard safety/coordination meetings. Topics may include the following:

1. Discuss highlights and shortcomings of the previous week's diversion program.
2. Overall Project diversion rate in comparison to requirements.
3. Material salvage/reuse strategy implementation updates.
4. Upcoming C&D issues Onsite: Moving/Locations of containers. Source-separated bins Onsite for specific scopes/Contractors.

C. Orientations: All employees and Subcontractors who are working at the Site shall be educated on the requirements of C&D at their Orientation.

1.05 C&D MATERIALS MANAGEMENT PLAN (PLAN)

A. List each type of material expected to be generated during C&D and whether it will be salvaged, reused, recycled, or disposed of in a landfill using the King County template in Appendix A. Include total estimated quantity of each type of material, quantity for each means of recovery, and handling and transportation procedures. Indicate quantities by weight but use same units of measure throughout the Plan. Projects shall use the County's Product Volume to Weight Conversion Rates: https://kingcounty.gov/~/media/depts/dnrp/solid-waste/business/documents/Conversions.ashx

B. Reuse Onsite: For materials that will be salvaged and reused in this Project, describe methods for preparing and storing salvaged materials before incorporation into the Plan.

C. Reuse Offsite: For materials that will be salvaged and reused off-Site, describe methods for preparing and storing salvaged materials. Include a brief description of how the materials will be marketed and distributed.

D. Recycled Materials: Include list of local receivers and processors likely to be used and type of recycled materials that will be sent to each. Include names and addresses.

E. Disposed Materials: Indicate how and where C&D Waste will be disposed of. Include name and address of each transfer station that is intended to be used. Also include the name(s) of the landfill(s) in which the waste will be disposed.

F. Handling and Transportation Procedures: Include method to be used for separating recyclable materials from waste including sizes of containers, container labeling, and designated locations where materials separation will be performed.

1.06 C&D MATERIALS MANAGEMENT REPORT (REPORT)

A. Cumulative progress (monthly) and final Report shall include the following for each material recycled, reused, or salvaged from the Project. A template may be provided by King County if the Contractor does not have a standard.

1. The total amount of the material, in tons or cubic yards.
2. The receiving party name, address, and phone number.
3. Net total costs or savings to the Project in present value.
4. Manifests, weight tickets, receipts, and invoices (as support documentation).
    a. Recycling Receipts: Copy of receipts issued by designated material recovery facilities for mixed materials. Include weight tickets from the recycling hauler or material recovery facility and verification of the recycling rate for mixed loads at facility.
    b. Disposal Receipts: Copy of receipts issued by a disposal facility for C&D waste that is disposed in a landfill.
    c. Salvaged Materials Documentation: Types and quantities, by weight, for materials salvaged for reuse Onsite, sold or donated to a third-party.

d. Mixed Recyclable Materials Documentation: include the appropriate quarterly C&D diversion/recycling rate of the receiving facility. These rates are available online at: http://www.seattle.gov/utilities/construction-resources/collection-and-disposal/construction-and-demolition/qualified-facilities. Note that mixed materials should only be recyclable materials. All non-recyclable C&D materials shall be placed in a separate C&D waste container, destined for a landfill.

B. Submit the final Report and documentation as required.

1.07 SUBMITTALS

A. Complete and submit prior to preconstruction conference:

1. C&D Materials Management Plan.

B. Complete and submit prior to progress (monthly) and final payment requests:

1. C&D Materials Management Report.

1.08 PAYMENT

A. C&D document payment requirements:

1. One percent (1%) of the awarded Contract Price shall be assigned for preparation and Submittal of the C&D documents (as described above in Submittals):

a. A maximum of one quarter of one percent (0.25%) for Submittal of the C&D Materials Management Plan and Deconstruction and Salvage Assessment.

b. A total of one half of one percent (0.50%) shall be progressed monthly for the Submittal of the monthly Report distributed evenly for the duration of the Contract.

c. The remaining one quarter of one percent (0.25%) shall be retained and progressed only after the final Report is submitted to the Project Representative and determined to be accurate and complete.

1.09 REVENUES

A. Revenues or other savings obtained from recycled, reused, or salvaged materials shall accrue to Contractor unless otherwise noted in the Contract Documents.

1.10 RESOURCES

A. King County Solid Waste Division:

1. Construction and demolition site provides general information on the County's C&D recycling program, program contact and online resources: https://kingcounty.gov/ depts/dnrp/solid-waste/programs/green-building/construction-demolition.aspx.

2. Publications may also be found online at: www.greentools.us.

3. "What Do I Do With...?" online database: https://info.kingcounty.gov/services/recycling-garbage/solid-waste/what-do-i-do-with/.

4. List of designated C&D facilities: https://kingcounty.gov/depts/dnrp/solid-waste/programs/green-building/construction-demolition/designated-facilities.aspx.

5. For questions and/or clarifications contact:
    a. King County Solid Waste Division, at 206-477-4466 or swd@kingcounty.gov.
    b. Kinley Deller, King County C&D Program Manager, at 206-477-5272.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION

3.01 PLAN IMPLEMENTATION

A. Provide handling instructions, containers, storage, signage, transportation, and other items as required to implement C&D Materials Management Plan (Plan) during the entire duration of the Contract.

B. Instruct workers, Subcontractors, and Suppliers on proper waste management procedures, as appropriate for the Work.

C. Clearly label containers for C&D materials with a list of acceptable and unacceptable materials:

1. The list of acceptable materials must be the same as the materials recycled at the recycling processor or Designated Facility.
2. Container labels, including list of acceptable and unacceptable materials shall be in language(s) and/or pictures understood by all the Contractor's and Subcontractors' workers.
3. Protect and manage containers and their contents in accordance with the requirements of the recycling processor or Designated Facility. All non-recyclable C&D materials shall be placed in a separate non-recyclable C&D waste container destined for a designated C&D waste transfer station.

D. Designate a Waste Diversion Management Coordinator to be responsible for implementing, monitoring, and reporting status of the C&D Materials Management Plan and Report(s). The designated Coordinator shall be present at the Project Site full time for the duration of the Project.

E. Include a C&D materials reduction provision in material purchasing agreements for construction materials requesting that, to the greatest extent possible, materials and equipment be delivered in packaging made of recyclable material, the amount of packaging be reduced, and packaging taken back for reuse or recycling. Require that Subcontractors have the same waste reduction provisions in material purchasing agreements.

F. Train employees, Subcontractors, and Suppliers on proper C&D material management procedures. Distribute Plan to all Onsite employees, Subcontractors, and Suppliers before starting to implement. Review Plan procedures and locations established for salvage, recycling, reuse, and disposal with new employees.

G. Site Access and Temporary Controls: Conduct C&D materials management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities. Designate and label specific areas on the Project Site necessary for separating materials that are to be salvaged, recycled, and reused.

H. Conduct regular visual inspections of containers. Remove unacceptable materials, maintain labels/signage, and remove non-recyclable C&D materials, Dangerous Waste, and Universal Waste from recyclables container(s).

3.02 RECYCLING OF NON-HAZARDOUS C&D MATERIALS

A. Recycle paper and recyclable beverage/food containers used by Onsite workers. Compost food waste where composting service is available.

B. Preparation of Materials: Prepare and maintain recyclable materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.

C. General Procedures: Separate recyclable materials from non-recyclable materials, trash, and debris.

1. Provide appropriately marked containers or bins for controlling C&D materials until they are removed from the Project Site. Include a list of acceptable and unacceptable materials at each container and bin. Inspect containers and bins for contamination and remove contaminated materials if found.

2. Store materials off the ground and protect from the weather in designated area(s) away from the demolition area. Do not store within the drip line of remaining trees. Cover to prevent windblown dust.

3. Remove recyclable materials from the property and transport to a recycling receiver or processor as often as required to prevent overfilling bins.

4. Submit recycling and process facility records: Provide receipts to document acceptance of waste by landfills licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

3.03 RECYCLING PROCEDURES FOR SPECIFIC C&D MATERIALS

A. Acoustical ceiling panels and tile: Stack large clean pieces on wood pallets and store in a dry location.

B. Asphalt Paving:

1. Asphalt paving removed as a result of selective demolition shall be recycled by transporting to established asphalt recycling facilities. Demolished asphalt shall also be stockpiled on site as directed by the Project Representative.

C. Concrete:

1. Concrete removed as a result of selective demolition shall be recycled by transporting to established concrete recycling facilities.

2. Pulverize concrete to maximum size suitable for recycling or reuse application(s), as identified for onsite use or by a destination facility.

3. Confirm separation requirements of the concrete receiving facility for metal reinforcements.

4. Contractor shall maintain records, including weight tickets, of all recycled concrete loads. Provide Submittal to King County compiling tons of concrete recycled upon Project completion. Include in the C&D Materials Management Report (Report).

D. Conduit: Reduce conduit to straight lengths and store by type and size.

E. Green Waste: Green waste, such as trees, plants, and brush, removed as a result of selective demolition shall be distributed on site as approved by the County or recycled by delivery to approved compost facilities. Green waste removed from within Area 8 Limits of Construction shall be disposed of in the active portion of CHRLF. Contractor shall maintain records, including volume or weight tickets, of all recycled green waste loads and submit to King County a compilation of tons of green waste recycled upon Project completion. Include in Report.

F. Masonry: Remove metal reinforcement, anchors, and ties from masonry and sort with other metals. Pulverize masonry to maximum size suitable for recycling or reuse application(s) other than undamaged, whole masonry units. Clean and stack undamaged, whole masonry units on wood pallets.

G. Packaging:

1. Cardboard and boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
2. Polystyrene Packaging: Separate and bag materials.
3. Pallets: As much as possible, collect pallets for reuse, and require deliveries using pallets to remove pallets from Project Site. For pallets that remain on site, recycle with clean wood.
4. Pallet Wrap: Plastic film material shall be kept dry and consolidated into bags.
5. Crates: Break down crates and recycle with clean wood.

H. Paint: Seal containers and store by type.

I. Piping: Reduce piping to straight lengths and store by type and size. Separate supports, hangers, valves, sprinklers, and other components by type and size.

J. Scrap Metal: Separate metals by type. Scrap metal, such as fencing and old reinforcement bar, removed as a result of selective demolition, shall be recycled at established metal recycling facilities. Contractor shall maintain records, including weight tickets, of all recycled metal loads and provide a compilation of tons of scrap metal recycled upon Project completion to King County.

1. Structural Steel: Stack members according to size, type of member, and length.
2. Remove and appropriately manage disconnected wires with lead stabilizers, consistent with the National Electric Code (NFPA 70) requirements.

K. Wood: Separate lumber, engineered wood products, panel products, and treated wood materials.

1. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.
2. Reusable: Sort and stack materials according to size, type, and length as required for reuse.
3. Non-reusable: Clean wood shall be recycled. Painted and treated wood should be disposed of as waste.

3.04 DISPOSAL OF NON-HAZARDOUS C&D WASTE

A. Except for items or materials to be salvaged, recycled, or otherwise reused, remove C&D waste from the Project Site and legally dispose of via a designated facility,

transfer station, or landfill acceptable to authorities having jurisdiction or if no larger than 12 IN in any direction, materials may be hauled to the active refuse area. Except as otherwise specified, do not allow C&D waste that is to be disposed of to accumulate on site. Remove and transport C&D waste in a manner that will prevent spillage on adjacent surfaces and areas. Do not burn or incinerate C&D waste.

B. Containers for C&D waste to be landfill disposed shall be clearly labeled as: “C&D Waste for Landfill.”

C. Some C&D materials, such as filter fabric, plastic perforated pipe, pipe insulation, and roofing felt/protection board, are not readily recyclable, salvageable, or reusable. Such C&D waste is to be legally disposed of in a designated landfill. The Contractor is responsible for loading and transportation of solid waste. Weight tickets of solid waste loads are to be maintained and written documentation provided to King County as scheduled or upon Project completion, in accordance with the requirements of this Section.

D. Landfill Disposal Records: Indicate receipt and acceptance of waste by landfills licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

END OF SECTION 01 74 19

Instructions

Fill out the following Construction & Demolition Diversion Plan for all C&D projects at 30% design.

Next to each potential waste material produced, select the appropriate check box to identify if the material will likely be diverted for "reuse on site", "salvage off site", "recycle source separated", "recycle comingled", or "disposal". Select more than one if appropriate.

Use the "Hauler" column to identify who will likely haul material to the receiving facility and the "Receiving Facility" column to select the location where materials will be hauled.

Construction & Demolition Diversion Plan

Department:

Project Name: Project Number:

Location: Project Manager:

Material Type	N/A	Reuse on site	Salvage off site	Recycle Source Separated	Recycle Commingled	Disposal	Hauler	Receiving Facility	Comments
Asphalt Paving *									
Asphalt Shingles									
Brick *									
Carpet/padding									
Concrete *									
Cardboard *									
Glass									
Gypsum/Drywall **									
Land Clearing †									
Metals *									
Plastics									
Plastic Film Wrap									
Rock/Gravel †									
Soil/Sand †									
Wood									
Hazardous Waste †									
Commingled Recycling									
Garbage									
Other									
Other									

** May not be taken for disposal within the City of Seattle*

*** Clean gypsum may not be taken for disposal within the City of Seattle*

† *Must be tracked and reported, but do not count toward C&D diversion rate*

Deconstruction & Salvage Assessment

Project/Permit Number _____ ☐ **Whole Building Removal (demolition)** ☐ **Alterations**

☐ **Nonresidential Project** ☐ **Residential Project**

Project Address _____

Owner/Agent Name _____ **Phone** _____

Certified salvage verifier (If required) _____

Contact Name *Company* *Phone*

A **deconstruction & salvage assessment** is required when you submit your application for all projects that include demolition, such as whole building removal and alterations, where the area of work is either greater than 750 square feet OR the construction value is greater than $75,000. Use the deconstruction & salvage assessment matrix below to identify all building materials impacted by demolition that could be salvaged and reused ON or OFF-SITE instead of being sent to a landfill or recycled.

☐ **By checking this box, you have determined your project does not meet either the 750 s.f. or $75,000 threshold and do not need to complete this form.**

Who fills out this form:

The Owner or Owner's Agent when…	The project scope involves additions or alterations
	Material removed from a project is going to be reused on-site or at a specific alternate project site ○ Project #/Address_____
A certified salvage verifier when…	The project includes whole building removal (Deconstruction/Demolition)

- **A certified salvage verifier is a person listed on the King County approved salvage verifier list.** A certified salvage verifier may use this or an alternate form
- ONLY a certified salvage verifier may check off this box if there is nothing of value to salvage ☐

_____

(Signature of certified salvage verifier)

Deconstruction & Salvage Assessment Matrix

Building Component	Specific Material	Quantity	Notes
Cabinets	Solid Wood (with back panel)		
	Other (with back panel)		
Carpet	Tile		
	Roll		
Doors	Interior		
	Exterior		
	Garage		
Flooring	Solid Floor		

Building Component	Specific Material	Quantity	Notes
Insulation	Batts		
Lighting Fixtures	Lighting Fixtures		
Plumbing	Bathtub/sinks		
	Piping		
	Other fixtures meeting current code		
Roofing	Metal		
	Wood		
	Plywood		
	Asphalt Shingles		
	Composite		
Siding	Metal		
	Wood		
	Plywood		
	Vinyl		
	Composite		
Wall Covering	Drywall		
	Solid Wood Paneling		
	Plywood Paneling		
Wall Sheathing	Plywood		
	Shiplap		
	OSB		
Windows	Insulated aluminum		
	Wood		
	Vinyl		
	Composite		
Wood	Clean dimensional lumber		
	Clean scrap lumber		
	Painted/treated lumber		
Miscellaneous	Trim		
	Fence/gate		
	Countertop		
	Mechanical Equipment		
	Appliance		
	Deck		

Keep a copy of the deconstruction & salvage assessment to help complete the Waste Diversion Report (WDR) for all materials generated on the job site.

☐ *I have complied with the regulations of the Puget Sound Clean Air Agency regarding asbestos identification, notification, and abatement.*

To the best of my knowledge, I pledge that the information provided is accurate: _____

(Owner/Agent Signature here)

Instructions

Please complete this report for your construction or demolition project prior to Final Inspection Approval from the applicable permitting department.

Construction & Demolition Diversion Report

Department: | Division:

Project Name: | Project Number:

Location: | Project Manager:

Asbestos Abatement Performed?:

Diversion Records: Recyclable Materials

	Material Type	Diversion Method	Tons:	Hauler:	Receiving Facility:
1					
	If Other Material Type:	If Other Diversion Method:		If Other Hauler:	If Other Receiving Facility:
2					
	If Other Material Type:	If Other Diversion Method:		If Other Hauler:	If Other Receiving Facility:
3					
	If Other Material Type:	If Other Diversion Method:		If Other Hauler:	If Other Receiving Facility:
4					
	If Other Material Type:	If Other Diversion Method:		If Other Hauler:	If Other Receiving Facility:
5					
	If Other Material Type:	If Other Diversion Method:		If Other Hauler:	If Other Receiving Facility:
6					
	If Other Material Type:	If Other Diversion Method:		If Other Hauler:	If Other Receiving Facility:

Diversion Records: Garbage

	Material Type	Diversion Method	Tons:	Hauler:	Receiving Facility:
7	Garbage	Disposal			
				If "Other" specify Hauler:	If "Other" specify Receiving Facility:

Diversion Records: Site Specifc Materials

	Material Type	Diversion Method	Tons:	Hauler:	Receiving Facility:
8	Land Clearing Debris				
		If Other Diversion Method:		If Other Hauler:	If Other Receiving Facility:
9	Material Type	Diversion Method	Tons:	Hauler:	Receiving Facility:
	Rock and Gravel				
		If Other Diversion Method:		If Other Hauler:	If Other Receiving Facility:

10	Material Type	Diversion Method	Tons:	Hauler:	Receiving Facility:
	Soil or Sand				
		If Other Diversion Method:		If Other Hauler:	If Other Receiving Facility:

Diversion Rates and Tonnage

Total Tons of Material: (Excluding site-specific materials)	0	**Diversion Percentage**	**N/A**
Total Tons of Diverted Material: (Excluding garbage and site-specific materials)	0		

Total Tons of Site-Specific Materials:	0

Recycling Economics Worksheet

Self-hauling

Cost of Recycling

Material	Tons or Yards	Tip Fee	Subtotal 1	# Loads	Hours Per Load	Labor rate and/or truck costs per hour	Subtotal 2	Total Cost
		$ -	$ -			$ -	$ -	$ -
		$ -	$ -			$ -	$ -	$ -
		$ -	$ -			$ -	$ -	$ -
		$ -	$ -			$ -	$ -	$ -
		$ -	$ -			$ -	$ -	$ -
		$ -	$ -			$ -	$ -	$ -
		$ -	$ -			$ -	$ -	$ -
		$ -	$ -			$ -	$ -	$ -
		$ -	$ -			$ -	$ -	$ -
Totals			$ -				$ -	$ -

Cost of Not Recycling

Material	Tons or Yards	Tip Fee	Subtotal 1	# Loads	Hours Per Load	Labor rate and/or truck costs per hour	Subtotal 2	Total Cost
Garbage		$ -	$ -			$ -	$ -	$ -

Savings or Cost of Recycling

Cost of Not Recycling	Cost of Reyclcing	**Total Savings**
$ -	$ -	**$ -**

Recycling Economics Worksheet - Sample

Self-hauling

Cost of Recycling

Material	Tons or Yards	Tip Fee	Subtotal 1	# Loads	Hours Per Load	Labor rate and/or truck costs per hour	Subtotal 2	Total Cost
Wood	6.5	$ 45.00	$ 292.50	13	1	$ 25.00	$ 325.00	$ 617.50
Asphalt Shingles	3.5	$ 50.00	$ 175.00	6	1	$ 25.00	$ 150.00	$ 325.00
Metal Oil Tank		$ -	$ -			$ -	$ -	$ 105.00
Copper/Aluminum/Steel	0.5	$ -	$ -	1		$ -	$ -	$ (10.40)
Drywall	4	$ 50.00	$ 200.00	8	1	$ 25.00	$ 200.00	$ 400.00
Concrete	1	$ 15.00	$ 15.00	1	1	$ 25.00	$ 25.00	$ 40.00
		$ -	$ -			$ -	$ -	$ -
		$ -	$ -			$ -	$ -	$ -
		$ -	$ -			$ -	$ -	$ -
Totals			$ 682.50				$ 700.00	$ 1,477.10

Cost of Not Recycling

Material	Tons or Yards	Tip Fee	Subtotal 1	# Loads	Hours Per Load	Labor rate and/or truck costs per hour	Subtotal 2	Total Cost
Garbage	15.5	$ 71.00	$ 1,100.50	29	1.00	$ 25.00	$ 725.00	$ 1,825.50

Savings or Cost of Recycling

Cost of Not Recycling	Cost of Reyclcing	Total Savings
$ 1,825.50	$ 1,477.10	**$ 348.40**

Recycling Economics Worksheet

Commercial Hauler

Cost of Recycling

Material	Tons or Yards	Tip Fee	Subtotal 1	# Loads	Hauling Fee	Subtotal 2	# of months	Container Rental	Subtotal 3	Total Cost
			$ -		$ -	$ -		$ -	$ -	$ -
			$ -		$ -	$ -		$ -	$ -	$ -
			$ -		$ -	$ -		$ -	$ -	$ -
			$ -		$ -	$ -		$ -	$ -	$ -
			$ -		$ -	$ -			$ -	$ -
			$ -		$ -	$ -			$ -	$ -
			$ -		$ -	$ -			$ -	$ -
			$ -		$ -	$ -			$ -	$ -
			$ -		$ -	$ -			$ -	$ -
Totals			$ -			$ -			$ -	$ -

Cost of Not Recycling

Material	Tons or Yards	Tip Fee	Subtotal 1	# Loads	Hauling Fee	Subtotal 2	# of months	Container Rental	Subtotal 3	Total Cost
Garbage		$ -	$ -		$ -	$ -		$ -	$ -	$ -

Savings or Cost of Recycling

Cost of Not Recycling	Cost of Reyclcing	Total Savings
$ -	$ -	**$ -**

Recycling Economics Worksheet - Sample

Commercial Hauler

Cost of Recycling

Material	Tons or Yards	Tip Fee	Subtotal 1	# Loads	Hauling Fee	Subtotal 2	# of months	Container Rental	Subtotal 3	Total Cost
Asphalt (recycled onsite)	600	$ -	$ -	0	$ -	$ -	0	$ -	$ -	$ -
Wood	24	$ 25.00	$ 600.00	12	$ 37.50	$ 450.00	3	$ 30.00	$ 90.00	$ 1,140.00
Cardboard	3	$ (39.00)	$ (117.00)	1	$ 37.50	$ 37.50	4	$ 30.00	$ 120.00	$ 40.50
Drywall	14	$ 45.00	$ 630.00	2	$ 50.00	$ 100.00	2	$ 30.00	$ 60.00	$ 790.00
			$ -			$ -			$ -	$ -
			$ -			$ -			$ -	$ -
			$ -			$ -			$ -	$ -
			$ -			$ -			$ -	$ -
			$ -			$ -			$ -	$ -
Totals			$ 1,113.00			$ 587.50			$ 270.00	$ 1,970.50

Cost of Not Recycling

Material	Tons or Yards	Tip Fee	Subtotal 1	# Loads	Hauling Fee	Subtotal 2	# of months	Container Rental	Subtotal 3	Total Cost
Garbage	641	$ 70.63	$ 45,273.83	6	$ 54.12	$ 324.72	$ 6	$ 30.00	$ 180.00	$ 45,778.55

Savings or Cost of Recycling

Cost of Not Recycling	Cost of Reyclcing	**Total Savings**
$ 45,778.55	$ 1,970.50	**$ 43,808.05**

SECTION 01 78 00
CLOSEOUT PROCEDURES

PART 1 GENERAL

1.01 SUMMARY

A. Section includes the following:

1. Substantial Completion.
2. Punchlist procedures.
3. Final Acceptance, and Payment.
4. Project Record Documents include, but are not limited to:
    a. Project As-Built Drawings.
    b. Construction logs.
    c. Photographs.
    d. Correspondence, Change Orders, Field Directives, RFIs.
    e. Operation and Maintenance Manuals.
5. Warranties.
6. Schedule of Contract closeout procedures.

1.02 REFERENCES

A. Comply with the requirements of King County Policies and Public Rules for Project Closeout, refer to Document Code CON-7-5-2 (AEP), available at <http://www.kingcounty.gov/operations/policies/aep/contractingaep/con752aep.aspx>.

1.03 SUBSTANTIAL COMPLETION

A. In addition to the requirements in Section 00 72 00 – General Terms and Conditions, the Contractor shall within its Request for Substantial Completion:

1. Allow Owner's full and unencumbered use of the Work, including access to utilities.
2. Make arrangements for final changeover of locks, keys, gates, and other access restriction measures consistent with removal of the Contractor’s personnel from the Project Site.
3. Deliver tools, spare parts, extra stock of materials, and similar physical items to Project Representative in accordance with requirements of the Contract Documents.
4. Remove all equipment, signage, and debris from the Site.

1.04 PUNCH LIST PROCEDURES

A. The Punch List (list of incomplete items of Work) Procedures for Substantial Completion and Final Acceptance shall be as described in the General Terms and Conditions.

1.05 FINAL ACCEPTANCE AND PAYMENT

A. Project Representative will consult with King County Records Manager for completeness of records provided by Contractor prior to Final Acceptance notification.

B. The Contractor shall submit to Project Representative the following documentation twenty-one (21) calendar days before Final Acceptance unless noted otherwise:

1. Final Affidavit of Amounts Paid.
2. Provide As-Built Drawings.
3. Final, complete Record Documents ten (10) days following issuance of the Certificate of Substantial Completion.
4. Final Application for Payment.
5. In addition, complete the following:
    a. Complete Project Site cleanup.
    b. Complete all remaining obligations as set forth within this Section.

1.06 PROJECT RECORD DOCUMENTS

A. Maintain onsite until close-out, one set of the following Project Record Documents; record actual revisions to the work:

1. Contract Documents.
2. Addenda.
3. Change Orders and other Modifications to the Contract.
4. Reviewed Shop Drawings, product data and samples.

B. Contractor shall red-line the Drawings and Technical Specifications on a weekly basis concurrent with construction progress. The Contractor shall supply a red-line of the Project Record Documents that shall document all additions and modifications to the original Contract Documents as follows:

1. Specifications: Legibly mark and record at each Product section description of actual Products installed, including the following:
    a. Manufacturer's name and product model and number.
    b. Product substitutions or alternates utilized.
    c. Changes made by Addenda and Modifications.
2. Project Record Documents and Shop Drawings: Legibly mark each item to record actual construction including (as applicable):
    a. Measured horizontal and vertical location of underground utilities and appurtenances referenced to permanent surface improvements.
    b. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
    c. Field changes of dimension and detail.
    d. Details not on original Contract Documents.

C. Submit electronic files for the following items to Project Representative with the claim for final Application for Payment:

1. One (1) complete full size (22-inch by 34-inch) sets of finalized As-Built Drawings
2. One (1) complete set of Contract Documents, including approved Field Work Directives and Change Orders.
3. Sorted by Change Order Number, one (1) complete set of Contractor's correspondence, including but not limited to RFIs, memos and emails that may serve as backup documentation for any discussions resulting in Change Orders or that document negotiations of Change Orders.
4. One (1) set of Operations and Maintenance Manuals.

D. 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.
2. Electronic files that contain more than ten (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. PDF files shall be text searchable.
5. PDF files shall be set up to print correctly (legible and correctly sized) 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. Provide King County with authorization to reproduce and distribute each file.
9. Detailed procedures for handling electronic submittals will be discussed at the preconstruction conference.

1.07 WARRANTIES

A. A one (1) year warranty applicable to all the Work shall be provided.

B. Provide two (2) executed copies of each warranty document required for all Milestones by the Contract Documents within ten (10) days following issuance of the Certificate of Substantial Completion.

1.08 SCHEDULE OF CONTRACT CLOSEOUT PROCEDURES

A. The following Closeout Procedures Checklist gives the order and responsibility for the requirements of the Final Contract Closeout. This list may not include all items required by the Owner's General Terms and Conditions and other Specification Sections.

B. Contract Closeout Documents Checklist: Complete the items indicated and submit this checklist when directed by Project Representative.

Responsibility	#	Procedure	Date
Contractor	1.	Notify Project Representative that the Work is Substantially Complete.	
Project Representative	2.	Inspect the Work, prepare Punch List and issue Certificate of Substantial Completion.	
Contractor	3.	Notify Project Representative that Punch List items have been completed.	
Project Representative	4.	Verify that Punch List items have been completed.	
Contractor	5.	Prepare the Final Application for Payment that includes the following: a. Affidavit of Wages Paid for Contractor and all Subcontractors. b. Release of Liens Certificate from all Subcontractors. c. Project Record Documents. d. Construction & Demolition Waste Reports. e. Warranties. f. Stamped permit set of documents. g. Final Affidavit of Amounts Paid to Subcontractors. h. Certificate of Compliance.	
Project Representative	6.	Issue Notice of Completion and Final Acceptance.	
Contractor	7.	Notify Project Representative of the date scheduled to turn over all project related files both paper and electronic no later than ten (10) days following issuance of the Certificate of Final Acceptance.	
Project Representative	8.	Prepare Notice of Completion of Public Works Contract and send to State Department of Revenue with copy to Employment Security Office, and Labor and Industries.	
Project Representative	9	Contact SWD Records Management Specialist no later than 30 days after Notice of Substantial Completion with an estimate of the number of boxes of paper files to be turned over in addition to any electronic files.	
Project Representative	10.	Receive the following from the state: a. Certificate of Payment of State Excise Taxes, Dept. of Revenue. b. Certificate of Payment of Contributions and Interest – Department of Employment Security. c. Letter from State Department of Labor and Industries – Contract Compliance Unit.	
Project Representative	11.	Initiate Lien Search forty-five (45) days after date of Final Acceptance: a. Receive Lien Search Results from Records.	
Project Representative	12.	Process release of retainage when all state releases are received and liens are cleared.	

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION – NOT USED

END OF SECTION 01 78 00

SECTION 02 31 40
HAZARDOUS MATERIALS AND DANGEROUS WASTE

PART 1 GENERAL

1.01 SUMMARY

A. Section includes the excavation, classification by Owner, temporary stockpiling and protection on the Project Site, loading, hauling and disposal of Hazardous Materials and Dangerous Waste encountered during Work.

1.02 DEFINITIONS

A. RCRA: Resource Conservation and Recovery Act.

B. Dangerous Waste: As defined in Section 01 35 00 – Health and Safety.

C. Hazardous Material: As defined in the Owner's General Terms and Conditions and to include the definition contained in Section 01 35 00 – Health and Safety, which also applies.

D. Washington Administrative Code (WAC) Chapter 173-303 – Dangerous Waste Regulations.

E. BMP: Best Management Practice.

F. CHRLF: Cedar Hills Regional Landfill.

G. HWM: Hazardous waste manifest.

H. TCLP: Toxicity Characteristic Leaching Procedure.

I. TPH: Total petroleum hydrocarbons.

J. VOC: Volatile organic compound.

K. PCB: Polychlorinated biphenyl.

L. SVOC: Semi-volatile organic compound.

M. WSDOT: Washington State Department of Transportation.

N. EPA: United States Environmental Protection Agency.

O. HAZWOPER: Hazardous Waste Operations and Emergency Response.

1.03 QUALITY ASSURANCE

A. Use only firms or individual trades qualified to perform work required under this Section.

B. Emergency Response Contact: Designate a 24 HR emergency response person who is familiar with the unique activities on the Site, and who has comprehensive emergency response and incident mitigation experience, or who has immediate access to that knowledge and information.

C. Regulatory Requirements:

1. Comply with the requirements of Section 01 09 05 – Reference Standards and as listed herein.

2. Utilize a WSDOT-licensed transporter complying with Dangerous Waste and RCRA Regulations.

1.04 SUBMITTALS

A. Approval Submittals:

1. Contingency Response Plan to be provided by Contractor and approved by Owner prior to mobilizing to the Site.

    a. The intent of this Plan is to describe measures that will be taken to reduce the risk of and to respond to a spill or other Hazardous Materials release on the Project Site.

    b. The Contingency Response Plan shall include the following elements:

        1) Narrative that addresses the type of materials, locations of use, locations and methods of storage, and methods of containment and treatment for potential pollution sources associated with the following activities:

            a) Storage and Handling of Liquids (including but not limited to petroleum products, solvents, detergents, paint, pesticides, and concrete admixtures).

            b) Storage and Stockpiling of Construction Materials, Debris, and Dangerous Wastes.

            c) Fueling.

            d) Maintenance, repairs, and storage of vehicles and equipment.

            e) Asphalt saw cutting, slurry, and wash water disposal.

            f) Handling of pH elevated water.

            g) Application of chemicals, including pesticides and fertilizers.

        2) Pollution Prevention Site Plan that identifies and delineates the following:

            a) Locations where liquids will be stored and delineate secondary containment areas that will be provided.

            b) Locations where construction materials and wastes will be generated and stockpiled.

            c) Provisions to manage stormwater (run on and runoff), leachate, and windblown debris from contaminated/hazardous materials.

            d) Location of fueling for vehicles and equipment if stationary tanks will be used. This includes showing lighting and signage for fueling during evening hours.

            e) Containment areas for fuel spills.

            f) Maintenance and repair areas for equipment. Clearly note that signs must be posted that state that vehicle washing shall not occur in this area.

            g) Truck washout area and identify location of slurry/wash water sumps and tool rinsing areas.

            h) Identify chemicals that will be applied and where they will be stored.

i) Where spill response materials will be stored.

3) Spill Prevention and Cleanup Report:

a) List possible sources of a spill and identify the BMPs to be used for each source to prevent a spill.

b) Identify personnel responsible for spill prevention and cleanup and clearly list responsibilities of each person identified. An emergency coordinator in compliance with WAC 173-303-350 shall be identified. Identify the designated 24 HR emergency response contact required elsewhere in this Section. 24 HR Contact information for these personnel must be provided.

i Personnel identified shall be maintained on the Project throughout the duration of the Project. Any change in personnel shall require the prior approval of Project Representative.

c) Provide contact information to facilitate emergency notifications in the event of a Hazardous Materials release or other spill emergency.

d) Describe the procedures to be used for monitoring spill prevention BMPs and for responding to a spill incident, including record-keeping of inspections and spills.

e) Identify where spill response materials will be stored.

f) Identify disposal methods for contaminated water and soil after a spill including submittal requirements to jurisdictional authorities.

g) A form must be provided for each subcontractor that states it has read and agreed to the Contingency Response Plan prior to starting work onsite.

h) One (1) additional bound copy of the final Contingency Response Plan shall be submitted to Project Representative for distribution to Seattle-King County Public Health Department.

4) Certifications: Provide copies of the current HAZWOPER Certifications prior to personnel performing work on the Project Site.

B. Quality Assurance Submittals:

1. Name and contact information for Contractor’s emergency response contact person.

2. Hazardous Material Release Report, as applicable.

3. Spill Cleanup Report, as applicable.

1.05 DESCRIPTION

A. Dispose of Dangerous Waste identified by Project Representative.

B. Provide labor and materials at no cost to the Owner to clean up all spills of Hazardous Materials caused by the Contractor and Subcontractors that occur on the Project Site, on roadways and other locations.

1. Clean-up must comply with applicable regulations.

C. Identification of Suspect Dangerous Waste:

1. Project Representative will observe excavation activities for the presence of Suspect Dangerous Wastes.
    a. If Suspect Dangerous Wastes are encountered, Project Representative will take material samples for testing to classify these materials.
    b. Testing by an independent laboratory could include tests for TPH, total metals, selected TCLP metals, PCBs/pesticides, SVOCs and VOCs.
    c. Preliminary test results from samples received at a Seattle area laboratory before 3:00 PM (Monday through Friday) will normally be available within four to five working days and as short as three working days with advance notice to the laboratory.
    d. Final results and summary reports for legal documentation will take additional time.
    e. Contractor must accommodate isolation and sampling, collection, and temporary storage of Suspect Dangerous Wastes.
2. Project Representative will inform the Contractor of Dangerous Waste suspected or confirmed to be present.
    a. Should such a notification be necessary, the Contractor will be instructed on how to proceed.
3. Immediately notify Project Representative of soils or refuse encountered or conditions that differ significantly from those ordinarily encountered onsite based on the visual appearance, odors, sudden onset of health effects encountered during excavation and handling, or other distinguishing characteristics.

D. Potential Areas with Hazardous Materials:
1. Exact nature of the refuse disposed of at CHRLF is unknown and has the potential to contain Hazardous Materials.
2. If suspected contamination is encountered, Project Representative shall provide Contractor with direction for how to proceed.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver and store products to Site under provisions of 01 60 00 – Product Requirements, and per the following requirements:
1. Store materials in a protected location, accessible to workers, in a clearly marked closed container or containers.
2. Do not relocate spill response materials around the Project Site.
3. Inform workers of the locations of the spill response materials.

1.07 ADDITIONAL REQUIREMENTS

A. Hazardous Material Release Events:
1. Immediately notify Project Representative upon knowledge of release of a Hazardous Material associated with the Project.
2. Submit a written report to Project Representative within 24 HRS of a release of Hazardous Material associated with the Project.

a. Forward copies of the report to other agencies as directed by Project Representative.

b. Describe the location, size or volume, type, and affected area of the spill or release.

c. Identify the events and corrective actions taken.

d. Identify notifications that were made in the process of responding to the spill or release, and afterward.

e. Identify problems in implementing corrective actions or problems complying with the regulations.

PART 2 PRODUCTS

2.01 EQUIPMENT

A. Provide items and equipment as necessary to implement the Contingency Response Plan and to prevent and contain spills.

B. The items described in this Part 2 are the minimum required items.

C. Spill Containment Barrier:

1. Type: Inflatable or pop-up type spill containment barriers for use on level ground.
2. Capacity: Minimum one thousand (1,000) GAL capacity.
3. Quantity: Provide one (1).

D. Containers:

1. Provide two (2) 65-GAL minimum size empty containers with lids.
2. Provide similar containers to the spill kits identified in this Section.

E. Provide mobile, on-call tank truck for pumping and transporting liquids.

2.02 MATERIALS

A. Spill Kits:

1. Overpack drum type spill kit.
2. Sixty-five (65) GAL minimum kit capable of adsorbing at least forty-six (46) GAL.
3. Quantity: Provide two (2).
4. Provide one of the following products:

a. Parker Systems, Inc. (866) 472-7537; “65 Gallon Overpack Spill Kit PS-SKA/65 – Universal.”

b. DAWG Spill Control People (800) 935-3294; “KIT136 – Universal 65 Gallon Overpack Spill Kit.”

c. Absorbents Online (800) 869-9633; “GPSK65 - 65 Gallon Universal Spill Kit.”

d. Or Approved Equal.

PART 3 EXECUTION

3.01 PREPARATION

A. Spill Response Materials:

1. Have spill response materials, equipment, tools, and other items on hand throughout the construction period.
2. Provide spill response materials that are compatible with the types of Hazardous Materials likely to be encountered on the Project Site.
    a. Include containers, adsorbents, and personal protective equipment.
3. Provide miscellaneous equipment and tools necessary to perform the likely work activities necessary to contain, cleanup, handle, transport, and dispose of Hazardous Materials in conformance with the regulations.

B. Contingency Response Plan:

1. Provide approved plan prior to commencing any work that would be covered by this plan. Identify the sequence of activities.
2. The Contingency Response Plan is to be in effect during the period the Plan is approved until such time the Contractor is informed by Project Representative that the Plan is retired.
3. Conditions for retirement of the Contingency Response Plan include but are not limited to:
    a. Completion of earthwork activities including excavation, fill, and placement of subgrade materials.
    b. Completion of trenching activities that could pose a hazard or threat to surface water features and wetlands.
    c. Completion of other work that could pose a hazard or threat to surface water features and wetlands.
    d. Completion of work requiring liquids such as petroleum products, solvents, detergents, paint, pesticides, and concrete admixtures.
4. Comply with applicable regulations.

3.02 CONSTRUCTION

A. Segregate suspect and confirmed Dangerous Waste from other materials.

B. Minimize potential for spills and releases of Hazardous Materials.

C. Temporarily store suspect and confirmed Dangerous Waste.

1. Retain suspect and confirmed Dangerous Waste at the Project Site until such time the material can be properly classified by Project Representative.
2. Establish and maintain sufficient temporary storage and stockpiling of suspect and confirmed Dangerous Waste in a location acceptable to Project Representative in advance.
3. Provide Project Representative access to temporary storage and stockpiles of suspect and confirmed Dangerous Waste.

D. Handling of Hazardous Materials:

1. Handle Hazardous Materials in accordance with WAC Chapter 173-303.
2. Have appropriate vehicles or containers ready for use with Hazardous Materials.
3. Use spill containment barriers when appropriate to prevent the release of suspect Hazardous Materials.

E. Transport Hazardous Materials in compliance with local, state, and federal laws.

F. Dispose of Hazardous Materials at Owner-approved, appropriately permitted facility.

G. Disposal of Dangerous Waste:

1. The disposal facility should be contacted to obtain authorization to transport Dangerous Waste to its facility for disposal prior to transport being performed.
2. The disposal facility may require additional waste characterization prior to its acceptance of Dangerous Waste.
    a. Arrange and manage additional waste characterization as required, and as approved by Project Representative.
    b. Waste characterization required to be performed by the disposal facility in its process of accepting and determining final disposition and placement of Dangerous Waste, will be performed by Project Representative.
3. The Owner will be the designated generator of Dangerous Waste. The US EPA Identification Number for this Site is WAD047848122.

3.03 SPILL RESPONSE:

A. Take immediate action to implement appropriate necessary containment and cleanup procedures.

B. Minimize the effect of spills and release of Hazardous Materials.

3.04 CLEANING

A. Immediately clean up spills and releases of Hazardous Materials to the satisfaction of Project Representative.

1. Project Representative will inform the Contractor when clean-up activities are satisfied.

B. Decontaminate equipment and vehicle components coming in contact with suspect Dangerous Waste or Hazardous Materials before the equipment and vehicles are relocated to other locations:

1. Decontamination using high pressure washing and steam cleaning methods are suitable.
2. Propose alternative methods to Project Representative for acceptance.
3. Implement necessary procedures to contain, handle, transport, and properly dispose of wastewater resulting from decontamination activities.

3.05 FIELD QUALITY CONTROL

A. Provide disposal receipts, truck trip and weight tickets to Project Representative.

1. Indicate the characteristics of the material being handled and hauled.

2. Identify the driver and truck number.

B. Provide copies of HWMs to Project Representative.

1. Instruct disposal facilities to provide copies of completed HWMs mailed directly to Project Representative within thirty (30) calendar days of disposal.

END OF SECTION 02 31 40

SECTION 03 20 00
CONCRETE REINFORCING

PART 1 GENERAL

1.01 GENERAL REQUIREMENTS

A. SCOPE:

1. This section specifies reinforcing steel for use in reinforced concrete.

1.02 REFERENCES

A. REFERENCE STANDARDS: The publications referred to hereinafter form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only. The latest edition of referenced publications in effect at the time of the bid shall govern, except where a specific date or edition is given below. In case of conflict between the requirements of this section and the listed standards, the requirements of this section shall prevail.

AWS D1.4	Structural Welding Code - Reinforcing Steel
ACI 117	Tolerances for Concrete Construction Materials
ACI 315	Details of Concrete Reinforcement
ACI 318	Building Code Requirements for Reinforced Concrete
ACI SP-66	ACI Detailing Manual
ASTM A82	Steel Wire, Plain, for Concrete Reinforcement
ASTM A185	Steel Welded Wire, Fabric, Plain for Concrete Reinforcement
ASTM A615	Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM A706	Specification for Low-Alloy Steel Deformed Bars for Concrete Reinforcement
ASTM A775	Epoxy-Coated Reinforcing Steel Bars
ASTM A884	Epoxy-Coated Steel Wire and Welded Wire Reinforcement
CRSI-PRB	Placing Reinforcing Bars
CRSI-MSP 1	Manual of Standard Practice
FEDSPEC QQ-W-461H	Wire, Steel, Carbon (Round, Bare and Coated)

1.03 SUBMITTALS

A. The following information shall be submitted for review in accordance with the Contract Documents.

1. A copy of this specification section, with addenda updates, with each paragraph check marked to show specification compliance or marked to show deviation.

2. Bar placement shop drawings plus electronic PDF file showing grade of steel, steel bar quantities, sizes, spacing, dimensions, configurations, locations, mark numbers, lap splice lengths and locations, concrete cover and reinforcing steel supports. Reinforcing steel shop drawings shall be of sufficient detail to permit installation of reinforcing steel without reference to the contract drawings. Shop drawings shall not be prepared by reproducing the plans and details indicated on the contract drawings but shall consist of completely redrawn plans and details as necessary to indicate complete fabrication and installation of reinforcing steel, including large scale drawings at joints detailing bar placement in congested areas. Placement drawings shall be in accordance with ACI 315. Reinforcing details shall be in accordance with ACI SP-66.

3. Certified mill test reports for all reinforcing.

4. Bar tags.

5. Welder qualification certificate in accordance with AWS DI.4.

6. Manufacturer and type of proprietary reinforcing steel splices. A current ICC Report and manufacturer's literature that contains instructions and recommendations for each type of coupler used shall be submitted.

B. Changes to the Contract Documents made by the Contractor in reinforcing steel shop drawings shall be called out in the letter of submittal. Such changes will not be acceptable unless the Project Representative has expressed consent to such changes in writing.

C. Review of shop drawings by the Project Representative will be limited to compliance with the general intent of the Contract Documents. Contractor is responsible for correctness of information on shop drawings.

PART 2 PRODUCTS

2.01 BAR REINFORCEMENT

A. Reinforcing bars shall be Grade 60 deformed bars conforming to ASTM A615. Smooth dowel bars shall conform to ASTM A615, Grade 60, with a metal end cap at the greased or sliding end to allow longitudinal movement.

B. Reinforcement resisting earthquake-induced flexural and axial forces in frame members and in wall boundary members labeled “special moment frames” and “special shear walls” shall comply with low alloy ASTM A706. ASTM A615 Grade 60 reinforcement may be used in these members if the following requirements are met:

1. The actual yield strength based on mill tests does not exceed the specified yield strength by more than 18,000 pounds per square inch (retests shall not exceed this value by more than an additional 3,000 pounds per square inch).

2. The ratio of the actual ultimate tensile stress to the actual tensile yield strength is not less than 1.25.

C. All reinforcement bars lacking grade identification marks shall on delivery be accompanied by a manufacturer's guarantee of grade.

D. All bars shall be new stock free from rust scale, loose mill scale, excessive rust, dirt, oil, and other coatings which adversely affect bonding capacity when placed in the work. Any bars having excessive rust scale, loose mill scale, or a thick rust coat shall be thoroughly cleaned, or shall be rejected and removed from the premises upon order of the Project Representative.

E. Bars shall be delivered bundled and tagged with identifying tags.

2.02 EPOXY COATED BAR REINFORCEMENT

A. Epoxy coated bars shall conform to ASTM A775 and ASTMA884.

B. Epoxy coated reinforcing steel bar patching material shall be compatible with coating material, inert in concrete, obtained from manufacturer of the epoxy resin used to coat the reinforcing steel bars and meet the requirements of ASTM A775.

2.03 THREADED BARS

A. Threaded bars shall have continuous rolled-in-pattern of thread-like deformations along the entire length. Hex nuts and couplers shall be provided that develop 125 percent of yield strength of bar. Threaded bars shall conform to ASTM A615 grade

60. Threaded bar manufacturers shall be DYWIDAG System International, San Diego, California, "DYWIDAG Threadbar," or equal.

B. Cut threads or regular reinforcements shall not be substituted for threaded bars.

2.04 MECHANICAL COUPLERS

A. Mechanical couplers shall be provided where shown and where approved by the Project Representative. The couplers shall develop a tensile strength which exceeds 125 percent of the yield strength of the reinforcement bars being spliced at each splice.

B. Where the type of coupler used is composed of more than one component, all components required for a complete splice shall be supplied. This shall apply to all mechanical splices, including those splices intended for future connections.

C. Reinforcing bar couplers shall only be used where indicated on the Drawings or approved by the Project Representative.

D. Reinforcing bar couplers shall be mechanical butt splices of the sleeve-threaded type.

E. The total slip of the reinforcing bars within the splice sleeve after loading in tension to 30,000 pounds per square inch and relaxing 3,000 pounds per square inch shall not exceed 0.010 inch.

F. All splicing procedures shall be in accordance with the manufacturer's recommendation.

G. Ends of reinforcing bars to be spliced shall be cut nominally square.

H. Reinforcing bar couplers shall have a clear cover of not less than indicated on the Drawings or specified for the bars when measured from the surface of the concrete to the outside of the sleeve. Stirrups, ties, and other reinforcement shall be placed if necessary to provide planned clear cover to reinforcement. Unless noted on the drawings, adjacent bar couplers shall be staggered at least two feet apart.

I. Mechanical couplers shall be DYWIDAG reinforcing steel couplers by DSI, San Diego, California, or equal.

2.05 WIRE FABRIC

A. Wire fabric shall be 6-inch by 6-inch welded steel mesh conforming to ASTM A185.

2.06 WIRE AND PLAIN BARS

A. Wire used as reinforcement and bars used as spiral reinforcement in structures shall be cold drawn steel conforming to ASTM A82.

2.07 TIE WIRE

A. The wire shall be minimum 16 gage annealed steel conforming to FEDSPEC QQ-W-461H.

2.08 BAR SUPPORTS

A. Bar supports coming into contact with forms shall be CRSI Class 1 plastic protected or Class 2 stainless steel protected and shall be located in accordance with CRSI MSP-1 and placed in accordance with CRSI PRB.

1. Manufactured concrete block supports with embedded tie wires (wire dobies) shall be provided for footing and slabs on grade. Do not use brick, broken concrete masonry units, spalls, rocks, construction debris, or similar material for supporting reinforcing steel.

2. Stainless steel or plastic protected plain steel supports shall be provided for other work.

PART 3 EXECUTION

3.01 GENERAL

A. The Contractor, without relinquishing authority and responsibility for supervision and direction of the work, agrees to follow the specified means, methods, techniques, sequences, and procedures.

3.02 INSTALLATION

A. SHIPPING, HANDLING AND STORAGE

1. Reinforcing steel shall be shipped to the jobsite with attached plastic or metal tags having permanent mark numbers which match the shop drawing mark numbers. All reinforcing shall be supported and stored above ground. Use only plastic tags secured to the reinforcing steel bars with nylon or plastic tags for epoxy coated reinforcing steel bars.

B. FABRICATION

1. Reinforcing steel shall not be bent or straightened in a manner which will injure the material. Bars with kinks or with bends not shown on the shop drawings shall not be used. Heating or welding bars shall be performed in accordance with AWS Dl.4. Bars shall not be welded at the bend. Tack welding of cross bars is not acceptable.

2. Bars shall be cut and bent in accordance with the provisions of ACI 315 and ACI 318. All bars shall be bent cold. Minimum diameter of bends of reinforcing steel bars shall be as indicated in ACI-318 paragraph 7.2. Bars shall be free from defects and kinks and from bends not indicated on the Drawings. Reinforcing steel bars shall have the following tolerances:

a. Sheared lengths shall be within +/- 1 inch.

b. Overall dimensions of stirrups, ties, and spirals shall be within +/- ½ inch.

c. All other bends shall be within +0 inch, -½ inch

C. PLACEMENT

1. Reinforcing steel shall be placed in accordance with CRSI standards.

2. Reinforcing steel shall be positioned accurately and secured against displacement by using annealed iron wire or clips at intersections and shall be supported by concrete or metal chairs, spacers or metal hangers. Steel rods and pegs may be used to support reinforcing steel on rock foundations. Reinforcing steel shall be placed in such a manner as to not damage waterproofing membrane or plastic lining which have been previously applied or constructed. Vapor barrier sheathing at slab-on-grade shall be protected by adding 2 inches of sand over sheathing. Reinforcing steel shall be slightly relocated where necessary to clear waterstop. Reinforcing steel shall not be placed on fresh concrete or forced into fresh concrete.

3. Positioning support for embedded items shall not be welded to the reinforcement. Additional reinforcement may be provided for this purpose.

4. Contract bars shall not be used as support bars. Provide additional reinforcing steel as support bars.

5. Bars shall be fastened securely in place with annealed steel wire ties. Bars shall be tied sufficiently often to prevent shifting. There shall be at least three ties in each bar length (does not apply to dowel laps or to bars shorter than 4 feet, unless necessary for rigidity). Slab bars shall be tied at every intersection around the periphery of the slab. Wall bars and slab bar intersections other than around the periphery shall be tied at not less than every fourth intersection, but at not greater than the following maximum spacings:

	Slab Bars, inches	Wall Bars, inches
Bars No. 5 and smaller	60	48
Bars No. 6 through No. 9	96	60
Bars No. 10 and No. 11	120	96

D. CONCRETE COVER

1. Unless specified otherwise on the Drawings, reinforcing steel bar cover shall conform to the following minimum measurements:

   a. Reinforcing steel bar cover shall be 3 inches for concrete cast against earth.

   b. Reinforcing steel bar cover shall be 2 inches for reinforcing steel bars for formed concrete surfaces exposed to earth and weather.

   c. Reinforcing steel bar cover shall be 2 inches for any formed surfaces exposed to or above any liquid.

   d. Reinforcing steel bar cover shall be 1 ½ inches for reinforcing not in the above categories unless noted otherwise on the design drawings.

E. SPLICING

1. Where reinforcing bars are to be lap spliced at cold joints in concrete, Contractor shall ensure that reinforcing bars extend from concrete first placed, a minimum length equal to the required lap splice length. Where lap splice length is not indicated on the drawings, the splice length shall be as specified in ACI 318 for "Class B" splices.

2. In slabs, beams, girders, and walls, reinforcing steel shall not be spliced in areas of maximum stress. Splices of adjacent bars shall be staggered.

F. BAR SUPPORTS

1. Bar supports shall be located and placed in accordance with CRSI standards. Concrete block supports shall be provided for footings and slabs on grade only. Bar supports at all other work shall be hot-dip galvanized steel. All bar supports shall be furnished in sufficient number to prevent sagging and to support loads during construction, but in no case shall the quantities and locations of the supports be less than indicated in ACI 315. Bar supports, where used in slabs which will be exposed to view, shall be equipped with plastic tips. No use shall be made of brick, broken concrete masonry units, spalls, rocks, or similar material for supporting reinforcing steel.

G. CLEANING

1. Prior to concrete placement, reinforcing steel shall be cleaned of mill rust scale, dried concrete, or other coatings that may destroy or reduce bond. Reinforcement reduced in section is not acceptable.

END OF SECTION 03 20 00

SECTION 03 30 00
CAST-IN-PLACE CONCRETE

Part 1 Part 1 General

1.01 Summary

A. Scope:

1. This section specifies cast-in-place concrete produced at a ready-mixed plant and truck-mixed or produced on-site which consists of furnishing all material, mixing and transporting equipment, and performing all labor for the proportioning, mixing, transporting, placing, consolidating, finishing and curing of concrete.

B. Quality Assurance:

1. Quality Control Project Representative

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

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

2. Quality Control by Contractor:

a. Where required to demonstrate conformance with the specified requirements for cast-in-place concrete, the Contractor shall provide the services of an independent testing laboratory which complies with the requirements of ASTM E329. The testing laboratory shall sample and test concrete materials as specified in paragraphs 2.01-B, 2.03-C, and 3.09-A of this specification section. Costs of testing laboratory services shall be borne by the Contractor.

3. Basis for Quality:

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

1.02 References

C. Reference Standards: The publications referred to hereinafter form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only. The latest edition of referenced publications in effect at the time of the bid shall govern. In case of conflict between the requirements of this section and the listed references, the requirements of this section shall prevail.

American Concrete Institute (ACI):

Reference	Title
211.1	Practice For Selecting Proportions For Normal, Heavyweight, And Mass Concrete
301	Structural Concrete For Buildings
304	Guide For Measuring, Mixing, Transporting, And Placing Concrete
305.1	Hot Weather Concreting
306.1	Cold Weather Concreting
309	Guide For Consolidation Of Concrete
318	Building Code Requirements For Reinforced Concrete
350	Code Requirements For Environmental Engineering Concrete Structures
350.1	Tightness Testing Of Environmental Engineering Concrete Structures

American Association Of State Highway And Transportation Officials (ASHTO):

Reference	Title
M251	Plain And Laminated Elastomeric Bridge Bearings
T210	Method Of Test For Aggregate Durability Index

American Society For Testing And Materials (ASTM):

Reference	Title
C31	Practice For Making And Curing Concrete Test Specimens In The Field
C33	Concrete Aggregates
C39	Test Method For Compressive Strength Of Cylindrical Concrete Specimens
C42	Test Method For Obtaining And Testing Drilled Cores And Sawed Beams Of Concrete
C88	Test Method For Soundness Of Aggregates By Use Of Sodium Sulfate Or Magnesium Sulfate
C94	Ready-Mixed Concrete
C117	Test Method For Materials Finer Than 75-Micrometer (No. 200) Sieve In Mineral Aggregates By Washing
C131	Test Method For Resistance To Degradation Of Small Size Coarse Aggregate By Abrasion And Impact In The Los Angeles Machine
C136	Method For Sieve Analysis Of Fine And Coarse Aggregates
C142	Test Method For Clay Lumps And Friable Particles In Aggregates

C143	Test Method For Slump Of Hydraulic Cement Concrete
C150	Portland Cement
C156	Water Retention By Concrete Curing Materials
C157	Test Method For Length Change Of Hardened Hydraulic Cement Mortar And Concrete
C172	Practice For Sampling Freshly Mixed Concrete
C192	Making And Curing Concrete Test Specimens In The Laboratory
C231	Test Method For Air Content Of Freshly Mixed Concrete By The Pressure Method
C260	Air Entraining Admixtures For Concrete
C289	Test Method For Potential Reactivity Of Aggregates (Chemical Method)
C309	Liquid Membrane Forming Compounds For Curing Concrete
C494	Chemical Admixtures For Concrete
C595	Blended Hydraulic Cements
C618	Fly Ash And Raw Or Calcined Natural Pozzolan For Use As A Mineral Admixture In Portland Cement Concrete
C989	Slag Cement For Use In Concrete And Mortars
C1240	Silica Fume Used In Cementitious Mixtures
D75	Practice For Sampling Aggregates
D2419	Test Method For Sand Equivalent Value Of Soils And Fine Aggregate

Army Corps Of Engineers Specification:

Reference	Title
CRD-C572	Waterstops

Federal Specifications

Reference	Title
Fedspec Uu-B-790A	Building Paper, Vegetable Fiber (Kraft, Waterproofed, Water Repellent, And Fire Resistant)

1.03 Submittals

D. The following information shall be submitted for review in accordance with the Contract Documents:

1. A copy of this specification section, with addenda updates, with each paragraph check-marked to show specification compliance or marked to show deviations.

2. Each proposed mix design showing:
    a. The expected strength at 28 days,
    b. Corresponding slump before and after the introduction of high-range water-reducing admixtures,
    c. Water/cement ratios,
    d. Expected air entrainment,
    e. Weights and test results of the ingredients,
    f. Aggregate gradation,
    g. Test results of mix design prepared by an independent testing laboratory, and
    h. Other physical properties necessary to review each mix design for conformance with these specifications.
    i. If a special mix design is being used to combat chloride ions in the environment, including but not limited to the use of a corrosion inhibitor admixture, submit a letter that describes the anticipated time to initiation of corrosion of concrete- embedded metal based on the mix design, concrete clear cover, and chloride concentration in the environment. The report is to be written by a professional corrosion engineer licensed in the state of Washington, an NACE International certified corrosion specialist, or an NACE International certified cathodic protection specialist.
3. Test results from concrete mix trial batch testing.
4. Product literature and technical data for aggregates, cement and pozzolan.
5. Manufacturer's product data and installation instructions for:
    a. Bonding compounds
    b. Retardants
    c. Surface hardener
    d. Curing compounds
    e. Evaporation reducer
    f. Shrinkage reducing admixtures
    g. Corrosion inhibitors
6. Procedures for hot and cold weather placement and curing methods.
7. Samples of concrete panels when indicated herein.

PART 2 PRODUCTS

2.01 Materials

A. Cement:
    1. Portland cement shall be ASTM C150, Type I or II (general use).
    2. Type V, (high sulfate resistance) low alkali, containing less than 0.60 percent by weight of alkalis.

3. Dual rated Type II/V.
4. Portland pozzolan cement shall be ASTM C595, Type Ip(Ms), interground, low alkali.

B. Aggregates:

1. General:
   a. Except as modified herein, fine and coarse aggregates shall conform to ASTM C33 Class 3M.
   b. Fine and coarse aggregates shall be regarded as separate ingredients. Aggregates shall be nonreactive and shall be washed before use.
   c. Make tests for size and grading of the fine and coarse aggregates in accordance with ASTM C136.
   d. Keep fine and coarse aggregates separate prior to their admission into the concrete mixer, and clean and free from foreign substances. Use methods in piling and handling of aggregates such as to prevent the segregation of the several sizes of particles.
   e. When aggregates which are satisfactory to the Project Representative have been selected, secure the entire supply of each material from the same source so as to maintain the same quality and grading throughout the work. Should it become necessary to change the source or characteristic of the materials used, this will only be done as additional proportioning and other tests have been completed for the new materials, and subject to such safeguards as the Project Representative may impose for the maintenance of the quality of the aggregate herein specified.
   f. The tests specified shall be performed prior to commencing concrete work.
2. Fine Aggregate:
   a. Fine aggregate shall consist of natural sand, manufactured sand, or a combination thereof.
   b. Gradation of fine aggregate shall conform to ASTM C33 when tested in accordance with ASTM C136.
   c. Fine aggregate shall not exceed 40 percent for pumping by weight of combined aggregate total, except for concrete with coarse aggregate of less than maximum size 1/2 inch.
   d. Other tests shall be in accordance with Table A:

Table A

Test	Test Method	Requirements
Amount Of Material Passing No. 200 Sieve	ASTM C117	3 Percent Maximum By Weight
Reactivity With Alkalies In Cement	ASTM C289	Innocuous
Sand Equivalent	ASTM D2419	Minimum 75

3. Coarse Aggregate:

   a. Coarse aggregate shall be hard, dense and durable gravel or crushed rock free from injurious amounts of soft and friable particles, alkali, and organic matter. Other deleterious substances shall not exceed the limits listed in ASTM C33, Table 3.

   b. Use coarse aggregate for concrete classes specified herein that shall be well graded between the limits as described in ASTM C33, Table 2, unless otherwise specified. During progress of the work, variations from the specified gradations will be acceptable in individual tests if the average of three consecutive tests is within the specified limits.

   c. Other tests shall be in accordance with Table B:

Table B

Test	Test Method	Requirements
Durability index	AASHTO T210	Minimum 75
Soundness maximum loss	ASTM C88	10 percent with sodium sulfate
Amount of material passing No. 200 sieve	ASTM C117	1.0 percent maximum by weight
Abrasion	ASTM C131	35 percent maximum loss after 500 revolutions in a Los Angeles Abrasion Machine
Clay lumps and friable particles	ASTM C142	1.5 percent maximum by weight
Reactivity	ASTM C289	Innocuous

C. Pozzolan:

1. Pozzolan shall be Class N, natural pozzolan, or Class F, fly ash, conforming to ASTM C618. Fly ash pozzolan shall contain less than 1 percent by weight carbon and less than 3 percent by weight sulfur trioxide. Pozzolan supplied during the life of the project shall have been formed at the same single source, manufacturer and quarry. The pozzolan color shall not substantially alter the resulting concrete from the normal gray color and appearance.

2. If specified, pozzolan shall be silica fume conforming to the requirements of ASTM C 1240. Silica fume may be added up to a maximum of 12 percent by weight of the minimum quantities of Portland cement. A high-range water-reducing admixture shall be used to maintain the water-cement ratio

D. Admixtures:

1. General: Admixtures shall be compatible with the concrete. Calcium chloride or admixtures containing calcium chloride are not acceptable. Admixtures shall be used in accordance with the manufacturer's recommendations and shall be added separately to the concrete mix.

2. Water Reducing Retarder: Water reducing retarder shall be ASTM C494, Type D, and shall be Basf, Pozzolith 322-N; Sika Chemical Corp., Plastocrete 161; or equal.

a. The water reducing retarder shall reduce the water required at least 8 percent for a given concrete consistency and shall comply with the water/cement ratio standards of Aci 211.1.

3. High Range Water Reducing Admixtures: High range water reducing (superplasticizing) admixtures shall conform to ASTM C494, Type F. Acceptable products include: Basf “Glenium 3000NS”; Sika Chemical Corp. “Sikament Ff or 686”; Euclid Chemical Co. “Eucon 37”; W.R. Grace “Adva 195”; or equal.

4. High Range Water Reducing And Retarding Admixtures: High range water reducing and retarding admixtures shall conform to ASTM C494, Type G. Acceptable products include: W.R. Grace “Daracem 100”; Euclid Chemical Co. “Eucon 537”; or equal.

5. Air Entraining Agent: Air entraining agent shall be Basf, Mb-AE90; or equal. For concrete that will not be treated with surface hardener, the air entraining agent added shall produce an entrained air content between 3 and 5 percent, in accordance with ASTM C260. Entrained air shall be less than or equal to 3 percent where surface hardener is required.

6. Water Reducing Accelerator: Not permitted.

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

8. Ground Granulated Blast-Furnace Slag (Ggbfs) Admixture:

   Ggbfs shall conform to requirements of ASTM C 989, Grade 100 or 120. Ggbfs may replace Portland cement at a ratio of 1.0 pound Ggbfs for each pound of Portland cement replaced. A maximum of 70 percent by weight of cement may be replaced with Ggbfs.

9. Calcium Nitrate Corrosion Inhibitor Admixture: Calcium nitrate based corrosion inhibitor shall contain 30 percent, plus or minus 2 percent, calcium nitrate by weight. Calcium nitrate based corrosion inhibitor shall be added at a rate of 1.0 to 6.0 gallons per cubic yard of concrete to achieve the desired level of corrosion mitigation. Calcium nitrate based corrosion inhibitor shall be Master Builders/Basf Rheocrete CN1, Grace Construction Products DC1, or equal.

E. Water:

1. Water for washing aggregate, mixing, wetting forms, and curing shall be clean potable water free from injurious amounts of oil, alkalis, organic materials and other deleterious substances.

2.02 CONCRETE PRODUCED ON-SITE

A. Delivery And Storage

1. Cement:

a. Cement shall be stored immediately upon receipt. Cement in bags shall be stored in a weatherproof structure which shall be as airtight as practicable. Floors shall be elevated above the ground a distance sufficient to prevent the absorption of moisture. Bags shall be stacked close together to reduce circulation of air but shall not be stacked against outside walls. The manner of

storage shall permit easy access for inspection and identification of each shipment.

b. Bulk cement shall be transferred to elevated airtight and weatherproof bins. At the time of use, cement shall be free flowing and free of lumps. Cement which has been in storage longer than 6 months shall not be used.

2. Aggregates:

a. Aggregates shall be stored on areas covered with tightly laid wood planks, sheet metal, or other hard and clean surfaces in a manner that will prevent the inclusion of foreign material.

b. Aggregates of different sizes shall be stored in separate piles. Stock piles of coarse aggregate shall be built in horizontal layers exceeding 4 feet in depth to minimize segregation. Segregated aggregates shall be remixed to conform to the grading requirements.

3. Admixtures:

a. Admixtures shall be stored in such a manner that they will not be damaged in the containers. Air-entraining admixtures which have been in storage for longer than 6 months or which have been subjected to freezing shall not be used.

4. Pozzolan:

a. Pozzolan shall be delivered and stored in the same manner as cement.

2.03 CONCRETE CHARACTERISTICS

A. Mix Proportioning:

1. An approved laboratory shall design all mixes. Comply with ACI 211.1 and ACI 304R to produce plastic, workable mixture suitable for concrete work indicated, which will develop required compressive strengths indicated.

2. Normal weight concrete shall be composed of specified cement, pozzolan, admixtures, aggregates and water proportioned and mixed to produce a workable, strong, dense, and impermeable concrete. The Contractor may substitute interground portland-pozzolan cement conforming to ASTM C595, containing the specified amount of pozzolan in lieu of portland cement and pozzolan.

3. Concrete classes shall be provided in accordance with Table C:

Table C – Concrete Classes

Concrete Class	ASTM C33 Coarse Aggregate Size Number	Nominal Size Laboratory Sieve	Minimum Cementitious Material Content (pounds/ cuyd concrete)	Pozzolan, Percent by Weight of Portland Cement [a]	Air Entraining Agent	Water Reducing Retarder	Water Reducing Accelerator	Minimum 28-day Compressive Strength [b]
1	57	1" x No.4	560	15-20	yes	yes	no	4500 psi
2	67	¾" x No.4	560	15-20	yes	yes	no	4500 psi
4	57	1" x No.4	420	0	yes	no	no	3000 psi
5 [c]	57	1" x No.4	375	15-20	yes	no	no	2000 psi

Notes for table:

[a] Cement can be replaced by pozzolan pound per pound, up to 15 to 20 percent of total weight.

[b] Compressive strength shall be determined at the end of 28 days based on test cylinders made and tested in accordance with ASTM C39. Maximum water/cement ratio shall not exceed 0.40 by weight for compressive strength of 4500 psi or higher, 0.45 for compressive strength of 3000 psi, and 0.65 for other strength concrete. Maximum water/cement ratio shall not exceed 0.38 for concrete containing high range water reducing admixtures. Water/cement ratio is based on the combined amount of cement and pozzolan.

[c] Concrete encasement for electrical and signal conduit shall contain 2 pounds of red oxide per sack of cement.

B. Use:

1. Concrete shall be provided by class for the corresponding use as listed in Table D:

Table D

Type of Use	Class of Concrete	Working Slump (Inches) [+/- 1]
Mass concrete Foundation footings and slabs 24 inches thick or more Piers and cassions	1	4
Foundation footings and slabs less than 24 inches thick Floor and roof slabs and beams	1 or 2	4
Walls and columns in non-liquid retaining structures	1 or 2	5
Walls and columns in liquid retaining structures	1 or 2	4
Substructure walls	1 or 2	4
Site pavement, sidewalks and curbs	4	4
Pipe encasement and electrical or signal ductbanks	5	6
Protective cover of dowels intended for future construction	5	4
Concrete fill	5	6
Concrete with high range water reducing admixtures	1 or 2	8

C. Mix Acceptance:

1. General: Before beginning concrete work, the Contractor shall determine the proper proportions of materials for each class of concrete. The mix shall consist of specified cement, pozzolan, admixtures, aggregate and water. Methods for selecting and adjusting proportions of the ingredients shall be in accordance with ACI 211.1. Verification of mix characteristics for submittal may be achieved using either the Trial Mix Design method or Field Experience method. Concrete shall not be placed in the field until the submitted mix design and trial batch mix test results, as applicable, have been accepted by the Project Representative.

2. Trial Mix Design

   a. Class 1 And 2 Concrete:

      1) The Contractor shall submit mix designs to the Project Representative for approval. The mix design shall include:

      2) Concrete supplier's mix number with proportions of materials per cubic yard.

3) Supplier certifications for cement, pozzolan, and aggregate.

4) Product data for admixtures.

5) Upon approval of the submitted concrete mix designs, the Contractor shall make arrangements for field trial batches with the supplier and the Project Representative. The Project Representative shall be notified 1 week in advance of trial batch mix work. Trial batch mix work shall be performed with representatives of the Project Representative and Contractor's testing laboratory being present. Sampling and testing of concrete shall be done by the Contractor's testing laboratory. Certified copies of the laboratory test results shall be submitted to the Project Representative. The Project Representative reserves the right to sample and test the trial batches.

6) The trial batches shall establish field proportions for mixes which may contain minor adjustments to the submitted mix design. Trial batches shall be tested for compressive strength and drying shrinkage.

   a) Compressive Strength: Eight standard test cylinders, prepared in accordance with ASTM C31, shall be obtained from each trial batch. Slump shall be measured in accordance with ASTM C143. Cylinders shall be tested in compression in accordance with ASTM C39. Four test cylinders shall be tested at 7 days and the remaining four at 28 days. The ratio of average 7-day and 28-day strength shall be established. The average compressive strength of the four test cylinders tested at 28 days shall be equal to or greater than the required average compressive strength (f'cr) on which the mix design is based. The required average compressive strength (f'cr) shall be calculated as specified strength (f'c) plus 1200 psi.

   b) Drying Shrinkage: Drying shrinkage specimens shall be prepared from the same trial mix concrete used for preparing compression test cylinders. From each mix, three specimens shall be prepared. The drying shrinkage specimens shall be 4 x 4 x 11 inch prisms with an effective gage length of 10 inches, prepared, cured, dried and measured in accordance with ASTM C157 and as modified herein. Specimens shall be removed from molds at an age of 23 $\pm$ 1 hour after batching and shall be placed immediately in water at 73 $\pm$ 3 degrees F. Expansion, expressed as a percentage of original length, shall be measured at age 7 days. This length at age 7 days shall be the base length for drying shrinkage calculations. Specimens shall then be stored immediately in a humidity control room maintained at 73 $\pm$ 3 degrees F and 50 $\pm$ 4 percent relative humidity for the remainder of the test. Measurement, to determine the drying shrinkage, expressed as percentage of base length, shall be made and reported separately for 7, 14, 21 and 28 days of drying after 7 days of moist curing. The average drying shrinkage of each group of the test specimens after 28 days of drying shall not exceed 0.048 percent. Liquid containing structures using Class 1 or 2 concrete are intended to be watertight. When used for liquid containing structures, the average drying shrinkage shall not exceed 0.040 percent in the laboratory at 35 days (7 days moist cure and 28 days drying) as tested by ASTM C157

b. Class 4 And 5 Concrete:

1) The Contractor shall submit mix designs to the Project Representative for approval. The mix design shall include:

a) Concrete supplier's mix number with concrete proportions per cubic yard

b) Certifications for cement, pozzolan, and aggregate

c) Product data for admixtures

d) Historical compressive strength test results for same mix number used on other projects within the last 12 calendar months. Test records shall represent materials, quality control procedures, and conditions expected to apply to this work. At least 30 consecutive tests or two groups of consecutive tests totaling at least 30 tests shall be used to establish a standard deviation and a required average compressive strength (f'cr), as described in ACI 318, Part 3, Chapter 5. The arithmetic average of at least 10 consecutive test results, not used in calculating the standard deviation, shall exceed f'cr.

2) If there is insufficient historical compressive strength data for the submitted mix design, then the mix design shall undergo trial batch testing as described for Class 1 and 2 concrete.

3. Field Experience Data: When sufficient test data for a particular mix design is available which is identical or substantially similar to that proposed for use, Contractor may substitute use of this data in lieu of a trial mix design. Field data, reports, and analysis shall conform to ACI 318 Section 5.3, except as modified herein. Use of historical mix design data does not allow modification of the project mix specifications herein without the express review and acceptance of the Project Representative.

a. Historical mix design proportions for which data are submitted may vary from the specified mix within the following limits:

1) f'c as specified or up to 500 psi above;

2) w/cm ratio as specified or lower;

3) Pozzolan content within 5 percent of that specified;

4) Maximum coarse aggregate size may not vary smaller, but gradation of coarse aggregate may vary;

5) Fine aggregate fraction within +0/-5 percent of that specified; and

6) Slump after introduction of admixtures +0/-1 inch.

2.04 BONDING COMPOUNDS

A. Epoxy resin bonding compounds shall be used for wet areas.

1. Sika Chemical Corporation, Sikadur 35 hi-mod Lv, 32 hi-mod, 32 hi-mod Ltl, 31 hi-mod gel as applicable; or equal by Master Builders Technologies; or equal.

B. Nonepoxy bonding compounds shall be used for areas not classified as wet areas.

1. Burke Acrylic Bondcrete; Imperial Chemical Industrial Inc. Thoro System Products Division, Acryl 60 or Thorobond; or equal.

2.05 RETARDANT

A. Retardant for exposing aggregates for nonformed surfaces in construction joints shall be Sika Rugasol-S, Horn Aggretex-H, or Burke True Etch Surface Retarder, or equal. Retardant shall be applied in accordance with manufacturer's instructions sufficient to ensure a minimum penetration of 1/8 inch.

2.06 SURFACE HARDENER

A. Surface hardener shall be premixed, noncolored, nonmetallic, and dry shake applied.

1. Mastercron by Master Builders Technologies; Burke Non- Metallic Hardener; or equal.

2.07 CURING MATERIALS

A. Liquid Membrane-Forming Compounds:

1. Curing Compounds:

a. Curing compounds shall conform to ASTM C309.

1) Burke Wax Emulsion Clear; Burke Aqua Resin Cure; W.R. Meadows Sealtight 1300-Clear; or equal.

b. Curing compound shall be of the dissipating-resin type in applications where concrete finishes (such as waterproofing, coatings and floor coverings) may require removal of curing compound prior to application of finish.

1) Burke Res X, All Resin Cure Voc; W.R. Meadows Sealtight 1100-Clear; or equal.

2. Curing And Sealing Compounds:

a. Curing and sealing compounds shall conform to ASTM C309, Type 1, and shall be suitable for interior and exterior concrete use.

b. Masterseal by Master Builders Technologies; W.R. Meadows Sealtight Vocomp-20; or equal.

B. Sheeting:

1. Polyethylene-coated burlap for use as concrete curing blanket shall be 4-mil thick, white opaque polyethylene film impregnated or extruded into one side of the burlap. Burlap shall weigh not less than 9 ounces per square yard. The loss of moisture, when determined in accordance with the requirements of ASTM C156, shall not exceed 0.055 gram per square centimeter of surface.

2. Waterproof Paper And Plastic:

a. Polyethylene-coated waterproof paper-sheeting for use as concrete curing blanket shall consist of white polyethylene sheeting free of visible defects, uniform in appearance, having a nominal thickness of 2 mils and permanently bonded to waterproof paper conforming to the requirements of Federal Specification Uu-B-790A (Int. Amd. 1). The loss of moisture, when determined in accordance with the requirements of ASTM C156, shall not exceed 0.055 gram per square centimeter of surface.

b. Polyethylene sheet for use as concrete curing blanket shall be white and shall have a nominal thickness of 6 mils. The loss of moisture when determined in

accordance with the requirements of ASTM C156 shall not exceed 0.055 gram per square centimeter of surface.

3. Curing rugs for use in water curing, as specified herein, shall be heavy shag rugs or carpets or cotton mats that weigh a minimum of 12 ounces per square yard when dry.

2.08 EVAPORATION REDUCER

A. Evaporation reducer shall reduce surface moisture evaporation by forming a monomolecular film when sprayed on concrete surfaces.

1. Confilm by Master Builders Technologies; Eucobar by Euclid Chemical Co.; or equal.

2.09 SAMPLES OF CONCRETE FLOOR AND WALL FINISHES

A. A sample concrete panel, representative of the workmanship and finish required, shall be prepared. Panel dimensions shall be 2 feet by 2 feet by 3 inches thick, unless prior arrangements have been made with the Project Representative to incorporate the sample panel within the completed work. Sample concrete panels are required for the following finishes, as defined in Part 3:

1. Smooth Rubbed Finish
2. Grout Cleaned Finish (Sacking)
3. Sandblast Finish
4. Float Finish
5. Steel Trowel Finish
6. Broom Finish

B. The Project Representative shall approve the sample prior to use.

PART 3 EXECUTION

3.01 GENERAL

A. The Contractor, without relinquishing authority and responsibility for supervision and direction of the work, agrees to follow the specified methods, techniques, sequences and procedures.

B. The Project Representative may conduct field quality assurance tests for concrete strength. The testing laboratory may be the Public Works Materials Testing Laboratory. The Contractor shall notify the Project Representative at least 48 hours in advance whenever a sample and test of concrete materials is required by these specifications.

3.02 FORMWORK

A. All forms shall be sealed and watertight. The Contractor shall design and construct all formwork systems to provide only those lines and delineations indicated, unless otherwise approved by the Project Representative. Formwork, shall be constructed to allow erection in proper sequence and to permit removal without damage to the finished concrete surfaces.

B. The Contractor shall design, construct, and erect all forms for reuse; withdraw projecting nails or other objects from contact surfaces before reusing; clean and completely recondition all forms prior to reuse; and repair any damage to forming surfaces caused during previous usage. Approval shall be required for each reuse. Formwork with patches or repairs affecting appearance of the concrete surfaces shall not be permitted. The Contractor is responsible for the strength and suitability of the formwork.

C. Prior to placing concrete, wet wood forms sufficiently to tighten up cracks. Wet all other materials sufficiently to reduce suction and maintain concrete workability.

3.03 CONCRETE REINFORCEMENT

A. Concrete reinforcement shall conform to the Concrete Reinforcing Section (03 20 00).

3.04 CONSTRUCTION JOINTS

A. General:

1. Concrete in each unit of construction shall be placed continuously. Before new concrete is placed on or against concrete which has set, forms shall be retightened and the surface of the set concrete shall be rough and clean. Concrete surfaces on which new concrete is placed shall not be wetted.

B. Locations:

1. Unless otherwise shown on the drawings, construction joint locations shall be as follows:

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

   b. Joints in beams or girders shall be located at or near the midpoint between supports.

   c. Joints in floors shall be located within the middle third of spans of slabs, beams, and girders. Joints in girders shall be offset a minimum distance of two times the width of intersecting beams.

   d. Joints in walls and columns shall be at the underside of floors, slabs, beams or girders and at the tops of footings or floor slabs. Joints in columns shall be perpendicular to the axis. Beams, girders, or slabs supported by columns or walls shall not be cast or erected until concrete in the vertical support members is no longer plastic.

   e. Beams, girders, haunches, drop panels, and capitals shall be placed monolithically as part of a slab system, unless otherwise shown in contract documents.

   f. Slabs shall be cast in strips not to exceed 40 feet in width and not to exceed 900 square feet in area, with maximum 1 ½ to 1 ratio of side lengths. Contraction joints shall be placed transverse to the length of the strip. Spacing of contraction joints shall be approximately equal to the width of the strip. Minimum lapsed time between placing adjacent strips shall be 72 hours.

The requirements for size of slab panels may be waived if joints are specifically located on the Contract Drawings.

C. Construction:

1. Construction joints shall be formed as specified. A rough surface of exposed concrete aggregates shall be produced using a surface retardant or sandblasting at construction joints, including joints between slab and topping concrete. The limit of the roughened surfaces shall be 1 inch away from the joint edges.

   a. When using surface retardant, surface mortar shall be removed within 24 hours after placing by high pressure water jetting, stiff brushing, or combination of both to expose coarse aggregate. Exposed surface shall be cleaned.

   b. When sandblasting, remove 1/8 inch of laitance film and expose coarse aggregate. Exposed surface shall be cleaned.

2. Reinforcing steel and welded wire fabric shall be continued across construction joints. Joints shall be perpendicular to the main reinforcement.

3. Beams, girders, and floor slabs shall not be cast until concrete in supporting walls and columns is no longer plastic.

4. No joint will be allowed between a slab and a beam or girder unless otherwise shown on the drawings.

5. Vertical construction joints shall be chamfered at exposed faces.

3.05 EXPANSION JOINTS

A. Expansion joints shall be as shown on the drawings. Reinforcement or other embedded metal items bonded to the concrete shall not extend through expansion joints. Waterstops shall be provided in expansion joints for water-containing structures and as indicated on the drawings.

3.06 INSERTS AND EMBEDMENTS

A. Inserts and embedments shall include such items as pipes, castings, conduits, sleeves, anchor bolts, or other miscellaneous metal parts that pass through or are embedded in concrete. Nailing blocks, plugs, strips, and similar items necessary for the attachment of trim, finish, or similar work shall also be embedded.

B. Aluminum items shall not be embedded in concrete unless effectively coated to prevent aluminum-concrete reaction or electrolytic action between aluminum and steel.

C. All inserts and embedded items shall be positioned accurately and supported against displacement. Install ties and supports necessary to keep items in place. Anchor bolts shall be positioned using templates.

D. Inserts and embedments shall not interfere with clearance and alignment of steel reinforcement, or concrete cover. Additional reinforcement shall be provided around large openings as shown on the drawings.

E. Voids in sleeves and anchor slots shall be filled temporarily with readily removable material to prevent the entry of concrete into the voids.

F. Prior to placing concrete, inserts and embedments shall be cleaned, inspected, and approved.

3.07 CONCRETE MIXING AND TRANSPORTING

A. Concrete shall be truck-mixed, ready-mixed concrete conforming to the applicable portions of ASTM C94. Materials shall be proportioned by weighing. Pozzolan shall be introduced into the mixer with cement and other components of the concrete mix; pozzolan shall not be introduced into a wet mixer ahead of other materials or with mixing water. Water shall be introduced at the time of charging the mixer; additional water may be introduced within 45 minutes from charging the mixer, provided the specified slump is not exceeded.

B. Each load of ready-mixed concrete delivered to the job site shall be accompanied by a batch ticket and weigh ticket showing the information listed in ASTM C94, Section 16.

3.08 BATCHING AND MIXING CONCRETE PRODUCED ON SITE

A. Batching

1. General: Concrete shall be batched only from a plant with a current National Ready Mix Concrete Association Certificate of Compliance. The Contractor shall provide and maintain such means and equipment as are required to accurately determine and control the relative amounts of the various materials, including water, cement, pozzolan, admixtures, sand and each individual size of coarse aggregate used in the concrete. Concrete batches shall be proportioned on the basis of integral sacks of cement unless the cement is weighed. Pozzolan shall be introduced into the mixture only with cement and other dry components of the concrete mix. Pozzolan shall not be introduced into wet mixer ahead of other materials or with mixing water. The amounts of sand and coarse aggregate required for each batch of concrete shall be determined by weighing, and the required water by either weighing or metering.

    a. Aggregates shall be deposited in the batch bins directly over the discharge gates. Coarse aggregate shall be deposited in the batch bins through effective rock ladders when the free drop of the aggregate exceeds 4 feet. Equipment for conveying batch materials from the weighing and batching hoppers shall be constructed, maintained, and operated so that there shall be no spillage of the batched materials or overlapping of batches.

    b. The Contractor shall provide sufficient trucks of adequate size to continuously deliver batched material. Each truck shall carry a delivery ticket showing the mix number, size of batch, and the time water was added to the batch.

2. Weighing And Metering Equipment: Weighing and metering equipment shall be sealed by the state agency having authority over weights and measures and shall be capable of ready adjustment for compensating for the varying weights and moisture changes which affect the concrete mix proportions and concrete consistencies. Batching equipment shall be constructed and operated so that when the entire plant is running the combined inaccuracies in feeding and measuring materials will not exceed 1 percent for water or cement and pozzolan, 2 percent for any size of aggregate, and 1 1/2 percent for the total aggregate in any batch. Equipment shall be designed for convenient confirmation of the accuracy required for each batch. The equipment for measuring water shall be such that leakage will not occur when the valves are closed.

a. The Contractor shall provide standard test weights and other auxiliary equipment required for checking the operating performance of each scale or meter and shall make tests at intervals of not more than 6 months in the presence of the state inspector. The Contractor shall provide copies of the complete results of check tests made, and shall make such adjustments, repairs, or replacements as necessary to secure satisfactory performance.

b. Where the batching plant involves the use of storage bins and weighing hoppers, each weighing unit shall include a visible springless dial or equally suitable device which will register the scale load at any stage of the weighing operation from zero to full capacity. The weighing hoppers shall be constructed to permit the convenient removal of overweight material in excess of the prescribed tolerances. Each dial and water-measuring device shall be in full view of the operator and, if practicable, the weighing equipment shall be arranged so that the operator may conveniently observe the operation of the bin gates and also the materials discharged into the mixer hopper.

3. Batching equipment in automatic plants shall be interlocked so that:

a. A new weighing cycle cannot be started until the batchers are emptied and the dispatcher discharge gates and valves are closed.

b. The batcher discharge gate cannot be opened until the correct weights of the materials are in the batching hoppers and the scales in balance.

c. The discharge gates cannot be closed until materials are entirely discharged from the hopper and are back in balance.

d. The water batcher discharge valve cannot be opened until the filling valve is closed. The admixture dispenser shall be interlocked to operate with the water batcher.

4. Dispensers for admixtures shall have sufficient capacity to measure at one time the full quantity of properly prepared solution required for each batch. These admixtures shall be added to premeasured water for the batch, or their discharge into the batch shall be arranged to flow uniformly into the water stream for the batch from beginning to end of its flow into the mixer.

5. Dosages of admixtures shall not vary from the required dosage by more than 5 percent

B. Mixing

1. The concrete ingredients shall be mixed in batch mixers until the mixture is homogeneous and uniform in consistency. The mixing of each batch shall continue for at least 1 1/2 minutes for concrete not containing pozzolan and for at least 2 minutes for concrete containing pozzolan after all the ingredients, except the full amount of water, are in the mixer.

2. The minimum mixing period specified is predicated on proper control of the speed of rotation of the mixer and of the introduction of the materials, including water, into the mixer. Water shall be added prior to, during, and following the mixer charging operations. Excessive mixing time requiring the addition of water (retempering) to preserve and secure the required concrete consistency is not acceptable.

3. Mixers shall not be loaded in excess of their rated capacity. Each mixer shall be equipped with a satisfactory mechanically operated timing and signaling (or locking) and metering device for indicating and assuring the completion of the required mixing period and for counting the batches.

3.09 CONVEYING AND PLACING CONCRETE

A. Conveying Concrete:

1. Concrete shall be conveyed from the mixer to the forms in accordance with Aci 301, Chapter 8. Concrete which has segregated in conveying shall be removed from the site of the work.

B. Placing Concrete:

1. General:

   a. Concrete shall be placed in accordance with ACI 301.

   b. Limit free drop of concrete to 6 feet, except for walls and columns where the limit shall be 3 feet.

   c. Concrete shall be placed at or near its final position. Do not use vibrators for extensive shifting of fresh concrete.

   d. Deposit concrete in horizontal layers not more than 18 inches deep and continue pouring until section is completed. Control rate of pouring and depth of layers so that each layer will be covered within one hour after it is poured.

   e. Where horizontal or vertical pour joints are indicated in concrete, they shall be as shown on the coordination (lift) drawings. Place concrete continuously between pour joints. Concrete discharge shall be completed within 90 minutes after introduction of the water to the mixture.

2. Foundation, Footings, And Slab-On-Grade:

   a. Concrete foundation, footings, and slab-on-grade shall be placed only upon surfaces that are free from frost, ice, mud, loose or unsound rock, and other detrimental substances.

   b. Place concrete only after subgrade for footings, forms and reinforcement have been approved by the Project Representative.

3. Elevated Slabs:

   a. Concrete shall not be placed until shoring, bracing, and falsework has been inspected.

   b. Concrete for horizontal members or sections shall not be placed until the concrete in the supporting vertical members or sections has been consolidated and settlement due to bleeding has occurred.

4. Walls And Columns:

   a. Limit free vertical drop in concrete walls or columns to 3 feet.

   b. Pour walls and columns at a rate that will not displace the forms. Tell-tale devices shall be used to ensure that forms remain true and plumb.

C. Placing Concrete By Pumping:

1. Concrete Pump:

   a. Use only piston type pumps that are reversible.

   b. Do not use aluminum or aluminum lined pipe, or aluminum fittings.

   c. A standby pump of no less capacity than that in operation at the job shall be available within one hour's notice.

2. Pump Priming:

   a. Before starting each pumping operation, the pump and line shall be primed with a cement slurry to lubricate the system. Cement slurry shall be wasted outside the forms.

3. Slump:

   a. Water shall not be added after 45 minutes from the time of initial mixing at the batch plant. Within 45 minutes from the time of initial mixing at the batch plant, water may be added to achieve the slump limits specified in Table D.

   b. Slump adjustment—hen concrete slump test results are below the required slump, the slump may be adjusted by adding water up to the amount allowed in the accepted mixture proportions. Addition of water shall be in accordance with ASTM C94/C94M. Do not exceed the specified water/cement ratio or slump. Do not add water to concrete delivered in equipment not acceptable for mixing. After plasticizing or high-range water-reducing admixtures are added to the concrete at the site to achieve flowable concrete, do not add water to the concrete. Measure slump and air content of air-entrained concrete after slump adjustment to verify compliance with specified requirements.

   c. Slump may be measured at the transit mix truck or hose discharge at the discretion of the Project Representative. Slump loss in pumping, measured between the pumping unit inlet hopper and the hose discharge, shall not exceed 1 inch.

   d. The mix design entered on delivery ticket shall comply with that ordered.

D. Temperature Of Concrete:

1. The temperature of concrete when it is being placed shall not be less than 50 degrees F. For sections less than 24 inches thick, the temperature of concrete shall not exceed 90 degrees F. For sections 24 to 36 inches thick, the temperature of concrete shall not exceed 80 degrees F. For sections greater than 36 inches thick, the temperature of concrete shall not exceed 75 degrees F. The Contractor shall employ effective means, such as using ice or hot water, placing at night, or other means as necessary to maintain the temperature of the concrete within the required temperature range.

E. Cold Weather Placement:

1. Remove snow, ice, and frost from all surfaces, including reinforcement against which concrete is to be placed. Embedded items shall be warmed to above 32 degrees F. Concrete shall not be placed when ambient temperature is below 40 degrees F unless provisions are made, in accordance with cold weather curing and sealing provisions of this specification, to keep the concrete and immediate surroundings at or above 50 degrees F for 72 hours after placement.

3.10 CONSOLIDATING CONCRETE

A. Concrete shall be consolidated in accordance with ACI 309R.

B. Vibration and tamping operations shall conform to ACI 309R. As concrete is placed in forms, work concrete around reinforcing steel, embedded items and into corners and angles. Extra care shall be given to work concrete around inserts, reveals, quirks, corners and plastic cones of ties to preclude rock pockets, air pockets, and other defects. Each 18-inch layer shall be compacted by mechanical internal vibrating equipment within 5 minutes of being placed supplemented by hand spading, tamping, and rodding.

C. Vibrators shall not be used to transport concrete inside forms. The use of form vibrators will not be permitted. Internal vibrators shall maintain a speed of not less than 7,000 impulses per minute when submerged in the concrete. Duration of vibration shall be limited to time necessary to produce satisfactory consolidation without causing objectionable segregation. Vibrators shall be applied at uniformly spaced points not farther apart than the visible effectiveness of the machine. Insert vibrator into previous unset layer to prevent cold joints. Supplement vibration by suitable methods to eliminate voids along forms for full depth of layer. Do not allow vibrators to strike overlaid plywood surfaces.

D. Keep at least one spare vibrator on job at all times while concrete is being placed.

3.11 FLOOR AND SLAB FINISHES

A. General:

1. The finishes specified herein include surface finishes, treatments and toppings for floors and slabs. Floors shall be sloped to drain uniformly. Unless otherwise specified, slope shall be minimum 1/8 inch per foot towards nearest drain. Dry cement shall not be used on fresh concrete surfaces to absorb excess moisture. Edges shall be rounded to a radius of 1/2 inch. Control joints shall be provided on single mat reinforcement slabs only and shall be grooved or sawcut to a depth of 1/4 of the slab thickness, unless otherwise shown on the drawings. Control joints shall be located at discontinuities and at 30 feet maximum spacing, unless otherwise specified or shown on the drawings.

2. The surfaces of pavements and sidewalks shall be screeded to grade and sloped to drain. Sidewalk cross slopes shall be 1/8 inch per foot minimum. The surface shall receive a broom finish. Edges and expansion joints shall be rounded to a radius of 1/2 inch. Control joints shall be grooved or sawcut to a depth of 1/4 of the slab thickness. Expansion joints shall be provided at maximum spacing of 20 feet; control joints shall be provided at maximum spacing of 5 feet for sidewalks, unless otherwise specified or shown on the drawings.

B. Float Finish:

1. Float finish shall conform to ACI 301, Chapter 11. Floating shall be performed with a hand or power-driven float. Floating shall compact and smooth the surface and close any cracks.

2. All slabs shall be float finished, as a minimum, unless otherwise specified in this Specification Section or when required by equipment manufacturer.

C. Steel Trowel Finish:

1. Steel trowel finish shall conform to ACI 301, Chapter 11. Immediately after final troweling, the surface shall be cured and protected as specified in this section.
2. Steel trowel finish shall be provided on floors unless specified otherwise.
3. Surface hardener shall be troweled into the finished surface where specified. Surface hardener shall be applied in two applications with the second application perpendicular to the first.

D. Broom Finish:

1. Broom finish shall conform to ACI 301, Chapter 11.
2. Broom finish shall be provided for sidewalks, walkways, decks, slabs on grade with exterior exposure, and where otherwise indicated or specified.

3.12 FORMED SURFACE FINISHES

A. General:

1. After removal of forms, the surfaces of formed concrete shall be given a finish as specified below.

B. Rough Form Finish:

1. Rough form finish shall conform to ACI 301, Chapter 10, except as modified herein. Tie holes shall be patched. Holes, depressions, bulges, or other defects 3/8 inch or larger shall be patched. Fins exceeding ¼ inch shall be chipped off or rubbed off. Unsound concrete in rock pockets shall be removed, and the void patched.
2. Unless otherwise specified in the specifications or shown on the drawings, rough form finish shall be used on concrete surfaces buried below grade; interior surfaces of wet wells; and tanks and channels from 1 foot below minimum water surfaces to the bottom, except at filter cells walls which should have smooth rubbed finish as described below.

C. Smooth Form Finish:

1. A smooth form finish shall consist of finishing the surfaces as necessary to produce smooth, even surfaces of uniform texture and appearance, free of bulges, depressions, and other imperfections. Tie holes and defects shall be patched. All fins shall be removed. Subcategories of smooth form finish include:
    a. Smooth Rubbed Finish:
        1) Smooth rubbed finish shall be produced on newly hardened concrete no later than the day following form removal. Surfaces shall be wetted and rubbed with carborundum brick or other abrasive until uniform color and texture are produced. No cement grout shall be used other than the cement paste drawn from the concrete itself by the rubbing process.
        2) Smooth rubbed finish shall be used as shown on the drawings.
    b. Grout Cleaned Finish (Sacking):
        1) Grout cleaned finish requires a sound, clean, dry substrate. Grind surface, including seams, bumps, and imperfections smooth and flat. Remove form release agent, laitance and curing compound, if present.

Wet a small area of concrete to be sacked and rub a slurry of gray concrete, white concrete (to match existing color), and fine sand into the surface with a sponge float. Non- epoxy acrylic bonding compound may be used in the slurry or mix water. Let dry a few minutes and scrape off excess slurry with the edge of a steel trowel. Rub area lightly with clean burlap until uniform in appearance.

2) If submitted and approved in advance, a commercial cementitious mortar compound may be used in lieu of field-mixed slurry in the grout cleaned finish. The compound shall be applied to smooth concrete surface per manufacturer's recommendations.

3) Grout cleaned finish shall be provided for painted and unpainted surfaces; surfaces of stair wells; interior surfaces of equipment rooms, galleries and tunnels; exposed pipe chases; operations areas; channels and tanks from 1 foot below minimum water surfaces to the top; and permanently exposed vertical and sloped surfaces.

D. Sandblast Finish:

1. Unless otherwise specified on the drawings, the degree of sandblasting shall be light. Light sandblasting is sufficient to expose fine aggregate with occasional exposure of coarse aggregate. Exposed coarse aggregate shall not project more than 1/16 inch from the matrix.

2. A sample panel shall be submitted and approved prior to full-scale sandblasting operations in the field.

3. Sandblast finish shall be used for external concrete surfaces of structures identified on the drawings.

3.13 RELATED SURFACE FINISHES

A. Monolithic Surfacing:

1. Monolithic surfacing shall be provided on floor areas as specified. Monolithic surfacing shall consist of a steel trowel finish hardened with a surface hardener as specified in this Section. Surface hardener shall be applied in accordance with the manufacturer's recommendations and directions.

B. Finishing Of Unformed Surfaces:

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

3.14 CURING AND SEALING

A. General:

1. Beginning immediately after placement, concrete shall be protected from premature drying, excessively hot or cold temperatures, and mechanical injury, and shall be maintained with minimal moisture loss at a relatively constant temperature for the period necessary for hydration of cement and hardening of concrete.

2. Concrete temperature shall be maintained between 50 and 90 degrees F during the curing period.

B. Curing Of Concrete:

1. Unless otherwise specified in this Section, curing shall be continued for at least 7 days.
2. Moisture retention measures for concrete surfaces not in contact with forms shall be provided by one of the following methods:
    a. Complete and continuous application of water which does not contain deleterious compounds harmful to the concrete.
    b. Use of curing rugs or blankets kept continuously wet.
    c. Use of waterproof paper or plastic.
    d. Application of liquid membrane forming compound applied per manufacturer's recommendations.
3. Moisture loss from concrete surfaces placed against wooden or metal forms shall be minimized by keeping the forms wet until they can be safely removed. As soon as can be done without damaging the concrete, the forms shall be loosened, and water shall run down inside of them. After form removal, the concrete shall be cured using one of the methods above for the duration of the curing period.
4. Curing compound shall not be used on concrete surfaces to be coated, waterproofed, moistureproofed, tiled, roofed or where other coverings are to be bonded, unless the curing compound is compatible with the final finish covering or it is removed prior to covering.
5. Steel troweled finish concrete floors which are not to receive tile, roofing, grout, terrazzo or other bonded coverings shall be cured with a curing and sealing compound. It shall be applied as soon as the concrete has set sufficiently so it is not marred by the application. Preparation of surfaces, quantities used, application procedures and installation precautions shall be followed in strict compliance with the manufacturer's instructions.
6. High-early-strength concrete shall be cured for at least 3 days, and shall be cured with methods that use water during the curing period. Application of liquid membrane forming compound is not acceptable.

C. Additional Requirements For Curing During Cold Weather:

1. When the mean daily outdoor temperature is less than 40 degrees F, provisions shall be made, as necessary, for heating, covering, insulating, or housing the concrete to maintain concrete temperature within the specified range. The use of combustion heaters shall be controlled in order to avoid damaging the concrete due to concentration of heat.

D. Additional Requirements For Curing During Hot Weather:

1. Hot weather is any condition or combination of conditions that accelerate the rate of moisture loss and/or rate of cement hydration. These conditions include high ambient heat (above 90 degrees F), high concrete temperature, low relative humidity, and/or wind velocity. During hot weather, provisions shall be made, as necessary, for windbreaks, shading, fog spraying, continuous sprinkling, or wet

coverings. Such protective measures shall be taken as quickly as concrete hardening and finishing operations allow.

3.15 PROTECTION

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

B. Do not place concrete during rainy weather unless approved measures are taken to prevent damage to concrete.

C. Protect concrete placed during periods of drying winds, low humidity, high temperatures and other conditions that may cause rapid drying. Apply a fine spray of water applied immediately after finishing and continue until final curing operations have begun.

D. Slabs in areas subject to construction traffic shall be protected with 6-mil kraft paper or polyethylene membrane for at least 2 weeks after placement.

3.16 CONCRETE REPAIRS AND MODIFICATION OF EXISTING CONCRETE

A. Repair Of Surface Defects:

1. Surface defects, including tie holes, rock pockets, honeycombing or otherwise defective concrete shall be repaired immediately following form removal. Excessive cracking or leaking cracks shall be repaired in accordance with this Specification Section.

2. Defective areas shall be chipped or cut back to solid concrete to a depth of at least 1 inch. Where half or more of the rebar circumference is exposed, remove concrete a minimum of 1” around the rebar. The edges of the cut shall be perpendicular to the surface of the concrete. Feathered edges shall not be permitted. The areas to be patched shall be cleaned by abrasive blasting or high pressure water jetting. Concrete substrate shall be free of any deleterious materials, and shall have a roughened surface with a minimum amplitude of 1/4 inch. Presoak concrete substrate to saturated surface dry condition immediately prior to application of bond coat for concrete repair material.

3. Portland cement mortar patching material shall be a mixture of the same materials and of approximately the same proportions as used for the concrete, except that coarse aggregate shall be omitted. Brush cement slurry bond coat into the surfaces. Before bond coat dries, apply dry pack and consolidate into place. Curing for the patched area shall be as specified for the concrete. As an alternative to field-mixed Portland cement mortar patching material, a commercial patching compound may be used per manufacturer’s recommendations, if submitted and approved in advance of concrete repair work.

4. Repaired area shall be equal in color, workmanship, texture and general appearance to that of the adjacent concrete.

B. Acceptance Of Concrete:

1. Completed cast-in-place concrete work shall conform to the applicable requirements of ACI 301 and the Contract Documents. Concrete work that fails to meet the requirements of ACI 301 or the Contract Documents shall be repaired as approved by the Project Representative to bring the concrete into compliance. Concrete that cannot be brought into compliance by approved repair methods will be rejected. Rejected concrete work shall be removed and

replaced. Repair methods shall be in accordance with ACI standards and are subject to the approval of the Project Representative. The cost of repairs and replacement of defective concrete shall be borne by the Contractor.

C. Repair Methods:

1. Damaged or excessively cracked concrete, as determined by the Project Representative in their sole discretion, shall be repaired by one of the following methods as approved by the Project Representative:

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

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

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

2. Repair Method Use:

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

   b. Repair Method 2 may be utilized in lieu of Method 1 for slabs which receive a raked finish. Method 2 may also be used with Construction Manager's approval for exposed trowelled and broom finishes after review of conditions, degree of exposure to public, and proposed repair product and installation. Finish shall substantially match adjacent surfaces.

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

D. Modification Of Existing Concrete:

1. Existing concrete shall be removed and the remaining surfaces prepared as specified. The remaining concrete shall be protected from damage.

2. Where possible, clean lines shall be made by sawing through the existing concrete. The concrete may be broken out after initial saw cuts in the event thickness prevents cutting through, or where existing reinforcing steel is specified to be exposed and utilized. Where it is not possible to use a saw, the initial cuts shall be made with chipping hammers. These cuts shall be sufficient to prevent damage to the remaining concrete.

3. In general, an opening in existing concrete shall be oversized 2 inches on all sides and built back to the correct dimension with an epoxy grout. Where oversized openings cannot be made, the concrete shall be cut to the correct dimension, with the exposed reinforcing cut or burned back 1 inch and the resulting hole filled with epoxy grout. Cut or broken concrete surfaces shall be repaired as specified in this section.

4. Where new concrete adjoins existing concrete surfaces or surfaces which have been cut, such surfaces shall be cleaned by sandblasting to remove laitance, loose coatings and foreign materials, and coated with the bonding compound just prior to the placement of the new concrete. Bonding compounds shall be as specified in this section.

5. Unless otherwise specified or shown on the drawings, continuity of reinforcing steel shall be obtained across the joint either by exposing existing bars to provide sufficient laps with new bars or by welding existing bars with new bars as per the Concrete Reinforcing Section (03 20 00) or by using mechanical connectors conforming to Aci. Where shown on the drawings, dowels shall be drilled and set with epoxy grout into existing concrete.

3.17 FIELD SAMPLING AND TESTS

A. General:

1. The Project Representative will conduct field sampling and tests to assure the quality of the materials and work used throughout the project. The Project Representative laboratory will provide the necessary labor, materials and facilities for sampling the aggregate, and for casting, handling and storing the concrete samples at the site of work. Aggregate will be sampled at the batch plant not less than 30 days prior to the use of such aggregate in the work, and at least weekly during concrete operations. Concrete will be sampled at the time of placement.

B. Sampling:

1. Aggregates:

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

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

c. Fine Aggregate: Samples shall be taken as specified for coarse aggregate. Samples of sand shall be taken when the sand is moist.

2. Concrete: Samples of freshly mixed concrete shall be obtained in accordance with ASTM C172. At the discretion of the Project Representative, samples of concrete may be taken at the transit mix truck chute, the pump hopper, or the hose discharge point.

C. Testing:

1. Aggregate: A minimum of one test of coarse aggregate per 400 cubic yards of concrete and a minimum of one test of fine aggregate per 200 cubic yards of concrete used shall be made to confirm continuing conformance with specifications for gradation, specific gravity, cleanliness, and sand equivalent, as applicable.

2. Concrete:

a. Strength Tests: Verification of mix design strength shall be accomplished by testing standard cylinders of concrete samples taken at the job site. Standard cylinders shall represent the concrete placed in the forms. One set of five standard cylinders shall be cast of each class of concrete for each 100 cubic yards or less in each separate structure. Casting, handling and curing of cylinders shall be in accordance with ASTM C31. Additional cylinders shall be provided when an error in batching is suspected. For the first 24 hours after casting, the cylinders shall be kept moist and measures taken so that air temperature will be between 60 and 80 degrees F. At the end of 24 hours, the cylinders shall be transported to the testing laboratory.

1) Testing of specimens for compressive strength shall be in accordance with ASTM C39. Tests shall be made at 7 and 28 days from time of casting. One test cylinder from each group of five shall be tested at the end of 7 days and two shall be tested at the end of 28 days. The fourth and fifth cylinder shall be tested only when the strength test fails to meet the required compressive test at 28 days.

2) Each strength test result shall be the average of the strengths of two test cylinders at 28 days. However, if one cylinder in the set of two shows evidence of low strength due to improper sampling, casting, handling or curing, the result from the fourth cylinder shall be used.

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

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

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

b. Tests For Consistency Of Concrete: The slump shall be as specified when measured in accordance with ASTM C143. Samples for slump determination shall be taken from the concrete during placing. Tests shall be made at the beginning of concrete placement operation and at subsequent intervals to ensure that the specification requirements are met. Slump tests shall also be performed whenever standard cylinders are cast.

c. Tests For Temperature And Air Content: Temperature tests shall be made at frequent intervals during hot or cold weather conditions until satisfactory temperature control is established. Whenever standard cylinders are cast, temperature tests shall be performed. Air content shall be as specified when measured in accordance with ASTM C231. Air content shall be measured whenever standard cylinders are cast.

3.18 WATERTIGHTNESS, TESTING AND REPAIR

A. Water Retaining Concrete Tanks And Channels:

1. Concrete tanks, basins, reservoirs and channels which have walls or slabs subjected to hydrostatic pressure shall be tested for watertightness. The tests shall be made after the structure is complete and the concrete has achieved its specified 28-day strength, but prior to application of waterproofing coating or backfilling. Filling of the tank for the watertightness test shall not exceed a rate of 4 feet per hour. Filling with water at this maximum rate shall continue to the maximum operating water surface. The water shall be kept at this level for at least 72 hours and then the dry sides of all walls and the base perimeter of the slab shall be visually inspected for evidence of leakage. Damp spots, leakage, or seepage revealed by the test, including those caused by shrinkage of concrete, honeycombed areas, construction joints, or other sources shall be repaired by Method 1, as described in paragraph 3.17-C.1a of this specification section. Damp spots are defined as spots from which water that can be picked up on dry hand.

2. The Contractor shall re-test tanks or channels which have been repaired to check the suitability of repairs. Water required for testing and re-testing shall be provided by the Contractor and disposed of so as not to create a nuisance.

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

Structure Type	ACI 350.1 Designation	Tightness Criterion
Cylindrical water and wastewater storage tanks and reservoirs other than digesters	Hst-025	0.025% per day
Digesters	Sht-050	0.050% per day (surcharged hydrostatic test)
Rectangular basins and tanks	Hst-050	0.050% per day
Concrete paved reservoirs and channels	Hst-100	0.10% per day

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

4. Volume loss shall be calculated by measuring the vertical distance from the water surface to a fixed point on the tank above the water surface taking into account evaporation from open surfaces. If the drop in water surface in the 24-hour period exceeds the values given in the table above, exclusive of evaporation, the leakage shall be considered excessive and shall be remedied. The Contractor shall retest structures which have been repaired to check the suitability of repairs. Water required for the testing and retesting shall be provided by the Contractor and disposed so as not to create a nuisance.

3.19 CLEANUP

A. Upon completion of the work and prior to final inspection, the Contractor shall clean all concrete surfaces as follows:

1. Floors: After sweeping with an ordinary broom to remove the loose dirt, the finish shall be wetted with soapsuds and rubbed with a scrubbing machine fitted with a wire brush or fine steel wool. The suds shall be mopped up, and the surface shall be flushed with clean water. Final scrubbing by hand or machine shall follow.

2. Floors With Curing And Sealing Compounds: Cleaned of loose dirt and debris by sweeping with ordinary brooms, then washed and mopped with clean water. Finally, one additional coat of the same initial curing and sealing compound shall be applied per manufacturer's recommendations. The Contractor shall receive approval from the Project Representative prior to application of the final coat.

3. Sidewalks And Paved Areas: Cleaned of loose dirt and debris by sweeping with ordinary brooms, then washed with clean water.

END OF SECTION 03 30 00

SECTION 10 73 16
CANOPIES

PART 1 GENERAL

1.01 SUMMARY

A. This Specification defines the requirements for canopy used to cover a water treatment pilot system. Procurement shall include all of the structural and functional components required to render the canopy fully useable. This Specification does not attempt to enumerate all details of accessories and appurtenances required. Such details shall be provided by the Manufacturer for approval by the Project Representative.

1.02 SECTION INCLUDES

A. Canopy

1.03 RELATED DRAWINGS

A. Contract Drawings.

1.04 REFERENCES

A. The publications listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by the basic designation only. The latest editions of the applicable standards shall apply.

1. AISI American Iron and Steel Institute
2. ASTM American Society for Testing and Materials
3. AWS American Welding Society
4. IBC International Building Code

B. The above list is not intended to be inclusive of all applicable standards and local codes. Vendor guarantees compliance with all applicable standards of industrial practice.

1.05 PRODUCT DESCRIPTION

A. The canopy shall be a cold-formed steel structure without sidewalls.

B. The canopy shall be 12’ – 0” wide, 42’ – 0” long and have an eave height of 15’ – 0”.

C. The canopy shall be designed such that the roof pitch adds minimal extra material and cost.

1.06 SUBMITTALS

A. Proposal:

1. General arrangement – provide spatial dimensions for the product layout along with anchoring details.
2. Preliminary foundation loads shall be submitted with bid to allow Engineer to complete preliminary design.

B. Product Data:

1. Component information: Information including materials of construction, coatings, (including color selection) and catalog information of major components.
2. Project bill of materials.
3. Special installation instructions.

C. Shop Drawings:

1. Arrangement Drawings: Drawings indicating layout, spacings, sizes, thickness, and types of cold-formed steel framing.
2. Fastening and Anchorage Details.
3. Drawings indicating reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and any attachments to adjoining work as applicable.

D. Quality Control Submittals:

1. Welding procedures and welding specifications.
2. Welding certificates.
3. Product certificates
    a. Studs and track.
    b. Anchor clips.
4. Product Test Reports: For each listed product, for tests performed by manufacturer and witnessed by a qualified testing agency.
    a. Steel sheet.
    b. Expansion anchors.
    c. Power-actuated anchors.
    d. Mechanical fasteners.
    e. Vertical deflection clips.
    f. Horizontal drift deflection clips.
    g. Miscellaneous structural clips and accessories.
5. Installer Qualifications: Provide documentation that the installing Contractor of the cold-formed framing system has five (5) years of experience on similar work and a project specific manufacturer approval letter from steel stud manufacturer or installing Contractor is recognized in Steel Framing Industry Associations (SFIA) “Contractor Certification Program”.
6. A certificate of conformance statement indicating that the equipment supplied meets the requirements of the Specification.

1.07 QUALITY ASSURANCE

A. The Project Representative reserves the right to inspection and surveillance at any time during fabrication within normal business hours. For this project, inspections by the Manufacturer shall be required to verify the conformance of activities or items to specified requirements. The Manufacturer’s work may be monitored by Engineer’s

personnel to monitor or observe an activity to verify that the activity conforms to the specified requirements.

B. Manufacturer shall be in good standing of the Steel Framing Industry Association (SFIA).

C. Framing members shall be certified in accordance with the SFIA “Code Compliance Certification Program”.

D. Anchoring clips in accordance with the SFIA Cold-Formed Connector Program shall be provided.

E. Certification: Provide a manufacturer’s certificate of proper installation that states the underdrain system has been installed in accordance with the manufacturer’s requirements and has been supervised by an authorized representative of the manufacturer and that all the specified testing has been conducted to insure proper performance.

F. Welding Qualifications:

1. Procedures and personnel shall be qualified according to the following:

a. AWS D1.1/D1.1M Structural Welding Code – Steel

b. AWS D1.3/D1.3M Structural Welding Code – Sheet Steel

1.08 PROJECT/SITE CONDITIONS

A. Elevation: 601 ft AMSL

B. Temperature

1. Outdoor

a. 0ºF to 95ºF

1.09 WARRANTY

A. The Manufacturer shall warrant the equipment being supplied to the Owner against all defects in workmanship and materials for a period of one (1) year from the date of startup or eighteen (18) months from shipment, provided that the plant installation, startup and subsequent operations are performed in strict accordance with written and oral instructions provided by the Manufacturer.

B. Any equipment purchased by the Manufacturer, as part of the Manufacturer’s equipment package shall be warranted as part of the Manufacturer’s equipment.

C. The Manufacturer shall replace or repair any part or parts which are determined to be defective during the warranty period, provided that the defects are not a result of misuse or neglect.

PART 2 PRODUCTS

2.01 GENERAL

A. This Specification gives a general description of what is required. Details may vary in accordance with the exact requirements of the equipment offered by the Manufacturer. Any additional auxiliary equipment necessary for the proper operation of the proposed installation not mentioned in these Specifications shall be specifically called out in the Bid.

B. A single supplier shall furnish all System components as specified and shall be experienced in the design and manufacture of filter systems. The Manufacturer shall be responsible for designing and furnishing a ready-to-install system, which meets all flow and structural design requirements specified.

2.02 MANUFACTURERS

A. Products shall be provided by Steel Framing Industry Association (SFIA) Members in good standing.

2.03 SYSTEM DESIGN

A. Structural Conditions

1. Canopy shall be designed to the following structural conditions:

a. Ground snow load = 103 pounds per square foot (psf)

b. Roof Snow Load = 73 psf minimum

c. Wind Speed = 110 miles per hour (mph)

d. Wind Exposure Category = C

e. Site Classification = D

f. Seismic Design Category = D

g. Building Risk Category = II

h. Governing Standard = 2021 IBC

B. Steel Sheet Components

1. Comply with the following standards:

a. AISI S240

b. ASTM A10003/A 1003M

c. Structural Grade Type H, metallic grade of coating as required by structural performance.

2.04 COMPONENTS

A. Component List

1. Canopy shall include but not be limited to the following components:

a. All structural steel beams and supports required for the structural design conditions.

b. Bolts, studs, clamps, anchors, and all other structural support components required for full installation of the canopy.

c. Water-proof steel roofing.

2.05 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: ASTM A780

B. Cement Grout: ASTM C476, Standard Specification for Grout for Masonry.

C. Nonmetallic, Non-shrink Grout: Premixed, nonmetallic, noncorrosive, non-staining grout complying with ASTM C 1107/C1107M.

D. Shims:

1. Load bearing, high-density multimonomer, nonleaching plastic
2. Cold-formed steel of same grade and coating as framing members supported by shims.

E. Sealer Gaskets: Closed-cell neoprene, ¼" thick, match width of bottom track or rim track members.

2.06 FABRICATION

A. Fabricated cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened per AISI S240, Manufacturer's written instructions, and this Section

1. Fabricate framing assemblies using jigs or templates.
2. Cut framing members by sawing or shearing; do not torch cut.
3. Gasten cold-formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with Fabricator. Wire tying of framing members is not permitted.
    a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
4. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by no fewer than three exposed screw threads.
5. Fasten other materials to cold-formed steel framing by welding bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.

C. Fabrication Tolerances: Fabricated assemblies' level, plumb, and true to line to a maximum allowable tolerance variation of 1/8" in 10 feet and as follows:

1. Spacing: Space individual framing members no more than plus or minus 1/8" from plan location. Cumulative error shall not exceed minimum fastening requirements or sheeting or other finishing materials.
2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8".

PART 3 EXECUTION

3.01 SHOP ASSEMBLY AND INSPECTION

A. The equipment specified herein shall be factory assembled as far as practical to verify that all mating parts can be field assembled. The manufacturer shall submit certification of shop trial assembly and photographs of assembly before shipment.

B. Shop inspection shall be performed by a qualified inspector and certified by the manufacturer. The inspection shall be documented and all deficiencies noted, corrected, re-inspected, and final completion formally authorized. Final shipment authorization shall be by the manufacturer to ensure completion of all fabrication,

assembly and inspection requirements. Inspection records and evidence of inspector qualification shall be submitted to the Owner upon request.

3.02 DELIVERY, STORAGE AND HANDLING

A. All cold-formed steel framing shall be protected from corrosion, moisture staining, deformation, and other damage during delivery, storage, and handling as required in AISI S202 “Code of Standard Practice.”

3.03 INSTALLATION, GENERAL

A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold -formed steel framing according to ASTM C1007 and to manufacturer’s written instructions unless more stringent requirements are indicated

C. Install shop or field-fabricated, cold-formed framing and securely anchor to supporting structure

1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16”.

D. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.

1. Cut framing members by sawing or shearing; do not torch cut.
2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
3. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
4. Locate mechanical fasteners and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetration.

E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

F. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

G. Erection tolerances: install cold-formed steel framing level, plumb and true-to-line to a maximum allowable tolerance of 1/8” in 10 feet and as follows:

1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.04 JOIST INSTALLATION

A. Install perimeter joist track sized to match joists. Align and securely anchor or fasten track to supporting structure at corners, ends, and spacings indicated on Shop Drawings.

B. Install joists bearing on supporting frame, level, straight, and plumb; adjust to final position, brace, and reinforce. Fasten joists to both flanges of joist track.

1. Install joists over supporting frame with a minimum end bearing indicated on Shop Drawings.
2. Reinforce ends and bearing points of joists with web stiffeners, end clips, joist hangers, steel clip angles, or steel stud section as indicated on Shop Drawings.

C. Space joists not more than 2” from abutting walls, and as indicated on Shop Drawings.

D. Frame openings with built-up joist headers consisting of joist and joist track, or another combination of connected joists if indicated.

E. Install joist reinforcement at interior supports with single, short length of joist section located directly over interior support, with lapped joists of equal length to joist reinforcement, or as indicated on Shop Drawings.

F. Install web stiffeners to transfer axial loads of walls above.

G. Install bridging at intervals indicated on Shop Drawings. Fasten bridging at each joist intersection as indicated on Shop Drawings

H. Secure joists to load-bearing interior walls to prevent lateral movement of bottom flange.

I. Install miscellaneous joist framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold-down angles, anchors, and fasteners, to provide a complete and stable joist-framing assembly.

3.05 FIELD QUALITY CONTROL

A. Testing: Project Representative will engage a qualified independent testing agency to perform field tests and inspections and prepare test reports, as desired.

B. Field and shop welds will be subject to testing and inspecting.

C. Testing agency will report test results promptly and in writing to Contractor and Architect.

D. Remove and replace work where test results indicate that it does not comply with the specified requirements.

E. Additional testing and inspecting, at Contractor’s expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.06 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A780 and Manufacturer’s written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 10 73 16

SECTION 26 05 00
COMMON WORK RESULTS FOR ELECTRICAL

PART 1 GENERAL

1.01 SECTION REQUIREMENTS

A. Submittals:

1. Product Data:

a. Conduit

b. Conductors

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Seismic-Restraint Loading:

1. Site Class as Defined in the IBC E.

2. Assigned Seismic Use Group or Building Category as Defined in the IBC: II.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NFPA 70.

2.02 RACEWAYS

A. Raceways:

1. Schedule 40 PVC

2. Cable Tray

3. LFMC: UL 360, zinc-coated, flexible steel with sunlight-resistant and mineral-oil-resistant plastic jacket.

4. Raceway Fittings: Specifically designed for raceway type used in Project.

B. Wireways: Nema 3R Sheet metal sized and shaped, with screw covers.

2.03 CONDUCTORS AND CABLES

A. Comply with NEMA WC70.

B. Conductors, No. 10 AWG and Smaller: Solid or stranded copper.

C. Conductors, Larger Than No. 10 AWG: Stranded copper.

D. Insulation: Thermoplastic, Type THHN-THWN or XHHW.

E. Wire Connectors and Splices: Units of size, ampacity rating, material, type, and class suitable for service indicated.

F. Cable Type TC-ER: tinned Copper Conductors, outdoor rated. CPE jacket, EPR insulation -XHHW-2, 90 degree C, 600 Volt. E-1 color code.

2.04 GROUNDING MATERIALS

A. Conductors: Solid for No. 8 AWG and smaller, and stranded for No. 6 AWG and larger unless otherwise indicated.

1. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

2. Bare, Solid-Copper Conductors: Comply with ASTM B 3.

3. Bare, Stranded-Copper Conductors: Comply with ASTM B 8.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts with clamp-type pipe connectors sized for pipe.

2.05 ELECTRICAL IDENTIFICATION MATERIALS

A. Raceway/ Cable Identification Materials: Snap-around, color-coding bands; flexible, preprinted, color-coded acrylic, Self-adhesive, color-coding vinyl tape; flexible, preprinted, self-adhesive vinyl.

B. Conductor Identification Materials: Color-Coding Conductor Tape: Self-adhesive vinyl tape 1 to 2 inches wide.

C. Tape Markers for Wire: Vinyl or vinyl-cloth, self-adhesive, wraparound type with circuit identification legend machine printed by thermal transfer or equivalent process.

D. Self-Adhesive Warning Labels: Factory printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.

E. Metal-Backed, Butyrate Warning Signs: Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch galvanized-steel backing; and with colors, legend, and size required for application.

F. Equipment Identification Labels: Engraved, laminated acrylic or melamine label; punched or drilled for screw mounting. White letters on a dark-gray background; red letters for emergency systems.

G. Fasteners: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

2.06 SUPPORT AND ANCHORAGE COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly, and provide finish suitable for the environment in which installed.

1. Channel Dimensions: Selected for structural loading and applicable seismic forces.

B. Raceway and Cable Supports: As described in NECA 1.

C. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and fittings.

D. Mounting, Anchoring, and Attachment Components:

1. Powder-Actuated Fasteners: Threaded-steel stud.

2. Mechanical-Expansion Anchors: Insert-wedge-type, stainless steel, for use in hardened portland cement concrete.

3. Concrete Inserts: Steel or malleable-iron, slotted-support-system units similar to MSS Type 18; complying with MFMA-3 or MSS SP-58.

4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.

5. Through Bolts: Structural type, hex head, high strength; complying with ASTM A 325.

6. Toggle Bolts: All-steel springhead type.

7. Hanger Rods: Threaded steel.

2.07 SEISMIC-RESTRAINT COMPONENTS

A. Rated strengths, features, and application requirements shall be as defined in reports by an evaluation service member of ICC-ES.

1. Structural Safety Factor: Strength in tension, shear, and pullout force of components used shall be at least four times the maximum seismic forces to which they will be subjected.

B. Angle and Channel-Type Brace Assemblies: Steel angles or steel slotted-support-system components; with accessories for attachment to braced component at one end and to building structure at the other end.

1. Seismic Mountings, Anchors, and Attachments: Devices as specified in "Support and Anchorage Components" Article, selected to resist seismic forces.

2. Bushings for Floor-Mounted Equipment Anchors: Neoprene units designed for seismically rated rigid equipment mountings, and matched to type and size of anchor bolts and studs used.

3. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for seismically rated rigid equipment mountings, and matched to type and size of attachment devices used.

PART 3 EXECUTION

3.01 GENERAL ELECTRICAL EQUIPMENT INSTALLATION REQUIREMENTS

A. Install electrical equipment to allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.

B. Install electrical equipment to provide for ease of disconnecting the equipment with minimum interference to other installations.

C. Install electrical equipment to allow right of way for piping and conduit installed at required slope.

D. Install electrical equipment to ensure that connecting raceways, cables, wireways, cable trays, and busways are clear of obstructions and of the working and access space of other equipment.

E. Install required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

F. Comply with NECA 1.

3.02 RACEWAY AND CABLE INSTALLATION

A. Outdoor Raceways Applications:

1. Exposed or Concealed: RNC.

a. Branch circuits: Schedule 40 PVC.

b. Feeder circuits: Schedule 80 PVC.

2. Connection to Vibrating Equipment: LFMC.

3. Boxes and Enclosures: Metallic, NEMA Type 3R or Type 4 as indicated on drawings.

B. Install pull wires in empty raceways.

C. Connect motors and equipment subject to vibration, noise transmission, or movement with a 72-inch (1830-mm) maximum length of flexible conduit.

D. Installation of Hangers and Supports:

1. Comply with NECA 1 and NECA 101 for installation requirements, except as specified in this article.

2. Separate dissimilar metals and metal products from contact with wood or cementitious materials, by painting each metal surface in area of contact with a bituminous coating or by other permanent separation.

3. Multiple Raceways or Cables: Install on trapeze-type supports fabricated with steel slotted channel.

4. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

5. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods, unless otherwise indicated or required by Code:

   a. To Wood: Fasten with lag screws or through bolts.

   b. To New Concrete: Bolt to concrete inserts.

   c. To Existing Concrete: Expansion anchor fasteners.

   d. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts.

   e. To Light Steel: Sheet metal screws.

   f. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount on slotted-channel racks attached to substrate.

6. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.03 GROUNDING

A. Pipe and Equipment Grounding Conductor Terminations: Bolted.

B. Connections to Structural Steel: Bolted.

C. Install grounding conductors routed along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

D. Make connections without exposing steel or damaging coating if any.

E. Install bonding straps and jumpers in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.

F. Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.

G. Bond to equipment mounted on vibration isolation hangers and supports so vibration is not transmitted to rigidly mounted equipment.

H. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes, using a bolted clamp connector or by bolting a lug-type connector to a pipe flange, using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.

2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.

3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

I. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells.

1. Measure ground resistance not less than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.

2. Perform tests by fall-of-potential method according to IEEE 81.

3. Report measured ground resistances that exceeds 10 ohms.

4. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

3.04 IDENTIFICATION

A. Power-Circuit Conductor Identification: For No. 3 AWG conductors and larger, at each location where observable, identify phase using color-coding conductor tape.

B. Warning Labels for Enclosures for Power and Lighting: Comply with 29 CFR 1910.145; identify system voltage with black letters on an orange background. Apply to exterior of door, cover, or other access.

C. Equipment Identification Labels:

1. Labeling Instructions:

a. Outdoor Equipment: Engraved, laminated acrylic or melamine label, drilled for screw attachment.

b. Elevated Components: Increase sizes of labels and legend to those appropriate for viewing from the floor.

2. Equipment to Be Labeled:

a. Panelboards, electrical cabinets, and enclosures.

b. Transformers.

c. Disconnect switches.

d. Enclosed circuit breakers.

e. Motor starters.

f. Push-button stations.

g. Contactors.

D. Verify identity of each item before installing identification products.

E. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

F. Attach nonadhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.

G. Install system identification color banding for raceways and cables at 25-foot maximum intervals in straight runs, and at 15-foot maximum intervals in congested areas.

H. Color-Coding for Phase and Voltage Level]Identification, 600 V and Less: Ungrounded service, feeder and branch-circuit conductors.

1. Colors for 208/120-V Circuits:

a. Phase A: Black.

b. Phase B: Red.

c. Phase C: Blue.

2. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) from terminal points.

I. Underground-Line Warning Tape: Continuous underground-line warning tape directly above line at 6 to 8 inches (150 to 200 mm) below finished grade.

3.05 SEISMIC REQUIREMENTS

A. Install seismic-restraint components using methods approved by the evaluation service providing required submittals for component.

B. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, upper truss chords of bar joists, or at concrete members.

END OF SECTION 26 05 00

SECTION 26 05 23
CONTROL-VOLTAGE ELECTRICAL POWER CABLES

PART 1 GENERAL

1.01 SUMMARY

A. Coordinate cabling requirements with the PLC shop drawings and controls drawings provide as required. The entire project is outdoors with the exception of the weather rated enclosures. All cable and terminations are to be outdoor rated except where they occur inside of weather rated enclosures.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product. Clearly indicate where this product will be used.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.02 SOURCE QUALITY CONTROL

A. Factory test balanced twisted pair cables according to TIA-568-C.2.

B. Cable will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

PART 3 EXECUTION

3.01 EXAMINATION

A. Test cables on receipt at Project site.

1. Test each pair of twisted pair cable for open and short circuits.

3.02 INSTALLATION OF RACEWAYS AND BOXES

A. Comply with requirements in Section 260500.

3.03 INSTALLATION OF CONDUCTORS AND CABLES

A. Comply with NECA 1.

B. General Requirements for Cabling:

1. Comply with TIA-568-C Series of standards.

2. Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems."

3. Terminate all conductors; cable must not contain unterminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.

4. Cables may not be spliced and must be continuous from terminal to terminal. Do not splice cable between termination, tap, or junction points.

5. Cables serving a common system may be grouped in a common raceway. Install network cabling and control wiring and cable in separate raceway from power wiring. Do not group conductors from different systems or different voltages.

6. Secure and support cables at intervals not exceeding 30 inch and not more than 6 inch from cabinets, boxes, fittings, outlets, racks, frames, and terminals.

7. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems." Install lacing bars and distribution spools.

8. Do not install bruised, kinked, scored, deformed, or abraded cable. Remove and discard cable if damaged during installation and replace it with new cable.

9. Cold-Weather Installation: Bring cable to room temperature before dereeling. Do not use heat lamps for heating.

10. Pulling Cable: Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems." Monitor cable pull tensions.

11. Support: Do not allow cables to lay on removable ceiling tiles.

12. Secure: Fasten securely in place with hardware specifically designed and installed so as to not damage cables.

13. Provide strain relief.

14. Keep runs short. Allow extra length for connecting to terminals. Do not bend cables in a radius less than 10 times the cable OD. Use sleeves or grommets to protect cables from vibration at points where they pass around sharp corners and through penetrations.

15. Ground wire must be copper, and grounding methods must comply with IEEE C2. Demonstrate ground resistance.

C. Balanced Twisted Pair Cable Installation:

1. Comply with TIA-568-C.2.

2. Install termination hardware as specified in Section 271513 "Communications Copper Horizontal Cabling" unless otherwise indicated.

3. Do not untwist UTP cables more than 1/2 inch (12 mm) at the point of termination to maintain cable geometry.

D. Installation of Control-Circuit Conductors:

1. Install wiring in raceways. Comply with requirements specified in Section 260500.

3.04 CONTROL-CIRCUIT CONDUCTORS

A. Minimum Conductor Sizes:

1. Class 1 remote-control and signal circuits; No 14 AWG.

2. Class 2 low-energy, remote-control, and signal circuits; No. 16 AWG.

3. Class 3 low-energy, remote-control, alarm, and signal circuits; No 12 AWG.

3.05 FIRESTOPPING

A. Comply with TIA-569-D, Annex A, "Firestopping."

B. Comply with BICSI TDMM, "Firestopping" Chapter.

3.06 GROUNDING

A. For data communication wiring, comply with TIA-607-B and with BICSI TDMM, "Bonding and Grounding (Earthing)" Chapter.

3.07 IDENTIFICATION

A. Identify data and communications system components, wiring, and cabling according to TIA-606-B; label printers must use label stocks, laminating adhesives, and inks complying with UL 969. Provide outdoor labels for all outdoor identification.

B. Identify each wire on each end and at each terminal with a number-coded identification tag. Each wire must have a unique tag.

3.08 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Visually inspect cable jacket materials for UL or third-party certification markings. Inspect cabling terminations to confirm color-coding for pin assignments, and inspect cabling connections to confirm compliance with TIA-568-C.1.

2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.

B. End-to-end cabling will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION 26 05 23

SECTION 26 22 13
LOW-VOLTAGE DISTRIBUTION TRANSFORMERS

PART 1 GENERAL

1.01 SUMMARY

A. Section includes distribution, dry-type transformers with a nominal primary and secondary rating of 600 V and less, with capacities up to 1500 kVA.

1.02 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Data: Certificates, for transformers, accessories, and components, from manufacturer.

B. Source quality-control reports.

C. Field quality-control reports.

1.03 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. ABB, Square D, Eaton, ACME, Cooper

2.02 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Transformers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

2.03 GENERAL TRANSFORMER REQUIREMENTS

A. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.

B. Comply with NFPA 70.

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

C. Transformers Rated 15 kVA and Larger:

1. Comply with 10 CFR 431 (DOE 2016) efficiency levels.

2. Marked as compliant with DOE 2016 efficiency levels by an NRTL.

D. Encapsulation: shall have core and coils completely resin encapsulated.

E. Cores: Electrical grade, non-aging silicon steel with high permeability and low hysteresis losses.

F. Coils: Continuous windings without splices except for taps.

1. Coil Material: Copper.

2. Internal Coil Connections: Brazed or pressure type.

2.04 IDENTIFICATION

A. Nameplates: Engraved, laminated-acrylic or melamine plastic signs for each distribution transformer, mounted with corrosion-resistant screws. Nameplates and label products are specified in Section 260500 "Common Work Results for Electrical."

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.

B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's written instructions.

C. Examine concrete bases for suitable mounting conditions where transformers will be installed.

D. Verify that ground connections are in place and requirements in Section 260500 "Common Work Results for Electrical" have been met. Maximum ground resistance shall be 5 ohms at location of transformer.

E. Environment: Enclosures shall be rated for the environment in which they are located. Covers for NEMA 250, Type 4X enclosures shall not cause accessibility problems.

3.02 INSTALLATION

A. Install transformers level and plumb on a concrete base with vibration-dampening supports. Locate transformers away from corners and not parallel to adjacent wall surface.

B. Construct concrete bases

1. Coordinate size and location of concrete bases with actual transformer provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

C. Secure transformer to concrete base according to manufacturer's written instructions.

D. Secure covers to enclosure and tighten all bolts to manufacturer-recommended torques to reduce noise generation.

E. Remove shipping bolts, blocking, and wedges.

3.03 CONNECTIONS

A. Ground equipment according to Section 26 05 00 "Common Work Results for Electrical."

B. Connect wiring according to Section 26 05 00 "Common Work Results for Electrical."

C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

D. Provide flexible connections at all conduit and conductor terminations and supports to eliminate sound and vibration transmission to the building structure.

3.04 FIELD QUALITY CONTROL

A. Perform tests and inspections with certified technical electrical test agency.

B. Small (Up to 167-kVA Single-Phase or 500-kVA Three-Phase) Dry-Type Transformer Field Tests:

1. Visual and Mechanical Inspection.

    a. Inspect physical and mechanical condition.

    b. Inspect anchorage, alignment, and grounding.

    c. Verify that resilient mounts are free and that any shipping brackets have been removed.

    d. Verify the unit is clean.

    e. Perform specific inspections and mechanical tests recommended by manufacturer.

    f. Verify that as-left tap connections are as specified.

    g. Verify the presence of surge arresters and that their ratings are as specified.

2. Electrical Tests:

    a. Measure resistance at each winding, tap, and bolted connection.

b. Perform insulation-resistance tests winding-to-winding and each winding-to-ground. Apply voltage according to manufacturer's published data. In the absence of manufacturer's published data, comply with NETA ATS, Table 100.5. Calculate polarization index: the value of the index shall not be less than 1.0.

c. Perform turns-ratio tests at all tap positions. Test results shall not deviate by more than one-half percent from either the adjacent coils or the calculated ratio. If test fails, replace the transformer.

d. Verify correct secondary voltage, phase-to-phase and phase-to-neutral, after energization and prior to loading.

C. Remove and replace units that do not pass tests or inspections and retest as specified above.

D. Test Labeling: On completion of satisfactory testing of each unit, attach a dated and signed "Satisfactory Test" label to tested component.

3.05 CLEANING

A. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

END OF SECTION 26 22 13

SECTION 26 24 16
PANELBOARDS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Lighting and appliance branch-circuit panelboards.

1.02 DEFINITIONS

A. MCCB: Molded-case circuit breaker.

B. SPD: Surge protective device.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of panelboard.

1.04 INFORMATIONAL SUBMITTALS

A. Panelboard schedules for installation in panelboards.

1.05 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.06 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace panelboards that fail in materials or workmanship within specified warranty period.

1. Panelboard Warranty Period: 18 months from date of Substantial Completion.

PART 2 PRODUCTS

2.01 PANELBOARDS COMMON REQUIREMENTS

A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Section 260548.16 "Seismic Controls for Electrical Systems."

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NEMA PB 1.

D. Comply with NFPA 70.

E. Enclosures: Surface-mounted, dead-front cabinets.

1. Rated for environmental conditions at installed location.

a. Outdoor Locations: NEMA 250, Type 3R.

2. Height: 84 inches maximum.

3. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box. Trims shall cover all live parts and shall have no exposed hardware.

4. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover. Trims shall cover all live parts and shall have no exposed hardware.

F. Incoming Mains Location: Bottom.

G. Phase, Neutral, and Ground Buses: Hard-drawn copper, 98 percent conductivity.

H. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Hard-drawn copper, 98 percent conductivity.

2. Main and Neutral Lugs: Mechanical type, with a lug on the neutral bar for each pole in the panelboard.

3. Ground Lugs and Bus-Configured Terminators: Mechanical type, with a lug on the bar for each pole in the panelboard.

I. NRTL Label: Panelboards shall be labeled by an NRTL acceptable to authority having jurisdiction for use as service equipment with one or more main service disconnecting and overcurrent protective devices. Panelboards shall have meter enclosures, wiring, connections, and other provisions for utility metering. Coordinate with utility company for exact requirements.

J. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals. Assembly listed by an NRTL for 100 percent interrupting capacity.

2.02 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Panelboards shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

B. Surge Suppression: Factory installed as an integral part of indicated panelboards, complying with UL 1449 SPD Type 1.

2.03 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Manufacturers

1. Square D, Eaton, Siemens, ABB.

B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

C. Mains: Circuit breaker.

D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

E. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.04 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Manufacturers

1. Square D, Eaton, Siemens, ABB to match panel.

B. MCCB: Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers:

a. Inverse time-current element for low-level overloads.

b. Instantaneous magnetic trip element for short circuits.

c. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

2. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.

3. GFCI Circuit Breakers: Single- and double-pole configurations with Class A ground-fault protection (6-mA trip).

4. Arc-Fault Circuit Interrupter Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.

5. Subfeed Circuit Breakers: Vertically mounted.

6. MCCB Features and Accessories:

a. Standard frame sizes, trip ratings, and number of poles.

b. Breaker handle indicates tripped status.

c. UL listed for reverse connection without restrictive line or load ratings.

d. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.

e. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and HID lighting circuits.

f. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.

g. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.

h. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

C. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.

1. Fuses and Spare-Fuse Cabinet: Comply with requirements specified in Section 262813 "Fuses."

2.05 IDENTIFICATION

A. Panelboard Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles shall be located on the interior of the panelboard door.

B. Breaker Labels: Faceplate shall list current rating, UL and IEC certification standards, and AIC rating.

C. Circuit Directory: Directory card inside panelboard door, mounted in transparent card holder.

PART 3 EXECUTION

3.01 INSTALLATION

A. Comply with NECA 1.

B. Install panelboards and accessories according to NEMA PB 1.1.

C. Comply with mounting and anchoring requirements specified in Section 26 05 48.16 "Seismic Controls for Electrical Systems."

D. Mount top of trim 90 inches above grade unless otherwise indicated.

E. Mount panelboard cabinet plumb and rigid without distortion of box.

F. Install overcurrent protective devices and controllers not already factory installed.

1. Set field-adjustable, circuit-breaker trip ranges.

G. Make grounding connections and bond neutral for services and separately derived systems to ground. Make connections to grounding electrodes, separate grounds for isolated ground bars, and connections to separate ground bars.

H. Install filler plates in unused spaces.

3.02 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads; incorporate Owner's final room designations. Obtain approval before installing. Handwritten directories are not acceptable. Install directory inside panelboard door.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 260500 " Common Work Results for Electrical."

3.03 FIELD QUALITY CONTROL

A. Contractor hired technical electrical testing group to perform tests and inspections.

B. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.

2. Test continuity of each circuit.

C. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test for low-voltage air circuit breakers stated in NETA ATS. Certify compliance with test parameters.

2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

D. Panelboards will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results, with comparisons of the two scans. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

END OF SECTION 26 24 16

SECTION 26 27 26
WIRING DEVICES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. GFCI receptacles, 125 V, 20 A.

2. Toggle switches, 120/277 V, 20 A.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.03 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

PART 2 PRODUCTS

2.01 GENERAL WIRING-DEVICE REQUIREMENTS

A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

B. Comply with NFPA 70.

C. RoHS compliant.

D. Comply with NEMA WD 1.

E. Device Color:

1. Wiring Devices Connected to Normal Power System: Almond unless otherwise indicated or required by NFPA 70 or device listing.

F. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.02 GFCI RECEPTACLES, 125 V, 20 A

A. Weather-Resistant, GFCI Duplex Receptacles, 125 V, 20 A:

1. Manufacturers:

a. Hubbell GFRST20 OR equivalent receptacle from Leviton or Pass & Seymour.

2. Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle. Square face.

3. Configuration: NEMA WD 6, Configuration 5-15R.

4. Type: Non-feed through.

5. Standards: Comply with UL 498 and UL 943 Class A.

6. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" and "Receptacles in Damp or Wet Locations" articles.

2.03 TOGGLE SWITCHES, 120/277 V, 20 A

A. Single-Pole Switches, 120/277 V, 20 A:

1. Hubbell, Leviton, Pass & Seymour

2. Weatherproof in-use.

3. Standards: Comply with UL 20 and FS W-S-896.

2.04 WALL PLATES

A. Single Source: Obtain wall plates from same manufacturer of wiring devices.

B. Single and combination types shall match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.

C. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant in-use thermoplastic with lockable cover.

PART 3 EXECUTION

3.01 INSTALLATION

A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

B. Coordination with Other Trades:

1. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.

C. Device Installation:

1. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.

2. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

D. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the right.

E. Arrangement of Devices: Unless otherwise indicated, mount with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang cover plates.

3.02 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Test Instruments: Use instruments that comply with UL 1436.

2. Test Instrument for Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

B. Tests for Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.

2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.

3. Ground Impedance: Values of up to 2 ohms are acceptable.

4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.

5. Using the test plug, verify that the device and its outlet box are securely mounted.

C. Test straight-blade for the retention force of the grounding blade according to NFPA 99. Retention force shall be not less than 4 oz. (115 g).

D. Wiring device will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

END OF SECTION 26 27 26

SECTION 26 28 13
FUSES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Cartridge fuses rated 600 V ac and less for use in the following:

a. Control circuits.

b. Enclosed controllers.

c. Enclosed switches.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.03 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Bussman Fuses

2.02 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, current-limiting, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.

1. Provide dual element time delay fuses for all motor or other in-rush type loads.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NEMA FU 1 for cartridge fuses.

D. Comply with NFPA 70.

E. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

B. Provide 3 spare fuses of each type to owner. Provide signed receipt in O&M submittal

3.02 IDENTIFICATION

A. Install labels complying indicating fuse replacement information inside of door of each fused switch and adjacent to each fuse block, socket, and holder.

END OF SECTION 26 28 13

SECTION 26 28 16
ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Fusible switches.
2. Nonfusible switches.
3. Molded-case switches.
4. Enclosures.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include nameplate ratings, dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

1.03 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.04 WARRANTY

A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace components that fail in materials or workmanship within specified warranty period.

1. Warranty Period: One year(s) from date of Substantial Completion.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Enclosed switches and circuit breakers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event.

2.02 GENERAL REQUIREMENTS

A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.

C. Comply with NFPA 70.

2.03 FUSIBLE SWITCHES

A. Manufactured by Sq D, ABB, or Eaton.

B. Type HD, Heavy Duty:

1. UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate fuses.

2. Lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

2.04 NONFUSIBLE SWITCHES

A. Manufactured by Sq D, ABB, or Eaton.

B. Type HD, Heavy Duty, Three Pole, Single Throw, aller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

2.05 MOLDED-CASE CIRCUIT BREAKERS

A. Manufactured by Sq D, ABB, or Eaton.

B. Circuit breakers shall be constructed using glass-reinforced insulating material. Current carrying components shall be completely isolated from the handle and the accessory mounting area.

C. Circuit breakers shall have a toggle operating mechanism with common tripping of all poles, which provides quick-make, quick-break contact action. The circuit-breaker handle shall be over center, be trip free, and reside in a tripped position between on and off to provide local trip indication. Circuit-breaker escutcheon shall be clearly marked on and off in addition to providing international I/O markings. Equip circuit breaker with a push-to-trip button, located on the face of the circuit breaker to mechanically operate the circuit-breaker tripping mechanism for maintenance and testing purposes.

2.06 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: UL 489, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location. Provide type Nema 3R unless otherwise noted.

PART 3 EXECUTION

3.01 INSTALLATION

A. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted in advance and then only after arranging to provide temporary electric service according to requirements indicated:

1. 14 day minimum notice

2. Provide a method of procedure for all work (MOP)

B. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

C. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

D. Install fuses in fusible devices.

E. Comply with NFPA 70 and NECA 1.

3.02 IDENTIFICATION

A. Comply with requirements in Section 260500.

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.

2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.03 FIELD QUALITY CONTROL

A. Tests and Inspections for Switches:

1. Visual and Mechanical Inspection:

a. Inspect physical and mechanical condition.

b. Inspect anchorage, alignment, grounding, and clearances.

c. Verify that the unit is clean.

d. Verify blade alignment, blade penetration, travel stops, and mechanical operation.

e. Verify that fuse sizes and types match the Specifications and Drawings.

f. Verify that each fuse has adequate mechanical support and contact integrity.

B. Tests and Inspections for Molded Case Circuit Breakers:

1. Visual and Mechanical Inspection:

a. Verify that equipment nameplate data are as described in the Specifications and shown on the Drawings.

b. Inspect physical and mechanical condition.

c. Inspect anchorage, alignment, grounding, and clearances.

d. Verify that the unit is clean.

e. Operate the circuit breaker to ensure smooth operation.

C. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

1. Test procedures used.

2. Include identification of each enclosed switch and circuit breaker tested and describe test results.

3. List deficiencies detected, remedial action taken, and observations after remedial action.

END OF SECTION 26 28 16

SECTION 26 29 13.03
MANUAL AND MAGNETIC MOTOR CONTROLLERS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Manual motor controllers.
2. Enclosed full-voltage magnetic motor controllers.
3. Enclosures.
4. Accessories.
5. Identification.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For each type of magnetic controller.

1. Include plans, elevations, sections, and mounting details.
2. Indicate dimensions, weights, required clearances, and location and size of each field connection.
3. Wire Termination Diagrams and Schedules: Include diagrams for signal, and control wiring. Identify terminals and wiring designations and color-codes to facilitate installation, operation, and maintenance. Indicate recommended types, wire sizes, and circuiting arrangements for field-installed wiring, and show circuit protection features. Differentiate between manufacturer-installed and field-installed wiring.
4. Include features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

1.03 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.04 QUALITY ASSURANCE

A. Testing Agency Qualifications: Accredited by NETA.

1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

B. UL Compliance: Fabricate and label magnetic motor controllers to comply with UL 508 and UL 60947-4-1.

C. NEMA Compliance: Fabricate motor controllers to comply with ICS 2.

D. Seismic Performance: Magnetic controllers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

2.02 MANUAL MOTOR CONTROLLERS

A. Motor Switches (MS): "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off or on.

1. Provide as scheduled on Mechanical Equipment Electrical Connection Schedule

2. Provide with fixed type, replaceable motor overloads.

3. Red pilot light.

2.03 ENCLOSED FULL-VOLTAGE MAGNETIC MOTOR CONTROLLERS

A. Description: Across-the-line start, electrically held, for nominal system voltage of 600-V ac and less.

B. Allowed Manufactures include: Square D, ABB, Eaton.

C. Standard: Comply with NEMA ICS 2, general purpose, Class A.

D. Configuration: Nonreversing.

E. Contactor Coils: Pressure-encapsulated type.

1. Operating Voltage: Manufacturer's standard, unless indicated.

F. Control Power:

1. For on-board control power, obtain from line circuit or from integral CPT. The CPT shall have capacity to operate integral devices and remotely located pilot, indicating, and control devices. Size with 50 percent space capacity.

G. Overload Relays:

1. Thermal Overload Relays:

a. Inverse-time-current characteristic.

b. Class 10 tripping characteristic.

c. Heaters in each phase shall be matched to nameplate full-load current of actual protected motor and with appropriate adjustment for duty cycle.

d. Class II ground-fault protection shall comply with UL 1053 to interrupt low-level ground faults. The ground-fault detection system shall include circuitry that will prevent the motor controller from tripping when the fault current exceeds the interrupting capacity of the controller. Equip with start and run delays to prevent nuisance trip on starting, and a trip indicator.

2.04 ENCLOSURES

A. Comply with NEMA 250, type designations as indicated on Drawings, Enclosures shall be NEMA 3R.

B. The construction of the enclosures shall comply with NEMA ICS 6.

2.05 ACCESSORIES

A. General Requirements for Control Circuit and Pilot Devices: NEMA ICS 5; factory installed in controller enclosure cover unless otherwise indicated.

1. Push Buttons, Pilot Lights, and Selector Switches: oil-tight.

a. Push Buttons: As indicated in the controller schedule.

b. Pilot Lights: As indicated in the controller schedule.

2.06 IDENTIFICATION

A. Controller Nameplates: Laminated acrylic or melamine plastic signs, as described in Section 260553 "Identification for Electrical Systems," for each compartment, mounted with corrosion-resistant screws.

B. Arc-Flash Warning Labels:

1. The label shall have an orange header with the wording, "WARNING, ARC-FLASH HAZARD," and shall include the following information taken directly from the arc-flash hazard analysis:

a. Location designation.

b. Nominal voltage.

c. Flash protection boundary.

d. Hazard risk category.

e. Incident energy.

f. Working distance.

g. Engineering report number, revision number, and issue date.

2. Labels shall be machine printed, with no field-applied markings.

PART 3 EXECUTION

3.01 INSTALLATION

A. Comply with NECA 1.

B. Wall-Mounted Controllers: Install magnetic controllers on walls with tops at uniform height indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For controllers not at walls, provide freestanding racks complying with Section 260529 "Hangers and Supports for Electrical Systems" unless otherwise indicated.

C. Maintain minimum clearances and workspace at equipment according to manufacturer's written instructions and NFPA 70.

D. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

E. Setting of Overload Relays: Select and set overloads on the basis of full-load current rating as shown on motor nameplate. Adjust setting value for special motors as required by NFPA 70 for motors that are high-torque, high-efficiency, and so on.

3.02 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.03 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Comply with the provisions of NFPA 70B, "Testing and Test Methods" Chapter.

2. Visual and Mechanical Inspection:

a. Compare equipment nameplate data with drawings and specifications.

b. Inspect physical and mechanical condition.

c. Inspect anchorage, alignment, and grounding.

d. Verify the unit is clean.

e. Inspect contactors:

1) Verify mechanical operation.

2) Verify contact gap, wipe, alignment, and pressure are according to manufacturer's published data.

f. Motor-Running Protection:

1) Verify overload element rating is correct for its application.

2) If motor-running protection is provided by fuses, verify correct fuse rating.

C. Motor controller will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.04 SYSTEM FUNCTION TESTS

A. System function tests shall prove the correct interaction of sensing, processing, and action devices. Perform system function tests after field quality control tests have been completed and all components have passed specified tests.

1. Develop test parameters and perform tests for the purpose of evaluating performance of integral components and their functioning as a complete unit within design requirements and manufacturer's published data.

2. Verify the correct operation of interlock safety devices for fail-safe functions in addition to design function.

3. Verify the correct operation of sensing devices, alarms, and indicating devices.

B. Motor controller will be considered defective if it does not pass the system function tests and inspections.

C. Prepare test and inspection reports.

3.05 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain controllers.

END OF SECTION 26 29 13.03

SECTION 26 29 23
VARIABLE-FREQUENCY MOTOR CONTROLLERS

PART 1 GENERAL

1.01 SUMMARY

A. Section includes separately enclosed, preassembled, combination VFCs, rated 600 V and less, for speed control of three-phase, motors. Coordinate VFCs closely with the controlled loads and equipment.

B. Provide IP output in addition to the digital and analog control points required on the I/O points list. Coordination selection of the VFC with industrial controls contractor requirements prior to pricing.

C. ABB ACS series is the basis of design. Equal units from Allen Bradley, Square D or Eaton are acceptable.

1.02 ACTION SUBMITTALS

A. Product Data: For each type and rating of VFC indicated.

B. Shop Drawings: For each VFC indicated.

1. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

2. Include diagrams for power, signal, and control wiring.

1.03 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.04 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1.05 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace VFCs that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 CONTROLS AND INDICATION

A. Status Lights: Door-mounted LED indicators displaying the following conditions:

1. Power on.
2. Run.
3. Overvoltage.
4. Line fault.
5. Overcurrent.
6. External fault.

B. Panel-Mounted Operator Station: Manufacturer's standard front-accessible, sealed keypad and plain-English-language digital display; allows complete programming, program copying, operating, monitoring, and diagnostic capability.

1. Keypad: In addition to required programming and control keys, include keys for HAND, OFF, and AUTO modes.
2. Security Access: Provide electronic security access to controls through identification and password with at least one level of access: View only; view and operate; and view, operate, and service.
    a. Control Authority: Supports at least four conditions: Off, local manual control at VFC, local automatic control at VFC, and automatic control through a remote source.

C. Historical Logging Information and Displays:

1. Real-time clock with current time and date.
2. Running log of total power versus time.
3. Total run time.
4. Fault log, maintaining last four faults with time and date stamp for each.

D. Indicating Devices: Digital display mounted flush in VFC door and connected to display VFC parameters including, but not limited to:

1. Output frequency (Hz).
2. Motor speed (rpm).
3. Motor status (running, stop, fault).

4. Motor current (amperes).

5. Motor torque (percent).

6. Fault or alarming status (code).

7. PID feedback signal (percent).

8. DC-link voltage (V dc).

9. Set point frequency (Hz).

10. Motor output voltage (V ac).

E. Control Signal Interfaces:

1. Electric Input Signal Interface: Coordinate with controls requirements. At a minimum provide (2) A in, (2) A out and (6) digital points.

2.02 ENCLOSURES

A. VFC Enclosures: NEMA 250, to comply with environmental conditions at installed location.

PART 3 EXECUTION

3.01 INSTALLATION

A. Wall-Mounting Controllers: Install with tops at uniform height and with disconnect operating handles not higher than 79 inches (2000 mm) above finished floor, unless otherwise indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For controllers not on walls, provide freestanding racks complying with Section 260529 "Hangers and Supports for Electrical Systems."

3.02 IDENTIFICATION

A. Identify VFCs, components, and control wiring. Comply with requirements for identification specified in Section 260500.

3.03 FIELD QUALITY CONTROL

A. Perform tests and inspections with the assistance of a factory-authorized service representative.

B. Acceptance Testing Preparation:

1. Test insulation resistance for each VFC element, bus, component, connecting supply, feeder, and control circuit.

2. Test continuity of each circuit.

C. Tests and Inspections:

1. Coordinate with commissioning requirements for the controls system and provide support and testing as needed.

D. VFCs will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports, including a certified report that identifies the VFC and describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations made after remedial action.

3.04 ADJUSTING

A. Program microprocessors for required operational sequences, status indications, alarms, event recording, and display features. Clear events memory after final acceptance testing and prior to Substantial Completion.

B. Set field-adjustable switches, auxiliary relays, time-delay relays, timers, and overload-relay pickup and trip ranges.

3.05 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, reprogram, and maintain VFCs.

END OF SECTION 26 29 23

SECTION 26 51 19
LED LIGHTING

PART 1 GENERAL

1.01 SUMMARY

A. Section includes the outdoor of LED luminaires:

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
2. Testing Agency Certified Data: For indicated luminaires, photometric data certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.

1.03 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of luminaire.

B. Product test reports.

C. Sample warranty.

1.04 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.05 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturer's laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.

B. Provide luminaires from a single manufacturer for each luminaire type.

1.06 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

B. Warranty Period: one year(s) from date of Substantial Completion.

PART 2 PRODUCTS

2.01 GENERAL

A. Provide as scheduled on the drawings.

2.02 MATERIALS

A. Metal Parts:

1. Free of burrs and sharp corners and edges.
2. Sheet metal components shall be steel unless otherwise indicated.

3. Form and support to prevent warping and sagging.

B. Steel:

1. ASTM A36/A36M for carbon structural steel.
2. ASTM A568/A568M for sheet steel.

C. Galvanized Steel: ASTM A653/A653M.

D. Aluminum: ASTM B209.

2.03 METAL FINISHES

A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

2.04 LUMINAIRE SUPPORT

A. Comply with requirements in Section 260500 "Common Work Results for Electrical" for channel and angle iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch (13-mm) steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.

C. Wires: ASTM A641/A641M, Class 3, soft temper, zinc-coated steel, 12 gage (2.68 mm) .

D. Rod Hangers: 3/16-inch (5-mm) minimum diameter, cadmium-plated, threaded steel rod.

E. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

PART 3 EXECUTION

3.01 INSTALLATION

A. Comply with NECA 1.

B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.

C. Install lamps in each luminaire.

D. Supports:

1. Sized and rated for luminaire weight.
2. Able to maintain luminaire position after cleaning and relamping.
3. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.

E. Comply with requirements in Section 260500 "Common Work Results for Electrical" for wiring connections.

3.02 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260500 "Common Work Results for Electrical."

3.03 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.

B. Luminaire will be considered defective if it does not pass operation tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION 26 51 19

SECTION 40 20 00
PROCESS PIPING

PART 1 GENERAL

1.01 SUMMARY

A. This specification defines the material and design criteria for piping materials including pipe, flanges, fittings, bolts and gaskets.

B. Section Includes

1. AS2, 304S 304 Stainless Steel Pipe
2. AG1, CS Carbon Steel Pipe
3. P80, PVC Polyvinyl Chloride Pipe
4. TU, 316S 316 Stainless Steel Pipe

1.02 RELATED DOCUMENTS

A. Contract Drawings

1.03 REFERENCES

A. The publications listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by the basic designation only. The latest editions of the applicable standards shall apply.

1. ASTM American Society of Testing Materials
   a. ASTM A53 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
   b. ASTM A105 Standard Specification for Carbon Steel Forgings for Piping Applications
   c. ASTM A269 Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service
   d. ASTM A312 Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes
   e. ASTM D638 Standard Test Method for Tensile Properties of Plastics
   f. ASTM D792 Specific Gravity (Relative Density) and Density of Plastics by Displacement.
   g. ASTM D1785 Standard Specification for Polyvinly Chloride (PVC) Schedules 40, 80, and 120
   h. ASTM D1599 Pressure Testing of Plastic Pipe
   i. ASTM F708 Standard Practice for Designing and Fabricating Pipe Hanger and Support Systems
   j. ASTM F2805 Standard Specification for Multilayer Thermoplastic and Flexible Steel Pipe and Connections
2. MSS Manufacturers Standard Society of the Valve and Fittings Industry, Inc.
   a. MSS SP58 Pipe Hangers and Supports Materials, Design and Manufacture

b. MSS SP69Pipe Hangers and Supports Selection and Application

c. MSS SP89Pipe Hangers and Support Fabrication and Installation Practices

3. ANSI American National Standards Institute

a. ANSI/ASME A13.1 Scheme for the Identification of Piping Systems

b. ANSI B16.5 Pipe Flanges and Flanged Fittings

c. ASME B16.21 Gasket Dimensions

4. ASNT American Society for Non-destructive Testing

5. AWS American Welding Society

B. The above list is not intended to be inclusive of all applicable standards and local codes. Vendor guarantees compliance with all applicable standards of industrial practice.

1.04 SYSTEM DESCRIPTION

A. General Design Requirements

1. Designation AS2 (304 Stainless Steel) for solids consumable conveyance piping including zero valent iron (ZVI) and granular activated carbon (GAC) to the microelectrolysis (ME) reactor. Used for compressed air and carbon dioxide conveyance piping.

2. Designation TU (316 Stainless Steel) for chemical conveyance piping including sulfuric acid dosing piping and sodium hydroxide dosing piping.

3. Designation AG1 (Carbon Steel) for piping from truck connection to clean water tank.

4. Designation P80 (PVC) for all main process fluid aboveground piping including influent tank fill piping, ME reactor influent and effluent piping, effluent discharge piping, and all other locations depicted within the Contract Drawings. Used for vent air conveyance piping.

5. Where pipe diameter, thickness, pressure class, pressure rating, or thrust restraint is not shown or specified, design piping system in accordance with the following:

a. Process Piping: ASME B31.3, normal fluid service unless otherwise specified.

1.05 SUBMITTALS

A. Product Data

1. Submit Manufacturer’s product data including data on pipe materials, pipe fittings, solvent cement, primer, and accessories. Provide Manufacturer’s catalog information. Indicate specific pipe and fitting data, and ratings.

2. Manufacturer’s installation instructions. Indicate hanging and support methods, joining procedures.

B. Quality Control Submissions

1. Submit quality control submissions for approval by the Project Representative.

2. Supplier’s documentation of inspection and test results.

3. Certificate of Conformance Statement indicating the equipment supplied meets the requirements of the specification.

1.06 QUALITY ASSURANCE

A. The Supplier and Inspectors must comply with the following:

1. Regularly engaged in the design and fabrication of similar equipment for a minimum of ten (10) years.
2. Calibrated instruments and equipment and documented standard procedures for performing specified testing.
3. Certified in accordance with ASNT SNT-TC-1A for testing procedures required for this Project.
4. Testing Personnel: Qualified for nondestructive test methods to be performed.
5. Inspection Services: Qualified welding inspector AWS certified, AWS QC1 qualified, with prior inspection experience of welds specified.

B. Welder and Welding Operator Qualifications:

1. Welders' Certificates: Submit certificates, certifying welders employed on the Work, verifying qualification within the previous 12 months to Section IX, Article III of the ASME Boiler and Pressure Vessel Code.

C. The Project Representative reserves the right to inspection and surveillance at any time during fabrication during normal business hours. For this project, inspections by the Supplier will be required to verify the conformance of activities or items to specified requirements. Surveillance of the Supplier’s work may be monitored by the Project Representative’s personnel to verify that the activity conforms to the specified requirements.

1.07 DELIVERY, STORAGE, AND HANDLING

A. In accordance with the Contract Documents and the following:

1. Flanges: Securely attach metal, hardboard, or wood protectors over entire gasket surface.
2. Threaded or Socket Welding Ends: Fit with metal, wood, or plastic plugs or caps.
3. Linings and Coatings: Prevent excessive drying.
4. Cold Weather Storage: Locate products to prevent coating from freezing to ground
5. Handling: Use heavy canvas or nylon slings to lift pipe and fittings.

B. Plastic Piping (P80):

1. Shipping: Do not cut, kink, or otherwise damage pipe during transportation.
2. Storage:
    a. Limit stacking of pipe to a height that will not cause excessive deformation of bottom layers of pipes under anticipated temperature conditions.
    b. Where necessary, because of ground conditions, store pipe on wooden sleepers, spaced suitably and of such widths as not to allow deformation of pipe at point of contact with sleeper or between supports.

C. Metal Piping (AG1, AS2, TU)

1. Shipping: Do not dent or otherwise damage pipe during transportation.
2. Storage: Limit stacking of pipe to a height that will not cause excessive deformation of bottom layers of pipes under anticipated temperature conditions.
3. Where necessary because of ground conditions, store pipe on wooden sleepers, spaced suitably and of such widths as not to allow deformation of pipe at point of contact with sleeper or between supports.

D. Packing and Shipping:

1. The piping materials and fittings shall be suitably protected against damage or loss during shipment.
2. Any special tools and devices required for operation, maintenance, and dismantling of any equipment shall be included and delivered with the equipment in a new, unused condition. All special tools and devices shall be marked with a stainless-steel metal tag clearly identifying it for use with the piping materials.

E. Acceptance at Site:

1. Supplier is responsible for loss or damage of merchandise while shipment is in the possession of carrier and until it is delivered and unloaded at the final destination.
2. The Contractor is responsible for unloading.
3. The Contractor is responsible for inspecting the shipment for damage or missing parts within three days of the delivery. In case of any damage or discrepancy, the Contractor to inform the Project Representative, and indicate corrective action.

F. Storage and Protection:

1. All steel bolt threads, and other exposed parts shall be coated with a metallic base, rust inhibitive lubricant to prevent corrosion during shipping and storage and galling during use.

1.08 PROJECT SITE CONDITIONS

A. See 01 10 00 Summary of Work for site conditions.

1.09 WARRANTY

A. The Work shall be warrantied in accordance with Division 00 and Section 01 78 00 – Closeout Procedures.

PART 2 PRODUCTS

2.01 COMPONENTS

A. Stainless Steel Type 304 Piping, Fittings, and Valves (AS2):

1. Service:
   a. GAC Conveyance
   b. ZVI Conveyance
   c. Compressed Air Conveyance

d. Carbon Dioxide Conveyance

2. Nominal Operating Pressure
    a. 150 psig
3. Design Pressure
    a. 200 psig
4. Nominal Operating Temperature
    a. 20 °F – 95 °F (Ambient)
5. Fittings and Valves per Contract Document and Attachment 1

B. Carbon Steel Piping, Fittings, and Valves (AG1):
    1. Service:
        a. Potable water conveyance
    2. Nominal Operating Pressure
        a. 100 psig
    3. Design Pressure
        a. 150 psig
    4. Nominal Operating Temperature
        a. 20 °F – 95 °F (Ambient)
    5. Fitting and Valves per Contract Documents and Attachment 1.

C. PVC Piping – (P80)
    1. Service:
        a. Process liquid (wastewater)
    2. Nominal Operating Pressure
        a. 50 psig
    3. Design
        a. 150 psig
    4. Nominal Operating Temperature
        a. 20 °F – 95 °F (Ambient)
    5. Fitting and Valves per Contract Documents and Attachment 1.

D. Stainless Steel Type 316 Piping (TU):
    1. Service:
        a. Sulfuric Acid
        b. Sodium Hydroxide
    2. Nominal Operating Pressure
        a. 100 psig
    3. Design Operating Pressure

a. 150 psig

4. Nominal Operating Temperature
   a. 20 °F – 95 °F (Ambient)
5. Fitting and Valves per Contract Documents and Attachment 1.

PART 3 EXECUTION

3.01 INSTALLATION—GENERAL

A. Join pipe and fittings in accordance with manufacturer's instructions, unless otherwise shown or specified.

B. Remove foreign objects prior to assembly and installation.

C. Do not install this system outside of the temperature, humidity, ventilation, and environmental conditions recommended by the Supplier.

D. Flanged Joints:
   1. Install perpendicular to pipe centerline.
   2. Bolt Holes: Straddle vertical centerlines, aligned with connecting equipment flanges or as shown.
   3. Use torque-limiting wrenches to ensure uniform bearing and proper bolt tightness.
   4. Plastic Flanges: Install annular ring filler gasket at joints of raised-face flange.
   5. Raised-Face Flanges: Use flat-face flange when joining flat-faced flanges.
   6. Verify compatibility of mating flange to adapter flange gasket prior to selecting grooved adapter flanging.
   7. Flange fillers are prohibited.
   8. Threaded flanged joints shall be shop fabricated and delivered to Site with flanges in-place and properly faced.

E. Threaded and Coupled Joints:
   1. Conform to ASME B1.20.1.
   2. Produce sufficient thread length to ensure full engagement when screwed home in fittings.
   3. Countersink pipe ends, ream and clean chips and burs after threading.
   4. Make connections with not more than three threads exposed.

F. Stainless and Carbon Steel Piping
   1. Perform In-Plant piping welding and testing in accordance with ASME B31.3, Section IX. Welding for appurtenances such as pipe supports shall be in accordance with applicable AWS welding codes.
   2. Ensure area is safe prior to welding and comply with fire protection requirements.
   3. Ensure that welds develop the full strength of the pipe and fitting, and are neat, smooth and free from projection inside the pipe

4. Weld Quality: Free of cracks, incomplete penetration, weld undercutting, excessive weld reinforcement, porosity slag inclusions, and other defects in excess of limits shown in applicable piping code. Mark each weld with symbol identifying welder.
5. Prior to welding, clean all surfaces of loose scale, rust, paint or other foreign matter. Hold parts firmly together in rigid and proper relative position for assembly welding. Cut pipes and welded fittings to required angles to ensure accurate alignments and interfacing of welding surfaces.
6. Welding of auxiliary steel, pipe supports, etc., to tank, vessel and equipment is prohibited unless shown on the Contract Drawings.
7. Do not weld attachments in or within a distance of three times the pipe wall thickness of a welded joint.

3.02 INSTALLATION—EXPOSED PIPING

A. Piping Runs:
   1. Parallel to concrete pad or column lines and perpendicular to floor, unless shown otherwise.

B. Group piping wherever practical at common elevations; install to conserve pad space and not interfere with use of space and other work.

C. Unions or Flanges: Provide at each piping connection to equipment or instrumentation on equipment side of each block valve to facilitate installation and removal.

D. Install piping so that no load or movement in excess of that stipulated by equipment manufacturer will be imposed upon equipment connection; install to allow for contraction and expansion without stressing pipe, joints, or connected equipment.

3.03 TESTING

A. Materials and equipment tests shall be made by the Contractor as specified herein, and as required by code requirements and local and state regulations. Personnel performing the test shall be qualified and experienced. Tests shall be performed as many times as necessary to assure proper quality of materials and workmanship. If any tests reveal unsatisfactory materials or workmanship, such materials or installation shall be repaired or replaced to the satisfaction of the Project Representative.

B. All piping shall be tested upon completion. All hydrostatic testing shall conform to ASME B31.3 - Code for Pressure Piping, paragraph 137. Design pressures will be provided by the Project Representative at time of submittals.

C. All appropriate safety precautions shall be exercised by the Contractor when making a hydrostatic leak test. A preliminary pneumatic or hydrostatic test not to exceed 25 psig shall be applied prior to performing the specified test pressure.

D. The pressure in the piping system shall be held for the time specified in ASME B31.3, paragraph 137.4.5.

3.04 FIELD QUALITY CONTROL

A. The Supplier is expected to have and follow an internal quality control plan detailing appropriate inspections, standards, and tests. The overall objective is to ensure a quality end product that meets or exceeds the intent of this specification

END OF SECTION 40 20 00

PIPING MATERIAL CLASSES

CLASS	REV
AG1	**0**

Sheet 1 of 1

Commodity	**Abrv.**	**Nominal Operating Pressure, psig**	**Nominal Operating Temperature, °F**	**Design Code:** ASME B31.3
				Corr Allow: 0.06250 in.
Water	UW	100	20 °F – 95 °F (Ambient)	**Design Pressure, psig**
				150
Maximum operating temperature limited to 250°F based on valve limits.				

Nominal Pipe Size, in.	½	¾	1	1 ½	2	2 ½	3	4	6	8	10	12	14	16	18	20	24
CONSTRUCTION	Threaded joints - pipe, fittings, and valves. Flanged and threaded specialty items, control valves, and in-line elements.					Butt weld joints - pipe and fittings. Flanged valves and specialty items.											
PIPE	C.S. ASTM A53 Gr. B, Seamless or ERW, Galvanized					C.S. ASTM A53 Gr. B, ERW											
	Sch. 40, T & C					Std. Wt., B.E.											
NIPPLE	Use Pipe																
FITTINGS	ASME B16.3 Class 150, Threaded, Malleable Iron, Galvanized, ASTM A197					Butt welding fittings, ASME B16.9, C.S. ASTM A234 Gr. WPB, (Sch. same as pipe), B.E.											
UNION	ASME B16.3 Class 150, Threaded, Malleable Iron, Galvanized, ASTM A197					Use Flanges											
	Dielectric union - Screwed FPT Galvanized iron body, solder joint copper tail piece, dielectric insulating sleeve. (Used at copper piping interface)																
BRANCH CONNECTION	Use straight or reducing tees					Use straight tees for full size branches; Use thredolets/weldolets for reduced branches											
THREDOLET **ELBOLET THD.** **LATROLET THD.**	ASME B16.11 Class 3000 C.S. ASTM A105, Sch 80																
WELDOLET **ELBOLET B.W.**						C.S. ASTM A105, Std. Wt. x (Branch pipe Sch.) Bore											
FLANGES (Note 2)	Blind Flange, ASME B16.5 Class 150 R.F. C.S. ASTM A105																
GASKETS	1/16 in. thick Non-Asbestos Composition, GARLOCK BLUE-GARD Style 3000 Class 150 or approved equal.																
BALL VALVE	12XX																

Notes:

1. Pressure ratings shown on the pressure and temperature ratings are limited by:
   a) C.I. Valves per ANSI B16.1 and Steel Valves per ANSI B16.34.
   b) Flanges per ANSI B16.5.
   c) Temperature limitations based on soft seated valve trims (butterfly valves). Maximum temperature for EPDM seats is 250^0F.

2. Weld neck flanges are preferred. Use slip on flanges only when space is a constraint. Use weld neck flanges when adjacent to welding fittings.

3. Flat face flanges shall be used to mate to C.I. valve or equipment.

BALL VALVE	Ball Valve, 800 # screwed ends, forged steel body, chrome plated steel ball, TFE seats and seals.	12XX
1/2" to 2"	Level Operated, Apollo 73-100 Series or Approved Equal	

PIPING MATERIAL CLASSES

CLASS	REV
P80	**0**

Sheet 1 of 1

Commodity	Abrv.	Nominal Operating Pressure, psig	Nominal Operating Temperature, °F
Non-Pressurized Vent and Overflow Lines Only for the Following Commodities:			
Drain	DR	Atm	20 °F – 95 °F (Ambient)
Tempered Water	TW	50	20 °F – 95 °F (Ambient)
Influent	INF	50	20 °F – 95 °F (Ambient)
Vent	VT	Varies	20 °F – 95 °F (Ambient)
Maximum operating temperature limited to 110°F based on limits of CPVC flanges/unions at 140 psi.			

Design Code: ASME B31.3

Corr Allow: 0.00000 in.

Design Pressure, psig

150

Nominal Pipe Size, in.	1/2	3/4	1	1½	2	3	4	6	8	10	12
CONSTRUCTION	Socket Cement joints, except flanged at valves, specialty items, control valves, and in-line elements. Socket joints shall be primed with PVC primer and cemented with solvent cement.										
PIPE	Polyvinyl Chloride (PVC) ASTM D1785 Class 12454, Sch 80.										
NIPPLE	Use Pipe										
FITTINGS	Polyvinyl Chloride (PVC) ASTM D1785 Class 12454 & ASTM D2467, Sch. 80 Socket Ends										
UNION	PVC, ASTM D1785 Class 12454 & ASTM D2467, Sch. 80, Socket Ends, Viton "O"-Ring Seals					Use Flanges					
BRANCH CONNECTION	Use tee and reducer tee fittings & reducer bushings for reduced branch size										
FLANGES	Socket-Type, Class 150 PVC, ASTM D1785 Class 12454 & ASTM D2467, Sch. 80										
	Blind Flange, Class 150 PVC, ASTM D1785 Class 12454 & ASTM D2467, Sch. 80										
BOLTING	Stainless Steel Type 316 stud bolts, ASTM A193 Gr. B8M with S.S. Type 316 heavy hex nuts ASTM A194 Gr. 8M, with 316 S.S. bolt washers installed with silicone thread lubricant.										
GASKETS	1/8 in thick GARLOCK Stress Saver 100% pure PTFE bonded to EPDM elastomer or approved equal, ASME B16.5 Class 150 full face										
BALL VALVE	112X				111X						
CHECK VALVE	6110 (Ball Check) or 7110 (Swing Check)										
BUTTERFLY VALVE	2112										
Notes:											

BALL VALVE	Ball Valve, 150#, socket ends, PVC double union body, TFE seats, Viton seals	112X or 111X
1/2" to 6"	Lever Actuated, Chemtrol Model TU or Approved Equal	
CHECK VALVE	Check Valve, 150#, Socket Ends, PVC Body, Swing Check/True Union Ball Check, EPDM Seats	6110 or 7110
1/2" to 2"	Hayward or Approved Equal	
BUTTERFLY VALVE	Butterfly Valve, #150, Socket/Threaded Ends, PVC Body, PVC Disk, EPDM Seats, 410 Stainless Steel Stem	2112
1/2" to 2"	Lever Operated, Hayward or Approved Equal	

PIPING MATERIAL CLASSES

CLASS	REV
AS2	**0**

Sheet 1 of 1

Commodity	Abrv.	Nominal Operating Pressure, psig	Nominal Operating Temperature, °F
Zero Valent Iron	ZVI	0	20 °F – 95 °F (Ambient)
Granular Activated Carbon	GAC	0	20 °F – 95 °F (Ambient)
Carbon Dioxide	CO2	12	20 °F – 95 °F (Ambient)
Carrier Air	CA	150	20 °F – 95 °F (Ambient)
Maximum operating temperature limited to 300°F based on valve limits.			

Design Code: ASME B31.3

Corr Allow: 0.03130 in.

Design Pressure, psig

200

Nominal Pipe Size, in.	1/2	3/4	1	1 ½	2	2 ½	3	4	6	8	10	12	14	16	18	20	24
CONSTRUCTION	Socket weld joints - pipe, fittings and valves. Flanged and threaded specialty items, control valves, and in-line elements.					Butt weld joints - pipe and fittings. Flanged valves and specialty items.											
PIPE	Stainless Steel, ASTM A312 Gr.TP304L/TP304 dual certified, EFW, Double Butt Seam Welded																
	Sch. 40S					Sch 10S, B.E.											
NIPPLE	Use Pipe																
FITTINGS	ASME B16.11 Class 3000, socket weld, S.S. ASTM A182 F304L					Butt welding fittings, ASME B16.9, S.S. ASTM A403 Gr. WP304L, Sch. same as pipe), B.E.											
UNION	MSS-SP-83 Class 3000, socket weld, S.S. ASTM A182 F304L, steel to steel seats					Use Flanges											
BRANCH CONNECTION	Use Fittings					Use straight tees for full size branches, use sockolets / weldolets for reduced size branches											
SOCKOLET **ELBOLET S.W.** **LATROLET S.W.**	ASME B16.11 Class 3000, S.S. ASTM 182 Gr. F304L Sch. 40S Bore																
WELDOLET **ELBOLET B.W.**						ASTM A182 F304L, Sch 10S x Sch 10S Bore, ASME B36.19											
FLANGES (Notes 1 & 4)	Blind Flange, ASME B16.5 Class 150 R.F. ASTM A182 F304L																
	Socket Weld, ASME B16.5 Class 150 R.F. ASTM A182 F304L					Weld Neck, ASME B16.5 Class 150 R.F. ASTM A182 F304L (Class 300 R.F. for Orifice Flanges) (Sch. same as Pipe) bore											
						Slip-on, ASME B16.5 Class 150 R.F. ASTM A182 F304L											
						Lap Joint, Class 150, ASME B16.5 Class 150 R.F. ASTM A182 F304L											
Nominal Pipe Size, in.	1/2	3/4	1	1 ½	2	2 ½	3	4	6	8	10	12	14	16	18	20	24
STUB END	S.S. ASTM A403 WP304L, ANSI B16.9, Short Pattern, Wall to match pipe																
BOLTING	Stainless Steel Type 316 stud bolts, ASTM A193 Gr. B8M with S.S. Type 316 heavy hex nuts and washers per ASTM A194 Gr. 8M installed with silicone thread lubricant.																
GASKETS	1/16 in. thick Non-Asbestos Composition, GARLOCK Fawn Gylon style 3500. Pressure Class to suit flange rating and facing.																
BALL VALVE (Notes 2 & 5)	141X																
	142X									A-15-GO							
BUTTERFLY VALVE (Note 3)						B-27				B-27-GO							
HOSES	SPH-20																
		SPH-55															

Notes:

1. Weld neck flanges are preferred. Use slip on flanges only when space is a constraint. Use lap joint flanges only when necessary.
2. For throttling valve services, globe valves are preferred.
3. For shutoff service, butterfly valves 14" and larger cannot be used for differential pressures in excess of 150 psig.
4. Provide flange shields at all flanged joints and at valve bonnets for all hazardous services.
5. 142X valve in sizes smaller than 2½" shall be used for instrument root valves only.

BALL VALVE		
1/2" to 2"	Ball Valve 150#, Scoekt Weld Ends, 3 Piece Construction, 304L SS body per ASTM A351 Gr. CF3, Std. port, 304 SS ball and stem, RPTFE seats and seals. 1/4 turn actuation with lockable level handle	
	Lever Operated, Apollo 86A series or equal	141X
1/2" to 6"	Ball Valve, ANSI Class 150, R.F. flanged ends, Type 316 SS body per ASTM A351 Gr. CF8M, Std. Port, 316 SS Ball and Stem, Reinforced TFE Seat and Steam Packing	
	Floating Ball, Lever Operated, Jamesbury Fig. No. 5150-11-3600-MT-1 or Approved Equal	142X

PIPING MATERIAL CLASSES

CLASS	REV
TU	**0**

Sheet 1 of 1

Commodity	Abrv.	Nominal Operating Pressure, psig	Nominal Operating Temperature, °F
Sulfuric Acid	SA	100	20 °F – 95 °F (Ambient)
Sodium Hydroxide	SH	100	20 °F – 95 °F (Ambient)
Maximum operating temperature limited to 250°F based on valve limits.			

Design Code: ASME B31.3

Corr Allow: 0.00 in.

Design Pressure, psig

150

Nominal Pipe Size, in.		¼	⅜	½	¾	1	1¼	1½	2
CONSTRUCTION		Tubing and tube compression fittings - valves, control valves, and in-line elements, Swagelok or Equal							
TUBING	**MAT'L**	Type 316 S.S. Tubing, ASTM A269 Gr. TP316 Seamless							
	WALL (in.)	0.035		0.049		0.083		0.109	
NIPPLE		Use Tubing							
FITTINGS		Use Tube Fittings, Type 316 Stainless Steel, Swagelok or Equal							
BRANCH CONNECTION		Use Tube fittings, Type 316 Stainless Steel, Swagelok or Equal							
BALL VALVE (Note 1)		14XX							
CHECK VALVE		74XX or 94XX							

Notes:

1. Use ball valve for quick opening services as required. Otherwise, gate valves are preferred.

SECTION 40 63 43
PROGRAMABLE LOGIC CONTROLLER SYSTEM

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes requirements for the programable logic controller system for this project.

B. Allen Bradley PLC Based Control System or approved equal for automated process control is required for this project.

C. Controls Contractor shall be an Allen Bradley certified industrial controls contractor or approved equal with the capacity to provide design build services for the controls system for this project

D. Carefully review the electrical drawings, PID drawing and complete construction document package for system requirements.

E. Review and include requirements of Control System Notes on drawing E0.01.

1.02 DEFINITIONS

A. Algorithm: A logical procedure for solving a recurrent mathematical problem. A prescribed set of well-defined rules or processes for solving a problem in a finite number of steps.

B. Analog: A continuously varying signal value, such as current, flow, pressure, or temperature.

C. Binary: Two-state signal where a high signal level represents "ON" or "OPEN" condition and a low signal level represents "OFF" or "CLOSED" condition. "Digital" is sometimes used interchangeably with "Binary" to indicate a two-state signal.

D. Controller: Generic term for any standalone, microprocessor-based, digital controller residing on a network, used for local or global control. Three types of controllers are indicated: network controllers, programmable application controllers, and application-specific controllers.

E. Control System Integrator: An entity that assists in expansion of existing enterprise system and support of additional operator interfaces to I/O being added to existing enterprise system.

F. E/P: Voltage to pneumatic.

G. Gateway: Bidirectional protocol translator that connects control systems that use different communication protocols.

H. HLC: Heavy load conditions.

I. I/O: System through which information is received and transmitted. I/O refers to analog input (AI), binary input (BI), analog output (AO) and binary output (BO). Analog signals are continuous and represent control influences such as flow, level, moisture, pressure, and temperature. Binary signals convert electronic signals to digital pulses (values) and generally represent two-position operating and alarm status. "Digital," (DI) and (DO), is sometimes used interchangeably with "Binary," (BI) and (BO), respectively.

J. I/P: Current to pneumatic.

K. LAN: Local area network.

L. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.

M. Mobile Device: A data-enabled phone or tablet computer capable of connecting to a cellular data network and running a native control application or accessing a web interface.

N. MTBF: Mean time between failures.

O. Network Controller: Digital controller, which supports a family of programmable application controllers and application-specific controllers, that communicates on peer-to-peer network for transmission of global data.

P. Peer to Peer: Networking architecture that treats all network stations as equal partners.

Q. POT: Portable operator's terminal.

R. Router: Device connecting two or more networks at network layer.

S. TCP/IP: Transport control protocol/Internet protocol.

T. UPS: Uninterruptible power supply.

U. USB: Universal Serial Bus.

V. User Datagram Protocol (UDP): This protocol assumes that the IP is used as the underlying protocol.

1.03 PREINSTALLATION MEETING

A. Preinstallation Conference: Conduct conference at Project site.

1.04 ACITION SUBMITTALS

A. Multiple Submissions:

1. If multiple submissions are required to execute work within schedule, first submit a coordinated schedule clearly defining intent of multiple submissions. Include a proposed date of each submission with a detailed description of submittal content to be included in each submission.
2. Clearly identify each submittal requirement indicated and in which submission the information will be provided.

3. Include an updated schedule in each subsequent submission with changes highlighted to easily track the changes made to previous submitted schedule.

B. Product Data: For each type of specified product.

1. Construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Operating characteristics, electrical characteristics, and furnished accessories indicating process operating range, accuracy over range, control signal over range, default control signal with loss of power, calibration data specific to each unique application, electrical power requirements, and limitations of ambient operating environment, including temperature and humidity.
3. Product description with complete technical data, performance curves, and product specification sheets.
4. Installation, operation, and maintenance instructions including factors effecting performance.
5. When manufacturer's product datasheets apply to a product series rather than a specific product model, clearly indicate and highlight only applicable information.
6. Each submitted piece of product literature to clearly cross reference specification and drawings that submittal is to cover.

C. Software Submittal:

1. Cross-referenced listing of software to be loaded on the PLC, gateway, and controller.
2. Description and technical data of all software provided and cross-referenced to products in which software will be installed.
3. Operating system software, operator interface and programming software, color graphic software, controller software, maintenance management software, and third-party software.
4. Include a flow diagram and an outline of each subroutine that indicates each program variable name and units of measure.
5. Listing and description of each engineering equation used with reference source.
6. Listing and description of each constant used in engineering equations and a reference source to prove origin of each constant.
7. Description of operator interface to alphanumeric and graphic programming.
8. Description of each network communication protocol.
9. Description of system database, including all data included in database, database capacity, and limitations to expand database.
10. Description of each application program and device drivers to be generated, including specific information on data acquisition and control strategies showing their relationship to system timing, speed, processing burden, and system throughout.
11. Controlled Systems: Instrumentation list with element name, type of device, manufacturer, model number, and product data. Include written description of sequence of operation including schematic diagram.

D. Shop Drawings:

1. General Requirements:

a. Include cover drawing with Project name, location, Owner, Architect, Contractor, and issue date with each Shop Drawings submission.
b. Include a drawing index sheet listing each drawing number and title that matches information in each title block.

2. Include plans, elevations, sections, and mounting details where applicable.
3. Include details of product assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
4. Plan Drawings indicating the following:

    a. Screened backgrounds of PID drawing.
    b. Proposed routing of wiring, cabling, conduit, and tubing; coordinated with building services for review before installation.

5. Schematic drawings for each controlled system indicating the following:

    a. I/O points labeled with point names shown. Indicate instrument range, normal operating set points, and alarm set points. Indicate fail position of each damper and valve, if included in Project.
    b. I/O listed in table format showing point name, type of device, manufacturer, model number, and cross-reference to product data sheet number.
    c. A graphic showing location of control I/O in proper relationship to the system.
    d. Wiring diagram with each I/O point having a unique identification and indicating labels for all wiring terminals.
    e. Unique identification of each I/O that to be consistently used between different drawings showing same point.
    f. Elementary wiring diagrams of controls for motor circuits including interlocks, switches, relays, and interface to PLC controllers.
    g. Narrative sequence of operation.
    h. Graphic sequence of operation, showing all inputs and output logical blocks.

6. Control panel drawings indicating the following:

    a. Panel dimensions, materials, size, and location of field cable, raceways, and tubing connections.
    b. Interior subpanel layout, drawn to scale and showing all internal components, cabling and wiring raceways, nameplates, and allocated spare space.
    c. Front, rear, and side elevations and nameplate legend.
    d. Unique drawing for each panel.

7. Monitoring and control signal diagrams indicating the following:

    a. Control signal cable and wiring between controllers and I/O.
    b. Point-to-point schematic wiring diagrams for each product.
    c. Control signal tubing to sensors, switches, and transmitters.
    d. Process signal tubing to sensors, switches, and transmitters.
    e. Pneumatic main air and control signal tubing to pneumatic damper and

valve actuators, pilot-positioners if applicable, and associated transducers.

8. Color graphics indicating the following:

    a. Itemized list of color graphic displays to be provided.
    b. For each display screen to be provided, a true color copy showing layout of pictures, graphics, and data displayed.
    c. Intended operator access between related hierarchical display screens.

E. System Description:

1. Complete listing and description of each report, log and trend for format and timing, and events that initiate generation.
2. System and product operation under each potential failure condition including, but not limited to, the following:

    a. Loss of power.
    b. Loss of network communication signal.
    c. Loss of controller signals to inputs and outpoints.
    d. Operator workstation failure.
    e. Server failure.
    f. Gateway failure.
    g. Network failure.
    h. Controller failure.
    i. Instrument failure.
    j. Control damper and valve actuator failure.

3. Complete bibliography of documentation and media to be delivered to Owner.
4. Description of testing plans and procedures.
5. Description of Owner training.

F. Delegated Design Submittals: For PLC system products and installation indicated as being delegated.

1. Supporting documentation showing PLC system design complies with performance requirements indicated, including calculations and other documentation necessary to prove compliance.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Statements:

1. Systems Provider's Qualification Data:

    a. Brief description of past project including physical address, number of control points, and building's primary function.
    b. Description of past project PLC system, noting similarities to Project scope and complexity indicated.
    c. Names of staff assigned to past project that will also be assigned to execute work of this Project.
    d. Owner contact information for past project including name, phone number, and email address.

e. Contractor contact information for past project including name, phone number, and email address.

2. Manufacturer's qualification data.
3. Testing agency's qualification data.

B. Welding certificates.

C. Field Quality Control Reports: For system equipment and components.

D. Sample warranty.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For PLC system.

1. Include the following:

a. Project Record Drawings of as-built versions of submittal Shop Drawings provided in electronic PDF format.
b. Testing and commissioning reports and checklists of completed final versions of reports, checklists, and trend logs.
c. As-built versions of submittal Product Data.
d. Names, addresses, email addresses, and 24-hour telephone numbers of Installer and service representatives for PLC system and products.
e. Operator's manual with procedures for operating control systems including logging on and off, handling alarms, producing point reports, trending data, overriding computer control, and changing set points and variables.
f. Programming manuals with description of programming language and syntax, of statements for algorithms and calculations used, of point database creation and modification, of program creation and modification, and of editor use.
g. Engineering, installation, and maintenance manuals that explain how to do the following:

1) Design and install new points, panels, and other hardware.
2) Perform preventive maintenance and calibration.
3) Debug hardware problems.
4) Repair or replace hardware.

h. Documentation of all programs created using custom programming language including set points, tuning parameters, and object database.
i. Backup copy of graphic files, programs, and databases on electronic media.
j. List of recommended spare parts with part numbers and suppliers.
k. Complete original-issue documentation, installation, and maintenance information for furnished third-party hardware including computer equipment and sensors.
l. Complete original-issue copies of furnished software, including operating systems, custom programming language, operator workstation software, and graphics software.
m. Licenses, guarantees, and warranty documents.

n. Recommended preventive maintenance procedures for system components, including schedule of tasks such as inspection, cleaning, and calibration; time between tasks; and task descriptions.
o. Owner training materials.

1.07 MOCKUPS

A. Build mockups to verify HMI screens and user interaction with system. Owner to review and approve prior to final HMI design.

1. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.08 WARRANTY

A. Special Warranty: Manufacturer and Installer agree to repair or replace products that fail in materials or workmanship within specified warranty period.

1. Adjust, repair, or replace failures at no additional cost or reduction in service to Owner.
2. Include updates or upgrades to software and firmware if necessary to resolve deficiencies.

    a. Install updates only after receiving Owner's written authorization.

3. Perform warranty service during normal business hours and commence within 8 hours of Owner's warranty service request.
4. Warranty Period: Two year(s) from date of Substantial Completion.

    a. For Gateway: Two -year parts and labor warranty for each.

PART 2 PRODUCTS

2.01 PLC SYSTEM DESCRIPTION

A. Allen Bradley PLC based controls system, Control Logix 5580 with 1756-L8 controllers and PanelView 5310 HMI graphic display or approved equal. It shall include all points listed on the points list and 20% spare. PID drawings shall be closely reviewed and all related controls work included.

B. Installing contractor shall be an Allen Bradley or approved equal certified industrial controls contractor with the capacity to provide these design build services for the controls system for this project.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application

2.02 CONTROLLER SOFTWARE

A. General:

1. Software applications are to reside and operate in controllers..
2. Configure controllers to use stored default values to ensure fail-safe operation. Use default values when there is a failure of a connected input instrument or loss of communication of a global point value.

B. Security:

1. Secure operator access using individual security passwords and user names.
2. Passwords restrict operator to points, applications, and system functions as assigned by system manager.
3. Record operator log-on and log-off attempts.
4. Protect from unauthorized use by automatically logging off after last keystroke. Make the delay time operator-definable.

C. Scheduling: Include capability to schedule each point or group of points in system. Each schedule is to consist of the following:

1. Weekly Schedules:

    a. Include separate schedules for each day of week.
    b. Each schedule should include capability for start, stop, optimal start, optimal stop, and night economizer.
    c. Each schedule may consist of up to 10 events.
    d. When a group of objects are scheduled together, include capability to adjust start and stop times for each member.

2. Exception Schedules:

    a. Include ability for operator to designate any day of the year as an exception schedule.
    b. Exception schedules may be defined up to a year in advance. Once an exception schedule is executed, it will be discarded and replaced by regular schedule for that day of week.

3. Holiday Schedules:

    a. Include capability for operator to define up to 99 special or holiday schedules.
    b. Place schedules on scheduling calendar with ability to repeated each year.
    c. Operator able to define length of each holiday period.

D. System Coordination:

1. Include standard application for proper coordination of equipment.
2. Include operator with a method of grouping together equipment based on function and location.
3. Include groups that may be for use in scheduling and other applications.

E. Binary Alarms:

1. Set each binary point to alarm based on operator-specified state.
2. Include capability to automatically and manually disable alarming.

F. Analog Alarms:

1. Provide each analog object with both high and low alarm limits.
2. Include capability to automatically and manually disable alarming.

G. Alarm Reporting:

1. Include ability for operators to determine action to be taken in event of an alarm.
2. Route alarms to appropriate operator workstations based on time and other conditions.
3. Include ability for alarms to start programs, print, be logged in event logs, generate custom messages, and display graphics.

H. Remote Communication:

1. Include ability for system to notify operators by phone message, text message, and email in event of an alarm.

I. Sequencing: Include application software based on sequences of operation indicated to properly sequence chillers, boilers, and other applicable equipment.

J. Control Loops:

1. Support any of the following control loops, as applicable to control required:

    a. Two-position (on/off, open/close, slow/fast) control.
    b. Proportional control.
    c. Proportional plus integral (PI) control.
    d. Proportional plus integral plus derivative (PID) control.

        1) Include PID algorithms with direct or reverse action and anti-windup.
        2) Algorithm to calculate a time-varying analog value used to position an output or stage a series of outputs.
        3) Make controlled variable, set point, and PID gains operator-selectable.

    e. Adaptive (automatic tuning).

K. Staggered Start: Prevent all controlled equipment from simultaneously restarting after a power outage. Make the order which equipment (or groups of equipment) is started, along with the time delay between starts, operator-selectable.

L. Run-Time Totalization:

1. Include software to totalize run-times for all BI and BO points.
2. Assign a high run-time alarm, if required, by operator.

2.03 ENCLOSURES

A. General:

1. NEMA 4 Enclosure with Air Conditioning to house PLC system and variable speed drives (VSDs).
2. Include enclosure door with key locking mechanism. Key locks alike for all enclosures and include one pair of keys per enclosure.

B. Environmental Requirements:

1. Include temperature-controlled cooling within the enclosure

C. Accessories:

1. Air Conditioner:

a. Electric-powered, self-contained, air-conditioning unit specially designed for electrical enclosures to maintain temperature inside enclosure below ambient temperature outside enclosure.
b. Thermostatic control with adjustable set point from 60 to 120 deg F.
c. Enclosure side or top mounting with unit capacity, as required by application.
d. Designed for closed-loop cooling with continuous operation in ambient environments up to 125 deg F.
e. HFC refrigerant.
f. Reusable and washable air filter.
g. High-performance, industrial-grade, and high-efficiency fans.
h. Furnished with power cord and polarized plug for power connection.
i. Condensate management system with base pan side drain.
j. Mounting hardware, gaskets, mounting template, and instruction manual furnished with unit.
k. Outdoor units equipped with head pressure control for low ambient operation, compressor heater, coated condenser coil, and thermostat.

2. Bar handle with keyed cylinder lock set.

2.04 ELECTRICAL POWER DEVICES

A. Control Transformers:

1. Sizing Criteria: Size control transformers for total connected load, plus additional 50 percent of connected load for future spare capacity.
2. Transformer Minimum Capacity: 100 VA.
3. Protection: Provide transformers with both primary and secondary fuses. Integral circuit breaker is acceptable in lieu of fuses.

2.05 UNINTERRUPTABLE POWER SUPPLY (UPS) UNITS

A. Furnish local UPS unit for 20 minutes operation of the PLC system.

2.06 PRESSURE INSTRUMENT SIGNAL AIR PIPING AND TUBING

A. Polyethylene Tubing: Pressure Instrument Signal Air).

1. Fire-resistant, black virgin polyethylene in accordance with ASTM D1248, Type 1, Class C, and Grade 5.
2. Complying with stress crack test in accordance with ASTM D1693.
3. Diameter, as required by application, of not less than nominal 1/4 inch.

2.07 PROCESS TUBING

A. Products in this article are intended for signals to instruments connected to liquid and steam systems.

B. Copper Tubing:

1. Seamless phosphor deoxidized copper, drawn tempered with chemical and physical properties in accordance with ASTM B75/B75M.
2. Performance, dimensions, weight, and tolerance in accordance with ASTM B280.
3. Diameter, as required by application, of not less than nominal 3/8 inch.
4. Wall thickness, as required by application, but not less than 0.030 inch.

C. Stainless Steel Tubing (for Process Tubing):

1. Seamless Type 316 stainless steel, Grade TP, cold drawn, annealed and pickled, and free from scale.
2. Chemical and physical properties in accordance with ASTM A269/A269M.
3. Diameter, as required by application, of not less than nominal 3/8 inch.
4. Wall thickness, as required by application, but not less than 0.035 inch.
5. Furnish stainless steel tubing in 20 ft. straight random lengths.

2.08 CONTROL WIRE AND CABLE

A. All Control cabling shall be TC tray rated cable or outdoor rated cable installed in schedule 40 PVC conduit.

B. Wire: Single conductor control wiring above 24 V.

1. Wire Size: Minimum 18 AWG.
2. Conductors: 7/24 soft annealed copper strand with 2- to 2.5-inch lay.
3. Conductor Insulation: 600 V, Type THWN, and 90 deg C in accordance with UL 83.
4. Conductor Insulation Colors: Black (hot), white (neutral), and green (ground).
5. Furnish on spools.

C. Single, Twisted-Shielded, Instrumentation Cable above 24 V:

1. Wire Size: Minimum 18 AWG.
2. Conductors: Twisted, 7/24 soft annealed copper strand with a 2- to 2.5-inch lay.
3. Conductor Insulation: Type THWN rating.
4. Conductor Insulation Colors:

a. Twisted Pair: Black and white.
b. Twisted Triad: Black, red, and white.

5. Shielding: 100 percent type, 0.35/0.5-mil aluminum/Mylar tape, helically applied with 25 percent overlap, and aluminum side in with tinned copper drain wire.
6. Outer Jacket Insulation: 600 V, 90 deg C rating, and Type TC cable.
7. Furnish on spools.

D. Single, Twisted-Shielded, Instrumentation Cable 24 V and Less:

1. Wire Size: Minimum 18 AWG.
2. Conductors: Twisted, 7/24 soft annealed copper stranding with a 2- to 2.5-inch lay.
3. Conductor Insulation: Nominal 15-mil thickness, constructed from flame-retardant PVC.
4. Conductor Insulation Colors:

a. Twisted Pair: Black and white.
b. Twisted Triad: Black, red, and white.

5. Shielding: 100 percent type, 1.35-mil aluminum/polymer tape, helically applied with 25 percent overlap, and aluminum side in with tinned copper drain wire.
6. Outer Jacket Insulation: 300 V, 105 deg C rating, and Type PLTC cable.
7. Furnish on spools.

2.09 IDENITIFICATION

A. Instrument Air Pipe and Tubing:

1. Engraved tag bearing the following information:

a. Service (Example): "Instrument Air."
b. Pressure Range (Example): 0 to 30 psig.

2. Letter size minimum of 0.25 inch high.
3. Engraved phenolic consisting of three layers of rigid laminate. Top and bottom layers color-coded blue with contrasting white center exposed by engraving through outer layer.
4. Include tag with brass grommet, chain, and S-hook.

B. Control Equipment, Instruments, and Control Devices:

1. Laminated acrylic or melamine plastic sign bearing unique identification.

a. Include instruments with unique identification identified by equipment being controlled or monitored, followed by point identification.

2. Engraved phenolic consisting of three layers of rigid laminate. Top and bottom layers color-coded black with contrasting white center exposed by engraving through outer layer.
3. Fastened with drive pins.
4. Instruments, control devices, and actuators with Project-specific identification

tags having unique identification numbers following requirements indicated and provided by original manufacturer do not require additional identification.

C. Raceway and Boxes:

1. For raceways housing pneumatic tubing, add phenolic tag labeled " Instrument Air Tubing."
2. For raceways housing air signal tubing, add phenolic tag labeled " Air Signal Tubing."

2.10 SOURCE QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to evaluate the following in accordance with industry standards for each product, and to verify PLC system reliability specified in performance requirements:

B. Product(s) and will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. Verify compatibility with and suitability of substrates.

B. Examine roughing-in for instruments installed in piping to verify actual locations of connections before installation.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREINSTALLATION INTEGRATION TESTING

A. Perform the following pretesting of other systems and equipment integration with PLC system before field installation:

1. Test all communications in a controlled environment to ensure connectivity.
2. Load software and demonstrate functional compliance with each control sequence of operation indicated.
3. Using simulation, demonstrate compliance with sequences of operation and other requirements indicated including, but not limited to, the following:

a. Valves and equipment controlled through PLC system.
b. Equipment faults and system recovery with fault annunciation.
c. Analog and Boolean value alarming and annunciation.

4. Develop a method for testing interfaces before deployment.

5. Submit documentation supporting compliance upon request.

3.03 GENERAL INSTALLATION REQUIREMENTS

A. Install products to satisfy more stringent of all requirements indicated.

B. Install products level, plumb, parallel, and perpendicular with building construction.

C. Support products, tubing, piping wiring, and raceways. Brace products to prevent lateral movement and sway or a break in attachment when subjected to structural design force.

D. If codes and referenced standards are more stringent than requirements indicated, comply with requirements in codes and referenced standards.

E. Fabricate openings and install sleeves in ceilings, floors, roof, and walls required by installation of products. Before proceeding with drilling, punching, and cutting, check for concealed work to avoid damage. Patch, flash, grout, seal, and refinish openings to match adjacent condition.

F. Welding Requirements:

1. Restrict welding and burning to supports and bracing.
2. No equipment is cut or welded without approval. Welding or cutting will not be approved if there is risk of damage to adjacent Work.
3. Welding, where approved, is to be by inert-gas electric arc process and is to be performed by qualified welders in accordance with applicable welding codes.
4. If requested on-site, show satisfactory evidence of welder certificates indicating ability to perform welding work intended.

G. Fastening Hardware:

1. Wrenches, pliers, and other tools that damage surfaces of rods, nuts, and other parts are prohibited for work of assembling and tightening fasteners.
2. Tighten bolts and nuts firmly and uniformly. Do not overstress threads by excessive force or by oversized wrenches.
3. Lubricate threads of bolts, nuts, and screws with graphite and oil before assembly.

H. If product locations are not indicated, install products in locations that are accessible and that will permit service and maintenance from floor, equipment platforms, or catwalks without removal of permanently installed furniture and equipment.

3.04 INSTALLATION OF IDENTIFICATION

A. Install laminated acrylic or melamine plastic signs with unique identification on face for each of the following:

1. Gateway.
2. PLC controller.
3. Enclosure.
4. Electrical power device.

5. UPS unit.

B. Warning Labels and Signs:

1. Permanently attach to equipment that can be automatically started by PLC control system.
2. Locate where highly visible near power service entry points.

3.05 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and installations, including connections.

C. Tests and Inspections: Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Perform each visual and mechanical inspection and electrical test stated in NETA ATS. Certify compliance with test parameters.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Testing of Air-Signal Tubing:

1. Test for leaks and obstructions.
2. Disconnect each pipe and tubing line before test is performed, and blowout dust, dirt, trash, condensate, and other foreign materials with compressed air. Use commercially pure compressed air or nitrogen as distributed in gas cylinders. Use of compressed air from oil-free compressor with air dryer is an acceptable alternative for test.
3. After foreign matter is expelled and line is free from obstructions, plug far end of tubing run.
4. Connect pressure source to near end of tubing run with needle valve between air supply and tubing run.
5. Connect pressure gauge accurate to within 0.5 percent of test between shutoff needle valve and tubing run under test.
6. For air signal tubing, apply test pressure of 1.5 times instrument operating pressure range. Record pressure in tubing run every 10 minutes for one hour. Allowable drop in pressure in one-hour period to not exceed 0.1 percent of test pressure.
7. For pneumatic system pressures above 30 psig, apply pressure of 1.1 times operating pressure to tubing run. Record pressure in tubing run every 10 minutes for one hour. Allowable drop in pressure in one-hour period to not exceed 1 psig.
8. For pneumatic system pressures 30 psig and below, apply pressure of 1.5 times operating pressure to tubing run. Record pressure in tubing run every five minutes for one hour. Allowable drop in pressure in one-hour period to not exceed 0.5 psig.

3.06 PLC SYSTEM I/O CHECKOUT PROCEDURES

A. Check installed products before continuity tests, leak tests, and calibration.

B. Check instruments for proper location and accessibility.

C. Check instruments for proper installation on direction of flow, elevation, orientation, insertion depth, or other applicable considerations that will impact performance.

D. Check instrument tubing for proper isolation, fittings, slope, dirt legs, drains, material, and support.

E. For pneumatic products, verify that air supply for each product is properly installed.

F. Control Damper Checkout:

1. For pneumatic control dampers, verify that pressure gauges are provided in each air line connected to the damper actuator and positioner.
2. Verify that control dampers are installed correctly for flow direction.
3. Verify that proper blade alignment, either parallel or opposed, has been provided.
4. Verify that damper frame attachment is properly secured and sealed.
5. Verify that damper actuator and linkage attachment are secure.
6. Verify that actuator wiring is complete, enclosed, and connected to correct power source.
7. Verify that damper blade travel is unobstructed.

G. Control Valve Checkout:

1. For pneumatic control valves, verify that pressure gauges are provided in each air line connected to the valve actuator and positioner.
2. Verify that control valves are installed correctly for flow direction.
3. Verify that valve body attachment is properly secured and sealed.
4. Verify that valve actuator and linkage attachment are secure.
5. Verify that actuator wiring is complete, enclosed, and connected to correct power source.
6. Verify that valve ball, disc, or plug travel is unobstructed.
7. After piping systems have been tested and put into service, but before insulating and balancing, inspect each valve for leaks. Adjust or replace packing to stop leaks. Replace valve if leaks persist.

H. Instrument Checkout:

1. Verify that instrument is correctly installed for location, orientation, direction, and operating clearances.
2. Verify that attachment is properly secured and sealed.
3. Verify that conduit connections are properly secured and sealed.
4. Verify that wiring is properly labeled with unique identification, correct type, and size and is securely attached to proper terminals.
5. Inspect instrument tag against approved submittal.
6. For instruments with tubing connections, verify that tubing attachment is secure and isolation valves have been provided.
7. For flow instruments, verify that recommended upstream and downstream distances have been maintained.
8. For temperature instruments, verify the following:

a. Sensing element type and proper material.
b. Length and insertion.

3.07 FINAL REVIEW

A. Submit written request to Owner Commissioning Agent when PLC system is ready for final review. State the following:

1. PLC system has been thoroughly inspected for compliance with Contract Documents and found to be in full compliance.
2. PLC system has been calibrated, adjusted, and tested and found to comply with requirements of operational stability, accuracy, speed, and other performance requirements indicated.
3. PLC system monitoring and control of systems results in operation according to sequences of operation indicated.
4. PLC system is complete and ready for final review.

B. Upon receipt of written request for final review, Commissioning Agent to start review within reasonable period and upon completion issue field report(s) documenting observations and deficiencies.

C. Take prompt action to remedy deficiencies indicated in reviewer's field report(s) and submit second written request after all deficiencies have been corrected. Repeat process until no deficiencies are reported.

D. Compensation for Subsequent Reviews: Should more than two reviews be required, PLC system manufacturer and Installer to compensate entity/entities performing reviews for total costs (labor and expenses) associated with subsequent reviews. Estimated cost of each subsequent review to be submitted and approved by PLC system manufacturer and Installer before review.

E. Prepare and submit closeout submittals when no deficiencies are reported.

F. Part of PLC system final review to include demonstration to parties participating in final review.

1. Provide staff familiar with PLC system installed to demonstrate operation of PLC system during final review.
2. Provide testing equipment to demonstrate accuracy and other performance requirements of PLC system that is requested by reviewers during final review.
3. Demonstration to include, but not be limited to, the following:

a. Accuracy and calibration of 20 I/O points randomly selected by reviewers. If review finds that some I/O points are not properly calibrated and not satisfying performance requirements indicated, additional I/O points may be selected by reviewers until total I/O points being reviewed that satisfy requirements equals quantity indicated.
b. Correct sequence of operation after electrical power interruption and resumption after electrical power is restored for randomly selected systems.
c. Operation of randomly selected valves in normal-on, normal-off, and failed positions.

d. Reporting of alarm conditions for randomly selected alarms, including different classes of alarms, to ensure that alarms are properly received by operators and operator workstations.
e. Trends, summaries, logs, and reports set up for Project.
f. For up to three systems randomly selected by reviewers, use graph trends to show that sequence of operation is executed in correct manner and that systems operate properly through complete sequence of operation including different modes of operations indicated. Show that control loops are stable and operating at set points and respond to changes in set point of 20 percent or more.
g. Data entry to show Project-specific customizing capability including parameter changes.
h. Execution of digital and analog commands in graphic mode.

3.08 MAINTENANCE

A. Beginning at Substantial Completion, verify that maintenance service includes six months' full maintenance by PLC system manufacturer's authorized service representative. Include monthly preventive maintenance, repair or replacement of worn or defective components, cleaning, calibration, and adjusting as required for proper operation. Use only manufacturer's authorized replacement parts and supplies.

END OF SECTION 40 63 43

SECTION 43 22 16
LIQUID AGITATORS

PART 1 GENERAL

1.01 SUMMARY

A. This Specification defines the minimum requirements to furnish all labor, materials, equipment, tools, and incidentals to supply all primary mixing equipment. This Specification describes the requirements of mixing equipment to be furnished but does not attempt to enumerate all details of accessories and appurtenances required. Such details shall be submitted by the Manufacturer and the Contractor for approval by the Project Representative. The work shall include all factory testing including installation assistance, field testing, and adjustment after installation. The mixing equipment will include all the structural and functional components that are required to render it fully usable as well as be in accordance with this Specification, drawings, and other referenced information.

1.02 SECTION INCLUDES

A. AG-400 ME Reactor Agitator

1.03 RELATED DRAWINGS

A. Contract Documents

1.04 REFERENCES

A. The publications listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by the basic designation only. The latest editions of the applicable standards shall apply.

1. ABMA American Bearing Manufacturers Association
2. AGMA American Gear Manufacturer Association
3. AISC American Institute of Steel Construction
4. ANSI American National Standards Institute
5. ASCE American Society of Civil Engineers
6. ASTM ASTM International
7. AWS American Welding Society
8. NEMA National Electrical Manufacturers' Association
9. SSPC Steel Structures Painting Council

B. The above list is not intended to be inclusive of all applicable standards and local codes. Manufacturers guarantee compliance with all applicable standards of industrial practice.

1.05 SYSTEM DESIGN

A. Each piece of mixing equipment shall be of nominal dimensions as listed below and provide sufficient mixing energy as noted. The mixing equipment shall be furnished and installed to perform satisfactorily and as specified when operated under the following conditions.

1. AG-400:

a. Agitator shall be used to incorporate 0.25 molar (M) sulfuric acid into a homogenous solution and induce and maintain off-bottom suspension of two granular media:

1) Granular activated carbon (GAC)

a) Specific gravity = 2.0 – 2.2

2) Zero-valent iron (ZVI)

a) Specific gravity = 2.2 – 3.6

b. Agitator shall be center mounted on a 4” diameter ANSI 150# flange, for a closed top, three-legged bottom vessel, with dimensions measuring 16” in diameter by 87” in overall height plus support flange for agitator mounting (4.5” straight height). The vessel is a cylinder with a cone bottom and flat top. The cylinder portion of the vessel has a straight wall height of 67” and the conical portion of the vessel as a height of 14”.

c. The operating liquid level shall be kept to approximately 78” (6.5’) which includes the bottom conical portion of the vessel.

~~d.~~ Agitator shaft will be submerged in process water with the following characteristics: pH 3.5 – 9.0 water, viscosity of 1 - 2 cP, specific gravity of approximately 1.00. The vessel will be filled in batches to operate with a working volume of 60 gallons. The vessel will be filled at a flow rate of approximately 24 gallons per minute, operate in batch for 30 – 60 minutes, and then be emptied at approximately 15 gpm.

e. Mixing power shall be sized for inducing a homogenous solution.

f. Motor shall be TEFC, 60 Hz, 230/460 V, 3-phase. No VFD required.

g. All portions of the output shaft/impeller directly in contact with the process fluid shall be type 316 stainless steel.

h. Vessel shall have three (3) 1.5” baffles located 120° with a wall clearance of 0.2” and height of 67”.

1.06 SUBMITTALS

A. Submittals to be in accordance with the Contract Documents.

B. Product Data:

1. Component information: Information including materials of construction, coatings, and catalog information of major components (with Bid).

2. Manufacturer’s standard Operations and Maintenance (O&M) Manuals prior to equipment startup. Refer to the Contract Documents for additional requirements. At a minimum the O&M Manual shall include:

a. System operation.

b. Long-term and short-term shutdown procedures.

c. Calibration procedures.

d. Cleaning procedures.

e. Troubleshooting.

f. Routine maintenance procedures.

g. List of Common spare parts.

h. Appendices containing O&M Manuals of ancillary equipment suppliers.

3. Project bill of materials including mechanical and electrical components utilized (with Bid).

4. Special installation instructions.

C. Shop Drawings:

1. Arrangement Drawings: Drawings showing location and layout of all system components including shaft, motor, and mounting connection points (with Bid).

2. Electrical Drawings: Complete wiring diagrams clearly identifying field installed cabling.

3. Structural Drawings: Empty and operating weight data for equipment and piping. Anchoring requirements, tank bridge mounting details, and reaction loads to be transmitted to the agitator mounting beam shall be provided.

D. Quality Control Submittals:

1. Documented calibration information for all instrumentation.

2. Manufacturer's documentation of inspection and test results.

3. A certificate of conformance statement indicating that the equipment supplied meets the requirements of the Specification.

4. A Site Acceptance Test (SAT) procedure shall be coordinated with Contractor and be submitted for review and acceptance by the Project Representative.

5. Quality Assurance / Quality Control Plan in accordance with the Contract Documents.

1.07 QUALITY ASSURANCE

A. The Project Representative reserves the right to inspection and surveillance at any time during fabrication within normal business hours. For this project, inspections by the Manufacturer will be required to verify the conformance of activities or items to specified requirements. The Manufacturer's work may be monitored by Project Representative's personnel to monitor or observe an activity to verify that the activity conforms to the specified requirements.

B. The mechanical agitator shall be furnished, coordinated, and tested by one supplier. Agitator gearboxes shall be factory tested prior to shipment.

C. All equipment and material shall be designed and constructed in accordance with applicable standards as indicated.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Packing and Shipping:

1. Each drive unit, including motor, shall be completely factory assembled, aligned, and crated for shipment. Accessory equipment that cannot be shipped assembled to the unit, such as shafts, baseplates, impellers, and anchorage materials, shall be separately crated, clearly marked as to the contents, and shipped on the same shipment as the drives.

2. All gears and bearings shall be protected from rusting while being stored by the application of shop-applied protective coatings. Each reducer interior shall be sprayed with a vapor phase inhibitor to further guard against internal corrosion.
3. Each component shall be tagged to identify its location, tag number, and function in the system. Identification shall be prominently displayed on the outside of the package.
4. All equipment shall be boxed, crated, or otherwise protected from damage and moisture during shipment, handling, and storage. All equipment shall be protected from exposure to corrosive fumes and shall always be kept thoroughly dry. For extended storage periods, plastic equipment wrappers should be avoided to prevent accumulation of condensate in gears and bearings. All exposed surfaces subject to rust, such as mounting flange faces, shall be covered with a rust-preventative compound.
5. Any special tools and devices required for operation, maintenance, and dismantling of any equipment shall be included and delivered with the equipment in a new, unused condition. All special tools and devices shall be marked with a stainless-steel tag clearly identifying them for use with the agitator.
6. Shaft couplings shall also be wrapped with waterproof shrink-wrap.
7. The shipped components shall be suitably protected against damage or loss during shipment. Also, the shipment skids shall include design elements (e.g., lifting rings, forklift slots, etc.) that facilitate field handling.

B. Acceptance at Site:

1. Manufacturer shall be responsible for loss or damage of equipment and materials while shipment is in the possession of carrier and until it is delivered.
2. Unloading shall be the responsibility of the Contractor. The Contractor shall perform initial inspection within three days of delivery.

C. Storage and Protection:

1. The equipment shall be stored in a clean, dry location, free from construction dust, precipitation, and excess moisture. If stored for more than two weeks, the equipment shall receive all maintenance considerations required by the Manufacturer for proper storage of the equipment. At no time shall the agitator; including all associated equipment, and appurtenances; be stored outdoors, uncovered and/or unprotected.
2. All steel bolt threads, and other exposed parts shall be coated with a metallic base, rust inhibitive lubricant to prevent corrosion during shipping and storage and galling during use.

1.09 PROJECT/SITE CONDITIONS

A. See 01 10 00 Summary of Work for site conditions.

PART 2 PRODUCTS

2.01 GENERAL

A. A single responsible Manufacturer shall furnish all system components as specified. The Manufacturer shall be responsible for designing and furnishing a ready-to-install system, which meets all flow and structural design requirements specified.

B. Design the mixing equipment to ensure long-term stability in its operating characteristics. It shall be resistant to changes in head loss, flow uniformity, corrosion, and any other effects, which would in time, cause loss of efficiency or effectiveness of its operation.

2.02 ACCEPTABLE SUPPLIERS

A. SPXFlow- Lightnin Mixers

B. Ekato

C. Chemineer

D. Cal West Mashy

E. Or Approved Equal.

F. Substitutions: No substitution will be considered unless a written request to the Project Representative is received for approval at least ten (10) days prior to the established bid date. Evidence shall be submitted to demonstrate equivalency to the products and performance levels specified. Substitution to occur in accordance with the Contract Documents.

2.03 COMPONENTS – AGITATORS

A. Components are limited to AG-400

B. Mounting:

1. The agitator drive motor shall be flange-mounted in order to minimize motor and drive shaft alignment in the field. Agitator drive motors shall be flexibly connected to the gear reducer housing. The agitator motor, speed reducer, and its mounting hardware, couplings, and shaft shall be mounted on the vessel mounting flange (4” ANSI Class 150#) provided by the vessel manufacturer, and all components, including gears and bearings, shall not be in contact with the process fluid. All portions of the output shaft/impeller directly in contact with the process fluid shall be type 316 stainless steel.

2. The agitator, motor, and their mounting hardware and couplings shall be removable without entering the tanks.

3. The shaft shall be provided with a double mechanical seal.

C. Speed Reducers:

1. The speed reducer shall be specifically designed for mixing service. To facilitate installation and maintenance, the gear drive shall be comprised of helical and spiral bevel gearing with reduction ratios as required for the speed at which the impellers are to be driven.

2. As a minimum, all helical gearing shall meet the requirements of ANSI/AGMA 2009-A99. Spiral bevel gears shall be designed in accordance with the latest AGMA standards.
3. The speed reducer shall be enclosed in a fabricated steel drive housing. The fabricated housing shall be stress relieved before machining. Housing shall be of sufficient rigidity to prevent damaging misalignment when subject to the maximum agitator assembled combined forces.
4. The speed reducer used for the agitator shall be suitable for direct connection through a flexible coupling to the electric motor drive. The speed reducer shall be capable of continuous operation in the specified service and shall have a minimum service factor of 1.25 based on motor nameplate horsepower as defined in AGMA Standard Practice 6010-F97.
5. The speed reducer output shaft shall be constructed of sufficient size to carry the weight of the impeller shaft and impellers and supported so that the shaft deflection caused by operating loads does not affect alignment of the anti-friction bearings or cause misalignment of gearing during agitator operation.
6. The thermal rating of the speed reducer must not be exceeded by the design loads, or proper cooling shall be provided.
7. General maintenance including, but not limited to, motor changes, gear changes, replacement of all antifriction bearings (except the bearings supporting the output shaft), and the oil system maintenance shall not require the removal of the speed reducer housing from its foundation.
8. Speed reducer shall be provided with attachments necessary for lifting by monorail.
9. Mounting hardware shall be provided such that speed reducer height allows for service requirements and ease of operations for oil removal.

D. Bearings:

1. Bearings throughout the design shall be anti-friction type of ball, roller, or tapered roller design. Pressed- on type or sliding, journal type bearings are not acceptable. Replacement of any gear drive anti-friction bearing, except the bearing supporting the output shaft, shall not require removal of the speed reducer housing from its foundation.

E. Shaft Bearings:

1. The output shaft bearings shall be grease lubricated with grease inlet and relief accessible from the mounting surface.
2. Grease fittings serving the agitator and output shaft bearings are to be plainly marked and each grease fitting shall be protected with a removable neoprene cover.
3. Lubrication:
4. The speed reducer oil shall have a splash lubrication system. Splash lubrication by means of an oil slinger or by gears running in an oil bath is preferred.
5. Bearings located outside the reducer oil supply shall be grease-lubricated and shall be equipped with grease fittings and seals.

6. All bearings shall be located above the agitator mounting surface.
7. The reducer shall include provisions to prevent leakage of oil down the output shaft.
8. All oil lubricated bearings shall be located above the top of the main lubricant drain and sufficiently above the speed reducer oil sump as to prevent life shortening particulate matter and sludge from entering the bearings.
9. No oil seals will be permitted below the operating oil level for rotating elements.
10. A dip stick shall be provided to measure oil levels for all systems.

F. Oil Drain:
1. A single extended oil drain shall be provided, positioned for easy access, and located to leave not more than 1/4" of residual oil within the drive housing.

G. Guards:
1. All rotating parts external to the tank must be provided with guards that meet OSHA requirements to prevent finger access. Guards shall be ventilated to prevent excess heat buildup.

H. Impeller Shaft:
1. Impeller shafts shall be of type 316 stainless steel construction.
2. The output shaft shall be totally overhung, the use of submerged or steady bearings is not permitted.
3. Shafts shall be designed for a safety factor of 4 based on the yield strength of the particular metal. Use of bottom steady bearings is not permitted.
4. Shafts shall be free of surface imperfections and inclusions which might seriously affect the fatigue strength of the shaft and its corrosion resistance.
5. Shafts supporting the impellers shall be removable from the speed reducer without disturbing the internal gearing of the speed reducer.
6. Shaft designs shall limit operating speed to a maximum of 80 percent or less of first lateral harmonic vibration frequency (critical speed) without the use of stabilizing devices or guides. The critical speed and torsional and bending stress calculations shall include the mass and moment of inertia of the impeller and couplings with and without solids buildup.
7. Shaft assembly shall be designed to be removeable through a chain lift or similar overtop removal method.

I. Impellers:
1. Each agitator shall be provided with type 316 stainless steel impeller(s). The placement of impellers shall be determined by the agitator manufacturer.
2. The material thickness shall be sufficient for long term operation at the selected rotation speed assuming constant operation.
3. Impellers shall be removable from the shaft by means of a detachable hub, detachable blades, or a flange type coupling connection.

J. Painting:

1. Normally painted surfaces not subject to continuous wetting by the process liquid shall include motors and speed reducers. These painted surfaces of the drive assembly shall be commercially blast cleaned prior to application of the Manufacturer's standard primer. Preparation shall meet Steel Structures Painting Council Surface Preparation Specification, SSPC-SP6. All blast cleaning shall take place before any assembly occurs.
2. Abrasive blasting of final assemblies with rotating components is prohibited.
3. These surfaces shall receive surfacing and painting suitable for contact with wastewater that is dosed with 0.25M sulfuric acid, GAC, and ZVI.
4. Surfaces normally left uncoated, such as flexible couplings, etc., will not require special coatings; however, the surfaces shall be protected prior to shipment by a sprayed or hand-applied covering of rust preventative compound such as Rust-Gard. This coating shall be easily removed with a common solvent.

K. Motors:

1. Electric motor shall be TEFC, 60 Hz., 230/460VAC, 3-phase.

L. Spare Parts:

1. Vendor to provide a list of recommended spare parts with prices and lead times with proposal.
2. Vendor to provide all spare parts recommended for one year of operation.

PART 3 EXECUTION

3.01 SHOP ASSEMBLY AND INSPECTION

A. The equipment specified herein shall be factory-assembled as far as practical to verify that all mating parts can be field assembled. All mating parts shall be trial fit and match-marked. The manufacturer shall submit certification of shop trial assembly and photographs of assembly before shipment. The Project Representative and installing Contractor shall be given the opportunity to witness the shop assembly.

B. Shop inspection shall be performed by a qualified inspector and certified by the Manufacturer. The inspection shall be documented, and all deficiencies noted, corrected, re-inspected, and final completion formally authorized. Final shipment authorization shall be by the Manufacturer to ensure completion of all fabrication, assembly, and inspection requirements. Inspection records and evidence of inspector qualification shall be submitted to the Project Representative upon request.

C. All openings in the equipment shall be covered with the vapor phase inhibitor impregnated paper and water repellent tape. Water repellent tape and vapor phase inhibitor treated paper will be applied over any adapter sleeves, locknuts, dipsticks, breather assemblies, and other areas or openings requiring special protection.

3.02 INSTALLATION, START-UP, AND FINAL ACCEPTANCE

A. Installation shall be done by the Contractor with installation assistance provided by the Manufacture, as requested.

B. The Project Representative will review the SAT plan. Upon successful performance of the SAT by the Project Representative or Contractor, the equipment will be considered Accepted.

3.03 FIELD SERVICE

A. The equipment supplier shall provide their standard installation field services for a minimum of one day is requested.

B. All services shall be in accordance with the Contract Documents.

3.04 FUNCTIONAL TEST

A. The following tests will be performed by the installing Contractor with the assistance of the Manufacturer's representative:

1. Functional Tests: Conduct on each unit assisted by Manufacturer's representative (as requested) as follows:

a. Alignment: Prior to facility startup, test complete assemblies for correct rotation, proper alignment and connection, quiet operation, excessive vibration, and satisfactory specified performance.

b. Perform under actual or approved simulated operating conditions.

B. Functional Test Reports: Submit reports summarizing Functional Tests.

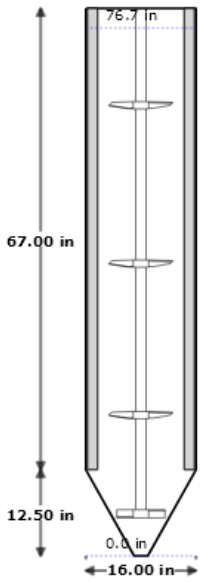
C. Provide a test report within 30 days of the functional test.

D. If any of the mixing equipment fails to perform to the specification listed herein, the Manufacturer shall make all modifications/ repairs required to meet specified performance within a reasonable amount of time. The manufacturer shall provide a written plan and schedule to meet the specified performance and shall have the option of repeating the tests with appropriate modifications subject to Project Representative's approval.

END OF SECTION 43 22 16

	CHEMINEER™ AGITATOR DATASHEET				
	Mixer Ref.:	**Mixer A**			
	Configured By:	**Kenn Johnston**			
	Configuration:	**11814d3b-cfac-47ed-a258-0c5d875ac672**			
Model No.:	**50DTN-1**	Shipping Weight:	**252.13108413841982 lb**		
Industry:	**null**	Max. Working Gauge Pressure:	**NOT IMPLEMENTED**		

TANK DETAILS	
Tank Configuration:	**Cylindrical**
Tank Diameter:	**16.00 in**
Straight Side Height:	**67.00 in**
Top Shape:	**Flat**
Bottom Shape:	**Conical; Depth: 12.50 in; Truncated Diameter: 2 in**
Number of Baffles:	**(4) @ 90°**
Baffles Width:	**1.5 in**
Baffles Wall Clearance:	**0.2222222222222222 in**
Baffles Height:	**67 in**
AGITATOR MOUNTING ARRANGEMENT	
Agitator Orientation:	**Vertical, on-center**
Agitator Mounting Surface:	**Structural Nozzle w/Flange**
Mounting Surface Height:	**0.00 in**
AGITATOR MOUNTING DESIGN LOADS	
Static Weight:	**229 lbf**
Bending Moment:	**534 in·lb**
Torque:	**458 in·lb**



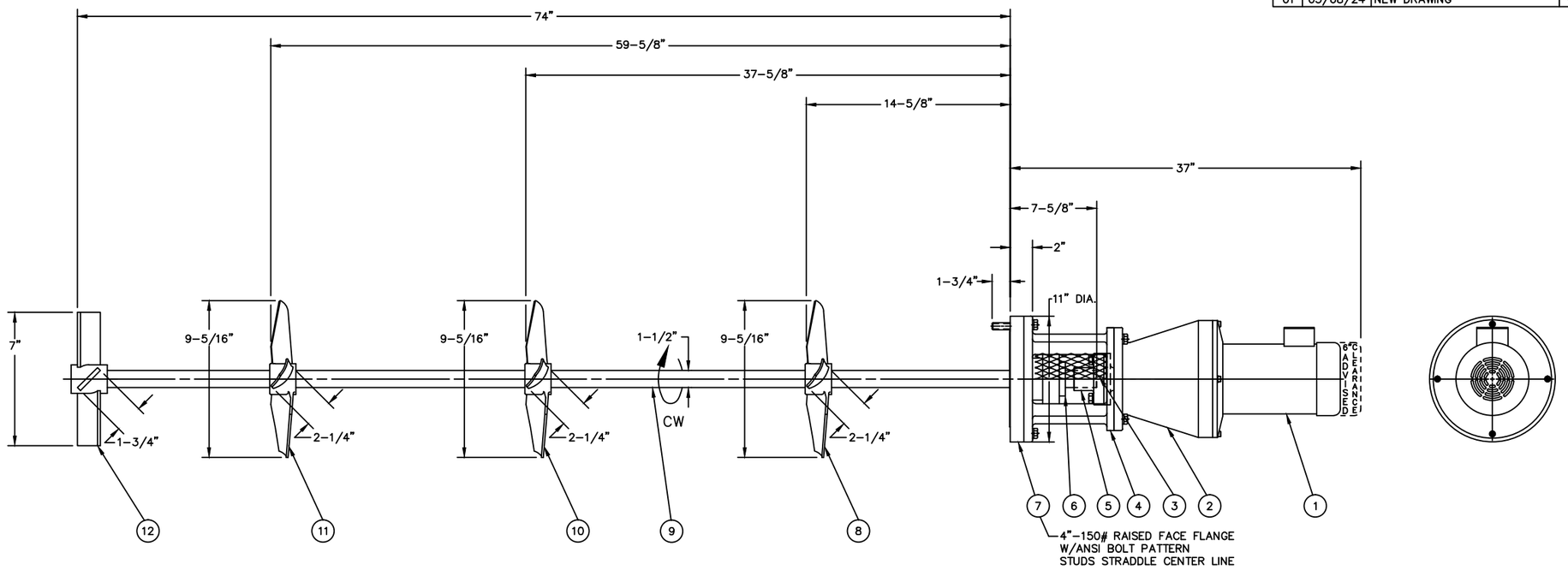
DRIVE CONFIGURATION	
Type and Options:	**Gear Drive; Nominal Speed: 350 RPM; Rotation Direction: Clockwise; Paint: Standard Paint RAL5005 Blue**
Motor:	**1.00 hp; 1800 RPM; 56C; TENV; Premium; 3-Ph; 230/460V; 60 Hz; Inverter Duty @ max 10:1 (VT) 10:1 (CT)**
Gearbox:	**Chemineer DT; Size: #50; Lubricant: Grease; Service Rating: Class III**
Shaft Seal:	**Double Mechanical Seal; Chesterton 255; Carbon/Silicon Carbide/Viton; Carbon/Silicon Carbide/ Viton**
Flange:	**Flange Size: NPS 4 150# ANSI; Stud Mounted (Tank flange must have thru holes); Flange Material: 316SS**

WETTED PARTS CONFIGURATION			
Shaft Diameter:	**1.5 in**	Shaft Material:	**316SS**
Finish:	**Chemineer Standard**	Impeller Material:	**316SS**

Station:	Extension from Mounting:	Diameter:	Pumping Direction:	Configuration:
Impeller, SC-3	**14.6 in**	**9.3 in**	**Down**	**Welded to Shaft; Integral Cast Construction**
Impeller, SC-3	**37.6 in**	**9.3 in**	**Down**	**Welded to Shaft; Integral Cast Construction**
Impeller, SC-3	**59.6 in**	**9.3 in**	**Down**	**Welded to Shaft; Integral Cast Construction**
Impeller, P-4	**74.0 in**	**7.0 in**	**Down**	**Welded to Shaft; Integral Cast Construction**

PROCESS DATA							
Process Stage:	Liquid Level:	Operating Volume:	Main Liquid:	Mix-In:	Mixture Viscosity:	Specific Gravity:	
Stage0	**76.7 in**	**13,860 in³**	**Landfill Gas Condensate**	**Mix-In Solids**	**1.0 cp**	**1.011**	
	Solids Mass Fraction: 0.033; Particle Size: 0.002						
MIXER PERFORMANCE							
Process Stage:	ChemScale:	Pumping:	Blend Time:	Uniformity:	Flow Regime:	Suspension Regime:	
Stage0	**6.20**	**237,811 in³/ min**	**0 s**	**99%**	**Turbulent**	**Uniform**	

NO.	DATE	REVISION	BY	ECR#
01	05/08/24	NEW DRAWING	–	----



NO.	DESCRIPTION	QUAN	MAT'L / TYPE
12	IMPELLER, (4) PITCHED BLADES TYPE P-4, WELDED TO THE SHAFT. BLADE MATL. = 316SS, HUB MATL. = EMPTY	1	SEE DESC.
11	IMPELLER, (3) PITCHED BLADES TYPE SC-3, WELDED TO THE SHAFT. BLADE MATL. = 316SS, HUB MATL. = EMPTY	1	SEE DESC.
10	IMPELLER, (3) PITCHED BLADES TYPE SC-3, WELDED TO THE SHAFT. BLADE MATL. = 316SS, HUB MATL. = EMPTY	1	SEE DESC.
9	EXTENSION SHAFT	1	316SS
8	IMPELLER, (3) PITCHED BLADES TYPE SC-3, WELDED TO THE SHAFT. BLADE MATL. = 316SS, HUB MATL. = EMPTY	1	SEE DESC.
7	MOUNTING FLANGE	1	316SS
6	MECHANICAL SEAL ASS'Y, REF DWG SQB12281B3-B02	1	CHESTERTON
5	LOW SPEED COUPLING	1	STEEL
4	PEDESTAL	1	CAST IRON
3	HANDHOLE COVER	4	COVERED CS
2	GEAR DRIVE, 50DT	1	CHEMINEER
1	MOTOR	1	-----

FOR APPROVAL ONLY

THE AGITATOR FLANGE IS SUPPLIED WITH INTEGRAL STUDS FOR MOUNTING TO THE TANK. THIS ARRANGEMENT IS NOT COMPATIBLE WITH PAD STYLE FLANGES. CONSULT THE AGITATOR IO&M MANUAL FOR DETAILS.

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CHEMINEER WILL SUPPLY, AT ITS DISCRETION, 316SS WETTED PARTS WHEN CARBON STEEL OR 304SS IS SPECIFIED.

FOR AGITATOR DETAILS SEE INSTALLATION, OPERATION, AND MAINTENANCE MANUAL 281

BAFFLE RECOMMENDATIONS: (4) @ 90°
1-1/2" W. X 67" LG.,
1/4" OFF TANK WALL

AGITATOR SUPPORT STRUCTURE SHOULD BE DESIGNED TO WITHSTAND THE FOLLOWING LOADS.
STATIC WEIGHT: 229 LBS
BENDING MOMENT: 45 FT-LBS
TORQUE REACTION: 38 FT-LBS

SHIPPING WEIGHT: 252 LBS
CERTIFIED BY _____ DATE _____

CRITICAL SPEED IS 264 RPM; DO NOT OPERATE BETWEEN 211 AND 317 RPM.

DO NOT OPERATE THE UNIT WITH LESS THAN ONE IMPELLER DIAMETER LIQUID COVERAGE ABOVE THE LOWEST IMPELLER.

MOTOR DATA
H.P. 1.00 RPM 1800
PHASE 3 HZ. 60 VOLTS 230/460
ENCLOSURE TENV FRAME 56C
HI EFF. STD DUTY 1.15 S.F.

CHEMINEER QUOTE # SQB012281/B3
CUSTOMER EQ.# MIXER B
QUANTITY 1
NOMINAL UNIT RPM 350
SERVICE RATING CLASS III

NOV / Chemineer™

MODEL 50DTN-1

FOR: SAME AS BILL-TO

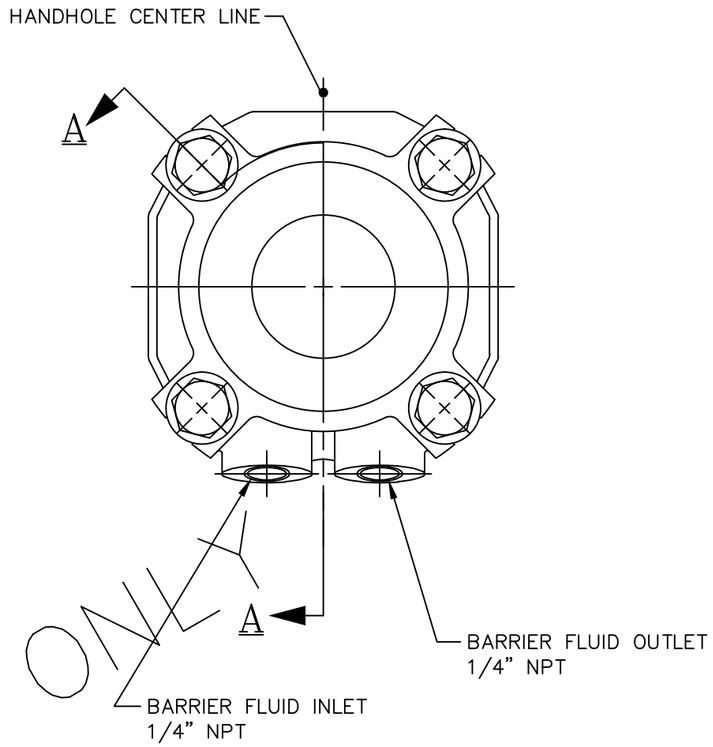
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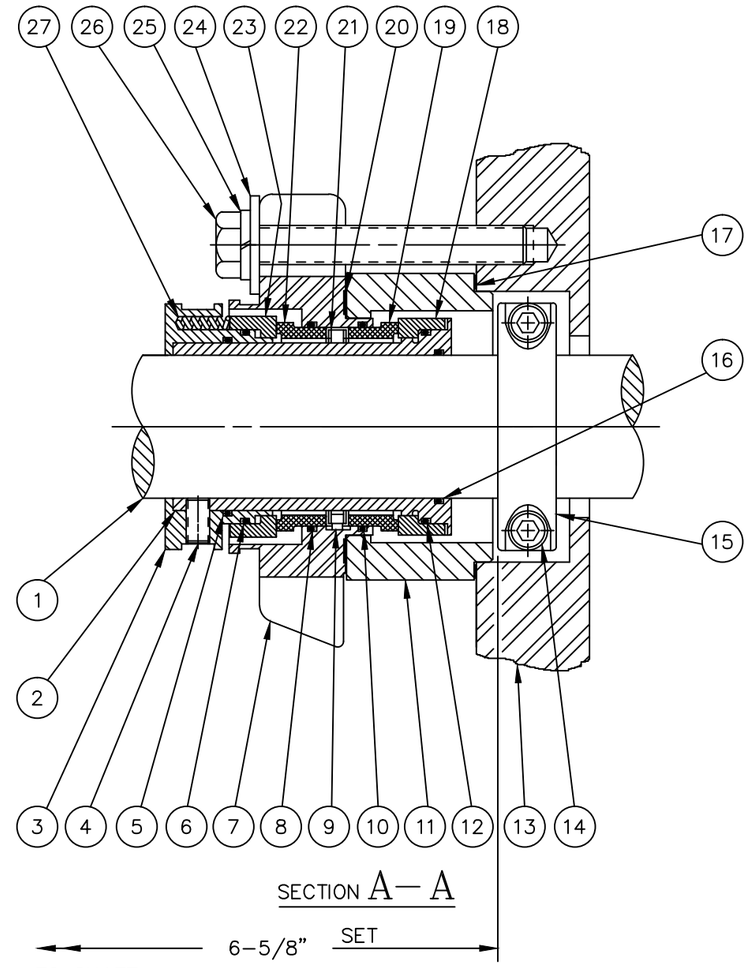
NO.	DATE	REVISION	BY	ECR#
01	05/08/24	NEW DRAWING	–	----

SEAL OPERATING PARAMETERS:
1) VESSEL TEMPERATURE: 0° F
2) VESSEL PRESSURE: 0 PSIG
3) *PRESSURIZE SEAL CAVITY TO 25–50 PSI ABOVE MAXIMUM OPERATING VESSEL PRESSURE PRIOR TO PRESSURIZING THE VESSEL OR OPERATING THE AGITATOR.

SHAFT DROPS 1/4" FOR SEAL CHANGE

NO.	DESCRIPTION	QUAN	MAT'L / TYPE
27	SPRING	8	HAST–C
26	HEX NUT	4	STEEL
25	SPRING LOCKWASHER	4	STEEL
24	FLAT WASHER	4	STEEL
23	ROTARY SEAL RING OUTBOARD	1	SLCN CARB
22	STATIONARY SEAL RING OUTBOARD	1	CARBON
21	FLOW CHANNEL (W/DRIVE CLIPS)	1	316SS
20	GASKET	1	215/3M
19	STATIONARY SEAL RING INBOARD	1	CARBON
18	ROTARY SEAL RING INBOARD	1	SLCN CARB
17	GASKET	1	TEFLON
16	O–RING	1	VITON
15	DROP COLLAR	1	303SS
14	CLAMP BOLT	2	303SS
13	MOUNTING FLANGE, 4"–150#	1	316SS
12	O–RING	1	VITON
11	ADAPTER PIECE	1	316
10	O–RING	1	VITON
9	DRIVE LUG	1	316SS
8	O–RING	1	VITON
7	GLAND	1	316SS
6	O–RING	1	VITON
5	O–RING	1	VITON
4	SET SCREW, (3) CUP POINT (3) QUARTER DOG POINT	6	316SS
3	LOCK RING	1	316SS
2	SLEEVE	1	316SS
1	SHAFT, 1–1/2" DIAMETER	1	316SS





CHEMINEER WILL SUPPLY, AT ITS DISCRETION, 316SS WETTED PARTS WHEN CARBON STEEL OR 304SS IS SPECIFIED.

PROPOSAL ONLY

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CHEMINEER QUOTE # SQB012281/B3
CUSTOMER EQ.# MIXER B
QTY. 1
REF. ASS'Y. DWG.# SQB12281B3–B01
_____
CERTIFIED BY _____ DATE _____

NOV / Chemineer™

MECHANICAL SEAL
CARTRIDGE ASSEMBLY
FOR: SAME AS BILL–TO

DRAWING NUMBER	AGS5.6	REV.	
SQB12281B3–B02	05/08/24	01	B

SECTION 43 42 41
MICRO-ELECTROLYSIS SYSTEM

PART 1 GENERAL

1.01 SUMMARY

A. This Specification defines the requirements for a specialty pressure vessel constructed to act as a Micro-electrolysis (ME) reactor. Procurement shall include all of the structural and functional components required to render the vessel fully usable. This Specification does not attempt to enumerate all details of accessories and appurtenances required. Such details shall be provided by the Manufacturer for approval by the Project Representative.

1.02 SECTION INCLUDES

A. ME-400 ME Reactor

B. BN-1000 Granular Activated Carbon (GAC) Bin

C. CY-1000 Screw Feeder

D. BN-1100 Zero Valent Iron (ZVI) Bin

E. CY-1100 Screw Feeder

F. Equipment Staircase and Platform

1.03 RELATED DRAWINGS

A. Contract Drawings.

1.04 REFERENCES

A. The publications listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by the basic designation only. The latest editions of the applicable standards shall apply.

1. ASME American Society of Mechanical Engineers
2. ANSI American National Standards Institute
3. AISC American Institute of Steel Construction
4. AWS American Welding Society
5. SSPC Steel Structures Painting Council
6. IBC International Building Code

B. The above list is not intended to be inclusive of all applicable standards and local codes. Vendor guarantees compliance with all applicable standards of industrial practice.

1.05 SYSTEM DESCRIPTION

A. ME System shall be provided with all components necessary for full function including but not limited to:

1. ME pressure vessel
2. GAC storage and feeding mechanism (screw feeder)

3. ZVI storage and feeding mechanism (screw feeder)
4. Stairway and access platform

B. The ME pressure vessel shall be compatible with a top-entering agitator that connects with a 4” ANSI Class 150# flange.

C. All ME pressure vessel wetted parts shall be made of type 316 stainless steel.

D. System staircase and access platform shall be of type 304 stainless steel.

E. The ME System shall include but not be limited to the following:

1. Integral piping, all valving (on/off and control as applicable), and instrumentation (if applicable) related to the operation and connection of the media delivery systems to the pressure vessel.
2. Lifting and earthing lugs.
3. Equipment safety guards.
4. Fasteners and accessories required for field assembly and installation.
5. Spare parts for installation and start-up.
6. Establishment of a spare parts inventory on site for operations, maintenance, and emergency parts to be provided on consignment basis.
7. Special tools required for assembly and maintenance.
8. Services of Supplier’s representatives for assistance with installation, commissioning, and start-up.

1.06 SUBMITTALS

A. Proposal:

1. General arrangement – provide spatial dimensions for the system layout and tie point connection sizes and locations.
2. Preliminary foundation loads shall be submitted with bid to allow Engineer to complete preliminary design.

B. Product Data:

1. Component information: Information including materials of construction, coatings, (including color selection) and catalog information of major components.
2. Manufacturer’s standard Operations and Maintenance (O&M) Manuals prior to equipment startup. At a minimum the O&M Manual shall include:
    a. System operation
    b. Long term and short-term shutdown procedures
    c. Calibration procedures
    d. Cleaning procedures
    e. Trouble shooting
    f. Routine maintenance procedures
    g. List of manufacturer recommended spare parts

h. Appendices containing O&M Manuals of ancillary equipment suppliers

3. Project bill of materials including mechanical and electrical components utilized with the original equipment manufacturer (OEM) names and part numbers.
4. Special installation instructions.

C. Shop Drawings:

1. Arrangement Drawings: Drawings showing location and layout of all system components including vessels, piping, valves and connection points.
2. Electrical Drawings:
   a. All drawings shall include the OEM name and part numbers.
      1) Complete wiring diagrams clearly identifying cabling to be installed in the field.
3. Structural Drawings: Empty and operating weight data for equipment and piping. Anchoring requirements and reaction loads to be transmitted to the foundation shall be provided.

D. Quality Control Submittals:

1. Welding procedures and welding specifications.
2. Documented calibration information for all instrumentation (if applicable).
3. Manufacturer's documentation of inspection and Factory Acceptance Test (FAT) (hydraulic/pressure test) results.
4. Test certificate from the factory as proof of testing for actuated valves confirming valve assemblies are tested for correct operation and the limits set by factory trained personnel.
5. A certificate of conformance statement indicating that the equipment supplied meets the requirements of the Specification.
6. A Site Acceptance Test (SAT) procedure shall be coordinated with Contractor and be submitted for review and acceptance by the Project Representative.

1.07 QUALITY ASSURANCE

A. The Project Representative reserves the right to inspection and surveillance at any time during fabrication within normal business hours. For this project, inspections by the Manufacturer shall be required to verify the conformance of activities or items to specified requirements. The Manufacturer's work may be monitored by Engineer's personnel to monitor or observe an activity to verify that the activity conforms to the specified requirements.

B. Certification: Provide a manufacturer's certificate of proper installation that states the underdrain system has been installed in accordance with the manufacturer's requirements and has been supervised by an authorized representative of the manufacturer and that all the specified testing has been conducted to insure proper performance.

C. Qualifications:

1. The Manufacturer must be regularly engaged in the design and fabrication of similar equipment for a minimum of ten years.

1.08 PROJECT/SITE CONDITIONS

A. Elevation: 601 ft AMSL

B. Seismic Conditions

1. Ss
    a. 1.35g
2. S1
    a. 0.44g
3. Ie
    a. 1.0
4. Site Classification
    a. D
5. Sds
    a. 1.03g
6. Sd1
    a. 0.62g
7. Seismic Design Category
    a. D

C. Wind Exposure Class C

D. Temperature

1. Outdoor
    a. 0ºF to 95ºF

E. Contact Water Quality:

1. pH: 3.5 –9.0 s.u.

1.09 WARRANTY

A. The Manufacturer shall warrant the equipment being supplied to the Project Representative against all defects in workmanship and materials for a period of one (1) year from the date of startup or eighteen (18) months from shipment, provided that the plant installation, startup and subsequent operations are performed in strict accordance with written and oral instructions provided by the Manufacturer.

B. Any equipment purchased by the Manufacturer, as part of the Manufacturer's equipment package shall be warranted as part of the Manufacturer's equipment.

C. The Manufacturer shall replace or repair any part or parts which are determined to be defective during the warranty period, provided that the defects are not a result of misuse or neglect.

PART 2 PRODUCTS

2.01 GENERAL

A. This Specification gives a general description of what is required. Details may vary in accordance with the exact requirements of the equipment offered by the Manufacturer. The Manufacturer shall design and furnish the complete System specified herein, including the connected drives, automation systems, and all appurtenances to make the system complete and operable. Any additional auxiliary equipment necessary for the proper operation of the proposed installation not mentioned in these Specifications shall be specifically called out in the Bid.

B. A single supplier shall furnish all System components as specified and shall be experienced in the design and manufacture of filter systems. The Manufacturer shall be responsible for designing and furnishing a ready-to-install system, which meets all flow and structural design requirements specified.

2.02 MANUFACTURERS

A. The system described in this Section shall be provided by ABM Equipment.

B. Only approved equals are allowed.

2.03 SYSTEM DESIGN

A. Vessel Size and Construction

1. The vessel straight height and nominal dimensions and nozzle locations shall be provided to the details datasheet provided in Attachment 1.
2. The vessel shall be made of material 316 stainless steel (SS).
3. The vessel shall be fully seal welded and void of any cracks and crevices.
4. The vessel and any support frames/structures shall be able to accommodate a top-entering agitator with a 4” ANSI Class 150# flange along with other agitator operation equipment such as the motor and gearbox.

B. GAC Conveyance

1. The GAC bin and screw feeder (feeding mechanism) shall consist of but not be limited to:
    a. All necessary conveyance piping between the GAC feeding mechanism and ME pressure vessel. GAC and ZVI are expected to share a common header into the ME pressure vessel.
    b. Appropriate GAC contact materials such as 304 SS, 316 SS, FDA approved vinyl, UHMW polyethylene, and ABS plastic.
    c. Motors required for conveyance of solid material.
    d. Minimum 2.5 cubic feet hopper with low level volume indication (probe type) for monitoring of solid material fill requirements.
    e. A wall-mounted NEMA-4X stainless steel electrical enclosure for necessary electrical connections, motor drives, and manual and remote adjustment of feeder conveyance rates.

2. The GAC feeding mechanism shall be able to provide the following:
    a. Minimum two (2) batches per hour.
    b. 3.3 – 8.4 lbs of GAC per batch with an estimated GAC bulk density of 22.5 – 25.0 lbs/cubic foot.
    c. Batch loading time of less than five (5) minutes.

C. ZVI Conveyance
1. The ZVI bin and screw feeder (feeding mechanism) shall consist of but not be limited to:
    a. All necessary conveyance piping between the GAC feeding mechanism and ME pressure vessel. GAC and ZVI are expected to share a common header into the ME pressure vessel.
    b. Appropriate GAC contact materials such as 304 SS, 316 SS, FDA approved vinyl, UHMW polyethylene, and ABS plastic.
    c. Motors required for conveyance of solid material.
    d. Minimum 2.5 cubic feet hopper with low level volume indication (paddle type, 5”) for monitoring of solid material fill requirements.
    e. A wall-mounted NEMA-4X stainless steel electrical enclosure for necessary electrical connections, motor drives, and manual and remote adjustment of feeder conveyance rates.
2. The ZVI feeding mechanism shall be able to provide the following:
    a. Minimum two (2) batches per hour.
    b. 6.7 – 16.7 lbs of ZVI per batch with an estimated ZVI bulk density of 62.4 – 62.6 lbs/cubic foot.
    c. Batch loading time of less than five (5) minutes

D. Stairway and Platform
1. The stairway and platform shall be made of material 304 SS.
2. All welds used in the construction of the staircase and walkway shall be cleaned and buffed.
3. The stairway and platform shall be void of cracks and crevices.
4. The stairway and platform are not to exceed the dimensions indicated in Attachment 1 by more than 3’ without prior approval from the Project Representative.

2.04 COMPONENTS

A. ME Pressure Vessel
1. Nozzles
    a. All vessel internals shall be adequately supported to prevent movement during shipment, installation, and normal operations.
    b. The vessel shall be equipped with five (5) 1.5” NPT decant ports along a straight vertical height section per Attachment 1.

c. The vessel shall be equipment with one (1) 1.5” NPT influent port near the top of the vessel on the side wall per Attachment 1.

d. The vessel shall be equipment with five (5) ¾” NPT sensor ports angled at 20° from the horizontal on the vessel side per Attachment 1

e. The vessel shall include one vessel top (1) ½” NPT port for the purpose of installing a pressure relief valve per Attachment 1.

f. The vessel shall include two (2) 3/8” NPT nozzles on top of the vessel for the purpose of spraying clean water over the media per Attachment 1.

g. The vessel shall include one (1) ¼” NPT nozzle on top of the vessel for chemical addition per Attachment 1.

h. The vessel shall include one (1) ½” NPT nozzle on top of the vessel for a pressure transmitter instrument per Attachment 1.

i. The vessel shall include one (1) 2” solids feed shoot on top of the vessel for the conveyance of GAC and ZVI per Attachment 1.

j. The vessel shall include one (1) ¾” NPT nozzle on the bottom cone sidewall for gas addition per Attachment 1.

k. The vessel shall include one (1) 2” tri clamp connection for a slurry valve at the bottom of the cone portion of the vessel per Attachment 1.

2. The vessel shall come with one (1) 2” butterfly valve for isolation of the vessel from the solids conveyance systems.

3. The vessel shall include one (1) 3” ANSI 150# flange on top of the vessel for mounting a separately provided agitator.

4. The vessel shall include four (4) baffles along the inner vessel sidewall located 90° apart per Attachment 1.

5. The vessel shall include three legs for support of the vessel with all necessary anchoring.

B. GAC Conveyance System

1. The GAC Conveyance System shall include one (1) storage hopper with a volume of 2.5 cubic feet.

2. The GAC Conveyance System shall include one (1) probe type low level indicator.

3. The GAC Conveyance System shall include a manual cover including a gasket and opening handle.

4. The GAC Conveyance System shall include one (1) solids feeder.

5. The GAC Conveyance System shall include one (1) 90-degree discharge outlet nozzle.

6. The GAC Conveyance System shall include a grounding kit for the feeder, hopper, and nozzle.

7. The GAC Conveyance System shall include any motors and/or automation necessary to meet the performance criteria described with the specification.

8. The GAC Conveyance System shall include all interconnecting piping and fittings for connection to the ME Pressure Vessel.
9. The GAC Conveyance System shall include a control system housed within a NEMA-4X stainless steel enclosure for motor control and system electrical/instrumentation connections.
10. The GAC Conveyance System shall include all other components deemed by the Supplier as necessary for successful operation.

C. ZVI Conveyance System

1. The ZVI Conveyance System shall include one (1) storage hopper with a volume of 2.5 cubic feet.
2. The ZVI Conveyance System shall include one (1) paddle type low level indicator.
3. The ZVI Conveyance System shall include a manual cover including a gasket and opening handle.
4. The ZVI Conveyance System shall include one (1) solids feeder.
5. The ZVI Conveyance System shall include one (1) 90-degree discharge outlet nozzle.
6. The ZVI Conveyance System shall include a grounding kit for the feeder, hopper, and nozzle.
7. The ZVI Conveyance System shall include any motors and/or automation necessary to meet the performance criteria described with the specification.
8. The ZVI Conveyance System shall include all interconnecting piping and fittings for connection to the ME Pressure Vessel.
9. The ZVI Conveyance System shall include a control system housed within a NEMA-4X stainless steel enclosure for motor control and system electrical/instrumentation connections.
10. The ZVI Conveyance System shall include all other components deemed by the Supplier as necessary for successful operation.

D. Platform and Staircase

1. The support platform and staircase shall be designed to meet the following dimensional requirements:
    a. The platform shall be of a height appropriate for Operator accessibility and function of all other system equipment including solids conveyance systems and the ME Pressure Vessel. This base height is anticipated to be approximately 82” – 83”.
    b. The staircase shall be constructed to meet all applicable standards while providing a minimal footprint. The staircase is anticipated to be approximately 75” long and 82” – 83” inches high.
    c. The length and width of the platform shall be constructed to provide a minimal footprint anticipated to be approximately 69” x 69”.
    d. Any designs that exceed the listed anticipated dimensions by more than 3” must be approved by the project representative.

2. The support platform shall be equipped with an unistrut capable of supporting a pressure relief valve situated on the top of the ME Pressure Vessel.
3. The support platform and staircase shall be designed according to the orientations indicated in Attachment 1.
4. The support platform and staircase shall be provided with all equipment necessary for anchoring on the structure.

PART 3 EXECUTION

3.01 SHOP ASSEMBLY AND INSPECTION

A. The equipment specified herein shall be factory assembled as far as practical to verify that all mating parts can be field assembled. All mating parts shall be trial fit and match-marked. The manufacturer shall submit certification of shop trial assembly and photographs of assembly before shipment. The Project Representative and installing Contractor shall be given the opportunity to witness the shop assembly. The assembled system shall be functionally tested prior to shipment, including actuation of valves for each configuration of filters and start-up and shut-down sequences.

B. Shop inspection shall be performed by a qualified inspector and certified by the manufacturer. The inspection shall be documented and all deficiencies noted, corrected, re-inspected, and final completion formally authorized. Final shipment authorization shall be by the manufacturer to ensure completion of all fabrication, assembly and inspection requirements. Inspection records and evidence of inspector qualification shall be submitted to the Project Representative upon request.

3.02 DELIVERY, STORAGE AND HANDLING

A. Packing and Shipping:

1. All equipment shall be provided to the site, to be unloaded by the installing Contractor with assistance from the Manufacturer as specified herein.
2. All equipment shall be boxed, crated, or otherwise protected from damage and moisture during shipment, handling, and storage. All equipment shall be protected from exposure to corrosive fumes and shall always be kept thoroughly dry. For extended storage periods, plastic equipment wrappers should be avoided to prevent accumulation of condensate in gears and bearings.
3. Each component shall be tagged to identify its location, tag number, and function in the system. Identification shall be prominently displayed on the outside of the package. All instrumentation shall have permanent stainless-steel tag firmly attached and permanently and indelibly marked with the instrument tag number, as given in the Drawings, shall be provided on each piece of equipment supplied.
4. Any special tools and devices required for operation, maintenance, and dismantling of any equipment shall be included and delivered with the equipment in a new, unused condition. All special tools and devices shall be marked with a stainless steel tag clearly identifying them for use with the filter Systems.
5. Securely blank all openings by using gasketed blank flanges (metal, plastic or wood) that have been drilled to the proper bolt circle and secured to the flange. Blanked nozzles shall also be wrapped with waterproof shrink-wrap.

B. Acceptance at Site:

1. Manufacturer shall be responsible for loss or damage of equipment and materials while shipment is in the possession of carrier and until it is delivered and unloaded at the destination.

C. Storage and Protection:

1. The equipment shall be stored in a clean, dry location, free from construction dust, precipitation and excess moisture. If stored for more than two weeks, the equipment shall receive all maintenance considerations required by the Manufacturer for proper storage of the equipment. At no time shall the treatment modules, including all associated equipment, media, and appurtenances, be stored outdoors, uncovered and/or unprotected.
2. The shipped components shall be suitably protected against damage or loss during shipment. The shipment skids shall include design elements (e.g., lifting rings, forklift slots, etc.) that facilitate field handling.
3. All steel bolt threads and other exposed parts shall be coated with a metallic based, rust inhibitive lubricant to prevent corrosion during shipping and storage as well as galling during use.

3.03 INSTALLATION, START-UP AND FINAL ACCEPTANCE

A. Installation shall be done by the Contractor with installation assistance provided by the Manufacturer as specified herein.

B. The manufacturer shall provide assistance (if required) to the installing Contractor to perform Functional Testing of all equipment to ensure safe and satisfactory operation, as witnessed and approved by the Project Representative. Prior to startup, all equipment shall be inspected by the Manufacturer for proper alignment, quiet operation, proper connection, and satisfactory performance.

C. Equipment shall be started-up by the Manufacturer or his separate Subcontractor(s).

D. Upon testing of the performance of the equipment based on the SAT procedure and determination by the Engineer that the equipment performs in accordance with these specifications. Contractor shall install media according to supplier’s instructions.

3.04 FIELD SERVICE

A. The Manufacturer shall provide the service of a qualified representative for one day of installation and inspection of the equipment, specifically to supervise the installation of the media, and one day for startup and training of operation personnel.

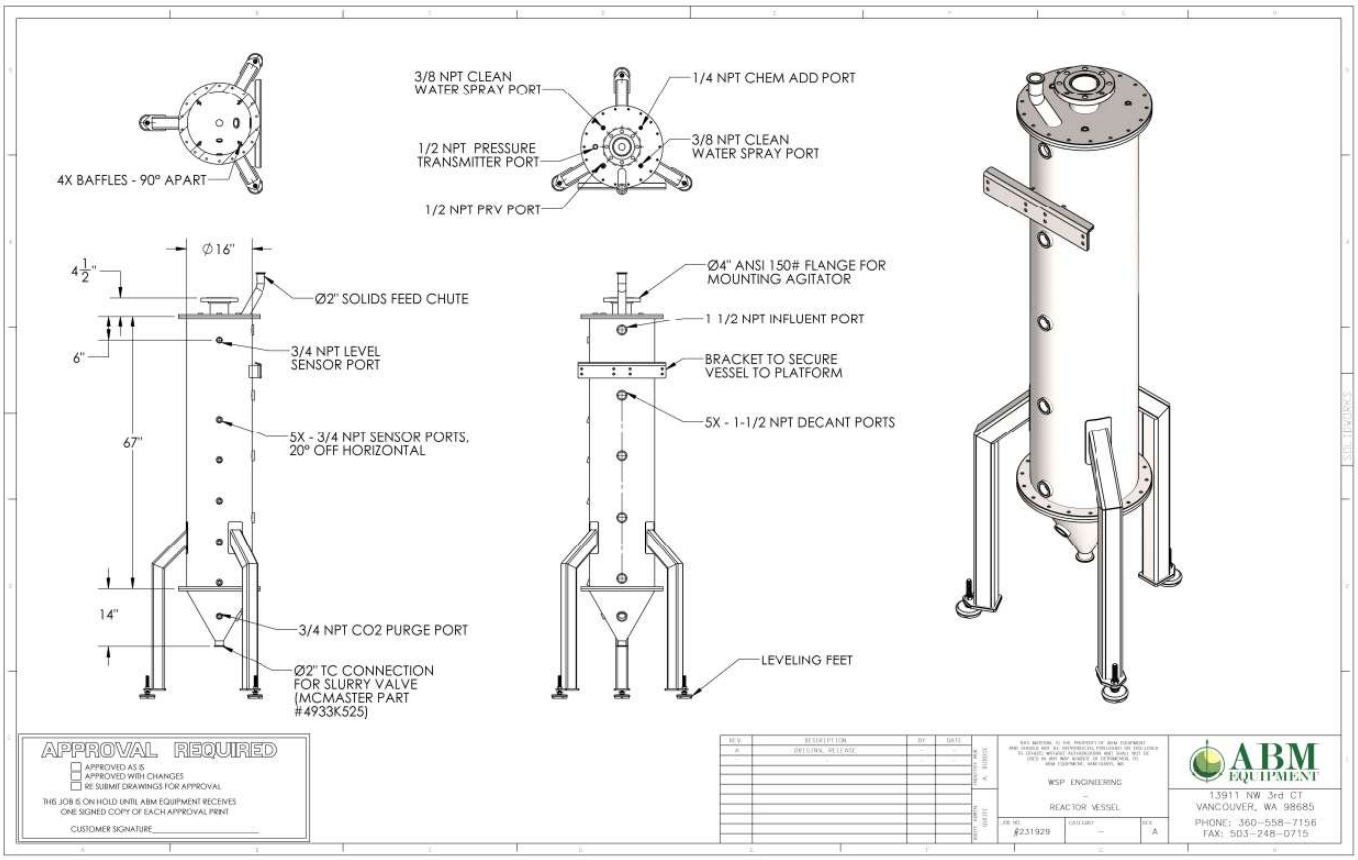
3.05 PERFORMANCE TEST

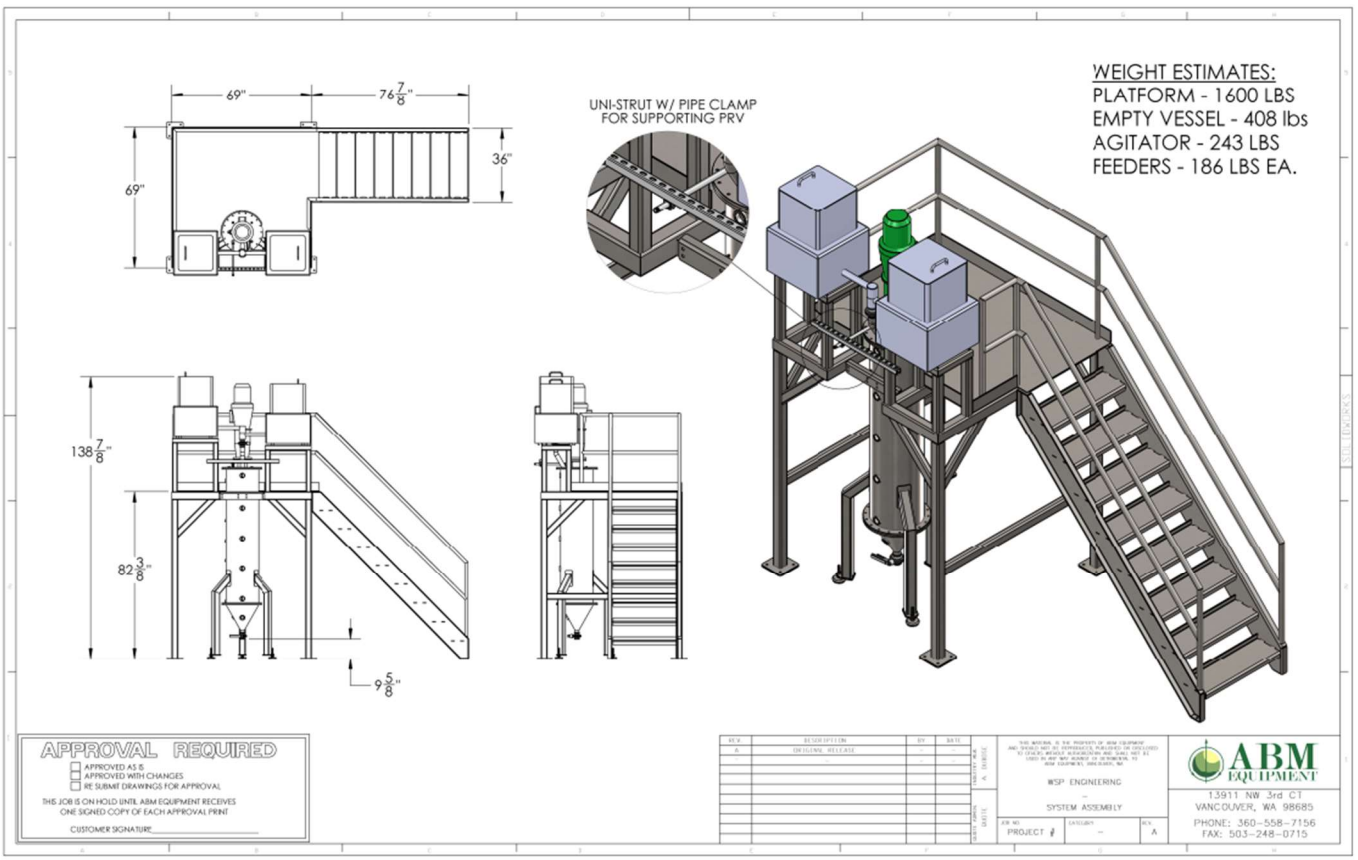
A. The system shall be tested over a period of time as determined by the Manufacturer to fully demonstrate the ability to meet specification. The filter system shall be tested at varying inputs to demonstrate the system’s ability to meet demand and adjust accordingly.

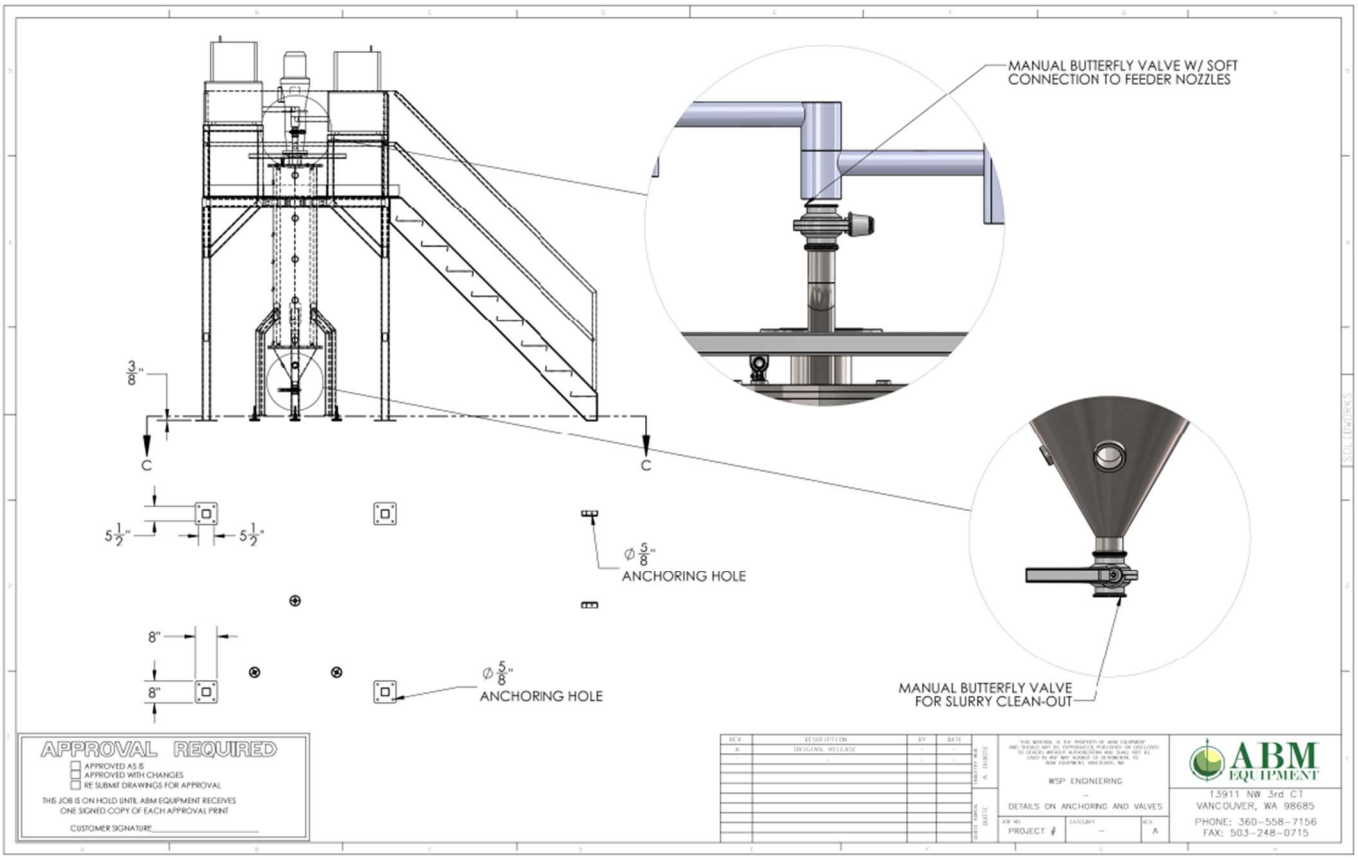
B. Manufacturer shall submit testing procedure for approval by the Project Representative.

C. Provide a test report within 30 days of the Functional Test and no later than 1 week after the Performance Test.

END OF SECTION 43 42 41


4X BAFFLES - 90° APART
3/8 NPT CLEAN WATER SPRAY PORT
1/4 NPT CHEM ADD PORT
1/2 NPT PRESSURE TRANSMITTER PORT
3/8 NPT CLEAN WATER SPRAY PORT
1/2 NPT PRV PORT
Ø16"
4 1/2"
Ø2" SOLIDS FEED CHUTE
6"
3/4 NPT LEVEL SENSOR PORT
67"
5X - 3/4 NPT SENSOR PORTS, 20° OFF HORIZONTAL
14"
3/4 NPT CO2 PURGE PORT
Ø2" TC CONNECTION FOR SLURRY VALVE (MCMASTER PART #4933K525)
Ø4" ANSI 150# FLANGE FOR MOUNTING AGITATOR
1 1/2 NPT INFLUENT PORT
BRACKET TO SECURE VESSEL TO PLATFORM
5X - 1-1/2 NPT DECANT PORTS
LEVELING FEET
APPROVAL REQUIRED
APPROVED AS IS
APPROVED WITH CHANGES
RE SUBMIT DRAWINGS FOR APPROVAL
THIS JOB IS ON HOLD UNTIL ABM EQUIPMENT RECEIVES ONE SIGNED COPY OF EACH APPROVAL PRINT
CUSTOMER SIGNATURE
WSP ENGINEERING
REACTOR VESSEL
#231929
A
ABM EQUIPMENT
13911 NW 3rd CT
VANCOUVER, WA 98685
PHONE: 360-558-7156
FAX: 503-248-0715


69"
76 7/8"
36"
69"
UNI-STRUT W/ PIPE CLAMP FOR SUPPORTING PRV
WEIGHT ESTIMATES:
PLATFORM - 1600 LBS
EMPTY VESSEL - 408 lbs
AGITATOR - 243 LBS
FEEDERS - 186 LBS EA.
138 7/8"
82 3/8"
9 5/8"
APPROVAL REQUIRED
APPROVED AS IS
APPROVED WITH CHANGES
RE SUBMIT DRAWINGS FOR APPROVAL
THIS JOB IS ON HOLD UNTIL ABM EQUIPMENT RECEIVES ONE SIGNED COPY OF EACH APPROVAL PRINT
CUSTOMER SIGNATURE
WSP ENGINEERING
SYSTEM ASSEMBLY
PROJECT #
A
ABM EQUIPMENT
13911 NW 3rd CT
VANCOUVER, WA 98685
PHONE: 360-558-7156
FAX: 503-248-0715


MANUAL BUTTERFLY VALVE W/ SOFT CONNECTION TO FEEDER NOZZLES
3/8"
C
C
5 1/2"
5 1/2"
Ø 5/8"
ANCHORING HOLE
8"
8"
Ø 5/8"
ANCHORING HOLE
MANUAL BUTTERFLY VALVE FOR SLURRY CLEAN-OUT
APPROVAL REQUIRED
APPROVED AS IS
APPROVED WITH CHANGES
RE SUBMIT DRAWINGS FOR APPROVAL
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DETAILS ON ANCHORING AND VALVES
PROJECT #
ABM EQUIPMENT
13911 NW 3rd CT
VANCOUVER, WA 98685
PHONE: 360-558-7156
FAX: 503-248-0715