West Point Treatment Plant Secondary Mixed Liquor Blower Replacement

Contract C01397C20

Volume 2 of 2

Technical Specifications
Contract Drawings

June 2020

King County

Department of Natural Resources and Parks
Wastewater Treatment Division

West Point Treatment Plant
Secondary Mixed Liquor Blower Replacement

Contract C01397C20

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King County

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King County

Department of Natural Resources & Parks
Wastewater Treatment Division

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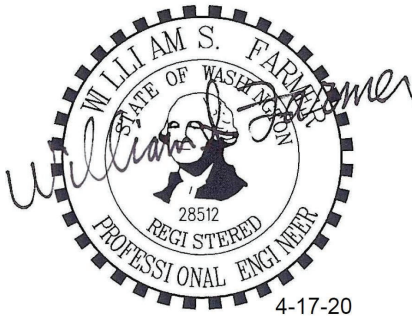

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King County

Department of Natural Resources & Parks
Wastewater Treatment Division

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SECTION 01 11 00

SUMMARY OF WORK

PART 1 GENERAL

1.01 SUMMARY

A. This Section contains a summary of the work in this Contract and other known work in the vicinity of the Contract work.

B. The work to be performed under this Contract consists of furnishing all tools, equipment, materials, supplies, and manufactured articles; furnishing all labor, transportation, and services, including fuel, power, water, and essential communications; and performing all work or other operations required for the fulfillment of the Contract, in strict accordance with the Contract Documents. Provide work complete. Provide all work, materials, and services not expressly indicated in the Contract Documents that may be necessary for the complete and proper construction of the work and administration of the contract.

C. The project work is located at West Point Treatment Plant, 1400 Discovery Park Blvd, Seattle, WA 98199. The purpose of this project is to reduce energy consumption in compliance with King County Ordinance 16927. The project replaces two existing centrifugal blowers with two new high-speed turbo blowers in the blower room located inside the Intermediate Pump Station building. The work also includes removing and salvaging the existing blowers and related piping.

1.02 WORK OF THIS CONTRACT

A. The work of this Contract includes:
   1. Installation of two new high-speed turbo blowers including appurtenances and piping modifications in the blower room at the Intermediate Pump Station.
   2. Removing and salvaging two existing blowers and appurtenances.
   3. Blower testing.
   4. Work shall be fully coordinated with the Project Representative who will coordinate with plant operators to assure that treatment plant operations are maintained at all times.
   5. Provide required documentation.
   6. And all other work as defined in the Contract Documents.

B. Accomplishment of work in the Contract Documents shall meet all requirements of the Contract including timeframes specified by Section 01 14 00.

C. The above description is not intended to be complete. The work to be completed is provided for in the Contract Documents. The summary in this Section is not intended to relieve the Contractor of the responsibility for reading and understanding the Contract Documents.

D. Federal, State and Local Laws, Statutes and Regulations are not individually referenced. This provision incorporates by reference the latest version of statutes, laws and regulations. In case of conflict between the requirements of the specifications and requirements of the statutes and regulations, the contractor shall bring them to the attention of the Project Representative. Lacking a specific response, the more stringent shall control. In no case can this contract be interpreted to override statutes and regulations of governing authorities.

E. National and industry codes cited, such as IBC, NEC, NFPA, shall include amendments and supplements by the authority having jurisdiction whether stated or not.

1.03 WORK UNDER OTHER COUNTY CONTRACTS OR BY COUNTY STAFF

A. West Point Treatment Plant is an operating facility with treatment operations that cannot be disrupted. All work must be fully coordinated with the Project Representative and plant operations staff.

B. Normal plant maintenance tasks.

C. Work Order contracts.

D. Digester 6 LSG Pipe Replacement.

E. EPS/IPS VFD Replacement pump rebuilds.

F. Floor Risk Reduction Commissioning and Testing.

G. Plant Preventative Maintenance activities.

1.04 OTHER RELATED CONTRACTS

A. Cooperate and coordinate with all agencies, trades, and contractors involved in the execution of these as well as work of others not listed but requiring coordination.

1.05 SPECIFICATION LANGUAGE

A. Specifications are written mostly in imperative and streamlined form. Unless indicated otherwise, this imperative language is directed to the Contractor. Additionally, the words "shall be" shall be included by inference where a colon (:) is used within sentences or phrases.
   1. Examples:
      a. Aggregate: ASTM C33.
      b. Adhesive: Spread with notched trowel.

B. Individual Specification sections may include a reference to other sections. Specification sections referenced are intended only to assist in identifying associated work and are not intended and shall not be considered to be all inclusive. The Contractor is responsible for performing all the work in the Contract Documents whether referenced in the specific specifications or not.

C. Whenever there is wording stating that an item is “as specified”, “as shown”, or “as indicated”, the reference is to all the Contract Documents. Stating “as specified”, “as shown”, or “as indicated” does not refer necessarily to a Drawing or Specification, but it refers to either.

D. Furnish, Install, Perform, Provide: The word “furnish,” when used in connection with services, materials, or equipment, shall mean to supply and deliver said services, materials, or equipment to the Site (or some other specified location) ready for use or installation and in usable or operable condition.
   1. The word “install,” when used in connection with services, materials, or equipment, shall mean to put into use or place in final position said services, materials, or equipment complete and ready for intended use.
   2. The words “perform” or “provide,” when used in connection with services, materials, or equipment, shall mean to furnish and install said services, materials, or equipment complete and ready for intended use.
   3. If the Contract Documents establish an obligation of Contractor with respect to specific services, materials, or equipment, but do not expressly use any of the four words “furnish,” “install,” “perform,” or “provide,” then Contractor shall furnish and install said services, materials, or equipment complete and ready for intended use.

E. Unless otherwise indicated, all materials and equipment incorporated into the Work shall be as specified and shall be new and free of defects.

F. Requirements for UL or FM label shall mean UL or FM label or other OSHA/Nationally Recognized Testing Lab (NRTL) agency when approved by Authority Having Jurisdiction (AHJ).

1.06 REFERENCES

A. Whenever a Specification in this Contract references the specifications of WSDOT or other Jurisdiction Having Authority, it is to define the technical standards to be met for this Contract; only the technical standards are referenced. Administrative provisions such as Measurement and Payment of the referenced specification shall not apply to this Contract in any instance.

B. References to industry, association and governing codes and standards are to be interpreted as reference to the version current at the date of submission of the contract bids.

1.07 STANDARDIZED EQUIPMENT

A. Pursuant to King County Code 2.93, the Wastewater Treatment Division has conducted a process to standardize certain equipment to achieve overall system efficiencies. Equipment designated as ‘sole source’ or allowing ‘no substitutions’ or with similar designation have been selected and specified in accordance with this code provisions.

1.08 PRODUCT REGISTRATION

A. Register King County, Wastewater Treatment Division with the equipment manufacturer to receive manufacturer’s notices on product quality, defect or safety issues. Register to the Asset Manager, Wastewater Treatment Division, King County; 201 South Jackson Street; Seattle, WA 98104.

END OF SECTION

SECTION 01 14 00

WORK RESTRICTIONS

PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies completion times, milestones, constraints, hours of work, and liquidated damages.

B. Schedule and conduct all work in a manner consistent with the Contract, and comply with the construction scheduling requirements, Contract milestones and constraints on the Work as specified.

1.02 COMPLETION TIMES

A. Achieve Substantial Completion within 250 days after the effective date of Notice to Proceed.

B. Achieve Final Acceptance within the time specified by the Project Representative and stated in the Certificate of Substantial Completion per Section 00700.

1.03 MILESTONES – NOT USED

1.04 CONSTRAINTS

A. The contracted work will be at an operating wastewater treatment plant that is continuously receiving and treating sewage. As such, all work shall be conducted in a manner that does not adversely impact or disrupt the operation of the facility. The Contractor shall coordinate the work with the Project Representative to avoid any interference with the operation of plant equipment and processes. The Contractor is responsible for mitigating the consequences of any unplanned or accidental shutdowns of network services or plant operations including fines incurred from associated permit violations.

B. The Contractor's work sequence may be constrained or interrupted by the Project Representative due to plant operational requirements.

C. Requests for plant outages shall be submitted a minimum of 2 weeks before planned work. Outage requests can not be guaranteed given potential conflicts with other requests and ongoing work at the plant including but not limited to:
   1. Digester 6 LSG Pipe Replacement
   2. EPS/IPS VFD Replacement pump rebuilds
   3. Flood Risk Reduction Commissioning and Testing
   4. Plant Preventative Maintenance activities

D. The Contractor is to account for the possibility of 10 days of Contractor work shutdown, as directed by King County, in the event that plant conditions change and previously approved work must be delayed.

E. The Contractor shall coordinate, schedule, and plan its work with the Project Representative.

1.05 HOURS OF WORK

A. Unless otherwise specified, conform with applicable jurisdictions and other pertinent ordinances regarding limitations on work hours or specific parts of the work.
   1. Request work hour variations in writing and obtain written approval from Local Authority Having Jurisdiction and the Project Representative prior to initiating work hours outside of the hours allowed by this Contract.

2. Work outside of the scheduled work hours shall be submitted and requires approval by the Project Representative 72 hours prior to the start of such work.
3. If the Contractor works unscheduled hours and/or if the Contractor has not obtained Project Representative's approval at least 72 hours prior to the start of unscheduled work, the contractor shall be liable for the costs of King County's overtime inspection at the rate of $107 for each hour for each person performing such inspection for the County.

B. Hours of work may be further modified by Section 01 41 26.

C. Submit a schedule of working hours in accordance with Section 00700.

1.06 LIQUIDATED DAMAGES

A. Liquidated damages for failure to achieve Substantial Completion: $3,482.14 per day.

B. Liquidated damages for failure to achieve Final Acceptance: $840.72 per day.

PART 2 PRODUCTS [NOT USED]

PART 3 EXECUTION [NOT USED]

END OF SECTION

SECTION 01 14 30

USE OF COUNTY FACILITIES AND EQUIPMENT

PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies the requirements for working in County facilities and use of County facilities and equipment.

1.02 COUNTY RESPONSIBILITIES

A. Only County personnel will operate the existing facility.

B. Contact between County operating personnel and the Contractor shall be through the Project Representative.

1.03 SUBMITTALS

A. Procedures: Section 01 33 00.

B. Documentation meeting the requirements for Contractor use of County equipment and special tools.

1.04 CONSTRAINTS

A. Per Section 01 14 00.

1.05 USE OF EXISTING PROCESS SYSTEM AND UTILITIES

A. No existing process or utility services shall be used without written permission from the Project Representative unless specified for Contractor use.

B. Equipment presently installed in the facility shall be available to County personnel at all times.

C. Locate all Contractor equipment and materials in an area that does not interfere with facility operation: coordinate with Project Representative.

D. If necessary to complete the work, coordinate and receive approval for all shutdowns of systems or equipment from the Project Representative. Provide a minimum of two weeks prior notice for coordination.

E. Provide lockout/tagout for energy systems using energy isolating devices, i.e., electrical, mechanical, pneumatic, hydraulic, thermal. Coordinate Contractor lockout/tagout procedure for each specific type of device with County procedure prior to implementation of the lockout/tagout. County will perform lockout/tagout for existing operating facilities.

F. Do not adjust or operate County equipment or systems except as specifically required by this Contract then do so only after approval of Project Representative.

1.06 USE OF COUNTY EQUIPMENT

A. If use of existing County overhead cranes or fixed location hoists is critically necessary for the completion of work, submit a request for use.
   1. County cranes and hoists are operated and maintained under compliance with general industry requirements WAC 296-24 and do not comply with construction industry requirements WAC 296-155.
   2. If required for construction, bring crane or hoist into compliance with and have it certified as in compliance with WAC 296-155 as a condition of use. If modification is required for use as a construction activity crane, provide a written description of the modification to the Project Representative and arrange for and make the modification only after approval of the Project Representative.
   3. Contractor's operator shall be certified per the requirements of WAC 296-155.

B. The Project Representative will review all requests to use and operate County equipment and special tools. To obtain approval, submit the following per Chapter 296-24 WAC, Chapter 296-62 WAC, and Chapter 296-155 WAC:
   1. Relevant Contractor's employee safety training records.
   2. Names of employees approved as "Authorized".
   3. Names of employees approved as a "Competent Person".
   4. Names of employees approved as "Qualified".
   5. Names of employees who are "Certified".

C. Prior to using County equipment, coordinate use and have qualified operator receive instructions on use from the Project Representative.

1.07 SPACE CLASSIFICATION AND OCCUPANCY LIMITATIONS

A. Be responsible for compliance with regulations regarding classifications of areas and spaces in facilities. These may include:
   1. Classified areas, as defined by the NFPA.
   2. Areas with occupancy limitations, as defined by the local applicable building code.
   3. Areas where there may be insufficient oxygen to sustain life.
   4. Areas defined as confined spaces in WAC Title 296-809.
   5. Hazardous areas as defined by the International Fire Code (IFC) and National Fire Protection Association (NFPA) where substances including, but not limited to, methane, chlorine, propane, hydrogen sulfide, and corrosive chemicals may be present.
   6. Areas of high noise exposure.
   7. Other restricted or specially classified areas.

B. Conduct work using means and methods that are allowable and compatible with space classifications, occupancy limitations, WAC requirements, and all other health, safety, and hazard risks.

C. Work within this Contract and other contracts may involve areas with health and safety limitations. Notify the Project Representative of limitations at least 10 days before they are created. Indicate the type, extent, duration, and other pertinent information regarding each limitation.

D. Ventilate and monitor all enclosed spaces, including excavations, areas when there is use of chemicals and coatings, and spaces exposed to or adjacent to sewage or sewage solids, in accordance with WAC 296-809. Ensure that no spaces present a hazard, including, but not limited to:
   1. Deficiency of oxygen.
   2. Methane, carbon dioxide, and hydrogen sulfide poisoning.
   3. Explosive gasses

E. Be aware that unforeseen toxic and/or flammable gasses and volatile liquids may be present in raw sewage in pipes, collectors, lift stations, and in the facility or be introduced without notice.

PART 2 PRODUCTS [NOT USED]

PART 3 EXECUTION

3.01 PROTECTION OF EQUIPMENT

A. Take precautions to protect County operating equipment, power supplies, distribution equipment, and instrumentation equipment from physical damage, and from exposure to weather, concrete dust, debris, dirt, and water.

B. Existing facilities and equipment are assumed to be in good working order. Damage or defects shall be reported to the Project Representative immediately prior to the start of work in the area.

3.02 SIGN-IN/SIGN-OUT REQUIREMENTS

A. Each day upon arrival at the Facility, report to the Administration Building and Operations Control room to sign-in on the Contractors Sign-in/Sign-out Sheet. Sign-in is required for all Contractors and subcontractors.

B. Upon departure from the Facilities, Contractor and subcontractor personnel report to the Operations Control room and sign-out on the Contractors Sign-in/Sign-out Sheet. Sign-out is required for all Contractors and subcontractors.

END OF SECTION

SECTION 01 15 00

CONSTRUCTION TESTING

PART 1 GENERAL

1.01 SUMMARY

A. This Section is supplementary to the applicable testing and inspection program in Section 00700. It describes the responsibilities of parties pertaining to testing and inspections. Additional specific testing and inspections are also specified in individual Sections.

1.02 REFERENCED STANDARDS

A. This Section incorporates by reference the latest revisions of the embedded standard referenced herein. In case of conflict between the requirements of this Section and those of a listed document, the requirements of this Section shall prevail.

Reference	Title
ASTM E329	Agencies Engaged in Construction Inspection, Testing, or Special Inspection

1.03 SUBMITTALS

A. Procedures: Section 01 33 00.

B. Qualifications: Provide documentation demonstrating accreditation as specified in ASTM E329.

C. Testing and Inspection Plan:
1. Identify tests and inspections, their timing and their frequency to meet the requirements of this Section for completion of the Work.
2. Include a weekly listing of the status of all tests and inspections and status of their submittals to the Project Representative.

D. Test results.

1.04 QUALITY ASSURANCE

A. Qualifications:
1. Independent testing company:
   a. Company and Personnel:
      1) Meet the certification and experience requirements indicated in ASTM E329.

1.05 INSPECTIONS AND TESTING

A. County responsibilities:
1. Independent acceptance testing of materials and materials as constructed in place as it deems necessary.
2. Witness tests performed by the Contractor.
3. Independent testing to verify Contractor test results as it deems necessary.
4. Required Inspections for County obtained permits including Special Inspections as required by the SBC and local building officials.

B. Contractor responsibilities:
1. Controlling the quality of its Work.

2. Testing, demonstrating, and documenting compliance with the Contract requirements, Specifications, Drawings, codes, and referenced standards for constructed items.
3. Demonstrating and documenting compliance with permits and regulatory agency requirements including requirements for Contractor obtained permits as required by the permitting authority.
4. Obtain the services of a certified Independent Testing Company to conduct quality control tests. Testing company to conform to ASTM requirements.
5. For County Acceptance Testing:
    a. Cooperate with testing personnel. Provide access to the work and to supplier's operations.
    b. Provide representative samples of materials to be tested in the required quantities.
    c. Furnish labor and facilities:
        1) For access to work to be tested.
        2) To obtain and handle test samples at the Site.
        3) To facilitate inspections and tests.
        4) For storage and curing test samples until removed to the laboratory.
        5) To repair any test areas in order to match original conditions.
        6) For testing and inspection in supplier's facilities.

C. Required testing shall not be cause for claims for delay or extra work.

1.06 COSTS

A. Paid by the County:
1. County testing and inspection, as required in this Section, except retests and re-inspections required due to defective work.
2. Additional testing as directed by Project Representative.

B. Paid by the Contractor:
1. Contractor testing and inspection and documentation, as required in this Section, to control quality and demonstrate and document conformance with the Contract Documents and applicable permits and codes.
2. Retesting and re-inspection required because of defective work.
3. Testing performed for the convenience of the Contractor.

1.07 CONFLICTING TEST RESULTS

A. In the event of conflicting test results, the test shall be re-run and compared.

B. Contractor and the Project Representative shall agree on the independent agency that will perform the retest.

C. Costs for the retest:
1. If the retest shows that the Contractor’s initial test results were acceptable as per the requirements in this Contract, then King County will be responsible for the costs of the retest.
2. If the retest shows that the Contractor’s initial test results were unacceptable as per the requirements in this Contract, then the Contractor shall be responsible for the cost of the retest.

PART 2 PRODUCTS [NOT USED]

PART 3 EXECUTION [NOT USED]

END OF SECTION

SECTION 01 16 00

LABOR MANAGEMENT PLAN

PART 1 GENERAL

1.01 SUMMARY

A. This section specifies the requirement for submittal of a Labor Management Plan on Contracts with a Contract Price of one million dollars ($1,000,000) or more at time of Contract execution by King County.

1.02 CONTRACTOR RESPONSIBILITIES

A. The Contractor acknowledges that because this is a time of the essence contract, any work stoppage, strike, slow down, picket or other disruptive activity which impacts the timely and accurate completion of the Project may cause the County significant economic damage.

B. Contractor shall comply with the provisions set forth within Section 00700 for Notice to County of Labor Disputes.

1.03 LABOR MANAGEMENT SUBMITTALS

A. Contractor shall submit the following Labor Management Plan in accordance with Section 00700 and Section 01 33 00 within 60 days following the Notice to Proceed with Work.

B. Provide a copy of the Contractor's collective bargaining agreements, if any, and their expiration dates.

C. Provide Contractor's labor relations history for both County and non-County projects of similar types of work set forth in Contract Documents for this Project for the last five years. Include the following details:
   1. Name and dates of the project.
   2. Description of the project.
   3. Final cost of the construction contract for the project.
   4. Description of any work stoppage, strike, picket, slow down or other labor disruption that occurred on the project, if any.
   5. Description of impacts to contract price or schedule resulting from the labor disruption that occurred on the project, if any.
   6. Description of the labor management methods used by the Contractor to prevent, mitigate or eliminate a labor disruption on the project.

D. Provide a description of any activities or events Contractor, or its Subcontractors, reasonably believe may cause a potential or actual work stoppage, strike, slow down or other labor disruption on the Project which may either (a) impact worker's performance at the Site or (b) impact the Contract Time or Contract Price for the Project.

E. Provide the plan(s) the Contractor and its Subcontractors will follow to prevent, mitigate or eliminate labor disruptions if they occur on the Project. Provide copies of any policies and procedures which support this plan(s).

F. Identify individual(s) responsible for implementing this Labor Management Plan for the Project. For each individual provide the following information.
   1. Name of individual and job title.
   2. Description of individual(s) experience over the last 5 years implementing labor management plans on projects of Similar Scope and Complexity to the Project. This should include:
      a. Name of project.
      b. Description of project.
      c. Final cost of the construction contract for the project.

d. Description of any labor problems or disruptions that occurred on the project and the impact the disruption had on the project.
e. Description of the steps taken by the identified individual(s) to prevent, mitigate or eliminate the labor problem or disruption for the project.

PART 2 PRODUCTS [NOT USED]

PART 3 EXECUTION [NOT USED]

END OF SECTION

SECTION 01 19 50

PROTECTION AND MAINTENANCE OF PROPERTY AND WORK

PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies protection and maintenance of underground and aboveground utilities, structures, and other improvements which may be affected by the work.

B. This Section also specifies requirements for Contractor disposition of third party claims in a timely manner.

1.02 REFERENCED STANDARDS

A. This Section incorporates by reference the latest revisions of the embedded standard referenced herein. In case of conflict between the requirements of this Section and those of a listed document, the requirements of this Section shall prevail.

Reference	Title
Chapter 19.122 RWC	Underground Utilities
WAC 296-155-657	Requirements for Protective Systems
WAC 296-24-960	Working on or Near Exposed Energy Parts

1.03 SUBMITTALS

A. Procedures: Section 01 33 00.

B. Listing of all utilities/facilities to be physically protected and relocated.

1.04 LOCATION OF EXISTING FACILITIES

A. Unless otherwise specified or approved by the Project Representative, protect, modify, and/or relocate all existing utilities required to complete the work.

B. In general, the locations of existing major utilities, whether aboveground or underground, are indicated on the Drawings with the exception of overhead power or other aboveground utilities supported on power/telephone poles. This information has been obtained from utility maps and field surveys. The County does not guarantee the accuracy or completeness of this information, and it is to be understood that other aboveground or underground facilities not shown on the Drawings may be encountered during the course of the work.

C. Contact all utility owners or operators having underground facilities within the work area and request the marking of their utilities. Be responsible for damages resulting from any failure to contact utility owners for location, routing, and marking of a specific utility and its subsequent effects. Promptly notify the Project Representative prior to any work in the area of a utility where a utility owner fails to meet its obligations under Chapter 19.122 RCW.

D. Protect, modify, and relocate all existing utilities and facilities required to accommodate Contractor's means and methods. Specific means and methods to be utilized by the Contractor are not known to the County. Therefore, the County will not be liable for utility protection, modification, and relocation not shown on the Drawings required by the Contractor due to its means and methods. It is the Contractor's responsibility to determine the requirements of the work required by the Contract Documents and make

provision for protection, modification, and relocation required to perform the work. Coordinate all protection, modification, and relocation work through the affected utility. Work to be completed to the utility owners' requirements and standards.

E. Temporary Support Systems: submit detail drawings of proposed methods to support, protect, and buttress utilities affected by the work. Methods proposed are required to be reviewed and accepted by the affected utility prior to submittal per Section 01 33 00.

F. Underground electrical, cable, and communication facilities:
   1. Determine the protection necessary to proceed safely to protect these underground facilities.

G. Roadways:
   1. Take adequate precautions to protect existing sidewalks, curbs, pavements, utilities, adjoining property, and structures, and to avoid damage thereto.
   2. Traffic signage, paint striping, and channelization shall be protected and replaced if necessary.
   3. Maintain the existing illumination pattern for signs and roads at all times unless otherwise specified.
   4. Install temporary roadway lighting as necessary.
   5. Access for emergency equipment shall be maintained at all times.

1.05 EMERGENCIES

A. Whenever work endangers the safety of life or property, including adjoining property or property in the immediate proximity of the work, take all prudent actions to prevent loss or injury.

1.06 DISPOSITION OF THIRD PARTY CLAIMS

A. The Contractor is responsible for all damage related to prosecution of the work. The County may receive notification of damages in writing from third parties as third party claims as a result of the prosecution of the work. When these third party claims are received by the County, they will be tendered to the Contractor. The Contractor is required to contact the claimant within 30 days of receipt of the claim from the Project Representative. The Contractor shall report to the Project Representative within 45 days of receipt with the Contractor's proposed action on the claim. If the Contractor fails to contact the claimant within the time stipulated above or disposition the claim within 90 days of receipt, the County may disposition the claim with the third party claimant and may withhold the amount of the settlement from the disposition from the next Application for Payment.

B. During all the procedural requirements listed above, the Contractor shall keep the Project Representative informed of the plan and actual progress.

PART 2 PRODUCT [NOT USED]

PART 3 EXECUTION

3.01 GENERAL

A. Contact Utility Underground Notification Service prior to an excavation per the requirements in Part 1, General.

B. Pothole to locate and expose all utility locations to be affected by the work prior to new construction in the area of the utility. Adjust work when location of utility is different than shown on the Drawings and materially impacts construction. If the utility requires relocation not shown on the Drawings and the Contractor incurs additional cost, then the County will consider additional costs. Relocation of minor utilities such as irrigation lines less than 4 inches, water service lines, building drainage pipes and direct burial cable will be considered incidental and not considered for additional costs.

C. If damage to a utility occurs, repair damage to the requirements of the utility owner prior to backfilling said utility.

END OF SECTION

SECTION 01 29 00

MEASUREMENT AND PAYMENT

PART 1 GENERAL

1.01 SUMMARY

A. Measurement is described under each bid item in this Section.

B. Payment for the various items on the Bidding Schedule, as further specified herein, shall include all compensation to be received by the Contractor for furnishing all tools, equipment, supplies, and manufactured articles, and for all labor, operations, and incidentals appurtenant to the items of work being described, as necessary to complete the various items of the work all in accordance with the requirements of the Contract Documents, including all appurtenances thereto and including all costs of compliance with the regulations of public agencies having jurisdiction, including safety and health requirements of the Occupational Safety and Health Administration of the U. S. Department of Labor (OSHA). No separate payment will be made for any item that is not specifically set forth in the Bidding Schedule, and all costs therefore shall be included in the prices named in the Bidding Schedule for the various appurtenant items of work.

C. Indirect costs, such as supervision and overheads, profit, the general conditions specified in the Contract, all shall be allocated to each bid item as applicable for work defined in the bid item. No separate payment will be made to the Contractor for these items.

1.02 BID ITEM MEASUREMENT AND PAYMENT

A. Bid Item No. 1 represents the entire scope of work covered by the Contract Documents.

B. Payment will be based on the percentage of completion of each item in the Schedule of Values.

PART 2 MATERIALS [NOT USED]

PART 3 EXECUTION [NOT USED]

END OF SECTION

SECTION 01 31 19

CONTRACT MEETINGS

PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies Contract meetings prior to and during construction.

1.02 PRECONSTRUCTION CONFERENCE

A. The Project Representative will chair a meeting of representatives of the Contractor, County staff, and other affected agencies prior to beginning construction. The purpose of the meeting will be to:
   1. Establish lines of authority and communication within the Contract team.
   2. To discuss the administrative requirements of the Contract.
   3. Address project issues if needed.
   4. To define the duties and responsibilities of all parties.

B. Agenda:
   1. Schedules.
   2. Health and safety
   3. Mobilization plans.
   4. Equal employment regulations.
   5. Apprenticeship programs.
   6. Administrative procedures of the Contract.
   7. Permits, easements, community relations.
   8. Other issues agreed between Contractor and County.

C. Ensure that the Contractor's Representative, superintendent, Safety Officer, and representatives of all major subcontractors are present at the meeting.

1.03 PROGRESS MEETINGS

A. General:
   1. Attend weekly progress meetings to discuss the issues and progress of the project. Meetings may be more or less frequent depending on the progress and status of the work.
   2. Arrange for attendance of subcontractors as necessary to discuss job progress.
   3. Meeting time to be mutually agreed to between the Project Representative and Contractor Representative.

B. Attendance at Progress Meetings:
   1. Attendance may be required from:
      a. Project Representative and other County staff.
      b. Contractor's representative and other Contractor staff.
      c. Other contractors, as pertinent to agenda.
      d. Subcontractors, as pertinent to agenda.
      e. Contractor Safety Officer.
      f. Representatives of governmental agencies, other regulatory agencies, or utilities.

C. Agenda for Progress Meetings:
   1. In general, the agenda for each meeting is to be agreed by Contractor and Project Representative and may include items such as:
      a. Review progress on action items from prior meetings.
      b. Review work progress since last meeting compared to the look ahead schedule.

c. Look ahead schedule for upcoming period.
d. Identification of problems that might impede planned progress.
e. Construction deficiencies.
f. Contract administrative deficiencies including:
    1) RFI status
    2) Submittal status
    3) RCO status
    4) RCP status
    5) As-built status
g. Coordination of projected work with other contractors.
h. Project Safety.
i. Other items as required by the Project Representative or the Contractor.

PART 2 PRODUCTS

2.01 MEETING RECORD

A. The Project Representative will record:
    1. List of issues discussed
    2. Agreements
    3. Follow-on action items required by either the Contractor or the County
    4. Construction deficiencies noted
    5. Contract administrative deficiencies noted
    6. Project safety issues

PART 3 EXECUTION [NOT USED]

END OF SECTION

SECTION 01 32 16

CONSTRUCTION PROGRESS SCHEDULES AND REPORTS

PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies requirements and procedures for preparing project schedules, schedule of values, and reports.

B. Incorporate milestones and constraints including, but not limited to, those indicated on the Drawings and in Section 01 11 00, Summary of Work, Section 01 41 26, Permits and Easements.

C. Purpose:
   1. Project Schedule:
      a. To assure planning to execute the work in the required Contract Time and avoid conflicts with other concurrent construction.
      b. To establish and monitor the scheduling and progress of Contract work activities.
      c. To assist the Project Representative in monitoring progress and for the assessment of Contract change impacts.
      d. To assist the Project Representative and Contractor in determining the completed work for processing of the Application for Payment.
   2. Schedule of Values: To provide an allocation of the Contract Price for measurement of monthly progress and payment.
   3. Reports: To provide a qualitative and quantitative record of work progress, planned progress, project schedule changes, and monthly progress payment.

D. Use the scheduling technique known as the Critical Path Method (CPM). Use the Precedence Diagramming Method (PDM) in preparing the CPM diagrams and calculations.

E. Failure to comply with the requirements of this Section will be cause for delay in review and acceptance of the Application for Payment. See Section 00700.

F. Failure to properly schedule the project and provide the required reports as set forth in this Section will adversely impact the ability of the County to manage its responsibility regarding time and cost management.

G. Use the scheduling software Primavera P6.

1.02 DEFINITIONS

A. Float:
   1. Float in the Project Schedule is defined as the period of time measured by the number of days each non-critical activity may be delayed before it and its succeeding activities become part of the Critical Path.
   2. Contractor and County may both utilize float to offset delays to the project work.

B. Draft Project Schedule:
   1. The initial Critical Path Method schedule (CPM) for the Contractors work that includes the early start/finish and late start/finish dates for each contract activity, milestone, constraint, significant contract activities and procurement of critical materials specified in Division 1 through Division 46.

C. Baseline Schedule:
   1. Includes revisions from the review comments of the Draft Project Schedule submittal.

2. A CPM cost loaded schedule that includes the Contractor's complete plan and all the necessary activities to perform the Contract work within the Contract Time including milestones and constraints defined in the Contract.

D. Schedule of Values:
   1. Schedule of Values identifies the various activities of the Contract work and their values and quantities including the overhead and profit of each activity.
   2. Cost information presented in a tabular Microsoft Excel 2013 or newer format to be used as a tool to track status of each activity on a monthly basis.

E. Monthly Update Schedule:
   1. Updates to the Baseline Schedule show the current construction schedule that reflects actual progress to date, updating all changes to the Contract, and the schedule plan to complete the work within the Contract Time.

F. Three Week Look-Ahead Schedule:
   1. A three week detailed look at work activities planned for this Period. Scope of detail is to review the past week of progress and the future three weeks of planned work activities.
   2. Provide this schedule with greater detail than the CPM and prepare it in a format that includes references to appropriate CPM schedule activity numbers and work breakdown.
   3. The three week look-ahead schedule shall coordinate with the Monthly Update Schedule.

G. Cost Loaded Schedule:
   1. The Baseline and Monthly Update Schedule in which each individual schedule activity has appropriate cost information in order to develop the required cash flow reports and to coordinate with the monthly Schedule of Values for the Application for Payment.

1.03 SUBMITTALS

A. Procedures: Section 01 33 00.

B. Qualifications: Submit within seven (7) days after the effective date of the Notice to Proceed.

C. Schedules:
   1. Submit all schedules in hardcopy and accessible electronic data files in the software format in which it was created. At a minimum, the data files shall provide the CPM Network Diagram; tabular report listing of each activity by Early Start and Total Float sorts; logic tie report providing the predecessor and successor for each activity; precedence diagram; and earned value projections.
   2. Draft Project Schedule: Submit at the Preconstruction Conference identified in Section 01 31 19. This submittal will be reviewed by the County as required in Section 01 33 00 to verify that the requirements of Specification Section 01 32 16 have been met and may require more than one submission by the Contractor to attain a Review Action of 1 (No Exceptions Taken) or 2 (Note Markings). When the Draft Project schedule receives a review status of 1 or 2, compile and note all comments and submit as the Baseline schedule.
   3. Baseline Schedule: Submit no later than 10 days after the dated return of the review comments from the County on the Draft Project Schedule. The Contractor is not entitled nor is the County required to make any progress payments for work until the Baseline Schedule has received a Review Action of 1 or 2. No more than one progress billing will be paid without an approved baseline schedule.
   4. Monthly Update Schedule: Submit with each Application for Payment.
   5. Three Week Look-Ahead Schedule: Submit during each progress meeting per Section 01 31 19.

D. Schedule of Values:
   1. Submit the initial Schedule of Values with the submission of the Draft Project Schedule.
   2. Submit the final Schedule of Values with the submission of the Baseline Schedule.

E. Reports:
   1. Daily reports: Submit on the first working day of the week for past weeks work.
   2. Monthly cash flow reports: Submit with each Application for Payment.
   3. Monthly production reports: Submit with each Application for Payment when requested by the Project Representative.
   4. Work Plan reports: Submit with when requested by the Project Representative.
   5. Monthly progress reports: Submit with each Application for Payment.
   6. Recovery Schedule: Submit as described in paragraph 3.03 when requested by the Project Representative.

1.04 QUALIFICATIONS

A. Submit names and qualifications of the personnel used for the preparation and maintenance of the schedule and reports. Demonstrate in the Statement of Qualifications that the individual(s) preparing the Baseline and Monthly Update Schedules are experienced and proficient in the use of the scheduling software. Changes in the person(s) named require submittal of the qualifications of the new person(s) to the Project Representative for acceptance.

1.05 SCHEDULES AND REPORT PREPARATION

A. The Project Representative may provide sample forms at the Preconstruction Conference for Contractor's use.

B. Any schedule having an early completion date (less than the Contract Time) shall show the time between the early completion date and the Contract Time date as “float.”

C. Schedule format:
   1. Each Baseline and Monthly Update Schedule in CPM format clearly showing the Critical path.
   2. Work breakdown structure:
      a. Work breakdown structure is a project oriented tree subdivision of the activities required to produce the end product.
      b. At a minimum, break the schedule down and band the activities together into the categories listed in the bid schedule and into the following categories:
         1) For each Section in Division 1 through Division 46.
         2) Procurement of major materials, including buy-out/issuance of purchase orders.
         3) Required Milestones, if any.
         4) Listed constraints, including permitting.
         5) Preparation and submittal of all material and equipment as shown in the Specifications.
         6) Submittal and review per Section 01 33 00.
         7) Record drawing preparation and submission.
         8) Asset management data list submission.
         9) Cultural Resources Plan implementation and monitoring.
         10) Report and schedule preparation per this Section.
         11) Operations and maintenance manuals preparation and submission.
         12) Manufacture training for specified equipment.
         13) Start-up and testing.
         14) Commissioning.
         15) Closeout Activities.
      c. Track fabrication and delivery activities of major items to be incorporated into the work.
      d. Include all data files created by the software with the schedule. This shall include, but not limited to, all required reports.
   3. In preparing the schedule, allocate the work into discrete activities such that the duration of each activity does not exceed 21 calendar days and construction activity values do not exceed $50,000, unless approved otherwise by the Project Representative. Non-construction activities (e.g., submittals, procurement, fabrication, punch list, operations and maintenance manuals, training, etc.) may have durations in excess of 21 calendar days.

4. Activity master list includes the following information from each activity:
    a. Activity Number.
    b. Activity Description: Adequately describes the activity as if it were looked at by itself.
    c. Performing Organization: Identification of company or firm performing the activity.
    d. Activity Value: Rounded to nearest hundred dollars. Prorated overhead and profit applied to each activity.
    e. Major Activity Identifier: Code for activity relationship to the work breakdown structure.
5. Activities related to submittals and procurement shall reflect subsets showing submittal preparation, submittal and review time for shop drawings, product data, samples, fabrication and delivery time, as-built drawings preparation, and preparation of submissions of operations and maintenance manuals.
6. Cost load for every activity:
    a. Each activity should have in its value as determined in the preparation of the activity.
    b. Certain activities have defined payment constraints in the specification.
        1) Progress schedule and reports: Per Section 01 32 16.
        2) Record Drawings: Per Section 01 78 39.
        3) Asset Management form: Per Section 01 78 40.
        4) Operation and maintenance manuals: Per Section 01 78 23.
        5) Spare parts: Per Section 01 78 43.
        6) Facility integration, testing and commissioning: Per Section 01 80 00.
        7) Mobilization and demobilization: Not greater than five percent (5%) of the Contract Price allocated for combined Mobilization plus Demobilization expenses; paid at seventy percent (70%) mobilization and thirty percent (30%) demobilization.
7. Schedule shall include hours of work, identification of the holidays and non-work days applicable to the schedule, constraints and milestones defined in Sections 01 14 00 and 01 41 26, and other Sections within the Contract Documents.
8. Prepare network diagrams on 11-inch x 17-inch or larger sheets. Network diagrams shall include the following contents for each activity:
    a. Number.
    b. Description.
    c. Duration.
    d. Early Start/Late Start.
    e. Early Finish/Late Finish.
    f. Predecessors.
    g. Successors.
    h. Float.
9. Contractor warrants that the value in the activity accurately reflects the value of that work activity.
10. Dates imposed on the schedule are not binding on the County and the Project Representative unless specified in the Contract.
11. Failure to include any element of work required for the performance of the Contract does not excuse the Contractor from completing the work as described in the Contract.
12. Requests from the Project Representative:
    a. When requested by the Project Representative, submit a written narrative of the Contractor's determination of durations for critical and near critical activities. Include in such explanation the number of crews, crew composition, number of shifts per day, number of hours in a shift, the number of work days per week, production curves for major commodities (e.g., below grade pipe, concrete, piping, wire and cable), construction equipment and supplier and delivery requirements.
    b. If required by the Project Representative, present documentation substantiating the cost allocations of those activities considered, in the opinion of the Project Representative, to be unbalanced.
13. Monthly Schedule updates shall include:
    a. Activity dates and earned value:
        1) Last Month Percent Complete.
        2) Current Percent Complete.
        3) Earned Value, rounded to the nearest dollar.

4) Duration, in workdays.
5) Actual Start.
6) Expected Finish.
7) Actual Finish.

b. Add or revise duration of activities and new activities to so that the Monthly Schedule Update(s) are consistent with executed change orders. Cost load the added activities. When revised or new activities change the Contract Price, add these activities to the Schedule of Values.

1.06 DRAFT PROJECT SCHEDULE

A. Prepared by Contractor and submitted at the Preconstruction Conference. Schedule submittal to include the electronic information on the data files of the software so the necessary reports can be printed out for assistance in reviewing the submitted data.

B. The Draft Project Schedule is the complete Contractor's plan to perform the Contract in accordance with milestones and constraints and within the Contract Time as defined in the Contract Documents. Draft schedule shall include all tasks defined in paragraph 1.05 of this Section.

C. The Draft Project Schedule shall include a print out of the cash flow forecast presented in the schedule.

1.07 BASELINE SCHEDULE

A. Work to be scheduled for completion within the amount of Contract Time specified. No claim for delay shall be allowed based on an early completion schedule.

B. Shows Contractor's complete plan for the work in the Contract. Baseline schedule shall include all the requirements of paragraph 1.05 of this Section, including cash flow requirements. Include all data files in the software so that necessary reports can be accessed.

C. Incorporate into the Baseline Schedule the Project Representative requests for clarification or additional information from the review of the Draft Project Schedule. The Project Representative comments shall not be construed as establishing the Contractor's schedule.

D. Utilized as the initial schedule for the start of monitoring the progress of the work.

1.08 MONTHLY UPDATE SCHEDULE

A. The Monthly Update Schedule is the most current update and a requirement of the Application for Payment, defined in Section 00700. Monthly Update Schedule(s) shall comply with requirements of Article 7 and the following:
1. Include a status of all activities through the last day of the month being progressed.
2. Include all executed change order work to date.
3. Include all the requirements and information, as required in paragraph 1.05 of this specification.
4. The latest agreed upon Monthly Update Schedule and the accepted Baseline Schedule will be used by the Project Representative to review requests for changes in contract.

1.09 SCHEDULE OF VALUES

A. Submit Schedule of Values in a tabular Microsoft Excel 2013 or newer format, including the following:
1. Contract Price allocated as specified in this Section. This is the activity value determined in paragraph 1.05C.6.
2. Dollars earned and percent complete for prior month.
3. Dollars earned and percent complete for current month.
4. Dollars earned and percent complete-to-date.
5. Balance Remaining.

B. Schedule of Values breakdown shall be taken from the task activities in the cost loaded schedule.

C. Include these costs on the Schedule of Values and the Progress Schedule breakdown.

ITEM	SPECIFICATION
Construction Project Schedule	01 32 16
Sustainability Reports	01 33 29
Construction and Demolition Material Management	01 74 19
Final Operation and Maintenance Data	01 78 23
Project Record Documents	01 78 39
Asset Attribute Collection	01 78 40
Spare Parts	01 78 43
Equipment Testing, Training and Commissioning	01 80 00
Variable-Speed Turbo Air Blowers	43 11 40

D. The total value of the activities shall be equal to the Contract Price.

E. Monthly Update Cost:
1. Submit with the Application for Payment as a condition precedent to receiving payment for work accomplished each month.
2. Update cost loading to reflect added activities in the new Monthly Update Schedule.

1.10 DAILY REPORTS

A. Submit daily reports including as a minimum, the day of the week, date, weather conditions, groundwater conditions (if applicable to the work), number and type of personnel working on the Contract (including subcontractor personnel) by trade, major equipment on site, materials delivered and materials installed, for each of the Schedule activities worked on by personnel, and progress for the day.

B. Daily reports to be signed as a certification of the information by an authorized Contractor's Representative.

C. Daily reports submitted to the Project Representative on first day of the next work week for the reports of the previous week.

1.11 THREE WEEK LOOK-AHEAD SCHEDULE

A. Prepare the Three Week Look-Ahead Schedule to show the previous week's progress and the work plan for the next three weeks. The Three Week Look-Ahead Schedule shall have a direct tie to the current accepted Monthly Update Schedule.

B. Distribute the three-week look ahead schedule to the Project Representative at each weekly progress meeting.

1.12 APPLICATION FOR PAYMENT AND MONTHLY REPORTS

A. Application for Payment is the Contractor's notice of the progress performed since the previous payment application. Cost of major materials or equipment may be included in the Application for Payment, as described in Section 00700. The progress on each activity performed since the last request is submitted to the Project Representative for review. The Application for Payment will be processed as specified in Section 00700.

B. Include an updated network diagram, cash flow projection, narrative monthly summary, and schedule data files. The update shall be as of the last day of the month being progressed. (Reference 1.03 C above).

C. Narrative Summary: Briefly describe the progress of the work. Describe how the work is progressing towards its completion. Identify schedule activities and milestones completed, major equipment deliveries, problems arising during the month, changes to the Total Project Float and any anticipated impacts on the schedule. If the updated schedule is showing that the Contract Time Requirements will not be met, describe the Contractor's action plan to return the project to a timely completion. Describe the work anticipated during the upcoming month, including major equipment deliveries and submittals.

D. Identify any changes in logic ties to the CPM Schedule, explain why the changes are needed and describe the impacts resulting from these changes.

E. Cash flow reports:
   1. Cumulative (S Curve): This cash flow chart provides cumulative cash flow over the duration of the project, and will show comparisons between the Baseline Project Schedule and the Updated Project Schedule. The comparison curves illustrate the Baseline Early and Late Starts cash flow in comparison to the actual progress, and updated revised Early and Late Starts.
   2. Monthly Histogram (Column Type): This cash flow chart provides monthly cash flow projections over the duration of the project and shows comparison columns for each month on the chart. The comparison histogram illustrates the Baseline Early and Late Starts Cash Flow in comparison to the Actual Progress and Updated Revised Early and Late Starts.
   3. Monthly data report showing each scheduled activity with previous progress, progress this period and cost remaining for each activity.

PART 2 PRODUCTS [NOT USED]

PART 3 EXECUTION

3.01 GENERAL

A. Submit Draft Project Schedule, Revised Draft Project Schedule, Baseline and Monthly Update Schedules as required. Include schedule data files. Work shall be completed by the Scheduler.

B. Submit schedule, reports, and updates by hard copy and electronic format.

C. Failure to comply with the requirements of this Section could be a cause for delay in the processing of the Application for Payment.

3.02 MONTHLY UPDATES

A. Prepare and submit a Monthly Update Schedule and graphic network diagram including cash flow reports with the monthly Application for Payment. When work is behind schedule, submit a written plan for completing the work within the milestones and Contract Time.

B. Include revisions in the Project Schedule's logic, along with a written statement and rationale. Use the same form and method employed in the Baseline Schedule.

C. Reflect the executed change order in both time and value in the next submission of the Application for Payment, the Schedule of Values, and schedule updates following the execution of the change order. Incorporate executed Contract Time changes and schedule revisions into the Monthly Update Schedule and Schedule of Values for each work change executed in the change order.

D. Submit the various reports specified above in the required time frame.

3.03 SCHEDULE ADJUSTMENTS

A. If in the opinion of the Project Representative the Contractor's progress is not in alignment with the Project Schedule, the Project Representative may ask the Contractor to make appropriate adjustments as required independently of the next Monthly Update Schedule and/or at the time of the next monthly update.

B. If in the opinion of the Project Representative, the Contractor's progress shows that the contract completion will be later than the current date of a Milestone, Substantial Completion and/or Final Acceptance, the Project Representative may request that the Contractor provide the following:
   1. The Contractor shall determine the cause of this slippage and inform the County in the current month's narrative the cause for the delay.
   2. Once the Contractor identifies the cause for the delay and informs the Project Representative, the Contractor prepares a written Recovery Plan proposing actions to correct the delay and demonstrating how the corrective actions will complete the Contract work within the required Contract Time. This plan and its initial results shall be included in the Contractors next Monthly Schedule Update. The actions could include increase the number of shifts, overtime operations, and/or days of work, both on and off the site.
   3. Corrective actions will be shown on the following Monthly Update Schedule along with their effect on bringing the project back to timely completion of the work. The schedule and narrative shall describe these actions and the projected results.
   4. If the Contractor fails to make necessary effort and does not demonstrate returning the project to completion within the Contract Time other actions, as defined in Section 00700, may be taken.

C. When the Contractor is preparing a change to the Contract and within this request for change asks for additional time, the Contractor shall support this request as defined in Section 00700 of the General Terms and Conditions of the Contract, along with the following information:
   1. Include any request for a change in the Contract Time in its Notice of Intent to submit a Request for Change Order and Change Proposal.
   2. Demonstrate that the Contract Time to extend the time of performance is not due to the fault, act, or omission of the Contractor, or anyone for whose acts or omissions the Contractor is responsible.
   3. Demonstrate that entitlement is due to a change in Contract Time because the progress of the Work on the Critical Path is delayed and completion of the Contract Work within Contract Time is delayed.
   4. Demonstrate that the delay is not a concurrent delay. Concurrent delays are defined in Section 00700 and are delays which impact the Critical Path and are caused by:
      a. The County and the Contractor,
      b. The County and an act of Force Majeure, or
      c. The Contractor and an act of Force Majeure.
      d. When delays are concurrent the Contractor shall only be entitled to a change in Contract Time. No change to the Contract Price shall be allowed as a result of such concurrent delay.

D. A Request for Change Order or a Request for Change Proposal that includes a request for an adjustment in the Contract Time shall:
   1. Be in writing and delivered to the Project Representative within the time period required in the Contract Documents.
   2. Include a clear explanation of how the event or conditions specifically impact the Critical Path and overall Project Schedule and the amount of the adjustment in Contract Time requested.
   3. Be limited to the change in the Critical Path of a Contractors' Project Schedule and any updates attributable to the event or conditions, which caused the request for adjustment. No extension of time or compensation for damages resulting from a delay will be granted unless the delay affects the timely completion of all Work under the Contract or timely completion of a portion of the Work for which time of completion is specific.
   4. Contractor shall be responsible for showing clearly on the Project Schedule and any updates that the event or conditions:
      a. Had a specific impact on the Critical Path and was the sole cause of such impact;

b. Could not have been avoided by resequencing of the Work or other reasonable alternatives;
c. Prevent the Contractor from completing the Project within the current Contract completion date.

5. Demonstrate that all reasonable efforts were made to prevent and mitigate the effects of this delay, whether occasioned by an act of Force Majeure or otherwise.

3.04 PAYMENT

A. Payment for the work specified in this Section shall be shown as a dedicated activity in the Baseline Schedule and in the Schedule of Values with a minimum value of one percent (1%) of the Contract Price. Progress items associated with this Section shall be distributed equally on a monthly basis over the Contract Time for the work.

B. Progressing of the monthly application for payment will be contingent upon satisfactory submissions of all reports. Payment for Monthly Update Schedule(s) could be denied and deducted if in the opinion of the Project Representative the information requested does not meet the requirements of Contract documents.

END OF SECTION

SECTION 01 33 00

SUBMITTALS PROCEDURES

PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies procedures and requirements for all submittals, substitutions, deviations, and the master submittal list required by the Specifications.

B. In addition to submittals required by individual Section specifications, submit information on items shown on the Drawings but not specified; and include proof of Professional Liability insurance for Work, which requires, either by Law or by Contract, the Submittal to be stamped by a licensed professional.

C. Submit information on all repair and corrective work required of or generated by the Contractor such that the acceptability of the quality of the repair or correction can be assessed before it is performed.

D. Submit descriptive information that will enable the Project Representative to assess whether the proposed materials, equipment, or methods of work are in general conformance with the work and in compliance with the Contract.

E. Specifically identify and annotate any deviation or substitutions in the submittal. If deviations or substitutions are not clearly identified or annotated, the original contract provisions shall prevail; if the item has been installed without specific acceptance of the deviation or substitution it shall be removed and the contract required item installed in its place.

F. No fabrication or construction work shall occur on a specific submittal item without a submittal Review Action of “1” NO EXCEPTIONS TAKEN or “2” NOTE MARKINGS. Any procurement or construction activity undertaken by the Contactor absent such a submittal Review Action will not be progress on project schedule or schedule of values.

G. Unless specified otherwise in this Contract, preparation, and revisions of submittals is to be an incidental expense and not a pay item.

1.02 MASTER SUBMITTAL LIST

A. Prepare and submit within 20 days after the effective date of the Notice-to-Proceed, a Master Submittal List listing of all items for which submittals are required by the Specifications. Organize the Master Submittal List by Specification Section number and include the following information for all listed items:
   1. Item identification.
   2. Specification Section number.
   3. Planned submittal date.
   4. Identification of those items that are substitutions or contain deviations from the Specifications.
   5. Identification of those items that require other jurisdictional agency review and approval.
   6. the List shall include columns for future use as information becomes available shall be provided for the following items:
      a. Trade name, model, and catalog designation.
      b. The scheduled need dates for control purposes.
      c. Date submitted.
      d. The date approval is needed.
      e. The date on which material is needed.

1.03 CONTRACTOR RESPONSIBILITIES

A. Be responsible for the accuracy and completeness of the information contained in each submittal. The cost to review the initial submittal and the first revised submittal shall be borne by the County. The cost to review all additional revised submittals shall be charged to the Contractor.

B. Verify that the material and equipment described in each submittal conforms to the requirements of the Contract prior to submittal.

C. Ensure that the material, equipment and methods of work used are described in the submittal.

D. Coordinate and integrate all submittal dates with the Baseline Schedule.

E. Annotate on the Submittal Transmittal Form 01 33 00-A if the submittal conflicts or may affect the work with other submittals.

F. Ensure coordination of submittals among the suppliers, related crafts, subcontractors, and with the planned work. The Contractor will be held responsible for any cost or schedule impact caused by a submittal coordination failure.

G. Submit a request for all substitutions using Form 01 33 00-B received from the Project Representative.

H. Call out all deviations from the Contract on the Submittal Form 01 33 00-A transmitted to Project Representative and note where applicable in the body of the submittal.

I. Include Preliminary Operations and Maintenance information as required in Section 01 78 23.

1.04 SUBMITTALS ON ITEMS DIFFERING FROM THAT REQUIRED BY THE CONTRACT DOCUMENTS

A. Approved Equal:
   1. Definition: An item of material or equipment proposed by the Contractor that has the same function, quality, durability, appearance, strength, and design characteristics equal to that named, that meets the requirements of the Specification, and is sufficiently similar so that no change in related work is required. The item of material or equipment shall reliably perform at least equally well for the function imposed by the design concept of the completed work as a functioning whole. In general, approved equal applies to manufactured items.
   2. Clearly note on the submittal Form 01 33 00-A if any items are submitted as an equal.
   3. Acceptance is at the Project Representative’s sole discretion and the decision regarding acceptance or rejection shall be final. If the Contractor disagrees, a Request for a Change Order shall be filed in accordance with contract provisions. Do not assume acceptance at any time prior to the rendering of decision by the Project Representative.

B. Substitution:
   1. Definition: An item of difference in materials, equipment, means, method, technique, dimension, sequence, or procedure which functionally meets the Contract requirements, but does not meet the Specification(s) and is equal to or better than the specified item.
   2. Substitutions requested by the Contractor shall conform to the requirements of Section 00700. A submittal shall be provided for each substitution request, must be submitted using Form 01 33 00-B, and shall address all items on the form. The request shall include complete specifications or means and methods for the item including procurement, operational and maintenance cost data. Substitution Request forms shall be numbered sequentially beginning with the number No. 1.
   3. Any Substitution not identified on a submittal is not accepted or approved regardless of any action taken on the submittal by the County. Action taken by the County on the submittal shall not relieve the Contractor from complying with the original Contract requirements.
   4. Acceptance is at the Project Representative's sole discretion and the decision regarding acceptance or rejection of the substitution shall be final. If the substitution is rejected, proceed with

the contract specifications without delay. Do not assume acceptance at any time prior to the rendering of a written decision by the Project Representative.

C. Deviations:
   1. Definition: A minor change or omission to a specified material, procedure or product proposed by the Contractor that does not fully conform to the requirements specified, but conforms to dimensional, operational, and maintenance requirements and can be shown to accomplish the functional and operational and maintenance performance of the specified item.
   2. Annotate in the submittal all deviations from stated requirements in the Contract. Any deviation not identified on the submittal is not accepted or approved regardless of any subsequent action on the submittal by the County. Failure of the County to comment on the deviation shall not relieve the Contractor from complying with the original Contract requirements.
   3. Acceptance is at the Project Representative's sole discretion and the decision regarding acceptance or rejection shall be final. Do not assume acceptance at any time prior to the rendering of a decision by the Project Representative.

PART 2 PRODUCTS [NOT USED]

PART 3 EXECUTION

3.01 TRANSMITTAL PROCEDURE

A. General:
   1. Submittals shall be transmitted via the Contract SharePoint Site in accordance with Section 00800, Supplemental Terms and Conditions. The Contract SharePoint site is a Microsoft Office web application platform developed and managed by the County for this Contract. The Project Representative will provide instructions to the Contractor's representative on the use of the Contract SharePoint site for Contract document file storage, including submittals. See Section 00800 for further details.
   2. Submittals shall be accompanied by Submittal/Transmittal Form 01 33 00-A and include all submittal materials. An electronic blank copy of this form will be provided by the Project Representative.
   3. Asset numbers shall be listed on Form 01 33 00-A for items being submitted. A separate form shall be used for each specific item, class of material, equipment, and items specified in separate, discrete sections for which a submittal is required.
   4. Submittals for various items shall be made with a single form when the items taken together constitute a manufacturer's package, or are so functionally related that expediency indicates checking or review the group or package as a whole.
   5. No multiple-Section submittals will be allowed except where previously approved by the Project Representative.
   6. A unique number, sequentially assigned, shall be noted on the transmittal form accompanying each item submitted. Original submittal numbers shall have the following format: "XXX"; where "XXX" is the sequential number assigned by the Contractor. Resubmittals shall have the following format: "XXXY"; where "XXX" is the originally assigned submittal number and "Y" is a sequential letter assigned for re submittals, i.e., A, B, or C being the 1st, 2nd, and 3rd resubmittals, respectively. Submittal 25B, for example, is the second resubmittal of Submittal 25.
   7. Submit all proposed approved equals as a part of the submittal process.
   8. PDF documents shall be bookmarked and searchable PDF files.

B. Samples: Submit the number requested in the Specification Section with the submittal form. Product samples and color samples shall not be transmitted electronically.

C. Certificates: Will be considered as information. No copy will be returned.

D. "Submit for information only": No copy will be returned.

3.02 REVIEW PROCEDURE

A. Within the review and response timeframe specified in 00700 the County's identified Review Action and any review comments will be transmitted to the Contractor.

B. The returned submittal will indicate one of the following actions:
   1. If the review indicates that the submittal is in general conformance with the Contract, the submittal copies shall be marked "No Exceptions Taken" and given a Review Action of "1." In this case, implement the work covered in the submittal.
   2. If the review indicates that the submittal requires limited corrections, the submittal copies will be marked "Note Markings" and given a Review Action of "2." In this case, begin to implement the work covered in the submittal in accordance with the markings noted. Where submittal information is to be incorporated in O&M data, a corrected copy shall be resubmitted; otherwise, no further action is required.
   3. If the review reveals the submittal is insufficient and contains incorrect data and the comments are of a nature that can be confirmed, the submittal copies shall be marked "Comments Attached -- Confirm" and given a Review Action of "3." A Review Action "3" does not allow implementation of the work covered by the submittal until the information requested to be confirmed in the submittal has been revised, submitted, and returned to the Contractor with a Review Action of either "1" or "2."
   4. If the review reveals the submittal is insufficient or contains incorrect data and the comments require that the submittal be revised and resubmitted, the submittal copies shall be marked "Comments Attached --Resubmit" and given a Review Action of "4". A Review Action "4" does not allow implementation of the work covered by the submittal until the information in the submittal has been revised, resubmitted, and returned to the Contractor with a Review Action of either "1" or "2."
   5. If the review reveals that the submittal is not in general conformance with the Contract, or if the submittal is incomplete, the submittal copies shall be marked "Rejected" and given a Review Action of "5." Submittals containing deviations or substitutions from Contract which have not been clearly identified by the Contractor fall into this category. A Review Action "5" does not allow implementation of the work covered by the submittal until the information in the submittal has been revised, resubmitted, and returned with a Review Action of either "1" or "2."

3.03 EFFECT OF REVIEW OF SUBMITTALS

A. Review of submittals shall not relieve the Contractor of its responsibility for errors or omission therein and shall not be regarded as an assumption of risks or liability by the County.

B. Unless Contractor specifically identifies and the County accepts a Deviation or Substitution on the submittal, no disposition of the submittal by the County changes the requirements of the Specification and Drawings.

END OF SECTION

SECTION 01 33 10

STANDARD FORMS

PART 1 GENERAL

1.01 SCOPE

A. Be responsible for completing the documentation forms for tests and evaluations required of the Contract.

B. Contractor-generated forms as otherwise required to document the work shall follow the format established on Form 01 33 10-A.

C. Electronic versions of some forms will be provided during construction.

1.02 SUBMITTALS

A. Procedures: Section 01 33 00.

B. Completed forms as required.

PART 2 PRODUCTS

2.01 FORMS

A. The forms listed below are reference from other Sections of the Contract Documents and shall be used to document the Contract work. Forms not included in this Section can be obtained from the Project Representative upon request on or after the Preconstruction Conference.

B. The following forms are included at the end of this Section.

Form No.	Title
01 33 00-A	Submittal/Transmittal Form
01 33 00-B	Substitution Request Form
01 33 10-A	Standard Form Format
01 33 29-A	Recycled Content Materials
01 33 29-D	Resource Reuse
01 33 29-E	Indoor Air Quality Management Plant During Construction
01 35 29-A	Monthly Contractor Injury Summary Report
01 74 19-A	Construction and Demolition Material Diversion Plan
01 74 19-B	Construction and Demolition Material Diversion Report
01 78 43-A	Spare Parts Release Form
01 80 00-A	Equipment Test Report Form
01 80 00-B	Training Attendance Form
01 80 00-C	Training Procedure Documentation Form
01 80 00-D	System Testing Deficiency Documentation Form
01 80 00-E	System Punchlist Documentation Form

Form No.	Title
09 90 00-A	Daily Coating Inspection Form
26 05 00-A	Wire and Cable Resistance Test Data Form
26 05 00-B	Installed Motor Test Data Form
26 05 00-C	Dry Transformer Test Data Form
26 05 00-D	Motor Control Center Test Form
26 05 00-K	Automatic Transfer Switch Test Form
40 05 01-A	Pipe System Testing Form
40 05 93-A	Motor Data Submittal Form
43 05 01-A	Manufacturer's Installation Certification Form
43 05 01-B	Manufacturer's Instruction Certification Form
43 05 01-C	Unit Responsibility Certification Form
43 11 40-A	Process and Fluid Components and Electrical Power Related Components -- Factory Testing Checklists
43 11 40-B	Blower Field Performance Test Results
	Forms as required for full documentation of the work.

PART 3 EXECUTION [NOT USED]

END OF SECTION

01 33 00-A SUBMITTAL/TRANSMITTAL FORM

Date Stamp

KING COUNTY
WASTEWATER
TREATMENT DIVISION

Contract Number: C01397C20

Submittal No. _____
Date _____

Is this a Resubmittal? YES ☐ NO ☐
If resubmittal, prior submittal number _____

Does Submittal contain deviations from the specifications? YES ☐ NO ☐

CONTRACTOR _____

Subcontractor or Supplier: _____

						This Section to Be Completed By King County	
Item No.	**P/C**	**Spec. Paragraph**	**Contractor's Cat. or Dwg. No.**	**Description of Item**	**Copies Submit**	**Review Action**	**Contractor Deviation**

Contractor certifies to review of submittal, verification of field measurements, and compliance with Contract Document unless noted otherwise in the submittal.

By: Date:

Reviewer Remarks

Legend-Review Action

1 No exceptions taken
2 Note Markings
3 Comments Attached-Confirm
4 Comments Attached-Resubmit
5 Rejected

P – Partial

C – Complete

Distribution:	**By (Print)**	**Date**
Initial Review Completed		
Project Representative		
Returned To Contractor		

01 33 00-A SUBMITTAL / TRANSMITTAL FORM (continued)

Project Representative's review is for general conformance with the Contract. Markings or comments not specifically addressed in writing by the Contractor and accepted by the Project Representative in writing, shall not relieve the Contractor from compliance with the Contract. The Contractor remains responsible for details and accuracy, for confirming and correlating all quantities and dimensions, for selecting fabrication processes, for techniques of assembly and for performing its work in a safe manner.				
Project Representative Review	Routing	Initial	Date	
No Exceptions Taken ☐				
Note Markings ☐				
Comments Attached-Confirm ☐				
Comments Attached-Resubmit ☐				
Rejected ☐				
Response Required of Contractor	Construction Division Use Only			
Confirm	Reviewed Copies To:		Date	
	Constr. Division Files			
	Project Representative			
Resubmit	Contractor Proj. Eng.			

01 33 00-B SUBSTITUTION REQUEST FORM

TO: _____

CONTRACT NO.: C01397C20 CONTRACT NAME: _____

We hereby submit for your consideration the following item instead of the specified item or procedure:

Section	Paragraph	Specified Item
_____	_____	_____

Proposed Substitution:

_____

_____

_____

_____

Attach complete data, including laboratory tests, if applicable. Include complete information on changes to Contract Drawings and/or Specifications which proposed substitution would require for its proper installation.

Fill in blanks below:

A. How will substitution affect dimensions shown on Drawings?

_____

_____

B. What effect does the substitution have on the Baseline or Update Schedule?

_____

_____

C. State quality and performance differences between proposed substitution and specified item or procedure.

_____

_____

_____

D. List the cost differences between proposed substitution and specified item or procedure. (Attach estimate/quote and indicate net change).

_____

_____

E. List manufacturer's name and address, trade name of product, and model or catalog number.

_____

_____

_____

F. Other information as required by the Project Representative.

_____

_____

_____

G. The undersigned states that the function, appearance and quality of the proposed substitution are equivalent or superior to those of the specified item and authorizes the payment to the County for all design changes including Project Representative, detailing, and County processing costs.

_____

_____

H. The undersigned states that there is a waiver of all claims for additional costs related to the substitution which may subsequently arise during the work.

_____

I. Manufacturer's guarantees the proposed and specified items are:

_____ Same _____ Different (explain on attachment)

Submitted by:

_____
Contractor Signature

_____
Firm

_____
Address

_____

Date: _____

For use by Project Representative

____ Accepted ____ Accepted as Noted

____ Not Accepted ____ Received Too Late

By: _____

Date:_____

Remarks: _____

NOTE: WHEN REQUIRED BY THE PROJECT REPRESENTATIVE, ALL SUBSTITUTIONS SHALL BE STAMPED AND SIGNED BY A PROFESSIONAL ENGINEER LICENSED IN THE STATE OF WASHINGTON.

Contract Name: _____

Contract No: _____ Date: _____

Form Title: _____

NOTE TO CONTRACTOR:

USE THE FOLLOWING SIGNATURE FORMATS AS APPROPRIATE

OR AS REQUIRED BY THE SPECIFICATION OR THE PROJECT REPRESENTATIVE.

SIGNATURE FORMAT A:

_____ _____
Signature of Manufacturer's Representative Date

_____ _____
Signature of Contractor Representative Date

_____ _____
Signature of Project Representative Date

SIGNATURE FORMAT B:

CERTIFIED _____ _____
Signature of Contractor Representative Date

WITNESSED _____ _____
Signature of Project Representative Date

01 33 29-A RECYCLED CONTENT MATERIALS

WTD Sustainability Report

Contract # _____
Contract Name _____

I,_____, from _____ verify that the information provided below is accurate, to the best of my knowledge.

This project uses materials with recycled content so that the sum of the post-consumer recycled content plus one-half of the post-industrial recycled content constitutes at least 5% of the total amount of materials in the project (measured in either cost, weight, or volume).

Total construction cost	
Total materials cost (exclude labor, equipment)	

Product Name	Vendor	Product Amount (Cost / Weight / Volume)	Recycled Content Information Source
Product Cost Subtotal			
Product amount subtotal as a percentage of the amount of all materials			

Narrative (Optional)
Please provide any additional comments or notes on special circumstances or considerations regarding the project's credit approach.

_____
_____
_____
_____
_____

FOR WTD USE ONLY:

Project # _____ Points Documented: _____
Spec Section _____

01 33 29-D RESOURCE REUSE

WTD Sustainability Report

Contract # _____
Contract Name _____

I, _____, from _____ verify that
(Responsible Individual) (Company Name)
the information provided below is accurate, to the best of my knowledge.

This project has used the salvaged, refurbished or reused materials, products and furnishings listed below, and that the typical replacement value of these materials as shown in the table below is equivalent to at least 5% of the cost of the total materials for the project.

Total construction cost	
Total materials cost (exclude labor, equipment)	

Product Name	Vendor	Product Cost
Product Cost Subtotal		
Product cost subtotal as a percentage of total material cost		

Narrative (Optional)
Please provide any additional comments or notes regarding special circumstances or considerations regarding project's credit approach.

_____
_____
_____
_____

FOR WTD USE ONLY:

Project # _____ Points Documented: _____
Spec Section _____

01 33 29-E CONSTRUCTION IAQ MANAGEMENT PLANT – DURING CONSTRUCTION

WTD Sustainability Report

Contract # _____
Contract Name _____

I, _____, from _____ verify that
(Responsible Individual) (Company Name)
the information provided below is accurate, to the best of my knowledge.

1. A copy of the project's Construction Indoor Air Quality (IAQ) Management Plan has been submitted.
2. The project's air handling units were operated during construction.
3. Photos highlighting the IAQ Management Plan practices have been submitted. The photos have been labeled to identify the highlighted approach.
4. If the air handling units were operated during construction, please provide a list of the installed filters and their locations in the table below.

Filter Manufacturer	Filter Identification (Model #)	Filter MERV rating	Location of Installed Filter	Filter Replaced Immediately Prior to Occupancy (Yes or No)

Narrative (Optional)
Please provide any additional comments or notes regarding special circumstances or considerations regarding the project's Indoor Air Quality approach.

_____
_____
_____
_____

FOR WTD USE ONLY:

Project # _____ Points Documented: _____
Spec Section _____

01 35 29-A MONTHLY CONTRACTOR INJURY SUMMARY REPORT

Contract Name: _____
Contract No: _____ Month: _____
Contractor: _____

OSHA RECORDABLE CASES

WORK GROUP	NUMBER OF CASES	
	Reporting Month	Year-to-Date
Hourly Employees		
Supervisory Personnel		
TOTAL		

LOST TIME ACCIDENTS

WORK GROUP	NUMBER OF CASES		LOST WORKDAYS	
	Reporting Month	Year-to-Date	Reporting Month	Year-to-Date
Hourly Employees				
Supervisory Personnel				
TOTAL				

TOTAL HOURS WORKED AT CONTRACT SITE

Reporting Month	
Year-to-Date	

INCIDENT AND SEVERITY RATE

Date of last lost-time accident: _____
Number of hours worked since last lost-time accident: _____

$$\text{Incident Rate} = \frac{\text{Total Number of OSHA Recordable Cases x 200,000}}{\text{Total Hours Worked at King County Project Site}}$$

$$\text{Severity Rate} = \frac{\text{Total Number of Lost Workdays x 200,000}}{\text{Total Hours Worked at King County Project Site}}$$

RATES	Reporting Month	Year-to-Date
Incident Rate		
Severity Rate		

Monthly Incident Summary

DATE	NAME	TRADE	COMPANY	INCIDENT	Contributors and Preventive Measures

Construction & Demolition Diversion Plan

Department: DNRP

Division: WTD

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 *	☐	☐	☐	☐	☐	☐	Other	Other	
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*

01 74 19-B CONSTRUCTION AND DEMOLITION MATERIAL DIVERSION REPORT

Construction & Demolition Diversion Report

Department:	DNRP	Division:	WTD
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	Rock and Gravel				
		If Other Diversion Method:		If Other Hauler:	If Other Receiving Facility:
10	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

01 78 43-A SPARE PARTS RELEASE FORM Page _____ of _____

Contract Name: _____

Contract No: _____ Place of Delivery: _____ Date: _____

Pallet/Skid Number	Container/ Item No.	Equipment I.D. No.	Spare Part Description

_____ _____

Signature of Contractor Date

_____ _____

Signature of Project Representative Date

Cc: Maintenance Supervisor: _____

Operations Supervisor: _____

Project Manager: _____

01 80 00-A EQUIPMENT TEST REPORT FORM

Equipment Name: _____

Equipment Number: _____

Specification Reference: _____

Location: _____

PREOPERATIONAL CHECKLIST

MECHANICAL

	Contractor		Vendor		Project Rep	
	Verified	**Date**	**Verified**	**Date**	**Verified**	**Date**
Lubrication						
Alignment						
Anchor Bolts						
Seal Water System Operational						
Equipment Rotates Freely						
Safety Guards						
Valves Operational						
O&M Manual Information Complete						
Manufacturer's Installation Certificate Complete						

ELECTRICAL (Circuit Ring-Out and High-Pot Tests)

	Contractor		Vendor		Project Rep	
	Verified	**Date**	**Verified**	**Date**	**Verified**	**Date**
Circuits:						
Power to MCC						
Control to HOA						
Indicators at MCC:						
Red (Running)						
Green (Power)						
Amber (Auto)						
Indicators at Local Control Panel						
Wiring Labels Complete						
Nameplates:						
MCC						
Control Station						
Control Panel						
Equipment Bumped for Rotation						

01 80 00-A EQUIPMENT TEST REPORT FORM (continued)

PIPING SYSTEMS

	Contractor		Vendor		Project Rep	
	Verified	**Date**	**Verified**	**Date**	**Verified**	**Date**
Cleaned and Flushed:						
Suction						
Discharge						
Pressure Tests						
Temporary Piping Systems in Place						

INSTRUMENTATION AND CONTROLS

	Contractor		Vendor		Project Rep	
	Verified	**Date**	**Verified**	**Date**	**Verified**	**Date**
Flowmeter Calibration:						
Calibration Report No.						
Flow Recorder Calibrated:						
Against Transmitter						
VFD Speed Indicator Calibrated Against:						
Independent Reference						
Discharge Over-Pressure Shutdown:						
Switch Calibration						
Simulate Discharge Over-pressure:						
Shutdown						

INITIAL OPERATION

MECHANICAL

	Contractor		Vendor		Project Rep	
	Verified	**Date**	**Verified**	**Date**	**Verified**	**Date**
Motor Operation Temperature Satisfactory						
Pump Operating Temperature Satisfactory						
Unusual Noise, Etc.						
Pump Operation:						
Measurement:						
Flow						
Pressure						
Test Gauge Number						
Alignment Hot						
Doweled In						

Remarks: _____

_____

ELECTRICAL

	Contractor		Vendor		Project Rep	
	Verified	**Date**	**Verified**	**Date**	**Verified**	**Date**
Local Switch Function:						
Runs in HAND						
No Control Power in OFF						
Timer Control in AUTO						
Overpressure Protection Switch:						
Functional in both HAND and AUTO						
Overpressure Protection Switch Set at 75 psig						
PLC Set at 24 Hour Cycle, 25 Minutes ON						

OPERATIONAL TEST

48-hour continuous test. Pump cycles as specified, indicators functional, controls functional, pump maintains capacity, over pressure protection remains functional, hour meter functional.

RECOMMENDED

Contractor Representative _____ Date _____

ACCEPTED

Project Representative _____ Date _____

01 80 00-B TRAINING ATTENDANCE FORM Page _____ of _____

Contract Name: _____

Contract No: _____ Date: _____

TRAINING PROCEDURES FOR _____

Trainer: _____ Company: _____ Phone No.: _____

Name	Company	Phone No.

01 80 00-C TRAINING PROCEDURE DOCUMENTATION

Contract Name: _____

Contract No: _____ Date: _____

TRAINING PROCEDURES FOR _____

Trainer: _____ Company: _____

TOPIC	DISCUSSION
Familiarization	
Safety	
Operations	
Preventative Maintenance	
Repairs	
Parts	
Contacts	
Guarantees	

01 80 00-D SYSTEM TESTING DEFICIENCY DOCUMENTATION FORM Page _____ of _____

Contract Name: _____

Contract No: _____ Date: _____

System: _____

Item No.	Dwg. or Spec. Reference	Description/Response

01 80 00-E SYSTEM PUNCHLIST DOCUMENTATION FORM

Contract Name: ____

Contract No: ______________________ Date: ______________________

Title: ____

Item No.	Date	Location	Description	King County Acceptance	Date

09 90 00-A DAILY COATING INSPECTION FORM Page _____ of _____

King County Wastewater Treatment Division	Contract Number:
	Contractor:
	King County Representative:
	Location of Work:

Description of Work Performed:

Environmental Conditions: Taken every 4 hours during work

Time	Activity	Weather	Surf Temp Lo/Hi (°F)	Wet Bulb (°F)	Air Temp (°F)	RH%	Dew Point (°F)

Material Application:

Manufacturer	Product No.	Batch Nos	Color	Application Method	Gal. Used	Thinner No.	Time	
							Start	Stop

Abrasive Blasting:

Abrasive Manufacturer:
Type:
Size:
Surface Profile (in mils):

Surface Profile Test Tape:

(Place Here)

09 90 00-A DAILY COATING INSPECTION FORM (continued) Page _____ of _____

Check Points: Check all that apply

Applies? (y/n)	Test	Standard	Result
	Anchor Profile	ASTM D4417	
	Moisture	ASTM D4263	
	Holiday	NACE RPO 188	
	Adhesion	ASTM D3359	
	Salt	Bresle Method	
	Prime Coat DFT	-	
	Intermediate Coat DFT	-	
	Final Coat DFT	-	
	Ambient Conditions	-	
	Recoat Time	-	

Comments:

_____

_____

_____

Approved by:

King County Representative: _____

Contractor Representative: _____

26 05 00-A WIRE AND CABLE RESISTANCE TEST DATA FORM

Contract Name: _____

Contract No.: _____

Wire or Cable No. _____ Date of test _____

Ambient temperature _____°F

Location of Test	Insulation Resistance (megohms)
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	
11.	
12.	
13.	
14.	
15.	
16.	
17.	

CERTIFIED _____ _____

Signature of Contractor Representative — Date

WITNESSED _____ _____

Signature of Project Representative — Date

26 05 00-B INSTALLED MOTOR TEST FORM

Contract Name: _____

Contract No.: _____

Motor Equipment Number _____ Date of test _____

Equipment Driven _____ Ambient temperature _____°F

MCC Location _____

a. Resistance:

Insulation resistance, phase-to-ground, megohms:

Phase A _____ Phase B _____ Phase C _____

b. Current at Full Load:

Phase _____ Current, amps _____

Phase _____ Current, amps _____

Phase _____ Current, amps _____

c. Thermal Overload Device: Manufacturer/catalog # _____ Amps _____

d. Circuit breaker (MCP) setting: _____

e. Motor Nameplate Markings:

Mfr _____ Mfr type _____ Frame _____ HP _____

Volts _____ Phase _____ Rpm _____ **Service factor _____

Amps _____ Hz _____ Ambient temp rating _____°C

Time rating _____ (NEMA 1-10.35) **Design letter _____ (NEMA MG-1.16)

Code letter _____ Insulation class _____

**Required for 3-phase squirrel cage induction motors only.

CERTIFIED _____ _____
Signature of Contractor Representative Date

WITNESSED _____ _____
Signature of Project Representative Date

26 05 00-C DRY TRANSFORMER TEST DATA FORM

Contract Name: _____

Contract No.: _____

Equipment No. Date of Test __
Location _____ Ambient temperature __°F

Winding: Primary ____ Secondary ___

a. Insulation-resistance test:

The test shall be made with a megohmmeter at the test voltage for a period of 1 minute.

Test results (megohms)

Voltage rating		Test voltage	Phase	Phase
0-600	1000	A-GRD _____		A-B ___
601-5000		2500	B-GRD _____	B-C ___
5000+	5000	C-GRD _____		C-A ___

Resistance readings less than the manufacturer's recommended value or less than 10 megohms shall be brought to the attention of the Project Representative.

b. Dielectric-absorption test:

The test shall be made with a megohmmeter at the test voltage for a period of 10 minutes.

Test results (megohms)

Voltage rating		Test voltage	Phase	Phase
0-600	1000	A-GRD _____		A-B ___
601-5000		2500	B-GRD _____	B-C ___
5000+	5000	C-GRD _____		C-A ___

c. Calculate polarization index:

Polarization Index

Ten minute reading / _____ = polarization index / One minute reading

Phase	Phase
A-GRD _____	A-B ___
B-GRD _____	B-C ___
C-GRD _____	C-A ___

Polarization index values less than 2 shall be brought to the attention of the Project Representative.

CERTIFIED ___ _____
Signature of Contractor Representative Date

WITNESSED _ _____
Signature of Project Representative Date

26 05 00-D MOTOR CONTROL CENTER TEST FORM

Contract Name: _____

Contract No.: _____

Equipment No. Date of Test __
Location _____ Ambient temperature ___°F

A. Mechanical check:

All bolted connections either bus-to-bus or cable-to-bus shall be torqued to the manufacturer's recommendations.

B. Electrical tests:

1. Measure insulation resistance of each bus section phase to phase and phase to ground for 1 minute using a megohmmeter at 1,000 volts.

Test results (megohms)
Phase Phase

A-GRD _____ A-B ___

B-GRD _____ B-C ___

C-GRD _____ C-A ___

2. Set the circuit breaker in the starter unit to comply with the requirements of NEC, Article 430-52 and Table 430-152.

3. Motor overload heater elements shall be sized and installed based on the actual nameplate full load amperes of the motor connected to the starter.

CERTIFIED ___ Date __
Contractor Representative

WITNESSED _ Date __
Project Representative

26 05 00-K AUTOMATIC TRANSFER SWITCH TEST FORM

Contract Name: _____

Contract No.: _____

Equipment No. _____ Date of Test _____

Location _____ Ambient temperature _____°F

A. Perform an insulation resistance test (1,000V DC for 1 minute):

Phase	A	B	C	
Pole-to-ground	_____	_____	_____	megohms
Pole-to-pole	AB _____	BC _____	CA _____	megohms

B. Perform the following operations and initial:
1. Manual transfer _____
2. Loss of normal power; _____ seconds delay
3. Return to normal power; _____ seconds delay

CERTIFIED _____ _____
Signature of Contractor Representative Date

WITNESSED _____ _____
Signature of Project Representative Date

40 05 01-A PIPE SYSTEM TESTING FORM

Contract Name: _____

Contract No: _____

Site Location: _____

Test Date: _____

PIPESPEC System Number: _____

Piping Symbol/Service: _____ Pipe Material: _____

Test Fluid: _____ Test Pressure: _____

Test Duration: _____

Leaks (Type, location):

_____

_____

_____

_____

_____

Repairs:

_____

_____

_____

_____

_____

_____ _____

Signature of Contractor Representative Date

_____ _____

Signature of Project Representative Date

40 05 93-A MOTOR DATA SUBMITTAL FORM

Contract Name: _____

Contract No: _____ Specification Section: _____

Equipment Name: _____ Equipment Number(s): _____

Site Location: _____

Project: _____

Nameplate Markings

Mfr: _____ Model: _____ Frame: _____ HP: _____

Volts: _____ Phase: _____ RPM: _____ Service Factor: _____

FLA: _____ LRA: _____ Freq: _____ Ambient Temp Rating: _____°C

Time Rating: _____ (NEMA MG1-10.36) Design Letter: _____ (NEMA MG-1.19) Insulation Class: _____ (NEMA MG-1.66)

KVA Code Letter: _____ (NEMA MG1-20.9) NEMA nominal efficiency: _____ (NEMA MG-12.58)

The following information is required for explosion-proof motors only:

Approved by UL for installation in Class: _____ Div: _____

UL frame temperature code: _____ (NEC Tables 500-2 and 500-2(b)) Group: _____ Atmosphere: _____

Data Not Necessarily Marked on Nameplate

Type of enclosure: _____ Enclosure material: _____

Rated for Inverter Duty? Yes ____ / No ____

Temperature rise: _____°C (NEMA MG1-12.42, 12.43) Weight: _____lbs

Space heater included? _____Yes _____No; if Yes, _____watts _____volts

Type of motor winding over temperature protection, if specified:

_____

Use the space below to provide additional information on other motor modifications, if specified:

_____

_____

_____

43 05 01-A MANUFACTURER'S INSTALLATION CERTIFICATION FORM

Contract Name: _____

Contract No: _____ Specification Section: _____

Equipment name: _____

Contractor: _____

Manufacturer of equipment item: _____

The undersigned manufacturer of the equipment item described above hereby certifies that it has checked the installation of the equipment and that the equipment, as specified in the Contract, has been provided and installed in accordance with the manufacturer's recommendations and that the trial operation of the equipment item has been satisfactory.

Comments: _____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____ _____

Signature of Manufacturer's Representative Date

_____ _____

Signature of Contractor Representative Date

_____ _____

Signature of Project Representative Date

43 05 01-B MANUFACTURER'S INSTRUCTION CERTIFICATION FORM

Contract Name: _____

Contract No: _____ Specification Section: _____

Equipment name: _____

Contractor: _____

Manufacturer of equipment item: _____

The undersigned manufacturer certifies that a service Project Representative has instructed maintenance and operating personnel in the proper maintenance and operation of the equipment designated herein.

Operations Check List (check appropriate spaces)

_____ Safety procedures reviewed
_____ Start-up procedure reviewed
_____ Shutdown procedure reviewed
_____ Normal operation procedure reviewed
_____ Others: _____
_____
_____
_____
_____

Maintenance Check List (check appropriate spaces)

_____ Safety procedures reviewed
_____ Described normal oil changes (frequency)
_____ Described greasing frequency
_____ Described preventive maintenance
_____ Described special tools required
_____ Described normal items to be inspected/reviewed for wear
_____ Others: _____
_____
_____
_____
_____
_____

_____ _____
Signature of Manufacturer's Representative Date

_____ _____
Signature of Contractor Representative Date

_____ _____
Signature of Project Representative Date

43 05 01-C UNIT RESPONSIBILITY CERTIFICATION FORM

Project: _____

Contract No: _____

System (Operating Unit): _____

Specification Section: _____

System components comprising the system and specification sections: _____

_____

- _____

- _____

- _____

- _____

_____

Name of Contractor: _____

Manufacturer of Master Equipment: _____

In accordance with Section 43 05 01, the contractor hereby certifies that it has coordinated the above listed components of this System to meet the operational specifications, assumes responsibility for the compatibility of the system components with each other and assumes responsibility for the system to perform as specified.

Comments: _____

_____

_____

_____

_____

_____

_____

_____

_____ _____

Signature of Manufacturer's Representative Date

_____ _____

Signature of Contractor's Representative Date

43 11 40-A PROCESS AND FLUID COMPONENTS AND ELECTRICAL POWER RELATED COMPONENTS -- FACTORY TESTING CHECKLISTS

1. Process and Fluid Components

Included in Performance Boundary			
	Included in Test	Determine by Calculation	Not Applicable
Inlet filter			
Inlet silencer			
Discharge silencer			
Inlet isolation valve			
Throttling valve			
After cooler			
Misc. pipe and fittings			
Inlet air cooler			
Discharge check valve			
Discharge isolation valve			
Enclosure doors or panel openings			
Estimated system inlet pressure drop			
Additional components not listed included as forming the blower package			

2. Electric Power Related Components

	Included in Performance Boundary		
	Included in Test	Determine by Calculation	Not Applicable
Drive motor			
Motor cooling fan(s)			
Magnetic bearing(s) and controller(s)			
Bearing cooling fan(s)			
Coolant pumps			
Lubrication pump(s) and accessories			
Heat exchanger fan(s)			
Package cooling fan(s)			
VFD(s)			
VFD line-side power- conditioning equipment			
VFD load-side power- conditioning equipment			
Eddy current or variable speed clutch			
Operation control panel(s)			
Power/isolation transformers and power supplies			
Power conditioner(s)			
Blower and motor cooling systems			
VFD cooling			
Additional components not listed included as forming the blower package			

43 11 40-B BLOWER FIELD PERFORMANCE TEST RESULTS

Design Point	Input kW Reading	Discharge Mass Flow (scfm)	Discharge Pressure (psig)	Ambient Temp. (degrees F)	Discharge Temp. (degrees F)	Relative Humidity (%)
1						
2						
3						
4						
5						
6						
7						
8						
9						

SECTION 01 33 29

SUSTAINABILITY REPORTING

PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies sustainability reporting requirements.

1.02 SUBMITTALS

A. Procedures: Section 01 33 00.

B. Completed sustainability reporting forms:
   1. Form 01 33 29 – A Recycled Content Materials
   2. Form 01 33 29 – D Resource Reuse
   3. Form 01 33 29 – E Indoor Air Quality Management During Construction

1.03 SUSTAINABILITY REPORTING FORMS

A. Appoint a person responsible for completing the forms. The person shall be responsible for tracking the information required throughout the submittal period to complete the forms.

B. The Contractor shall notify the Project Representative of changes in personnel performing this function.

C. Use the form in Section 01 33 10.

D. Amount of material (recycled material, local materials, FSC Certified wood) can be calculated on either weight, volume, or cost but must remain consistent.

E. Submit forms prior to Substantial Completion, or as directed by the Project Representative.

PART 2 PRODUCTS [NOT USED]

PART 3 EXECUTION

3.01 DOCUMENTATION

A. Complete and submit forms in accordance with this section.

3.02 SUSTAINABILITY INFORMATION PAYMENT

A. One half percent (0.5%) of the awarded Contract Price shall be assigned in the Schedule of Values for preparation and submittal of the sustainability reporting forms. Payment shall be made upon receipt of the completed forms per paragraph 1.03 and subsequent review with the submittal received a Review Action of either “1” (No Exceptions Taken) or “2” (Note Markings).

END OF SECTION

SECTION 01 35 29

HEALTH AND SAFETY

PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies procedures for complying with applicable laws and regulations related to worker safety and health. Adhere to applicable federal, state and local safety and health standards.

B. It is not the intent of the County to develop, manage, direct, and administer the safety and health programs of contractors or in any way assume the responsibility for the safety and health of their employees.

C. It is not the intent of the County to list and identify applicable safety codes, standards, and regulations requiring compliance by contractor and subcontractor groups. Contractor shall be solely responsible for identifying and determining all safety codes, standards, and regulations that are applicable to the work.

D. Wastewater conveyance and treatment systems are comprised of a vast array of structures and pipelines that carry a wide spectrum of residential and industrial waste substances and materials. As such, the Contractor's personnel may potentially be exposed to various hazards associated with wastewater sewerage systems and structures, including, but not limited to: active sewer flows, confined spaces, hazardous energy sources, fall hazards, flammable/explosive, toxic and suffocating gases; petroleum vapors; industrial discharges, rodents, insects and infectious biological organisms. Contractor and subcontractors shall inform and educate all personnel as to the hazards and shall require the necessary personal safety precautions associated with construction around live sewer systems and structures.

E. This Section addresses the Accident Prevention Program (APP) required in Chapter 296-800 WAC.

F. This Section describes the requirements for submittal of the Contractor's Site Specific Health and Safety Plan (HASP). A HASP is a supplement to a Contractor's APP, however, it need not duplicate material in the APP. The HASP identifies all real and potential hazards during each phase of execution of the Work and provides a specific plan to deal with each hazard. Essentially, a HASP is a Job Hazard Analysis (JHA) of the entire project. A JHA is sometimes referred to as Job Safety Analysis (JSA) or Activity Hazard Analysis (AHA). The HASP shall clearly define responsibilities for Contractor and subcontractor employees per Chapter 296-155 WAC and WRD 27.00.

1.02 REFERENCED STANDARDS

A. This Section incorporates by reference the latest revisions of the embedded standard referenced herein. In case of conflict between the requirements of this Section and those of a listed document, the requirements of this Section shall prevail.

Reference	Title
29 CFR 1910.146	Permit Required Confined Spaces
29 CFR 1910.147	Control of Hazardous Energy (lockout/tagout)
29 CFR 1926	Safety and Health Regulations for Construction (OSHA)
Chapter 49.17 RCW	Washington Industrial Safety and Health Act (WISHA)
Chapter 296-24 WAC	DOSH / WISHA General Safety and Health Standards
Chapter 296-37 WAC	DOSH / WISHA Safety Standards for Commercial Diving
Chapter 296-65 WAC	DOSH / WISHA Asbestos Removal & Encapsulation

Reference	Title
Chapter 296-67 WAC	DOSH / WISHA Process Safety Management Standards
Chapter 296-155 WAC	DOSH / WISHA Construction Safety
Chapter 296-800 WAC	DOSH / WISHA Safety and Health Core Rules
Chapter 296-803 WAC	DOSH / WISHA Lockout Tagout (Hazardous Energy Control)
Chapter 296-809 WAC	DOSH / WISHA Permit Required Confined Spaces
Chapter 296-823 WAC	DOSH / WISHA Bloodborne Pathogens
WRD 27.00	DOSH / WISHA Regional Directive
NFPA 70E	Standards for Electrical Safety in the Workplace
NFPA 820	Fire Protection in Wastewater Treatment and Collection Facilities
NFPA 51B	Standard for Fire Prevention during Welding, Cutting, and Other Hot Work
RCW 39.04.180	Trench Safety Systems, Safety Systems Required

1.03 SUBMITTALS

A. Procedures: Section 01 33 00.

B. Qualifications.

C. Company Accident Prevention Plan (APP):
   1. Update to reflect responses to Section 00440 review comments in the bid evaluation.
   2. Submit within five days of the effective date of the NTP.
   3. Submit revisions during the execution of the work.

D. Site Specific Health and Safety Plan (HASP):
   1. Submit specific to the scope of work prior to starting the related work.
   2. Revised HASP that addresses changes in the Work.

E. Accident/Incident Report(s): provide within 24 hours.

F. Minutes and list of attendees of the pre-job safety meeting: provide within three days of the meeting.

G. Minutes and list of attendees of weekly safety tailgate meeting: provide within three days of the meeting.

H. Monthly Contractor Injury Summary Report: provide each month on Form 01 35 29-A within ten days of the end of each month.

I. Weekly summary of the daily site safety walk-through.

J. Notice and listing of flammable liquids and liquefied petroleum gases when they are planned to be used on the Site.

1.04 QUALITY ASSURANCE

A. Qualifications:
   1. Site Health and Safety Officer:
      a. Possess a minimum of five years progressive safety experience on projects similar in nature to the work to be done on this Contract.
      b. Be knowledgeable concerning all Federal and State regulations applicable to safety.
      c. Completed the OSHA 40-hour Safety and Health Course (OSHA 500).

d. Possess competent person certification in construction safety disciplines related to the work to be performed and be able to identify competent persons required by State and Federal safety standards for which they are not certified.
e. Training and current certification for CPR and First Aid.
f. Possess training and be capable of performing accident investigations and developing a concise report.
g. Possess training in the development and presentation of safety training meetings.

2. Shift Safety Officers:
   a. Possess a minimum of three years progressive safety experience on projects similar in nature to the work to be done on this Contract.
   b. Be knowledgeable concerning all Federal and State regulations applicable to safety.
   c. Completed the OSHA 10-hour Safety and Health Course.
   d. Possess competent person certification in construction safety disciplines related to the work to be performed and be able to identify competent persons required by State and Federal safety standards for which they are not certified.
   e. Trained in and possess current certification for CPR and First Aid.
3. Although not required, the following qualifications may be considered as contributing to the relevant experience required.
   a. Certified Safety Professional (CSP) certification from the American Society of Safety Engineers.
   b. Degree from an institution of higher learning in Occupational Safety and Health.
   c. ASSE Certified Safety Technician (CST).
   d. Qualification as an instructor in CPR/First Aid or the OSHA 30 hour program.

B. Work shall meet the requirements of:
   1. 29 CFR 1926
   2. Chapter 49.17 RCW

1.05 SITE SPECIFIC HEALTH AND SAFETY PLAN (HASP)

A. A comprehensive HASP covers all aspects of the Contractor's work activities related specifically and distinctly to the Work and site conditions. The HASP shall be based on a site specific hazard analysis and shall explain how the APP elements and site specific safety procedures shall be applied to the identified hazards in the work.

B. At a minimum, provide the HASP detailing the safe work procedures and the safety preventive measures to be taken to provide an appropriate work environment for its employees, as well as County staff on site.

C. The HASP shall be descriptive in nature, to provide the appropriate level of understanding for the potential hazards associated with the work to be performed at all stages and phases.

D. The HASP shall provide an appropriate work environment for all persons on Site including Contractor and subcontractor employees, County staff, and authorized individuals.

E. The HASP shall address all necessary personal protective equipment (PPE), atmospheric/air monitoring, safety equipment and tools, safety planning and coordination necessary to perform work safely.

F. During the work, update as an addendum to the HASP, changes in conditions or scope of work before continuing work.

G. Before beginning the work addressed in the HASP, meet the requirements of Section 01 33 00 that indicate a marking of a “1” or a “2”.

H. HASP organization:
   1. Organized and bound to readily accept revisions and additions.

2. Outline form.
3. Table of contents.
4. Numbered pages.

I. Contractor and subcontractors are encouraged to use the consulting services of the State of Washington's Department of Labor and Industries (WISHA). The Seattle Field Office is located at:
315 5th Avenue South, Suite 200
Seattle, WA 98104-2607
(206) 515-2800
http://www.lni.wa.gov/wisha/
Call or write for assistance with the requirements of this Section.

1.06 CONTRACTOR SAFETY QUALITY ASSURANCE

A. Review the entire scope of work and applicable Contract requirements.

B. Inspect the work site location and adjacent structures and systems to ensure that all safety considerations and requirements are addressed and planned prior to the start of work in the site specific HASP.

C. Ensure that all Contractor and subcontractor employees comply with the APP and HASP.

D. Designate a Site Health and Safety Officer on site with appropriate training, responsibility, and full authority to coordinate, implement, and enforce the Contractor's APP and HASP for the duration of the Work.

E. In the APP and HASP, provide the name and telephone number of the Site Health and Safety Officer and the resume reflecting experience and training for the position. If there will be an alternate or additional staff with safety responsibilities, provide name and telephone number and qualifications in the APP and HASP.

F. Ensure that safe work principles and practices are followed in completing work tasks.

G. Document a daily site safety walk-through noting observations and corrective actions.

H. If the Health and Safety Officer is to be changed during the Contract, submit Qualifications per this Section of the proposed officer prior to implementation on the Contract.

I. Be responsible to correct hazardous conditions and practices. When more than one contractor is working within a given area, identify which personnel have the authority to take action to prevent physical harm and property damage.

1.07 HASP CONTENT

A. The following describes certain minimum precautions for consideration in developing a HASP. Include in the HASP all of the items which may apply to the work. There may be other items not indicated below which shall be addressed in the HASP. The items indicated below do not cover every possible situation or hazard. Items that are not needed shall be noted in the HASP as not applicable (N/A).

B. Construction COVID-19 Job Site Requirements:
1. The submitted HASP will include project site-specific job site requirements that conform to the following guidance documents:
   a. Governor Jay Inslee's Construction Requirements – Construction COVID-19 Job Site Requirements Implementation of Phase 1 Construction Restart – Proclamation 20-25.
   b. DOSH Directive 1.70 – General Corona Virus Prevention: General Coronavirus Prevention Under Stay Home - Stay Healthy Order

c. Additional COVID19 Job Site Requirements as they are identified by WTD Safety.

C. Hazard Communication (Chapter 296-800 WAC):
   1. Contaminant gases that may be encountered include, but are not limited to: hydrogen sulfide, methane, carbon monoxide, and carbon dioxide.
   2. Provide a written Hazard Communication Program and emergency management plan addressing these and other potential hazardous substances that may exist and be brought on site during the work.
   3. For work requiring use of hazardous materials and chemicals, provide a list and corresponding Material Safety Data Sheets (MSDS)/Safety Data Sheets (SDS) for hazardous chemicals to be used on site. If no hazardous chemicals are to be used, provide statement to that effect.

D. Lockout Tagout (Hazardous Energy Control) (Chapter 296-803 WAC):
   1. The nature of the work may expose workers to hazardous energy sources that include, but are not limited to, electrical, mechanical, pneumatic, hydraulic, thermal, and computerized systems.
   2. Provide a written plan outlining safe work practices addressing hazardous energy control procedures that meet the requirements of 29 CFR 1910.147 and Chapter 296-803 WAC.
   3. When working in existing WTD facilities, the written plan shall be coordinated and be compatible with WTD's existing program for Lockout Tagout (Hazardous Energy Control).

E. Fall Prevention and Protection (Chapter 296-24 WAC Part J-1 and Chapter 296-155 WAC Part C-1):
   1. The nature of the work may expose workers to fall hazards.
   2. Provide a written Fall Prevention and Protection plan outlining safe work practices addressing fall hazards that meet the requirements of Chapter 296-24 WAC Part J-1 and Chapter 296-155 WAC Part C-1.

F. Personal Protective Equipment (PPE) (Chapter 296-800 WAC):
   1. The nature of the work may expose workers to miscellaneous injury hazards that include, but are not limited to: head, hands, feet, body, eyes, and ears.
   2. Provide a written PPE plan outlining safe work practices addressing the use of PPE and clothing that meet the requirements of Chapter 296-800 WAC.

G. Biological Hazards and Bloodborne Pathogens (Chapter 296-823 WAC):
   1. Wastewater systems carry a wide spectrum of disease-producing organisms.
   2. Provide a written hazard communication and biological/bloodborne pathogen program detailing the preventive measures to be taken to provide an appropriate work environment for all site employees as well as County staff on site. These may include, but are not limited to:
      a. Instruction in appropriate measures to avoid contamination.
      b. A preventative inoculation program (tetanus/diphtheria, etc.) available to all employees.
      c. PPE and clothing to protect against infection, including rubber boots with full sole and heel steel insert-liners, safety glasses or goggles, and gloves.
      d. Facilities for workers to clean up, wash, and maintain good personal hygiene practices.

H. Fire Protection - Hot Work and Hot Work Permits (HWP):
   1. NFPA 51B - Standard for Fire Prevention During Welding, Cutting, and Other Hot Work shall be followed unless it does not meet the requirements of this section.
   2. A HWP shall be utilized in all WTD facilities and on construction sites where the potential for the ignition of explosive gases, liquids and flammable/combustible materials, and oxygen enriched atmospheres may potentially exist.
   3. Identify any type of work that produces a possible source of ignition in the presence of a fuel and oxygen (Fire Triangle) including, but not limited to: sparks, static electricity, welding, torch cutting, flame heating, brazing, grinding, sanding, and drilling. These activities are considered extremely dangerous in areas where the potential for a Lower Explosive Limit (LEL) above 10% or oxygen-enriched atmosphere above 23% could be encountered.
   4. A HWP is required for areas that are classified per the WAC or NFPA 820, as applicable.
   5. Permit-Required Confined Spaces.

6. Process Safety Management (PSM) system areas.
7. Class 1 Division 1/Division 2 hazardous locations.
8. All other areas where the hot work would be in close proximity to combustibles or flammables.
9. All sites under contractor control.
10. Document how contractor HWP is established.
11. Employ a system for issuing and monitoring HWP use.
12. A HWP is valid only for:
    a. The parties performing the work.
    b. The work shift when the work is conducted.
    c. Only for the conditions observed and evaluated when the permit is issued.
13. If a HWP is required by the local Fire Department/ Fire Marshall Jurisdiction Having Authority (JHA) the contractor shall be required to obtain a HWP. If not required by the JHA then the contractor shall use their own corporate HWP.
14. Torch applied roofing requires a HWP and a fire watch.
    a. Regular fire-watch inspections should be done throughout the day by a competent person and for a minimum of two hours starting when the last torch is extinguished on a roof. Inspections should include the roof's entire field, flashings and the underside of the roof deck.

I. Flammable Liquids and Liquefied Petroleum Gases (LPG):
1. No propane, propylene, butane, isobutane, and butylenes shall be stored inside buildings.
2. Provide a written list of any of these materials that will be used on Site.

J. Heavy Equipment Operations, Staging:
1. All vehicles shall have a service brake system, an emergency brake system, and a parking brake system. These systems shall be maintained in operable condition and may use common components.
2. Before leaving a motor vehicle unattended the motor shall be stopped. The parking brake shall be engaged and the wheels turned into curb or berm when parked on an incline. If parking on an incline and there is no curb or berm, the wheels shall be chocked or otherwise secured.

K. Suspect Material:
1. Unless otherwise indicated, promptly suspend work and notify the Project Representative of unusual conditions, including oily soil found on the Site. Work shall remain suspended until the Project Representative authorizes, in writing that the work may resume.

L. Traffic Control Plan:
1. The needs and control of all road users (motorists, bicyclists, and pedestrians) within the highway, or on private roads open to public travel, including persons with disabilities, through a temporary Traffic Control zone shall be an essential part of highway construction, utility work, maintenance operations, and the management of traffic incidents.
2. When the work requires the occupation of traffic lanes, parking lanes, parkways, or other public right-of way closures, it shall be per the Local Authority Having Jurisdiction. See Section 01 55 26 for requirements.

M. Electrical Safety:
1. Use either ground-fault circuit interrupters or assured equipment grounding conductor program to protect employees on construction sites covering all cord sets, receptacles which are not a part of the building or structure, and equipment connected by cord and plug which are available for use or used by employees. These requirements are in addition to any other requirements for equipment grounding conductors per WAC 296-155-447.
2. In work areas where the exact location of underground electric power lines is unknown, no activity that may bring employees into contact with those power lines shall begin until the power lines have been positively and unmistakably de-energized and grounded.
3. Where overhead electric conductors are encountered in proximity to a work area be responsible for ascertaining the voltage and minimum clearance distance required and maintaining the minimum clearance distance per WAC 296-155-428.

4. Do not permit an employee to work in such proximity to any part of an electric power circuit that the employee could contact the electric power circuit in the course of work, unless the employee is protected against electric shock by de-energizing the circuit and grounding it or by guarding it effectively by insulation or other means.
5. Work on energized equipment:
    a. Only qualified persons shall work on electric circuit parts of equipment that have not been de-energized under the procedures of WAC 296-155-429(4). Such persons shall be capable of working safely on energized circuits and shall be familiar with the proper use of special precautionary techniques, PPE, insulating and shielding materials, and insulated tools.
    b. Use of an Energized Electrical Work Permit shall be required to ensure all shock and arc flash hazard have been considered.

1.08 UTILITIES

A. Call the Utilities Underground Location Center (UULC) before you dig, phone number 811.

B. During the performance of the work, take appropriate precautions when working near, around, and with utilities, in order to protect the health and safety of the worker, the public, property, and the environment.

C. Provide a flagged warning line for all work conducted in proximity to power lines. Coordinate and meet the requirements of the utility owner for this work.

D. Coordinate and meet the requirements of the utility owner and the Project Representative to obtain approval to disconnect or reconnect utilities.

PART 2 PRODUCTS [NOT USED]

PART 3 EXECUTION

3.01 SAFETY AND HEALTH COMPLIANCE

A. Implement the written APP as required by Chapter 296-800 WAC, submitted in the bid evaluation per Section 00440 and accepted at the conclusion of the bid evaluation.

B. The Project Representative reserves the right to audit the Contractor's APP and implementation of the HASP.

C. Ongoing work and hazardous situations that are considered a health and safety risk by the Project Representative shall be corrected immediately.

D. Be responsible to stop that portion of the work that is determined to be an imminent or immediate threat to worker health and safety.

E. Ensure that necessary air monitoring, ventilation equipment; protective clothing, hazardous energy control devices, fall prevention, and other specified supplies and equipment are made readily available to employees to facilitate implementation of the APP and the HASP.

F. WTD facility entry:
    1. Protocols shall be followed.
    2. Enter all facilities in teams of two or more.
    3. With written approval of the Project Representative, Contractor may enter alone only for short-term walk through inspections that do not involve working on ladders, with electrical equipment, or entering confined spaces.
    4. Any work beyond short-term work that involves Contractor working alone requires written approval of the Project Representative.

G. Incidents:
   1. Notify the Project Representative immediately of all near miss incidents and all incident accidents involving personal injury and property damage.
   2. Provide a written report known as the Incident Report within 24 hours of any incident. Report for each incident occurrence shall include:
      a. Description of the event.
      b. Names of personnel involved.
      c. Description of injuries and treatment required (short term and long term).
      d. Description of property damage.
      e. Site visits and inspections of other agencies as a result of an incident. Include names of the persons, purpose of the visit, and any other pertinent information.

H. Conduct a pre-job safety meeting with Contractor staff and with all subcontractor staff. Submit list of attendees and minutes of pre-job safety meeting.

I. Conduct all weekly safety tailgate meetings. Submit list of attendees and minutes of weekly safety tailgate meetings.

J. Submit a Monthly Contractor Injury Report on Form 01 35 29-A in Section 01 33 10 consisting of a summary of the current month's injury accidents.

K. Use of intoxicants or of illegal or debilitating drugs while working on a County contract is prohibited.

L. Failure to comply with safety and health regulations may result in work suspension until adequate safety and health measures are implemented.

M. No Safety Officer shall be assigned that does not meet the requirements of this section.

N. Submit all safety related citations received for Contract work immediately upon receipt. If appealed to the state of Washington, notify the Project Representative a minimum of every month updating the status of the appeal until resolved. Submit documentation of the findings when resolved.

3.02 SITE SPECIFIC HEALTH AND SAFETY PLAN REVISIONS

A. In the event that the Project Representative, regulatory agencies, or jurisdictions determine the HASP, associated documents, or organizational structure to be inadequate to protect employees and the public:
   1. Modify the APP and HASP to meet the requirements of said regulatory agencies, jurisdictions, and the Project Representative.
   2. Provide submittal for revisions to the APP and HASP within seven days of the notice of a required modification.

3.03 POSTING

A. Provide and maintain a copy of the most up to date APP and the HASP at the Contractor's site office and at each of the subcontractors' offices.

3.04 COMPLIANCE

A. Failure to comply with this Section will result in work suspension until adequate safety and health measures are implemented.

3.05 TECHNICAL ASSISTANCE

A. Technical assistance is available from:
   Wastewater Treatment Division
   Safety and Hazardous Materials Program Office
   201 South Jackson St.
   Mail Stop: KSC-NR-0515
   Seattle WA 98104
   1. Contacts:
      a. Jim Faccone – WTD Safety and Hazardous Materials Program Manager
         1) Phone (206) 477-5379
      b. Terry Fiber – WTD Construction Safety Coordinator
         1) Phone (206) 477-5383

END OF SECTION

SECTION 01 35 43

ENVIRONMENTAL PROCEDURES

PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies environmental controls and requires plans that describe how the Contractor will manage environmental mitigation and controls during the Work.

1.02 REFERENCED STANDARDS

A. This Section incorporates by reference the latest revisions of the following embedded standards referenced herein. In case of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

Reference	Title
Chapter 173-201A WAC	Water Quality Standards for Surface Waters of the State of Washington
Chapter 173-60 WAC	Noise Levels
Chapter 173-303 WAC	Dangerous Waste Regulations

1.03 SUBMITTALS

A. Procedures: Section 01 33 00.

B. Environmental Mitigation Binder (EMB) and its revisions.

1.04 ENVIRONMENTAL MITIGATION BINDER (EMB)

A. Develop and maintain for the duration of the Contract an EMB that comprehensively incorporates plans for implementing all required environmental controls, including but not limited to the requirements of this Section and other referenced Sections.

B. The EMB specified in this section shall constitute the “Environmental Mitigation Plan” required in Section 00700.

C. The following plans and subsequent revisions shall be submitted as a part of the EMB.
   1. Spill Prevention and Spill Response Plan
   2. Construction and Demolition Material Management Plan (Section 01 74 19)
   3. Appoint a person who is qualified, authorized, and available 24 hours per day to supervise and enforce compliance with the Plans. Provide the person’s name, affiliation, and 24-hour-access phone number. Coordinate with the Project Representative to designate a temporary substitute if required.

D. Unless otherwise specified, complete the entire EMB prior to initiating the work.

E. In the event that the County, regulatory agencies, or jurisdictions determine any of the Plans in the EMB or the Contractor's activities to be inadequate to protect the environment:
   1. Stop the work in progress until adequate environmental protection measures are implemented.
   2. Modify the Plans to meet the requirements of regulatory agencies, jurisdictions, and the County.
   3. Submit and receive acceptance of modifications to the Plans prior to restarting the work.

1.05 SPILL PREVENTION AND SPILL RESPONSE PLAN (SPILL PLAN)

A. Prepare and submit a specific Spill Plan as a part of the EMB, to be used for the duration of the Work. The Spill Plan shall address the following requirements:
   1. Spill Prevention:
      a. Identify personnel responsible for managing and implementing the spill plan.
      b. Provide a site plan showing:
         1) Staging areas, chemical storage areas, fuel tanks, and refueling locations, and their relationship to drainage pathways, waterways, and other sensitive areas.
      c. Identify spill prevention and containment methods to be used.
      d. Identify security measures, inspection procedures and personnel training procedures as they relate to spill prevention, containment, response, management, and cleanup.
      e. Address: equipment maintenance, refueling, and cleaning activities and on site storage areas for hazardous materials.
   2. Spill Response:
      a. Outline spill response procedures including assessment of the hazard, securing spill response and personal protective equipment, containing and eliminating the spill source, and mitigation, removal, and disposal of the material.
      b. Include the following:
         1) Methods for immediately containing all visible floating oils with booms, dikes, or other appropriate means.
         2) Methods for immediately containing all visible oils on land using dikes, straw bales, or other appropriate means.
         3) Identification of the equipment and materials to be maintained on each Site to carry out the responsive measures.
         4) Location of disposal of waste materials at a legal site that accepts the waste.
         5) List of 24-hour response numbers for agency notification in the event of any oil or product discharges into public water, or onto land with a potential for entry into public waters.

1.06 CONSTRUCTION AND DEMOLITION MATERIAL MANAGEMENT PLAN

A. Include the accepted C&D Material Management Plan submitted per Section 01 74 19, and subsequent updates, in the EMB.

1.07 NOISE CONTROL PLAN

A. Prepare and submit a Noise Control Plan, to be included in the EMB, which identifies measures to mitigate noise generated by the work.

B. At a minimum, the Noise Control Plan shall include the following:
   1. Hours of work operation, including daytime and nighttime hours.
   2. Identification of noise-generating equipment.
   3. Layout of equipment, including anticipated changes in layout.
   4. Hours of operation of each piece of equipment.
   5. Noise mitigation measures for each piece of equipment.
   6. Any additional mitigation measures not related to a specific piece of equipment.

C. Update and modify identified mitigation measures whenever major activity changes or different noise-generating equipment is mobilized on the Site from the equipment previously submitted.

D. List mitigation measures for each Site and for each change in major activities to be performed at the Site.

E. The Noise Control Plan shall meet applicable noise codes and standards in the areas of work:
   1. Hours, of work at site: Section 01 14 00.

2. Noise Variances:
    a. Noise variances are prohibited for this project without additional approval.

F. Since Contractor means and methods are not known to the County, the following represents a list of potential noise mitigation measures:
    1. Use electric or hydraulic tools and equipment.
    2. Adjust noisy operations with the hours of work.
    3. Use noise walls on part or all of the Site.
    4. Use sound blankets, noise attenuation enclosures, and barriers.
    5. Install individual noise barriers or enclosures around equipment.
    6. Use the best available equipment and technology that assist in meeting noise requirements.
    7. Close gates of screening walls, where applicable.
    8. Provide equipment with properly sized and maintained mufflers and silencers as appropriate.
    9. Use broad-band alarms on equipment with back-up alarms.
    10. Limit engine idling time of vehicles, including delivery and haul trucks, to five minutes maximum.

PART 2 PRODUCTS – [NOT USED]

PART 3 EXECUTION

3.01 PERSON RESPONSIBLE

A. The person responsible for implementation of the plans in the EMB shall be given the authority to take appropriate actions to safeguard the environment during the work. The materials, equipment, and supplies necessary to implement the plans shall be readily available at all times.

3.02 SITE MAINTENANCE

A. In addition to the requirements of this Section, comply with the requirements of Section 00700 regarding site maintenance, site cleanup, the lawful handling of Hazardous Materials, and Contractor responsibilities.

B. Maintain lids on all refuse containers.

C. Handle paints, solvents, fuel, oil, and other construction materials with care to prevent entry of contaminants into storm drains, surface waters, or soils.

D. Remove materials and equipment from the site when they are no longer necessary. Do not allow waste material to remain on or adjacent to the site. Collect, carry off the site, and legally dispose of such materials as specified in Section 01 74 19.

E. Potentially contaminated soils (suspect soils) which require further analysis may be temporarily stockpiled on the site per the Project Representative’s requirements.

F. Be responsible for obtaining necessary permits or approval for the Contractor's disposal sites.

G. Unless otherwise indicated, restore ground surface to its pre-construction condition. Restore disturbed areas by replanting or repaving as soon as practical after construction.

3.03 CONSTRUCTION AND DEMOLITION MATERIALS MANAGEMENT

A. Comply with the requirements of Section 01 74 19.

3.04 WATER QUALITY PROTECTION

A. Conform to the regulations and requirements of legally authorized surface water management agencies. Do not allow water discharges to exceed the state or local Water Quality Standards.

B. If water quality standards or permit conditions are violated, shut down work causing the violation until protection and remediation is completed. Be responsible for all associated impacts.

C. Be responsible for the overflow of any storm drains resulting from the addition of flow from Contractor's activities and any damages associated with such overflow.

D. Conduct operations in such a manner as to prevent sediment, construction equipment wash water, and other pollutants from reaching existing sewers, storm drains, wetlands, and surface waters.

E. Prevent additional construction wastes such as paper, wood, garbage, sanitary wastes, and fertilizer from leaving the site and entering waterways. Dispose of all debris on land in such a manner that it cannot enter a waterway or cause water quality degradation.

F. Water in contact with uncured concrete is toxic to aquatic life. Do not discharge water contaminated with fresh concrete into surface water bodies or storm or sewer pipes. Water in contact with concrete may only be discharged when it complies with WAC 173-201A and is permitted by the authority having jurisdiction.

3.05 AIR POLLUTION CONTROL

A. Do not discharge smoke, dust, and other contaminants into the atmosphere that violate the regulations of the authorities having jurisdiction. Prevent smoke, dust, engine exhaust fumes, and other contaminants from entering building spaces by directing them away from building intake plenums, building doors, or openings.

B. Maintain construction vehicles and equipment in good repair. When exhaust emissions are determined to be excessive, repair or replace equipment.

C. Do not allow internal combustion engines to idle for prolonged periods of time. Unless otherwise needed for functioning of equipment, the Contractor shall not allow gasoline or diesel powered machines or equipment to idle longer than five minutes. Examples of this exception may include; testing, servicing, repairing, and reaching operating temperatures and safe operational conditions.
   1. Communicate this restriction to employees on a regular basis.
   2. The Contractor shall provide a written report on the fuel burn of each piece of heavy equipment to the Project Representative on a monthly basis.

D. Use electrically-powered equipment where practical.

E. Minimize dust nuisance by cleaning, sweeping, sprinkling with water, or other means. The use of water in amounts which result in mud on public streets is not acceptable as a substitute for sweeping or other methods. Make equipment for this operation available at all times.

F. Protect existing facilities and equipment from dust generated from the Contractor’s activities.

3.06 SPILL PREVENTION AND SPILL RESPONSE

A. Implement the Spill Plan as accepted. Modify as required.

B. All pollutants that occur on-site during construction shall be handled and disposed of in a manner that does not cause contamination of storm water or ground water.

C. Prevent, contain, and be responsible for spill clean-up of pollutants. Pollutant discharge into state waters or onto adjacent land is not permitted and violates state Water Quality Standards.

D. Store solid chemicals, liquid chemicals, paints, petroleum products, caustic solutions, and waste materials, including batteries and electronic components, to prevent entry of contaminants into all waters including groundwater.

E. Spill prevention:
   1. Store liquid and solid Hazardous Materials and other pollutants on durable impervious surfaces and within manufactured secondary containment vessels capable of containing 110 percent of the largest single container stored in the containment vessel. Plastic sheeting is not an acceptable product for use in a containment system for long term storage of chemicals or equipment with fuel tanks.
   2. Store waste liquids under cover, such as tarpaulins or roofed structures, to prevent entry of rainwater into the containment vessel.
   3. Place equipment with fuel tanks in secondary containment vessels, or if the equipment is moved often, attach spill pads under the fuel tank.
   4. Segregate non-compatible or reactive chemicals to prevent possibility of mixing.
   5. Clearly designate all waste storage areas, whether for waste oil or hazardous waste, as such and keep segregated from new product storage.
   6. Label all containers with the type of material being stored and post Material Data Sheets (MDS) near the storage areas.
   7. Store all “empty” containers not cleaned in an upright secure manner. Label the containers: “Empty.”
   8. Locate materials, refueling locations, and equipment away from drainage pathways, waterways, and other sensitive areas to the maximum extent possible.
   9. Identify and implement reasonable steps to be taken to prevent releases of liquid products from malicious tampering or vandalism.
   10. Inspect secondary containment vessels, fuel hoses, lubrication equipment, hydraulically-operated equipment, oil drums, and other equipment and facilities regularly for drips, leaks, or signs of damage, and maintain and store properly to prevent spills.

F. Spill response:
   1. Maintain at each work site, and restock as necessary to ensure an adequate and continuous supply, a spill kit containing the following materials at a minimum:
      a. Oil-absorbent booms: Four each, five feet long.
      b. Oil-absorbent pads or bulk material, adequate for coverage of 200 square feet of surface area.
      c. Oil-skimming system, if appropriate.
      d. Sand bags.
      e. Oil absorbent material, such as kitty litter or sawdust, for material spills on land.
      f. Gloves for use when performing the work.
      g. Plastic bags to collect the used material.
      h. Place spill kits near locations of chemical storage, fuel tanks, and fuel refilling stations. Identify the locations of spill kits on the ESC Plan.
      i. In the event of a spill: Immediately contain all visible pollutants on the water with booms, or other appropriate means.
      j. In the event of a spill: Immediately contain all visible pollutants on land using dikes, sand bags, or other appropriate means and remove using sand, ground clay, kitty litter, sawdust, or other absorbent material.
      k. Remove oil sheens from water in secondary containment vessels prior to discharge into state waters.
      l. Temporarily store cleaned up waste materials in drums or other leak-proof containers after clean-up and during transport to disposal. Dispose of waste materials properly at a legal site.

m. In the event of any oil or other chemical discharges into public waters, or onto land with a potential for entry into public waters, immediately notify the following agencies at their listed 24-hour response numbers:
    1) Washington Department of Emergency Management: (800) 645-7911
    2) U.S. Coast Guard National Response Center: (800) 424-8802

3.07 NOISE CONTROL

A. Implement the Noise Control Plan as accepted. Modify as required.

B. Unless otherwise indicated through a noise variance, comply with local controls and noise level rules, regulations and ordinances, which apply to work performed.

C. Schedule noisy activities to minimize their duration.

D. Each internal combustion engine, used on the job or related to the job, shall be equipped with a muffler of a type recommended by the manufacturer. No internal combustion engine shall be operated without said muffler.

E. Provide notification of special circumstances or emergency conditions that require work beyond the hours specified as follows:
    1. Notify the Project Representative and local authority in advance of any proposed extended work hours for preauthorization. Include a written request for authorization per Section 01 14 00 to perform work specified and the circumstances that warrant this request. Include any additional measures to mitigate noise generated by this construction activity if deemed necessary by the Project Representative.
    2. If an emergency situation occurs that warrants extended hours, notify the Project Representative immediately upon determining the need for this work.

F. Noise complaints received by the Project Representative during the work will be shared with the contractor. Work with the Project Representative, as required, to resolve noise related complaints. Modify the Noise Control Plan to reflect major changes.

3.08 FINES

A. Be responsible for all fines incurred from non-compliance with regulations of governing authorities.

END OF SECTION

SECTION 01 41 26

PERMITS AND EASEMENTS

PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies permit, easement and right-of-entry agreements requirements.

1.02 PERMITS

A. The County has acquired the following permits: Not Applicable.

1.03 EASEMENTS AND RIGHT-OF-ENTRY AGREEMENTS

A. The County has acquired the following easements and right-of-entry agreements: Not Applicable.

1.04 PERMITS, EASEMENTS AND RIGHT-OF-ENTRY AGREEMENTS OBTAINED BY CONTRACTOR

A. Prepare and submit to the proper authority or owner all information required for the issuance of such permit, easement, or right-of entry agreement. Pay all costs thereof including agency inspections and easement costs unless specifically provided otherwise in the Contract.

B. Provide a copy of each permit, permit applications, easement and right of entry agreement to the Project Representative prior to pursuing any Work covered by the permit or easement.

C. When required by the permit and during work progress covered by the permit, the Work shall be inspected as required by the issuing agency.

D. Provide a copy of the completed permit with the issuing agency acceptance or easement owner release.

E. Include in the Baseline Schedule the time to prepare, submit and obtain all Contractor obtained permits, easements and right-of-entry agreements.

1.05 SUBMITTALS

A. Procedures: Section 01 33 00.

B. Permits, permit applications, easements and right-of-entry agreements obtained by the Contractor.

C. All permit, easement or right-of-entry agreement compliance reports.

D. Approvals when work is complete for permits obtained by the Contractor.

E. Easement releases.

1.06 POSTING PERMITS AND EASEMENTS

A. Permits and easements, including those obtained by the Contractor, shall be posted at the site of the Work.

1.07 CONSTRUCTION RESTORATION ACCEPTANCE FORM

A. Whenever Work is performed on property other than street right of way, provide a written easement restoration acceptance form from the easement grantor or easement grantors agent for each property, parcel, or area certifying that the restoration of structures and/or surfaces has been completed to the satisfaction of the property owner, and that the owner has no claims for damages on account of such restoration.

B. The easement restoration acceptance shall comply with the requirements as set forth in the form provided by the Project Representative. If, in the opinion of the Project Representative, the release is unreasonably withheld by the easement owner, the County may, at its sole discretion, not require the easement restoration acceptance to be completed.

PART 2 PRODUCTS [NOT USED]

PART 3 EXECUTION [NOT USED]

END OF SECTION

SECTION 01 52 00

CONSTRUCTION FACILITIES

PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies the following Contractor temporary construction facilities and construction requirements:
   1. Utilities: Power, heating, ventilation, telephone, water, sanitary facilities and lighting.
   2. Miscellaneous Items: Parking, staging, cleaning, project signage, and Contractor office.

B. Unless otherwise noted, be responsible for all costs for utility usage and permitting associated with the requirements of this Section.

C. Unless otherwise noted, the County will not furnish any materials, facilities, utilities, or services.

1.02 SUBMITTALS

A. Procedures: Section 01 33 00.

B. A plan to meet each of the requirements of this Section.

C. Cut sheets illustrating that the onsite Contractor's Office is equipped with energy efficient light bulbs, all appliances including electronics are Energy Star rated and all water fixtures are WaterSense rated.

1.03 POWER

A. Connect to the West Point Treatment Plant power distribution system. Provide all equipment and cables for the connection.

1.04 VENTILATION

A. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gasses.

1.05 TELEPHONE

A. Provide for Contractor's own use, telephone service at the Contractor's site office.

B. In order that the Project Representative can coordinate with the Contractor on a local exchange, provide a telephone number contact where long distance does not apply for Project Representative's calls to field personnel.

1.06 WATER

A. Provide necessary water, piping, and special connections to an existing water supply.

1.07 SANITARY FACILITIES

A. Provide toilet and wash-up facilities for the work force at the site. Comply with applicable laws, ordinances, and regulations pertaining to the public health and sanitation of dwellings and camps.

1.08 PARKING AND STAGING AREA

A. Be responsible for obtaining and maintaining parking and staging areas unless otherwise specified.

1.09 CLEANING

A. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.

B. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.

C. Clean the exposed surfaces of piping, ductwork, or equipment which has become soiled with dirt, mortar, or other materials before covering with insulation, painting, or enclosing in the building structure.

1.10 CONTRACTOR'S OFFICE

A. A Contractor’s Office is not need for this project.

1.11 CONSTRUCTION SIGNS

A. Commercial or advertising signs shall not be allowed on the site.

PART 2 PRODUCTS [NOT USED]

PART 3 EXECUTION

3.01 RESPONSIBILITIES

A. Ensure all subcontractors, suppliers and individuals associated with Contract activities use approved routes.

END OF SECTION

SECTION 01 55 26

TRAFFIC CONTROL

PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies the requirements for Traffic Control Plans, Notification schedules, temporary barricades, signs, flaggers, lights, road surfaces, detours, and maintenance thereof; and other safeguards necessary to protect life, health and safety.

1.02 QUALITY ASSURANCE

A. This Section incorporates by reference the latest revisions of the embedded standard referenced herein. In case of conflict between the requirements of this Section and those of a listed document, the requirements of this Section shall prevail.

Reference	Title
MUTCD	U.S. Department of Transportation, Federal Highway Administration: Manual on Uniform Traffic Control Devices, Part VI "Work Zone Traffic Control Standards and Guidelines"

1.03 SUBMITTALS

A. Procedures: Section 01 33 00.

B. Off-site traffic control plans:
   1. submit to local authority having jurisdiction a minimum of 30 days prior to needed use for review and approval by the City.
   2. submit copy to Project Representative.

C. On-site traffic control plans.

D. Notification schedules.

E. Submit separate Traffic Control Plans and Notification Schedules for pipeline construction/excavation and pavement restoration work.

1.04 OFFSITE TRAFFIC CONTROL PLAN

A. Comply with the requirements of the Local Jurisdiction having Authority.

B. Identify specific streets which the Contractor determines will have a traffic impact.

C. Annotate proposed location of barricades, lighting, signing, temporary striping and other traffic control devices.

D. Show access to buildings, emergency exiting, or property within and immediately adjacent to construction site.

E. Anticipate traffic, bus zone and driveway relocation resulting from construction operations. Include anticipated loss of bus, passenger and truck loading zones.

F. Provide location of on street parking.

1.05 TRAFFIC CONTROL REQUIREMENTS

A. Work crews shall not impact two consecutive street intersections at the same time.

B. Maintain pedestrian and bicycle access at all times. Work with the Project Representative if pedestrian and bicycle pathways require temporary rerouting or closure.

C. Traffic flow on streets where work is not being performed shall not be revised.

D. Minor arterial streets shall be maintained in each direction at all times.

E. Unless otherwise indicated, provide for passage and access of emergency vehicles, police, fire, and disaster units at all times. Assume liability for damages resulting from failure to provide said access.

F. Use off duty police officers when affecting normal traffic operation at a signalized intersection.

G. Vehicular and pedestrian routing on streets where the work is not being performed shall not be revised.

H. At each site where a two-way roadway is restricted to one lane of two-way traffic provide a minimum of two certified flaggers in order to insure safe and effective planning of traffic through the constricted zone. Provide three certified flaggers when the construction zone length causes sight distance or communication problems between a two member team of flaggers to operate safely.

I. Lane restrictions for specific roadways shall be the following unless otherwise approved by the jurisdiction in writing:

J. Maintain two-way traffic 7-9 a.m. and 4-6 p.m. weekdays. Each traffic lane shall be at least 12 feet in width.

K. Maintain one lane with flaggers at all other times. Lane shall be at least 12 feet in width.

L. Provide a minimum of one week notice when driveway access will be restricted. Provide cleared residential driveway access at the end of every work day. Provide businesses, public service buildings, and industrial sites driveway access during their operating hours. Provide and maintain signage in accordance with this section and as shown on the traffic control plan.

M. Notify and obtain appropriate approvals from both the Police Department and the Fire Department of street closures.

N. Within the construction zones, provide parking restrictions and easels in accordance with the requirements of the local jurisdiction. If there are no local jurisdictional requirements, at a minimum, provide parking easels within 48 hours in advance of the need to clear parking. Keep parking restrictions to a minimum.

O. Provide the services of a uniformed police officer during working hours in the construction zone when signalized intersections are affected by construction to direct traffic, countermand the traffic signal and if necessary, to clear traffic backups. This officer is not for the convenience of the Contractor but rather to facilitate traffic movements.

P. Provide local access to all businesses, industrial sites and residences. Provide a certified flagger to prevent any conflicts between local access traffic and construction crews and/or heavy equipment whenever local access is required into/out of the construction zone.

Q. Provide road closure plans and provide for the type of traffic impacted. Provide design of the detour route for local access.

R. Provide concrete barriers to separate traffic flow from construction work.

S. Channel traffic flow into the work zone per approved Traffic Control Plan.

T. Provide a temporary 5-foot wide alternate pathway on the same side of the street when construction interferes with the usual pedestrian/cyclist pathways. Keep pedestrian/ cyclist, vehicles and open excavations along the arterial all separate from one another to meet safety requirements. Maintain minimum of three crosswalks at all affected intersections.

1.06 JOB COORDINATION

A. Coordinate construction to offer the least possible obstruction and inconvenience to public.

B. Coordinate with property and business owners in order to maintain convenient access for local traffic to private properties along the line of work at all times and/or as specified in this Section and on the Drawings.

C. Keep existing street lighting systems in operation during progress of the work at all times.

D. Do not open up sections of work and leave them unfinished. Finish work in process insofar as practicable.

E. Have under construction no greater length or amount of work than can be prosecuted properly with due regards to the rights of the public.

F. Coordinate revisions to existing traffic control with the affected agencies. Keep traffic controls in operation, unless otherwise required by the Project Representative, for the benefit of the traveling public during progress of the work.

G. As work progresses and as conditions permit, reset temporarily relocated or removed traffic and street name signs in their permanent location. Replace or repair signs and other traffic control devices damaged or lost.

H. Coordinate with property owners or designated representatives and service providers for uninterrupted garbage/recycling collection, mail and other delivery services.

1.07 NOTIFICATIONS PLANS

A. Update as necessary for the weekly Contract meetings and include the following address of affected business/property owners and the estimated dates and number of days construction will be within 150 feet of the addresses and fronting the properties.

B. Submit a Notification Plan within 30 days of the effective date of the Notice to Proceed and update for weekly Contract meetings a Notification Schedule to maintain access for adjacent or affected properties and businesses.

C. Notification Plan and Schedule shall include:
1. Name of affected business/property owner.
2. Mailing address of business or property owner.
3. Address of affected property if different.
4. Contact name and phone number.

5. Estimated week of construction within 150 feet of affected property.
6. Estimated number of days that construction will be fronting the property.
7. Special issues for maintaining access.

D. Request and obtain written approval from the Project Representative and the appropriate jurisdictional agency before partially or completely closing any street.

E. Notifications regarding work performed in street areas shall be in such detail as to give the time of commencement and completion of the work, names of streets to be closed, schedule of operation, routes of detours, etc.

F. To accommodate emergency vehicle rerouting, notify in writing, local fire and law enforcement authorities and other affected agencies not less than 72 hours prior to construction operations which deviate or delay traffic from the existing traffic patterns.

G. Notify the appropriate Transit Construction Coordinator at least 72 hours in advance of any construction that may disrupt transit service or park and ride operations. Cooperate with Metro Transit and assist in the relocations of the bus stop locations when access is prevented to existing bus stop locations during the construction.

H. Notification of the residents living adjacent to the work will be by the County two weeks in advance of the construction in the area of work.

I. Directly inform individual owners or household residents at least 48 hours in advance of beginning the work to minimize or eliminate inconveniences to the public. Inform owners of work which either blocks the use of the property in any way by construction or equipment, blocks the side sewer service connection, or shuts down the potable water system.

PART 2 PRODUCTS

2.01 SIGNS

A. Signs with special or non-standard messages are part of the Traffic Control Plan as required to properly convey information to the motorist or pedestrian. Be responsible for installing and maintaining these signs. Signs shall be in accordance with the requirements of the standards referenced in Part 1.

B. Signs with special or non-standard messages are part of the Traffic Control Plan as required to properly convey information to the motorist or pedestrian. Use signs in accordance with the standards referenced in Part 1 or as required by the business or property owner.

C. Signs:
1. 24 inches wide by 36 inches high, free standing, with lettering large enough to be visible for 150 feet;
2. Readable from two directions;
3. Sign "message" to be coordinated with property owner and submitted to Project Representative prior to fabrication.

PART 3 EXECUTION

3.01 TRAFFIC MAINTENANCE

A. Traffic control staff and flaggers required to be dedicated to traffic control and safety and not be performed by workers performing other work.

B. Take necessary measures to maintain a normal flow of vehicular and pedestrian traffic to prevent accidents and to protect the work throughout the construction stages until completion of the work. Make necessary arrangements to reroute traffic, provide and maintain barriers, cones, guards, barricades, and construction warning and regulatory signs. Regulatory devices provided by the Contractor shall be suitable for nighttime operation. Take effective measures necessary to protect other portions of the work during construction and until completion. This includes providing and maintaining necessary barricade lights, construction signs, guards, temporary crossovers, and flaggers in accordance with the standards referenced in Part 1.

C. Maintain emergency exiting from homes within and immediately adjacent to construction site.

D. Maintain vehicular traffic at all locations to the greatest extent possible and reduce and reroute traffic only for the shortest time possible consistent with effective construction operations. Required travel lanes shall not be blocked by the Contractor's activities, including trucks delivering materials unless approved by the Project Representative. Material deliveries and other related trucking activities shall occur in the Contractor's protected work or staging areas. Upon completion of a segment of work in streets, traffic shall be restored to normal flow as soon as possible. Maintenance of existing directional operation of street systems shall be maintained as much as possible.

E. When pavement markings are obliterated due to construction activities or pavement restoration, temporary pressure sensitive pavement marking tape, traffic buttons or delineators shall be installed where designated by the Project Representative. These temporary features shall be removed only upon installation of permanent traffic channelization.

F. Maintain access by emergency vehicles at all times in all roadways. Use temporary covers over cuts to accommodate traffic. Notify the Project Representative and the fire chief prior to limitation of access in any section of the roadway.

G. Maintain pedestrian movements through construction areas. Facilities for pedestrians include provisions for the safe movement of mobility and sight-impaired individuals. This includes temporary ramps.

3.02 ACCESS

A. Unless otherwise indicated, provide local access at all times.

B. Maintain access to private properties and businesses at all times including the work area; if access is required in the immediate work area, make provision in the Contractor operations to provide requested access.

C. Where, during some urgent stages of construction, the Project Representative concurs that temporary closure of an access to a property is unavoidable, coordinate the closure with the property owner and provide alternative access, if required. The existing access shall not be closed until the replacement access is available.

D. When it is necessary to close the adjacent property, backfill immediately after laying the pipe and place an interim surface to restore access. Arrange schedules so that access is available to properties daily when work is not occurring.

3.03 SAFETY

A. Use adequate safeguards, safety devices and protective equipment and take other needed actions to protect life, health and safety and to protect property in connection with the performance of the work.

B. Use flaggers, signs, and other devices, and erect and maintain barricades, guards, signs, warning signs, and detour signs, as are necessary to warn and protect the public at all times from injury or damage as a result of the Contractor's operations, which may occur on streets affected by such operations.

C. Where flaggers are employed, the flaggers' equipment and training shall be in accordance with the applicable laws and regulations. All required equipment shall be used by flaggers while actually flagging traffic

D. All flaggers are required to possess a current flagging certification card.

E. Provide standard signs as well as other appropriate signs prescribed by the Project Representative as applicable and necessary for the work. Erect signs on posts and supports and maintain them in a neat and presentable condition until the necessity for them has ceased. When the need for a sign has ceased, the Contractor, upon approval by the Project Representative, shall take down such sign. Control signs necessary for nighttime traffic control, or remaining in place during the night, shall be fully reflectorized.

F. Safeguard and direct traffic after the existing signs have been removed. Preservation and maintenance of traffic control and street name signs shall be the sole responsibility of the Contractor.

G. Provide and maintain temporary and permanent pavement markings including traffic markers, delineators, thermoplastic stop bars and crosswalks to meet the City current standards.

H. When required by the Project Representative, provide flaggers immediately, provide, erect, maintain and remove barricades and lights; and erect, maintain and remove standard signs.

I. In the event traffic signal or beacon is made inoperative by or at the request of the Contractor, provide an off-duty police officer as per laws and regulations, or provide suitable traffic control devices for control and movement of traffic during the time that the signal or beacon is inoperative.

J. Provide traffic control during the hours of construction and in a safe, prudent, operating manner. During the hours of non-construction, maintain all existing traffic lanes safe for vehicular traffic. Leave all unfinished work in a safe, non-hazardous condition to the public.

3.04 SIGNS

A. Check daily each item including weekends and holidays. Replace signs that are missing, vandalized, damaged, or not functioning properly within 24 hours of such act.

B. Non-applicable signs shall be removed or covered during periods not needed.

3.05 CONSTRUCTION AND MAINTENANCE OF DETOURS

A. Construct, maintain in a safe condition, and keep open to traffic detours that will accommodate traffic diverted from the roadway during construction.

B. Provide for all on-site or off-site detours required or necessitated by the work, including side street crossings, and temporary bridges over excavation or freshly placed concrete.

C. Keep roadways clean to assure the safe passage of pedestrians and vehicles.

END OF SECTION

SECTION 01 67 00

SHIPMENT, PROTECTION, AND STORAGE

PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies the minimum requirements for shipment, protection, and storage of all equipment, products, and materials. Where manufacturer or supplier have more stringent recommendations and requirements, those recommendations and requirements shall be followed. Where additional or more stringent requirements are covered in the individual specifications, those requirements shall be followed.

B. Equipment, products and materials shall be shipped, handled, stored, and installed in ways that will prevent damage to the items. Damaged items will not be permitted as part of the Work except in cases of minor damage that have been satisfactorily repaired and are acceptable to the Project Representative.

C. All items shall be protected from the elements.

PART 2 PRODUCTS [NOT USED]

PART 3 EXECUTION

3.01 PIPE

A. Pipe and appurtenances shall be handled, stored, and installed as recommended by the manufacturer, but shall, as a minimum include the prime coat and lining as specified in Division 40. Pipes with paint, tape coatings, linings or the like shall be stored to protect the coating or lining from physical damage or other deterioration. Pipes shipped with interior bracing shall have the bracing removed only when recommended by the pipe manufacturer.

3.02 EQUIPMENT

A. Package and Marking:
   1. All equipment shall be protected against damage from moisture, dust, dirt, debris, handling, or other cause during transport from manufacturer's premises to site and shall be shipped in sealed, weather-tight, enclosed packaging, covers, and containers.
   2. Bearing housings, vents, and other types of openings shall be wrapped or otherwise sealed to prevent contamination by grit and dirt.
   3. Each item or package shall be marked with the number unique to the specification reference covering the item and contact information (phone and name) from sender and receiver.
   4. Stiffeners shall be used where necessary to maintain shapes and to give rigidity. Parts of equipment shall be delivered in assembled or sub-assembled units where possible.

B. Shipping:
   1. Damage shall be corrected to conform to the requirements of the Contract before the assembly is incorporated into the work. Contractor shall bear the costs arising out of dismantling, inspection, repair and reassembly.
   2. Each item of equipment shall be shipped to the site of the work with the manufacturer's shop applied prime coating.

C. Storage:
   1. During the interval between the delivery of equipment to the site and installation, all equipment, unless otherwise specified, shall be stored in an enclosed space affording protection from weather, dust, and

mechanical damage and providing favorable temperature, humidity and ventilation conditions to ensure against equipment deterioration. The building may be a temporary structure on the site or elsewhere, but must be approved by the Project Representative. Maintain temperature and humidity in the building within the range required by manufacturer.

2. Equipment and materials to be located outdoors may be stored outdoors if protected against moisture condensation. Equipment shall be stored at least 6 inches above ground. Temporary power shall be provided to energize space heaters or other heat sources for control of moisture condensation. Space heaters or other heat sources shall be energized without disturbing the sealed enclosure.
3. All equipment: stored fully lubricated with oil, grease and other lubricants unless otherwise instructed by the manufacturer.
4. Moving parts: rotated a minimum of once weekly to ensure proper lubrication and to avoid metal-to-metal galling or “welding”. Upon installation of the equipment, the Contractor shall start the equipment, at least one half of operating load once weekly for an adequate period of time to ensure that it does not deteriorate from lack of use. Keep written records of maintenance and rotation which is performed prior to start up.

D. Protection of Equipment After Installation:
1. After installation, all equipment shall be protected from damage from, including but not limited to, dust, abrasive particles, debris and dirt generated by the placement, chipping, sandblasting, cutting, finishing and grinding of new or existing concrete, terrazzo and metal; and from the fumes, particulate matter, and splatter from welding, brazing and painting of new or existing piping and equipment. As a minimum, vacuum cleaning, blowers with filters, protective shieldings, and other dust suppression methods will be required at all times to adequately protect all equipment.
2. During concreting, including finishing, all equipment that may be affected by cement dust must be completely covered.
3. During painting operations, all grease fittings and similar openings shall be covered to prevent the entry of paint.
4. Electrical switchgear, unit substation, and motor load centers shall not be installed until after all concrete work and sandblasting in those areas have been completed and accepted and the ventilation systems installed.
5. Lubricants: changed upon completion of installation and as frequently as required thereafter during the period between installation and acceptance. New lubricants: put into the equipment at the time of acceptance.
6. Prior to acceptance, the Contractor shall have the manufacturer inspect the equipment and certify that its condition has not been detrimentally affected by the storage period. Such certifications by the manufacturer: deemed to mean that the equipment is judged to be in a condition equal to that of equipment that has been shipped, installed, tested and accepted in a minimum time period. As such, the manufacturer will guaranty the equipment equally in both instances. If such a certification is not given, the equipment: judged to be defective and: removed and replaced at the Contractor's expense.

E. Special Monitoring:
1. For the equipment listed below, the equipment shipment shall be packaged in a manner designed to protect the equipment against damage caused by sudden acceleration or deceleration, and a recording accelerometer, designed to record the magnitude of sudden impacts in three directions (X, Y, Z) on continuous strip charts with both time and "g" force scales, shall be shipped with, and fixed to each separately packed assembly or its packing crate. Upon arrival of each shipment, Contractor shall immediately notify the Project Representative; the accelerometer shall be removed in the presence of representatives of the Project Representative and Contractor. If the magnitude of the maximum acceleration exceeds three times the force of gravity (3.0g), it shall be considered presumptive evidence of damage and the assembly or subassembly shall be dismantled and inspected and tested for damage. All damage shall be corrected to the complete satisfaction of the Project Representative before the assembly is incorporated into the work. Contractor shall bear all costs arising out of dismantling, inspection, testing, repair, and reassembly, even if no damage is found.

2. The following equipment items require special monitoring:

Equipment	Equipment Number	Specification
Channel Aeration Air Blowers	B31CA011, B31CA021	43 11 40

3. Shipment of variable frequency drive equipment shall be on special vans with air suspension and accompanied by recording accelerometers designed to record the magnitude of sudden impacts in three directions on a continuous trip chart with both time and "g" force scales. The recorder shall be fixed to one of the shipping crates or truck bed. Upon arrival of each shipment, the Contractor shall immediately notify the Project Representative. The accelerometer shall be removed in the presence of representatives of the Project Representative and Contractor. If the magnitude of the maximum acceleration exceeds 3.0g, the equipment in the shipment shall not be unloaded from the carrier until the carrier dispatcher makes a determination as to the next step. The direction given by the carrier dispatcher shall be recorded on the driver's Bill of Lading and signed by the Contractor and driver. The manufacturer shall be notified and the equipment returned to the factory for inspection and repair or to the nearest service center at the discretion of the manufacturer. The manufacturer shall certify in writing that the equipment is serviceable and shall be returned to the jobsite, again, with an accelerometer in place to record the travel conditions.

END OF SECTION

SECTION 01 73 00

BRACING AND ANCHORING

PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies the seismic anchorage and bracing requirements for mounted and suspended equipment over 200 pounds.

B. This Section specifies engineered design requirements for seismic anchorage and bracing for installation of equipment over 400 pounds.

1.02 REFERENCED STANDARDS

A. This Section incorporates by reference the latest revisions of the embedded standard referenced herein. In case of conflict between the requirements of this Section and those of a listed document, the requirements of this Section shall prevail.

Reference	Title
ASCE 7	Minimum Design Loads for Building Structures
SBC	Seattle Building Code
SMACNA	Seismic Restraints Manual

1.03 SUBMITTALS

A. Procedures: Section 01 33 00.

B. Provide the following submittals:
1. Request for weight of County furnished equipment.
2. List of freestanding equipment weighing 200 pounds or more.
3. Anchorage details for equipment and freestanding items weighing between 200 and 400 pounds.
4. Sway bracing for elevated or suspended items such as ceiling systems, ducting, conduits, cable trays and piping.
5. Engineered design: No less than four weeks in advance of equipment installation, for items weighing over 400 pounds submit required anchorage and bracing drawings and calculations bearing the stamp of a Structural Engineer; show the criteria used to determine seismic coefficients and forces applied to the equipment.

1.04 DESIGN AND PERFORMANCE REQUIREMENTS

A. In accordance with SBC, all equipment shall be anchored and braced to resist seismic forces prescribed in the code and ASCE 7, Chapter 13. All equipment includes equipment which is free standing, supported by stand-frames, suspended, anchored to walls, and anchored to floors or slabs.

B. Seismic anchorage and bracing for equipment shall be designed by a State of Washington Registered Engineer using the site-specific seismic criteria.

1.05 SITE SEISMIC CRITERIA

A. Unless otherwise indicated, the SDS value (design, 5 percent damped, spectral response acceleration parameter for short periods) shall be determined for the equipment installation using the ASCE Hazard Tool found at:

   https://asce7hazardtool.online/

B. Using the latitude and longitude of the location of the equipment installation expressed to two decimal points. A Site Class D shall be used, unless otherwise noted.

C. Minimum criteria:
   1. Importance Factor: I[p] = 1.5.
   2. Component Amplification Factor: ASCE 7, Table 13.6-1.
   3. Component Response Modification Factor: ASCE 7, Table 13.6-1.
   4. Overstrength factor: ASCE 7, Table 13.6-1.
   5. If more restrictive criteria or additional design criteria are required per ASCE or other industry standards, the more restrictive or additional criteria shall be used.

PART 2 PRODUCTS [NOT USED]

PART 3 EXECUTION [NOT USED]

END OF SECTION

SECTION 01 74 19

CONSTRUCTION AND DEMOLITION MATERIAL MANAGEMENT

PART 1 GENERAL

1.01 SUMMARY

A. The Section specifies the County's requirements to divert Construction and Demolition (C&D) material from landfill disposal.

B. For C&D material generated from construction of the Project, the requirement is to divert a minimum of 80 percent of the total weight of the C&D material from landfill disposal.

C. Resources: King County Solid Waste Division Construction & Demolition Recycling website: http://your.kingcounty.gov/solidwaste/greenbuilding/construction-demolition.asp for general information on King County's construction recycling program, program contact and online resources.

1.02 DEFINITIONS

A. Alternative Daily Cover: Cover material other than earthen material which is placed on the surface of the active face of a municipal solid waste landfill at the end of each operating day to control vectors, fires, odors, blowing litter, and scavenging. ADC is considered a waste and does not count as recycling or beneficial use.

B. Construction and Demolition (C&D) Material: Includes all non-hazardous solid materials resulting from construction, renovation, alterations, repair, and demolition activities. Includes packaging, construction office materials, and materials that are recycled, reused, salvaged, or disposed of as nonrecyclable C&D waste.

C. C&D Material Management Plan: Project specific plan for the collection/handling, disposition, transportation and tracking of C&D material.

D. C&D Material Diversion Report: Report documenting execution and status of C&D material included in the C&D Material Management Plan.

E. Comingled C&D Recycling: The process of collecting mixed recyclable materials in one container on-site. The container is taken to a Designated C&D Material Recovery Facility where materials are separated for recycling. Diversion rate varies by facility and reporting period. Comingled C&D recycling containers shall not include items for which current recycling markets do not exist. Non-recyclable materials shall be placed into a separate Nonrecyclable C&D Waste container and disposed of at a Designated C&D Waste Transfer Facility as Nonrecyclable C&D Waste.

F. Dangerous Waste: Any solid waste designated as dangerous waste by the Washington state Department of Ecology under chapter 173-303 WAC, Dangerous waste regulations. This includes adhesives, aerosol cans, paint, solvents, solvent-soiled rags, asbestos, mercury-containing thermostats or switches, cleaners, thinners, treated wood.

G. Disposal: Removal of C&D Material to a Designated C&D Waste Transfer Facility.

H. Disposition: Specific diversion method or disposal of the C&D Material.

I. Diversion: Consisting of reuse, recycling and salvage of C&D Material.

J. Designated C&D Material Recovery Facility (MRF): Commingled/mixed C&D Material processing facilities that comply with King County Ordinance 18166. An updated list for King County is available at: http://your.kingcounty.gov/solidwaste/greenbuilding/rates.asp.

K. Designated C&D Waste Transfer Facility (WTF): Non-recyclable C&D waste processing facilities that comply with King County Ordinance 18166. An updated list for King County is available at: http://your.kingcounty.gov/solidwaste/greenbuilding/rates.asp.

L. Nonrecyclable C&D Waste: Any C&D waste that is not recyclable C&D waste. For the purpose of this Section, nonrecyclable C&D waste does not include excess material from vegetative land clearing or earthwork.

M. Recycle: To remove a C&D material from the site for repurposed use or for use in the manufacture of a new product.

N. Reuse: Making use of a C&D material without altering its form to be used on-site.

O. Salvage: Recovery of C&D materials for off-site use.

P. Universal Waste: Batteries, lights and lamps, and mercury-containing equipment as defined in WAC 173-303.

1.03 REFERENCED STANDARDS

A. This Section incorporates by reference the latest revisions of the embedded standard referenced herein. In case of conflict between the requirements of this Section and those of a listed document, the requirements of this Section shall prevail.

Reference	Title
KCC 18.17	Green Building Program
King County Ordinance 18166	King County Construction and Demolition Recycling Ordinance
Chapter 173-303 WAC	Dangerous Waste Regulations
Chapter 173-345 WAC	Recyclable Materials – Transporter and Facility Requirements

1.04 SUBMITTALS

A. Procedure: 01 33 00

B. C&D Material Management Plan: Submit and receive a submittal review disposition of “1” or “2” per Section 01 33 00 within 30 days after pre-construction meeting or prior to demolition and/or clearing activity.

C. C&D Material Diversion Report(s): Submit monthly with application for payment (or as required by the Project Representative). Submit final report prior to Final Acceptance.

1.05 PACKAGING FOR CONSTRUCTION MATERIALS AND EQUIPMENT

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

1.06 CONSTRUCTION AND DEMOLITION MATERIAL MANAGEMENT PLAN (PLAN)

A. General: Use the C&D Diversion Plan, Standard Form 01 74 19-A located in 01 33 10.

B. C&D Material Identification and Disposition: List each type of C&D Material and whether it will be salvaged, recycled, reused, or disposed of in a WTF. Include handling and transportation procedures.

C. Salvaged Materials: Include list of recipient's organization, contact person, and delivery location indicated in Section 02 41 00.

D. Recycled Materials: Include list of facilities likely to be used and type of recycled materials each will accept. Include names, addresses, and telephone numbers. This may be the Designated Facility, specific recycler(s) of source separated materials, or combination thereof.

E. Reused Materials: Include list of reused C&D Material as indicated in Section 01 78 40, and where the material will be reused.

F. Disposed Materials: Indicate where Nonrecyclable C&D Waste will be disposed of. Include name, address, and telephone number of each disposal location or WTF intended to be used.

G. Handling and Transportation Procedures: If source separation is used, include method that will be used for separating recyclable materials from waste including sizes of containers, container labeling, and location where materials separation will be performed.

H. All non-recyclable C&D materials must be placed in a separate Nonrecyclable C&D Waste container, destined for a WTF in accordance with WAC 173-345-040.

1.07 CONSTRUCTION AND DEMOLITION MATERIAL DIVERSION REPORT (REPORT)

A. General: Use the C&D Diversion Report template 01 74 19-B as provided in Section 01 33 10 or Project Representative approved equivalent.

B. The Report shall include the following for each material:
   1. The total amount of the material, in tons or cubic yards.
   2. The receiving party.
   3. For commingled materials, include the quarterly commingled C&D diversion/recycling rate of the receiving facility. This rate is available on-line at: http://www.seattle.gov/util/ForBusinesses/Construction/CDWasteManagement/RecyclingRequirements/CertifiedFacilities/index.htm.
   4. Manifests, weight tickets, receipts and invoices, including:
      a. Disposal Receipts: Copy of receipts issued by a WTF for C&D waste that is disposed in that WTF.
      b. Recycling Receipts: Copy of receipts issued by recycling facilities or Designated Facilities for commingled materials. Include weight tickets from the recycling hauler or material recovery facility and verification of the recycling rate for commingled loads at the facility.

C. Note that material used as Alternative Daily Cover does not count as diversion within King County.

D. Diversions rates and tonnage:
   1. Total tons of material.
   2. Total tons of diverted material.
   3. Material diversion percentage excluding site specific materials:
      a. Land clearing debris
      b. Rock and gravel
      c. Sand or soil

PART 2 PRODUCTS [NOT USED]

PART 3 EXECUTION

3.01 CONSTRUCTION AND DEMOLITION MATERIAL MANAGEMENT

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

B. Designate a C&D material diversion management coordinator to be responsible for implementing, monitoring, and reporting status of the Plan and Diversion Report(s).

C. Containers for C&D Materials to be recycled and/or diverted clearly labeled 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 MRF, WTF, or recycling processor.
   4. Commingled materials must only be those intended for recycle.
   5. All non-recyclable C&D materials must be placed in a separate Nonrecyclable C&D Waste container destined for a WTF.

D. Training:
   1. Train employees, subcontractors, and suppliers on proper C&D Material Management procedures.
   2. Distribute C&D Material Management Plan to all on-site employees, subcontractors and suppliers before starting the Work. Review Plan procedures and locations established for salvage, recycling, reuse and disposal with new employees.

E. Conduct regular visual inspections of recycle containers, and remove any Nonrecyclable C&D Waste, Dangerous Waste, or Universal Waste.

END OF SECTION

SECTION 01 74 23

FINAL CLEANING

PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies the final cleaning on the work performed or areas affected during performance of the work prior to completion of punch list items.

1.02 PURPOSE

A. The purpose of the cleaning is to clean up from the construction which occurred during the work of this Contract.

B. The site shall be maintained at the highest level of readiness and cleanliness. Take due care that materials purchased under this contract remain undamaged and free of dust and dirt at all times.

1.03 CLEANING REQUIREMENTS

A. Perform a wipe down with a wet towel and cleaning solvent as appropriate for the item being cleaned.

B. Clean all items affected by the work and ensure they are free of litter, trash, dust, dirt, stains, damage, or defects.

C. Wash, sweep, polish, or otherwise clean all new and existing finished wall surfaces, floors, windows, hardware, mirrors, lighting fixtures, and items of equipment.

D. Replace damaged, defaced, or marred items.

PART 2 PRODUCTS

2.01 CLEANING MATERIALS

A. Use cleaning materials and processes recommended by the manufacturers of the surfaces to be cleaned.

B. Use non-toxic clean agents when possible.

PART 3 EXECUTION

3.01 TIMING

A. Upon approval of schedule by the Project Representative, clean all rooms' materials, and equipment within the rooms including, but not limited to, all fixtures, equipment, flooring, piping, conduit, handrailing and tanks.

3.02 CLEANING

A. Use experienced workers or professional cleaners.

B. Remove dirt, stains, labels and foreign materials.

C. Repair and touch-up marred areas.

D. Broom clean paved surfaces; rake clean other surfaces of grounds; vacuum, polish and mop floors.

E. Remove snow and ice from access to buildings.

F. Replace air conditioning filters if units were operated during construction.

G. Clean ducts, blowers and coils if air conditioning units were operated without filters during construction.

H. Clean inside of electrical panels.

I. Touch up any scratches on equipment per Section 09 90 00.

END OF SECTION

SECTION 01 78 23

OPERATION AND MAINTENANCE DATA

PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies operating and maintenance (O&M) information and manuals.

1.02 SUBMITTALS

A. Procedures: Section 01 33 00.

B. Provide O&M Information from the OEM (original equipment manufacturer) at these project development phases.
   1. Provide preliminary O&M information with the original equipment product data submittal for all assets listed on the Asset Data Form 01 78 40-A (Section 01 78 40). The preliminary submittal shall conform to 3.01 of this Section.
   2. Prior to beginning System Testing per Section 01 80 00, provide Initial O&M submittal including all components in the system being tested. The Initial O&M submittal shall conform to 3.02 of this Section.
   3. After completion of commissioning but prior to final acceptance by the County, provide complete Final O&M manuals for all components in that system being accepted for beneficial use per 3.04.

1.03 CONTENT

A. Where specified, provide O&M information for equipment and material. Provide the following items of information:
   1. Names and addresses of the manufacturer, the nearest representative of the manufacturer, and the nearest supplier(s) of the manufacturer's equipment and parts.
   2. Significant design criteria including pertinent calculations used in designing, selecting, or verifying the suitability of the installed equipment.
   3. Performance data and curves: manufacturer's certified performance data and curves when specified in the Contract; otherwise, manufacturer's catalog performance data and curves.
   4. Lubrication information: manufacturer's recommendations regarding the lubricants to be used and lubrication schedule to be followed.
   5. Control diagrams: include diagrams for internal and connection wiring.
   6. Installation and startup procedures: manufacturer's recommendations for installation, adjustment, calibration, and troubleshooting.
   7. Operating procedures: manufacturer's recommended step-by-step procedures for starting, operating, and stopping the equipment under specified modes of operation.
   8. Preventive maintenance procedures: manufacturer's recommended steps and schedules for maintaining the equipment.
   9. Overhaul instructions and required parts and materials: manufacturer's directions for the disassembly, repair, and reassembly of the equipment, parts and any safety precautions that must be observed while performing the work.
      a. Overhaul parts list: manufacturer's recommendations of manufacturer's part numbers and quantity of parts which should be stored by the County and special storage precautions which may be required for a complete overhaul, as well as the generic title, description and manufacturer's part number of each component part of the equipment.
      b. Exploded view or plan and section views: detailed plan and section views of equipment shall be provided when exploded views are not available. All views shall have detailed part callouts matching those callouts of the manufacturer's overhaul parts list. Exploded or cut views of equipment shall be provided, if available, as a standard item of the manufacturer's information.

10. Specific information: as necessary where items of information are not included in the above list but are required for operation and maintenance.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Binders:
   1. Specialty Loose Leaf Inc. Model 98086.
   2. Oxford Esselte C619-3.
   3. Or Approved Equal.

2.02 BINDER MATERIALS

A. Binders for final bound O&M manuals:
   1. 3-post.
   2. Durable covers with metal piano hinges and locking slide bar assembly.
   3. Capable of extending to a maximum 5-inch thickness.

PART 3 EXECUTION

3.01 PRELIMINARY O&M INFORMATION SUBMITTAL

A. Provide OEM information adequate to insure the equipment:
   1. is packaged and shipped correctly,
   2. is stored and maintained properly per manufacturer's recommendations,
   3. is installed per manufacturer's recommendations,
   4. is maintained properly prior to commissioning,
   5. is fully tested and started per manufacturer's recommendation,
   6. Is maintained properly until accepted by the County.

B. Maintain and provide all records documenting the maintenance provided by the Contractor prior to commissioning.

3.02 INITIAL O&M SUBMITTAL

A. Manufacturer's standard brochures and OEM manuals, used to describe the equipment and the O&M procedures, shall be modified to reflect only the model or series of equipment used. Extraneous material shall be crossed out neatly or otherwise annotated or eliminated.

B. Photocopies of manufacturer's standard brochures and manuals will not be approved for the final bound sets.

C. Facsimile paper or photocopies of facsimile information will not be allowed.

D. Disposition of O&M information will be noted on the returned submittals. Only O&M information with a disposition of "1" or "2" shall be included in the O&M final bound sets.

E. Operational Testing shall not start on any equipment until Initial O&M information for that equipment is submitted and receives a disposition of "1" or "2."

3.03 FIELD CHANGES

A. Following the accepted installation and operation of an equipment item, the item's instructions and procedures shall be modified and supplemented to reflect field changes or additional field data information.

3.04 FINAL SUBMISSIONS

A. Provide:
   1. Three complete individually bound sets of the O&M information.
   2. A complete electronic copy of the approved, bound O&M information in a bookmarked and searchable PDF file distributed through a web link, FTP site, or cloud based file sharing site. Bookmarks shall be the same as the items in the Table of Contents.
   3. The information shall be organized in the binders in numerical order by the Specification Sections. All brochures and manuals contained therein shall be appropriately labeled with the applicable equipment name and equipment number as it appears in the Contract Documents, and shall also indicate the Specification Section.
   4. Each complete bound set and electronic file shall contain a table of contents and spare parts information and shall be provided with tab sheets to permit easy location of the desired sections of the manual.
   5. Each complete bound set and electronic file shall contain an index that includes a complete equipment list in alpha-numerical order by the equipment numbers assigned in the Contract Documents with the information required in Section 01 78 40. Each equipment number shall be cross-referenced to the applicable Specification Section tab located in the manuals.

3.05 PAYMENT

A. One percent of the awarded Contract Price shall be reserved for preparation and submittal of the final O&M manual. Payment will not be considered until the final O&M manual submittal is approved per this Section and Section 01 33 00 requirements.

END OF SECTION

SECTION 01 78 36

WARRANTIES

PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies Contractor responsibilities and procedures for product and equipment guaranty/warranty under this Contract. Requirements below are supplementary to those stated in Section 00700. Specific guaranty/warranty beyond the one year guaranty/warranty period are indicated in the individual Specification sections.

B. For the purpose of this Contract, the terms Warranty and Guaranty are interchangeable and use of one term shall mean the other as if it were used.

1.02 DETERMINATION OF WARRANTY DATES

A. Warranty dates for those portions of the work made available to King County for Possession and Use under the terms and conditions of the Contract shall be established at the time of availability provided that:
   1. The Possession and Use of that portion of the work is identified as a contractual milestone in Section 01 14 00. If the equipment is used only for a limited duration to support completion of other work, and is not fully available for Possession and Use by the County, the warranty period for the limited use equipment shall begin at Substantial Completion for the Project.
   2. The procedures for Testing, Training, and Commissioning are fulfilled for that portion of the work as required in Section 01 80 00.
   3. Final bound O&M manuals have been received for that portion of the work as required in Section 01 78 23.
   4. Spare Parts have been turned over for that portion of the work as indicated in Section 01 78 43.

B. County-Furnished Equipment: Unless noted otherwise, equipment purchased by the County and turned over to the Contractor for installation under this Contract shall have the warranty dates established in the same manner prescribed in Section 00700 and this section.

C. Except for products and equipment which have been accepted for possession and use by the County as indicated in this Section, the guaranty/warranty date(s) shall be established as indicated in Section 00700 upon Final Acceptance.
   1. In addition to any special warranties provided elsewhere in the Contract, Contractor warrants that all Work conforms to the requirements of the Contract and is free from any defect in equipment, material, design, or workmanship performed by Contractor or its Subcontractors and Suppliers.
   2. The warranty period shall be for the longer period of one year from the date of Substantial Completion of the entire Project of the duration of any special extended warranty offered by a supplier or common to the trade.
   3. With respect to all warranties, express or implied, for Work performed or materials furnished according to the Contract, Contractor shall:
      a. Obtain all warranties that would be given in normal commercial practice from the supplier and/or manufacturer;
      b. Prior to Final Acceptance require all warranties be executed, in writing, for the benefit of the County;
      c. Enforce all warranties for the benefit of the County; and,
      d. Be responsible to enforce any warranty of a Subcontractor, manufacturer, or Supplier, should they extend beyond the period specified in the Contract.

e. If, within an applicable warranty period, any part of the Work is found not to conform to the Contract, the Contractor shall correct it promptly after receipt of written Notice from the County to do so. In the event the County determines that Contractor corrective action is not satisfactory and/or timely performed, then the County has the right to either correct the problem itself or procure the necessary services, recommendations, or guidance from a third party. All damages incurred by the County and all costs for the County's remedy shall be reimbursed by the Contractor.
f. The warranty provided in this provision shall be in addition to any other rights or remedies provided elsewhere in the Contract or by applicable law.

PART 2 PRODUCTS [NOT USED]

PART 3 EXECUTION

3.01 DOCUMENTATION

A. Warranty dates and the durations of the warranty period shall be recorded and submitted on the New Assets Information Form 01 78 40 received from the Project Representative.

B. The warranty information shall be documented by Specification section in the same order as presented in the operations and maintenance manuals.

C. Vendor information including point-of-contact, company name, company address, and company emergency phone number shall be included for applicable equipment and components of the facility.

3.02 WARRANTY RESPONSE

A. The Project Representative shall be the point-of-contact for response to warranty related issues during the warranty period.

B. Upon notification of need for warranty response, provide written notification to the King County initiator, indicating scheduled time of response, so that King County personnel may be scheduled to be on hand to provide assistance, and witness the response and/or repair.

C. Items requiring warranty response within the warranty period will have a completely new warranty period established from the time of repair. Upon completion of the repair, provide written verification of the newly established warranty period to the Project Representative.

END OF SECTION

SECTION 01 78 39

PROJECT RECORD DOCUMENTS

PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies providing as-built drawings and other record documents and information.

B. For this Contract, the terms as-built documents and record documents are considered interchangeable and synonymous.

C. As-built or Record documents refer to the sum of all drawings, documents, and information specified.

1.02 SUBMITTALS

A. Procedures: Section 01 33 00.

B. As specified:
   1. For manually produced drawings: Full size 22x34 As-Built drawings;
   2. For CAD produced electronic files of as constructed information;
   3. Documentation specified for programmable or configurable components;
   4. Portable Document Format (PDF);
   5. Application software and configuration files in native file format;
   6. Electronic files distributed through a web link, FTP site, or cloud based file sharing site.

PART 2 PRODUCTS

2.01 GENERAL

A. Marked-up Contract Documents: Continuously maintain, update and correct mark-up information per 3.02 in CAD as electronic files in DWG and PDF format to reflect the "as constructed" conditions. As-Built documents and information shall be continuously updated to show:
   1. Work accomplished in the prior month to verify payment due.
   2. Field changes of dimensions and details made by contractor.
   3. Changes made by Change Order, responses to Request for Information or Field Directives.
   4. Dimensional location of all embedded, buried and concealed features as placed by contractor including mechanical pipe, electrical conduit, and structural embedments, and items not located or shown on the Drawings but placed by Contractor shall be recorded and provided to the County as prescribed in this Section. Conduit, structural embeds and piping shall be dimensioned relative to visible features whenever possible.

2.02 SUPPLEMENTAL CONTRACTOR PRODUCED DOCUMENTS

A. When technical specifications require Contractor to produce information supplemental to that in the contract drawings, produce and submit per the following CAD Construction Detail Drawings and Records requirements:
   1. Submit Hard copy as well as electronic format copy:
      a. Drawings shall be AutoCAD 2013 or newer ".dwg" format files.
      b. Drawings on 11-inch by 17-inch paper.
      c. Information prepared by the Contractor for construction or installation which is supplemental to the information and detail on the Contract Drawings and as required in the Specifications.
      d. Reference appropriate Contract Drawings which show the work.

B. Drawings shall be in the specified format for the following:
   1. All electrical and instrumentation drawings required to perform and document the work and/or additional information including:
      a. Fabrication or Equipment Arrangement Drawings with keyed Bills of Materials and List of nameplates and description of engravings
      b. Elementary Drawings
      c. Wiring Diagrams
      d. Loop Diagrams or Drawings
      e. Connection Diagrams
      f. Interconnection Diagrams
      g. One-line Diagrams
      h. Block Diagrams
   2. Schematics of internal wiring of supplied equipment. Provide electronic drawings of all internal wiring of supplied equipment; utilize the equipment supplier's drawings when preparing as-built drawings for connection.
   3. Interconnection diagrams for each conductor or cable, scheduled or unscheduled, in the Contract Documents.
   4. Prepare schematic diagrams for each control circuit.
   5. Obtain example formats of diagrams from the Project Representative.
   6. Diagrams included in the Contract Documents may be used for preparing As-builts.
   7. All additional information such as raceway number, cable number, wire numbers, wire colors, and pair numbers shall be added electronically by the Contractor and submitted.
   8. Application software and configuration files documentation for all programmable or configurable components.
   9. All mechanical drawings required to perform and document the work including:
      a. Contractor- or supplier-prepared fire protection sprinkler and alarm systems and other alarm systems accurately showing the location, size, and arrangement of piping, cable appurtenances, and controls.
      b. Details not shown on the Contract Documents or submitted documents but required for constructing and maintaining the facility including structural, mechanical, duct, and piping layouts.
      c. Piping vendor fabrication drawings including fittings, spool pieces etc.

PART 3 EXECUTION

3.01 MARKING DEVICES

A. For mark-ups to the Contract set of Documents use waterproof felt tip pens as required to maintain as-built drawings described in this section using the following color coding:
   1. Red: Document changes
   2. Blue: Dimensional and other notations
   3. Green: Work deleted

3.02 ELECTRONIC MEDIA DRAWINGS

A. All drawings provided in electronic format shall be provided on an external USB flash drive in AutoCAD, Release 2013 or newer, "dwg" and in "PDF" format files with borders and title blocks clearly identifying the Contract and drawing number. Each file shall include the drawing number and drawing title in the filename. The equipment and the scope of the drawing shall be as required in the specifications.

B. Drawing quality and size of presentation legible at a 50 percent reduction of such drawings; reduced drawings will be used for insertion in operations and maintenance manuals.

C. Text size: 0.125 inch for 22 x 34 inch drawings, 0.063 inch for 11 x 17 inch drawings.

D. When requested by the Contractor, the Project Representative will provide electronic copies of the original Contract Drawings in AutoCAD “dwg” format or Contract Specifications as developed by the design Team in “Word” of “Excel” format.

3.03 RECORDING

A. Record information concurrently with construction progress. No work shall be concealed until the required information is recorded. Be cautioned against ordering concrete until items concealed by the placement of the concrete are recorded on the drawings and as specified in this Section. Payment for concrete, earthwork or structure element placed without recording location of the concealed items may not be made for the concrete, earthwork or structure or the concealed item until the information is documented to the satisfaction of the Project Representative.

B. The following actual construction items shall be recorded on the Drawings:
   1. Elevation of foundation using elevation datum specified on the Contract Drawings.
   2. Reference horizontal and vertical locations of underground or concealed utilities and appurtenances to permanent surface improvements. Minimum requirements for accuracy specified in the following table.
   3. for each item show appropriate:
      a. CL = centerline
      b. I.E. = invert elevation
      c. t.o.c. = top of concrete

Description	Horizontal location	Vertical location (elevation)	Notes
Pressurized piping	CL +/- 1 ft	CL +/- 0.1 ft	Includes water and process lines (except irrigation sprinkler systems listed below)
Gravity storm drains and sewer lines	CL +/- 1 ft	I.E. +/- 0.01 ft	Recalculate slope if shown
Irrigation sprinkler systems including lines, valves, risers and drains	Plotted to scale or dimensioned +/-1 ft (see Notes)	Nominal depth of cover	Dimensions required when location cannot be established on surface by valves and risers
Sewer interceptors and trunks (alignment and profile drawings)	Coordinates, stations, and offsets +/-0.01 ft	I.E. +/- 0.01 ft	Recalculate actual slopes
Conduits, cable and duct banks at beginning and end of straight runs	CL +/- 0.25 feet	Nominal depth of cover to final grade or t.o.c. elevations +/-0.5 ft	Show actual conduit arrangement cross-sections and encasement width and height for encased duct banks

   4. The actual arrangement and routing of embedded conduit and piping relative to visible structural items. Conduit, structural embeds and piping shall be dimensioned off of walls, columns, or other similar features.
   5. Precise survey measurements (as defined in the table above):
      a. Taken on all final locations of buried or concealed items.
      b. Coordinates and elevations of starting and ending points and at directional changes.
      c. List coordinates from the survey on the As-Built drawings.
      d. Complete survey and recording before any burial by earthen, concrete or other materials.

3.04 DELIVERY TO PROJECT REPRESENTATIVE

A. As-Built drawings will be used to verify and document progress as stated in progress payment request per Section 01 32 16. Work not included in the As-Built drawings is not documented as performed and will not be included for payment in progress payment requests.

B. Prior to request for notice for substantial completion of any area or system on the project, transmit document including Contract title, date, Contractor's name and address, index with title and number of each record document, statement indicating completion of record information for specific areas or, if for project close-out, that the documentation is completed and in compliance with Contract requirements attested by the signature of the Contractor or the Contractor's authorized representative.

C. Commissioning will not begin until draft copies of electronic and hard copy As-built documents are received and approved by the Project Representative. Revise As-built documents as a result of any changes made or discovered during commissioning.

3.05 RECORD DOCUMENTS PAYMENT

A. Two percent (2%) of the awarded Contract Price shall be assigned for preparation and submittal of As-built documents. A maximum of one percent of the awarded Contact Price shall be progressed if the As-Built and information is up to date. The remaining one percent of the awarded Contract Price shall be retained and progressed only after all required documents are submitted to the Project Representative and are determined to be accurate and complete.

END OF SECTION

SECTION 01 78 40

ASSETS ATTRIBUTE COLLECTION

PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies providing asset data as specified in Part 3 for equipment, instruments, and sewer piping installed under this Contract.

1.02 SUBMITTALS

A. Procedures: Section 01 33 00.

B. Completed Asset Data Form 01 78 40-A readable with Excel submitted via email, SharePoint or on external USB memory device as specified herein.

PART 2 PRODUCTS

2.01 GENERAL

A. Asset Data Form 01 78 40-A:
   1. A listing of data required to be provided is included in Part 3.
   2. The Project Representative will provide an electronic version of Form 01 78 40-A to the Contractor prepopulated with asset numbers requiring collection of attribute data.
   3. Contractor shall provide all collected attribute data in electronic format on Form 01 78 40-A no later than the beginning of Operational Testing.
   4. Coordinate with the Project Representative to add or remove assets from Form 01 78 40-A as soon as possible to capture changes throughout the project.

B. Removed Asset Data Forms:
   1. When removing any equipment from the system with an assigned asset number, follow reporting requirements in Form 01 78 40-A.

PART 3 EXECUTION

3.01 ELECTRONIC DATA FORM 01 78 40-A

A. Asset Data Collection with Form 01 78 40-A:
   1. Obtain the electronic form from the Project Representative. DO NOT ALTER THE FORMAT of the original Form 01 78 40-A.
   2. Form 01 78 40-A contains 12 color coded and titled sections. The Asset Initialization Section, columns 1-13 will be populated by King County and shall not be changed or altered by Contractor. For each asset listed, Contractor shall populate Asset Details Section, columns 14-23 and the applicable equipment section that pertains to that asset type using the following instructions:
      a. If the asset is a pump, blower, or compressor, Contractor shall populate ASSET DETAILS section, Items 14-23 with all applicable attribute data and the PUMP/BLOWER/COMPRESSOR section, Items 24-36.
      b. If the asset is a valve, Contractor shall populate Asset Details section, Items 14-23 and the VALVE section, Items 37-47.
      c. If the asset is a motor or generator, Contractor shall populate Asset Details section, Items 14-23 and the Motor/Generator section, Items 61-74.

d. If the asset is a VFD, Contractor shall populate Asset Details section, Items 14-23 and the VFD section, Items 75-80.
e. If the asset is any electrical equipment other than a motor/generator or VFD, Contractor shall populate Asset Details section, Items 14-23 and the Electrical Equipment section, Items 81-92.
f. If the asset is any instrumentation or control equipment, Contractor shall populate Asset Details section, Items 14-23 and the Instrumentation/Controls section, Items 93-104.
g. For all mechanical assets not having a designated section, Contractor shall populate Asset Details section, Items 14-23 and the All Other Mechanical Equipment section Items 48-60.
h. If the asset is Sewer Infrastructure, Contractor shall populate Asset Details section Items 14-23 and the Sewer Infrastructure section, Items 124-137.
i. If the electrical or mechanical equipment/component consists of multiple assets listed in Pass 1, Item 2, the Contractor shall populate the Manufacturer's List Price, Items 19, for each asset listed with individual component costs.

3.02 SUBMIT TO PROJECT REPRESENTATIVE

A. Prior to Operational Testing, submit a fully populated Form 01 78 40-A to the Project Representative for validation. Operational Testing may proceed during the County's review of submitted data and any required resubmittals.

B. Commissioning shall not commence on any asset until Form 01 78 40-A submittal data for that asset has received a Review Action of either "1" (No Exceptions Taken) or "2" (Note Markings) as specified in Section 01 33 00.

C. Prior to Final Acceptance, update Form 01 78 40-A for any review markings and asset changes during testing or commissioning and submit the final version in electronic format. Final Acceptance for the contract shall not be granted until the final Form 01 78 40-A submittal has received a Review Action of "1" (No Exceptions Taken) as specified in Section 01 33 00.

3.03 ASSET DATA PAYMENT

A. One percent (1%) of the awarded Contract Price shall be assigned in the Schedule of Values for preparation and submittal of asset data information. Seventy-five percent (75%) of this amount shall be paid upon receipt of an acceptable initial Form 01 78 40-A per paragraph 3.02A containing the required information for the entire contract asset list; this may be prorated if the facility is commissioned in phases. The remaining twenty-five percent (25%) of this amount shall be retained and progressed on satisfactory submittal of updated documents per paragraph 3.02C before Final Acceptance.

END OF SECTION

New Assets

ASSETNO	ASSETSHORTDESC	ASSET_TYPE	PLANT_NO	NOUN	MODIFIER	A_OPT1	A_OPT2	DWGNO	ASSETLOCN
724-B31CA011	Channel Aeration Blower 1	E - Equipment	WP	BLOWER	AERATION	C01397C20	431140	M2414	724
724-B31CA021	Channel Aeration Blower 2	E - Equipment	WP	BLOWER	AERATION	C01397C20	431140	M2414	724
724-MTR31CA011	Channel Aeration Blower Motor 1	E - Equipment	WP	MOTOR	AC	C01397C20	431140	E2420	724
724-MTR31CA021	Channel Aeration Blower Motor 2	E - Equipment	WP	MOTOR	AC	C01397C20	431140	E2420	724
724-FLT31CA011A	Blower 1 Pre-Filter	E - Equipment	WP	FILTER	INLET AIR	C01397C20	431140	M2415	724
724-FLT31CA021A	Blower 2 Pre-Filer	E - Equipment	WP	FILTER	INLET AIR	C01397C20	431140	M2415	724
724-FLT31CA011B	Blower 1 Main Filter	E - Equipment	WP	FILTER	INLET AIR	C01397C20	431140	M2415	724
724-FLT31CA021B	Blower 2 Main Filter	E - Equipment	WP	FILTER	INLET AIR	C01397C20	431140	M2415	724
724-FLT31CA011C	Blower 1 Electronics Filter	E - Equipment	WP	FILTER	ELECTRONICS COOLING	C01397C20	431140	M2415	724
724-FLT31CA021C	Blower 2 Electronics Filter	E - Equipment	WP	FILTER	ELECTRONICS COOLING	C01397C20	431140	M2415	724
724-PCV31CA011	Blower 1 Blowoff Valve	E - Equipment	WP	VALVE	PRESSURE CONTROL	C01397C20	431140	M2414	724
724-PCV31CA021	Blower 2 Blowoff Valve	E - Equipment	WP	VALVE	PRESSURE CONTROL	C01397C20	431140	M2414	724
724-S31CA011	Blower 1 Blowoff Silencer	E - Equipment	WP	SILENCER	N/A	C01397C20	431140	M2415	724
724-S31CA021	Blower 2 Blowoff Silencer	E - Equipment	WP	SILENCER	N/A	C01397C20	431140	M2415	724
724-310402	Blower 1 Discharge Check Valve	E - Equipment	WP	VALVE	CHECK	C01397C20	431140	M2415	724
724-310502	Blower 2 Discharge Check Valve	E - Equipment	WP	VALVE	CHECK	C01397C20	431140	M2415	724
724-310403	Blower 1 Discharge Butterfly Valve	E - Equipment	WP	VALVE	BUTTERFLY	C01397C20	431140	M2415	724
724-310503	Blower 2 Discharge Butterfly Valve	E - Equipment	WP	VALVE	BUTTERFLY	C01397C20	431140	M2415	724
724-ME31CA011	Blower 1 Expansion Joint	E - Equipment	WP	JOINT	EXPANSION	C01397C20	431140	M2414	724
724-ME31CA021	Blower 2 Expansion Joint	E - Equipment	WP	JOINT	EXPANSION	C01397C20	431140	M2414	724
724-FP3151	Blower 1 System Control Panel	E - Equipment	WP	PANEL	FIELD	C01397C20	431140	E2420	724
724-FP3152	Blower 2 System Control Panel	E - Equipment	WP	PANEL	FIELD	C01397C20	431140	E2420	724
724-VFD31CA011	Blower 1 Variable Frequency Drive	E - Equipment	WP	DRIVE	VARIABLE FREQUENCY	C01397C20	431140	N31-05	724
724-VFD31CA021	Blower 2 Variable Frequency Drive	E - Equipment	WP	DRIVE	VARIABLE FREQUENCY	C01397C20	431140	N31-06	724
724-PLC31CA011	Blower 1 Programmable Controller	E - Equipment	WP	CONTROLLER	PROGRAM LOGIC	C01397C20	406343	N31-05	724
724-PLC31CA021	Blower 2 Programmable Controller	E - Equipment	WP	CONTROLLER	PROGRAM LOGIC	C01397C20	406343	N31-06	724
724-HMI31CA011	Blower 1 Human Machine Interface	E - Equipment	WP	INTERFACE	GRAPHICAL OPERATOR	C01397C20	406363	N31-05	724
724-HMI31CA021	Blower 2 Human Machine Interface	E - Equipment	WP	INTERFACE	GRAPHICAL OPERATOR	C01397C20	406363	N31-06	724

01 78 40 Form: Assets for Removal, Section 02 41 00 Rev. 9/20/2018.

DEA=Deactivated in Place; DEL=Removed for Deletion	Asset Number	Equipment Description	Final Disposition of Asset	(Maint Strategy)
Item A	Item B	Item C	Item D	Item E
ASSET_STATUS	ASSETNO	ASSETSHORTDESC	DISPOSITION	ASSETNOTES
DEL	724-B31CA011	ML Channel Aeration Blower 1	Retained by King Co.	
DEL	724-B31CA021	ML Channel Aeration Blower 2	Retained by King Co.	
DEL	724-MTR31CA011	ML Channel Aeration Blower Motor 1	Retained by King Co.	
DEL	724-MTR31CA021	ML Channel Aeration Blower Motor 2	Retained by King Co.	
DEL	724-FI31CA011	Blower 1 Intake Filter	Retained by King Co.	Unit to be retained based on direction from PR
DEL	724-FI31CA021	Blower 2 Intake Filter	Disposed	Unit to be retained based on direction from PR
DEL	724-ME31CA011	Blower 1 Intake Silencer	Retained by King Co.	Unit to be retained based on direction from PR
DEL	724-ME31CA021	Blower 2 Intake Silencer	Disposed	Unit to be retained based on direction from PR
DEL	V510	Blower 1 Intake Butterfly Valve	Retained by King Co.	
DEL	V510	Blower 2 Intake Butterfly Valve	Retained by King Co.	
DEL	310402	Blower 1 Discharge Check Valve	Retained by King Co.	
DEL	310402	Blower 2 Discharge Check Valve	Retained by King Co.	
DEL	310403	Blower 1 Discharge Butterfly Valve	Retained by King Co.	
DEL	310403	Blower 2 Discharge Butterfly Valve	Retained by King Co.	

SECTION 01 78 41

ASSET TAGGING REQUIREMENTS AND SCHEDULE

PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies County asset tags requirements for vendor and owner furnished equipment.

B. The general requirements specified in this Section are applicable to all assets listed on form 01 78 40-A.

1.02 SUBMITTALS

A. Procedure: 01 33 00.

B. Asset tag schedule including: accompanying tag information, tag material, tag dimensions, inscribing method, and text size.

C. Product data on adhesive tape used to attach laminated phenolic plastic asset tags.

D. Sample of stainless steel asset tag.

E. Sample of laminated phenolic plastic asset tag.

1.03 QUALITY ASSURANCE

A. The Project Representative reserves the right to refuse any tag or nameplate that does not meet the requirements of this section.

PART 2 PRODUCTS

2.01 EQUIPMENT ASSET TAGS

A. Asset tags shall be provided on all equipment as specified in this section.

B. Asset tag intended use:
   1. 316 stainless steel asset tags shall be the default material used for all equipment furnished under the project including use in corrosive environments, within chemical systems, indoor spaces, and outdoor spaces exposed to inclement weather conditions.
   2. Where stainless steel tags cannot be used or cannot easily be affixed to the equipment, conform to the requirements for laminated phenolic plastic tags.

C. Asset tag materials and text:
   1. Equipment and valve asset tags shall conform to the following shape, material, and size requirements.
   2. All text shall be legible, appropriately sized, and centered on the tag. Approved fonts shall be Tahoma. All text shall be capitalized. Italic text shall not be permitted.
   3. Asset tags shall not exceed 1/16-inch thickness.
   4. Print style shall be dependent on the asset tag material. Annealed, stamping, and hand written text on tags shall not be permitted.
      a. Stainless steel tags shall be inscribed using laser etching and printed on a silver background with black text.

b. Laminated phenolic plastic tags shall be engraved and printed on a black background with white text.

SHAPE	MATERIAL	TAG SIZE, (W X L)
Rectangular	316 Stainless Steel*	3/4" x 2-1/2”
		1” x 3”
		2-1/2” x 3-1/4”
	Laminated phenolic plastic	3/4" x 2”
		1” x 3”
		2-1/2” x 3-1/4”
		2” x 6”
Circular	316 Stainless Steel	1-1/2” dia
	Laminated phenolic plastic	
*All rectangular 316 stainless steel tags shall have 1/32-inch chamfer edges		

D. All asset tags shall convey the complete equipment asset number as shown on the 01 78 40-A form, including the FIRS identifier if the asset is located within the conveyance system (e.g., WW*EBI.W10-113).

E. Supplemental asset tag information to be noted on asset tags shall be dependent on the function and intended use of the equipment. Contractor to select tag type from the table below based on the required tag information as identified on the 01 78 40-A form and the Drawings. Supplemental asset tag information shall be limited to the following:
   1. Primary Process (influent, effluent, etc).
   2. Asset type or functional description (i.e. pump, screen, exhaust fan, etc.).
   3. Sequence Number if asset is part of a sequence (i.e. 1, 2, 3, etc.).
   4. ‘Fed From’ or ‘Power To’ information

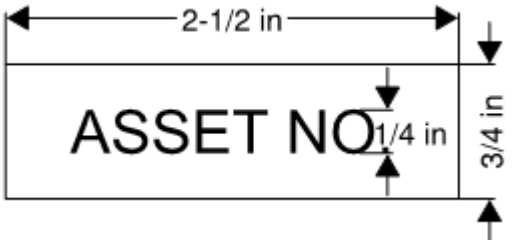
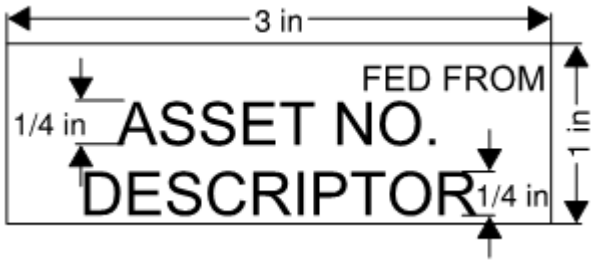
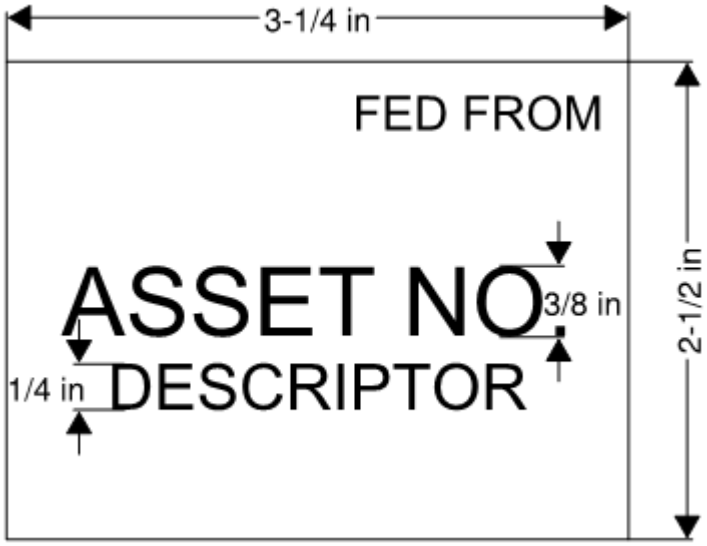
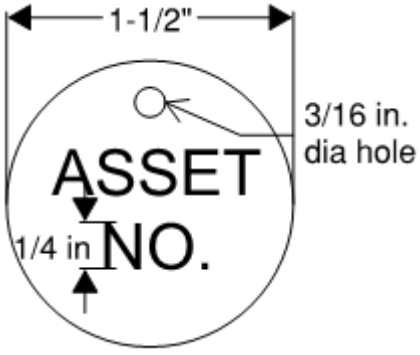
F. Use of screws, self-tapping screws, welds, magnetic strips, Velcro, and/or rivets shall not be permitted as an asset tag fastening method.

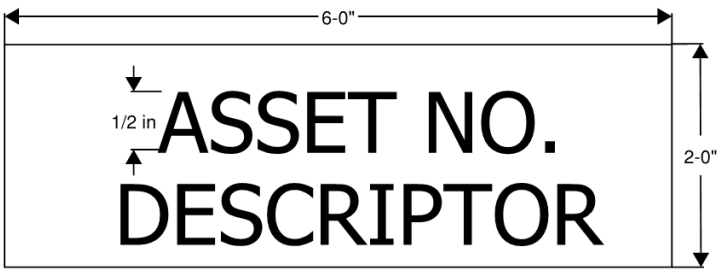
G. Asset tag adhesive products:
   1. 3M VHB Adhesive Transfer Tape F9469PC
   2. 3M Adhesive Transfer Tape 9472LE
   3. 3M Adhesive Transfer Tape 9485PC
   4. Approved equal

H. Asset tag fastening:
   1. Rectangular and circular 316 stainless steel asset tags shall be fastened using wire of the same material. Adhesive tapes shall not be used on stainless steel asset tags.
   2. Rectangular laminated phenolic plastic asset tags shall be fastened using an approved adhesive tape.
   3. Circular phenolic plastic asset tags shall be attached using plastic zip ties.

I. Deviations from this section including use of abbreviations, change in font style, tag materials, engraving method, asset tag information, text size, and fastening method must receive approval from the Project Representative prior to manufacture.

J. Additional identification requirements for piping identification and markers can be found in Section 40 05 01.

ASSET TAG TYPE	ASSET TAG SPECIFICATION	EXAMPLE
Asset tag type 1: For use when asset number and/or FIRS number needs to be conveyed	Rectangular 316 Stainless Steel or Phenolic Plastic 3/4" x 2" Min. asset number text height: 1/4"	
Asset tag type 2: For use when asset number, FIRS number, short description, and/or fed from information needs to be conveyed	Rectangular 316 Stainless Steel or Phenolic Plastic 1" x 3" Min. asset number text height: 1/4" Min. asset description text height: 1/4"	
Asset tag type 3: For use when asset number, FIRS number, short description, and/or fed from information needs to be conveyed	Rectangular 316 Stainless Steel or Phenolic Plastic 2-1/2" x 3"-1/4" Min. asset number text height: 3/8" Min. asset description text height:1/4"	
Asset tag type 4: For use when only the asset number needs to be conveyed	Circular 316 Stainless Steel or Phenolic Plastic 1-1/2" DIA. Min. asset number text height: 1/4"	

Asset tag type 5: For use on main control panels, motor control centers, variable frequency drives, and large pieces of equipment	Rectangular Phenolic Plastic 2" x 6" Min. asset number text height: 1/2" Min. asset description text height:1/2"	

2.02 ELECTRICAL AND INSTRUMENTATION AND CONTROL ASSET TAGS

A. All electrical, instrumentation and control, and communication asset tags shall conform to the requirements outlined in this Section unless otherwise noted herein or on the Drawings.

B. Asset tag material shall be limited to laminated phenolic plastic for use on all electrical or I&C equipment. Stainless steel tags shall not be permitted.

C. Additional identification requirements for electrical equipment are found in Section 26 05 00.

PART 3 EXECUTION

3.01 GENERAL ASSET TAG REQUIREMENTS

A. Asset tag placement:
   1. Asset tags shall, where possible, be affixed to an accessible and visible area adjacent to the piece of equipment that would remain fixed, should, for example, the piece of equipment be removed for maintenance. Examples:
      a. Mount asset tag for pumps and motors on the base plate.
      b. Hang the tag for an inline pump with a tie near the electrical connection at the pump.
      c. Hang the tag for a valve on the piping adjacent to the valve.
   2. For assets that are overhead, out of reach, or out of sight of staff, an asset tag shall be placed on the equipment itself as well as in an accessible, visible location on the panel used to control the equipment.
   3. Fastening of the tags and nameplates shall not interfere with normal operation of the equipment, or lock out tag out procedures. Tags shall not be placed in a location that covers manufacturer information.
   4. Do not insulate or paint over asset tags.

B. Surfaces shall be cleaned of dust, dirt, debris prior to the fastening of the asset tags.

3.02 SUBMIT TO PROJECT REPRESENTATIVE

A. Prior to Operational Testing, submit asset tag schedule and product information to be installed on the asset equipment. Operational Testing may proceed during the County's review of information on the required resubmittals.

B. Commissioning shall not commence on any asset until asset tags are installed on equipment and submittals for asset tagging has received a Review Action of either “1” (No Exceptions Taken) or “2” (Note Markings) as specified in Section 01 33 00.

C. Prior to Final Acceptance, update asset tags for any asset changes during testing or commissioning and submit the final version of the asset tag schedule. Final Acceptance for the contract shall not be granted until the final asset tag schedule submittal has received a Review Action of “1” (No Exceptions Taken) as specified in Section 01 33 00.

3.03 FIELD QUALITY CONTROL

A. King County construction management Staff in partnership with asset management staff will inspect equipment tags for correct identifying asset information according to the information in this Section, the 01 78 40-A form, and the Drawings.

END OF SECTION

SECTION 01 78 43

SPARE PARTS

PART 1 GENERAL

1.01 SUMMARY

A. This Section summarizes the requirements for turnover of spare parts. More specific information pertaining to types and quantities of the spare parts is provided in the individual Sections.

1.02 SUBMITTALS

A. Procedure: 01 33 00

B. Form 01 78 43-A

1.03 STORAGE

A. Until turnover required by Section 01 78 43, be responsible for the delivery, storage, and protection of spare parts and equipment required in accordance with manufacturer recommendations.

B. Store on pallets or shipping skids, and identify as follows:
   1. The pallets or skids shall be sequentially numbered, by Contract number. Each pallet or skid shall have a single, unique numerical designation.
   2. Items or containers on each skid shall be alphabetically ordered and identified by a tag with the following information. The containers or items on each pallet or skid shall always begin with "A", and proceed in alphabetical order. (Example: If pallet #007 has five items on it, the items would be individually tagged and identified as 007-A, 007-B, 007-C, 007-D, and 007-E.)
   3. The information recorded on the tags shall be in the same order in which the spare parts are turned over. Any reorganization of parts or containers on pallets must be reflected in accurate identification tags. Pallets, parts, or equipment with inaccurate, incomplete, or missing tags, will not be accepted.
   4. Spare parts subject to deterioration such as ferrous metal items and electrical components shall be properly protected by lubricants or desiccants and encapsulated in hermetically sealed plastic wrapping. The quality of protection shall be equal to that required for shipment overseas and storage in humid, tropical climates.
   5. Those spare parts with individual weights less than 50 pounds and dimensions less than 2'-0" W x 1'-6" H x 3'-0" L shall be stored in a heavy-duty wooden crates, with a hinged wooden cover. The hinges shall be heavy-duty strap types. Paint and identify boxes with stenciled lettering indicating "Spare Parts". A neatly typed inventory of the parts contained within shall be taped inside in a heavy-duty plastic protective sleeve to the underside of the cover. The crates shall be identified as per Section 01 78 43, and the parts description shall reference the typed inventory list taped to the cover.
   6. Provide access to spare parts for inspection while in storage.

PART 2 PRODUCTS [NOT USED]

PART 3 EXECUTION

3.01 TURNOVER OF THE SPARE PARTS

A. Provide 2 weeks written advance notification of intent to turn over all spare parts. The written notification shall be accompanied by a completed Spare Parts Release Form 01 78 43-A as provided by the Project Representative.

B. Provide for the delivery and off-loading of spare parts at a County location, as determined by the Project Representative.

C. Jointly inspect spare parts with the Project Representative and verify condition and quantities. Mutual agreement and signoff on the Spare Parts Release Form shall constitute turnover of the spare parts.

D. The spare parts may be delivered only upon completion of the operational testing phase of the work, and prior to issuance of Substantial Completion. The only exception shall be the acceptance of spare parts for that portion of the work accepted for Possession and Use prior to issuance of Substantial Completion.

3.02 DOCUMENTATION

A. Provide an electronic copy of the Spare Parts Release Form in Microsoft Excel software 2010 or newer and one hard copy to the Project Representative with the spare parts.

B. Include the Spare Parts Release Form in the final bound operations and maintenance (O&M) manual. Include mention of the Spare Parts Release Form in the Table of Contents.

3.03 PAYMENT

A. Spare parts payment shall be considered separate from the equipment being supplied. This amount shall be a minimum of five (5) percent of the equipment line item(s) on the schedule of values. No payment for spare parts will be released until the spare part is submitted and accepted per this Section.

END OF SECTION

SECTION 01 80 00

EQUIPMENT TESTING, TRAINING, AND COMMISSIONING

PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies the requirements for achieving, verifying, and documenting the working condition of the facility, according to its planned function and operation, including the training of operating and maintenance personnel. This process includes, but is not limited to, documentation and procedures, pre-installation and component testing, system and operational testing, commissioning, and possession and use by the County. The process is applicable to process, mechanical, electrical, and instrumentation systems and completed portions of the work, functioning as integrated systems of a completed operational facility.

B. Provide: power, fuel, compressed air supplies, chemicals, temporary facilities and all other necessary items and work required to complete the tests and inspections specified herein, unless otherwise specified as provided by owner.

C. If, under test, a portion of the work fails to meet the Contract requirements and is adjusted, altered, renewed, or replaced, tests on that portion, together with other portions of the work affected, shall be repeated within a reasonable time and in accordance with the specified conditions.

D. Test results to be within the tolerances set forth in the Specifications. If no tolerances have been specified, conform to tolerances established by recognized industry practice.

E. Where, in the case of an otherwise satisfactory installed test, doubt or dispute arises between the Project Representative and the Contractor regarding the test results or the methods or equipment used in the performance of such test, then the Project Representative may order the test to be repeated. The repeat test using such modified methods or equipment will be paid per the following:
   1. If the test results confirm the satisfactory installed test results, costs for the repeat test will be paid by the County.
   2. If the test results of an installed test fail to comply with the Contract requirements, all costs associated with the repeat tests and equipment necessary to achieve the Contract requirements are at the Contractor's expense.

F. Contractor shall be responsible for all pre-operational and component testing of mechanical components in accordance with testing requirements in respective Specification Sections.

1.02 REFERENCED STANDARDS

A. This Section incorporates by reference the latest revisions of the embedded standard referenced herein. In case of conflict between the requirements of this Section and those of a listed document, the requirements of this Section shall prevail.

Reference	Title
ASTM	American Society for Testing and Materials (ASTM)
HI	Hydraulic Institute Standards
IEEE	Institute of Electrical and Electronics Engineers
ISA	Instrument Society of Automation

B. Install testing equipment and apparatus with personnel trained in the trades and professions required to assure competent workmanship.

C. Supervise the installation of specific equipment testing items specified to be accomplished by factory-trained installation specialists furnished or certified by the equipment manufacturers.

D. Document the skills and training of workers engaged in the installation of testing equipment furnished by the Contractor.

E. Qualifications of Test Engineer: The Test Engineer shall have the following minimum qualifications:
   1. Shall be an employee of a company regularly engaged in testing and commissioning of systems of similar scope and complexity.
   2. Shall have demonstrated a history of successful testing and commissioning of systems of similar scope and complexity.
   3. Shall have completed work on at least three systems of equal or larger size that were similar in type and scope to those tested herein.

1.03 SUBMITTALS

A. Procedures: Section 01 33 00.

B. Provide a listing of all individual component and system testing to be performed within 30 days after Notice to Proceed.

C. Submit Qualifications of Test Engineer(s) meeting the requirements in paragraph 1.02E.

D. Testing, Training, and Commissioning Plans:
   1. Submit a minimum of one complete plan commensurate with the scope of work of this Contract.
   2. Test phase plan submittals:
      a. Pre-installation test phase.
      b. Component test phase.
      c. System test phase.
      d. Operational test phase: An update of System Test Phase documents with Operational Test Phase results and evaluations as related to other Systems, facilities, or contracts.
   3. Commissioning submittals
      a. Commissioning plan of action
      b. Commissioning schedule
      c. Commissioning documentation
   4. Test result report submittals.
      a. Pre-Installation tests
      b. Component tests
      c. System tests
      d. Operational tests
   5. Training Program submittals
      a. Listing of all individual equipment and systems
      b. Training Plans
      c. Documentation of training performed
   6. Roles and responsibilities of test participants (or entities) defined.
   7. Test Plan shall include applicable requirements also specified in Divisions 01 through 46 applicable to the systems to be tested.
   8. Format:
      a. Title page, Table of Content or Index, with page numbers on each page.
      b. Space for comments and notes.
      c. Hard bound and in native electronic and PDF format.
      d. Attachments or Appendices in native electronic and PDF format.
      e. Sequentially and/or alphanumerically organized, step-by-step procedures. Bulleted items not allowed, no exceptions.
      f. Organized, and spare to include annotations as needed, to facilitate stopping and restarting of any part of the test, at any time during testing.
      g. Either in 8-1/2”x11” and/or 11”x17” format.

1.04 TEST ENGINEER RESPONSIBILITIES

A. Designate the Test Engineer(s) approved in the bid evaluation and submitted per Section 00440, if applicable or submit the qualifications of designated Test Engineer(s) showing competence to perform the responsibilities.

B. The Test Engineer(s) shall be responsible for the following:
   1. Review and approve all functional and performance tests, test results, and testing documentation for all equipment and systems.
   2. Develop schedules for all testing, integrate testing into the master construction activity schedule, and coordinate all required testing.
   3. Develop test procedures and forms for documentation of all equipment tests, system functional tests, and cross system functional tests. Test procedures shall be in accordance with equipment manufacturer's recommendations, where applicable. Test procedures shall fully describe system configuration and steps required for each test. The test procedures reflect actual procedures used. The test procedures shall be appropriately documented so that another party can repeat the test to verify test results.
   4. Complete test procedure schedule, procedures, forms, and other documentation and submit for approval six months prior to starting any testing required by Division 40.
   5. Coordinate directly with all subcontractor and vendors specific to their responsibilities and contractual obligations.
   6. Observe the start-up and initial testing of equipment and then all final test of equipment and systems.
   7. Coordinate all cross system testing. Some examples of cross system testing are process instrumentation and controls (including, but not limited to contractor and vendor furnished systems), electrical, HVAC, fire alarm, life safety, Owner-furnished systems (when included in the project), etc.
   8. Note and document any inconsistencies or deficiencies in system operations and ensure system compliance or recommend modifications to system design which will enhance system performance.
   9. Coordinate the participation in the required testing and approve procedures, after verifying that pretests have been satisfactorily conducted and the systems are ready for final tests.
   10. Review as-built drawings provided by the various subcontractors and vendors for verification with as-built conditions.
   11. Obtain all documentation of equipment and systems' tests and assemble a final test report.
   12. Oversee training for the systems specified in the Specifications.
   13. Participation in commissioning tests, document that the facility is completely tested and within contract limits or identify non-compliant elements.

1.05 DEFINITIONS

A. Temporary Facility: Systems necessary to allow the existing facility or component to be removed from service while maintaining the required functional capacity.

B. System:
   1. A defined part of the Contract requirements, consisting of an arrangement of items, such as Equipment, structures, components, piping, wiring, materials, or incidentals, so related or connected to form an identifiable, unified, functional, operational, safe, and independent part of the Contract.
   2. Systems include, but are not limited to, the following main process equipment elements and associated
      a. Control valves
      b. Operators
      c. Monitoring equipment
      d. Switches
      e. VFD
      f. Supervisory Process Control System (SPCS, currently Emerson Ovation), and/or PLC I/O and Logic
      g. Local control

h. Operator Interface System (OIS)
i. Alarms and Annunciators
j. Specific systems may include, but are not limited to, the following:
    1) Temporary Facilities such as
        a) Temporary power.
        b) Temporary motor control center.
        c) Temporary control panel.
        d) Temporary Pumping.
        e) Temporary Odor control.
    2) Storm flow facilities.
    3) Motor operated valves.
    4) Flow meters.
    5) Motor operated sluice and slide gates.
    6) Raw sewage pumping system.
    7) Level monitoring equipment, including level transmitter, high level switches and low level switches.
    8) Level monitoring equipment, including bubbler system, level transmitters, high level switches and low level switches.
    9) Non-potable water.
    10) Seal water system.
    11) Instrument air system.
    12) Sump pump system.
    13) Gas monitoring systems.
    14) Stand-by power system.
    15) HVAC systems.
    16) Washdown pump system.
    17) Intrusion monitor system.
    18) Overflow metering system.
    19) Other systems per Contract Documents.

C. Test Phases
    1. Pre-installation Test Phase:
        a. Factory testing as specified in individual Specification Sections.
        b. Standard factory tests of manufacturer and standard industry practice.
        c. Delivery acceptance tests and inspections.
    2. Component Test Phase: Installed component tests and inspections.
    3. System Test Phase: Complete Systems tests and evaluations to demonstrate the components of the system interact and operate as specified.
    4. Operational Test Phase: Testing of the entire facility and interlocks. The full operation of the facility for a specified period that assures that all systems and processes operate to defined design criteria.

D. Commissioning Phase: Implement the commissioning phase in accordance with Article 3.05, Commissioning.

1.06 TESTING - GENERAL

A. Testing and performance criteria are described in the Contract documents, manufacturer's literature and industry standards

B. Prepare and submit test procedures, and schedules

C. Document and submit test results

D. Completely test and document the performance of temporary facilities before removing existing operating facilities.

1.07 TRAINING

A. Submit Master schedule and training program for operations and maintenance staff training:
   1. Procedures: per Section 01 33 00.
   2. Submit schedule 30 days prior to start of system test phase for first training presentation.
   3. Schedule to include:
      a. Target date and time for each operating and maintenance training presentation for each system, both field and classroom.
      b. Target date for initiation of Commissioning period.
      c. Do not schedule training on weekends or holidays observed by County.
      d. Coordinate training scheduling with applicable County staff work schedule.
      e. After each training presentation, submit completed Form 01 80 00-B and Form 01 80 00-C received from the Project Representative.

PART 2 PRODUCTS [NOT USED]

PART 3 EXECUTION

3.01 MATERIALS AND EQUIPMENT

A. Comply with the requirements of this Contract and the recommendations of the equipment manufacturers.

B. Provide test gauges, meters, recorders and monitors as required to supplement or augment the instrumentation system provided under this Contract to properly demonstrate that equipment fully satisfies the specified requirements. Specifically select devices employed for the purpose of measuring the performance of the facility's equipment and systems to be consistent with the variables to be monitored. Instruments are to be recently calibrated.

C. Demonstrate through re-calibration the accuracy of instruments employed for testing purposes.

D. Calibration procedures are in accordance with applicable standards of ASTM, ISA, and IEEE to insure the adequacy and calibration of gauges, meters, recorders and monitors.

3.02 INSTALLATION

A. Install test equipment in accordance with the manufacturer's requirements. Notify the Project Representative of any conflicts between a manufacturer's installation recommendations and the specific requirements of the Contract Documents.

B. Install test equipment provided by the County as designated under this Contract, in accordance with the details shown and Specified in the manufacturer's requirements. Notify the Project Representative of conflict between a manufacturer's installation recommendations and specific requirements of the Contract Documents.

3.03 TESTING

A. General requirements:
   1. Test and inspect equipment and partially completed or fully completed portions of the work to prove compliance with the Contract requirements.
   2. Unless otherwise noted, pay all costs of testing, including temporary facilities and connections.
   3. Receive Project Representative approval for the application of all tests only after Project Representative inspection of equipment for conformance with the Specifications.
   4. Tests and inspections, unless otherwise specified or accepted, are in accordance with the recognized standards of the industry. Allow for up to two additional setpoint changes during testing.

5. Procedures:
    a. Design testing procedures to duplicate, as nearly as possible, conditions of operation to insure that the equipment is not damaged. Once the testing procedures have been reviewed and approved by the Project Representative, organize by system into test packages and include the proper checkout, alignment, adjustment, and calibration signoff forms for each item of equipment and system.
    b. Jointly use forms with the Project Representative to ensure that documentation for each electrical, mechanical, and instrumentation equipment item has been properly recorded for installation and testing. Failure to follow the Project Representative approved procedure will result in non-acceptance of the equipment.
    c. Fulfillment of the test and inspection requirements are by either of the following:
        1) Tests and inspections carried out in Project Representative's presence, or:
        2) Certificates or reports of tests and inspections carried out by Project Representative approved persons or organizations.
    d. Maintain the systems test packages, which contain tests and sign-off forms including, but not limited to, piping, equipment, electrical, and instrumentation. Submit test packages to the County for inspection upon request.

3.04 TESTING BY PHASES:

A. Pre-installation Test Phase:
    1. As specified. Test items at the place of manufacture during or on completion of manufacture. Tests are comprised of hydraulic pressure tests, electric and instrumentation subsystem tests, performance and operating tests and inspections.
    2. Perform in accordance with the relevant standards of the industry if not specified in the Contract Documents.
    3. When items are delivered to the site, remove all coverings, containers, or crates in order to permit the Project Representative to conduct the inspection to determine if the items are of the specified quality and workmanship, and are visually in good order and condition at the time of delivery. Should the Project Representative find, in its opinion, indication of damage or deficient quality of workmanship, provide the necessary documentation or conduct such tests to demonstrate compliance.

B. Component Test Phase:
    1. General:
        a. Obtain approval of operation and maintenance information as specified in Section 01 78 23 prior to testing.
        b. Equipment to be tested to the specified requirements before a system is placed into operation.
        c. Incorporate requirements of the Specifications into the installed tests and inspection procedures and proceed in a logical, step-wise sequence to ensure that the installed equipment has been properly assembled, serviced, aligned, adjusted, connected, and calibrated prior to operation.
        d. Perform all changes, adjustments, or replacements required to make the Equipment operate.
    2. Component testing is required for all equipment, which may include piping, electrical, instrumentation, controls, safety, security, but not limited to:
        a. Equipment: Division 43.
        b. Piping system pressure testing and cleaning: Division 02, 40.
        c. Electrical System testing: Division 26
        d. Instrumentation System testing: Division 40.
        e. County supplied equipment as specified
        f. Provide and complete a checklist to verify discrete and analog inputs from field devices update PLC memory registers.
        g. Provide and complete a checklist to verify PLC discrete and analog outputs are connected to field devices.
        h. Provide and complete a checklist to verify PLC to Ovation discrete and analog signals are properly connected between the controllers.
        i. Test, check and correct deficiencies of:
            1) Power, control and monitoring circuits for continuity prior to connection to power source.

2) Voltage of all circuits.
3) Phase sequence.
4) Cleanliness of connecting piping systems.
5) Alignment of connected machinery.
6) Vacuum and pressure of all closed systems.
7) Lubrication.
8) Valve orientation and position status for manual operating mode.
9) Tankage integrity using clean water.
10) Instrumentation and control signal generation, transmission, reception and response.
11) Tagging and identification systems.
12) Proper connections, alignment, calibration and adjustment.

j. Calibrate all safety equipment.
k. Manually rotate or move moving parts to assure freedom of movement.
l. Bump electric motors to verify power and direction of rotation.
m. Perform other tests, checks, and activities required to make component ready for System Test Phase.
n. Complete Manufacturer's Installation Certification Form No. 43 05 01-A in Section 01 33 10 following all testing.
o. Complete forms per Section 01 33 10, as applicable to the project, following all testing.

3. System Test Phase:
   a. General:
      1) After the Project Representative has approved the Component Test Phase for each component within a system and has not found deficiencies in that portion of the work, test and operate all individual systems under operating conditions to determine as comprehensively as possible whether the equipment and system meet the requirements of the Specifications.
      2) Except as otherwise specified, employ potable water in the testing of all water and wastewater systems. For other systems use the intended fluid or a compatible substitute. Disposal of test media must be in compliance with laws and regulations and with proper permits. Submit disposal manifest to the Project Representative.
      3) Maintain temporary facilities until permanent facilities are in service.
   b. Following system testing:
      1) Recheck machines for proper alignment; re-align if necessary and dowel in place.
      2) Check equipment for loose connections, unusual movement or other indications of improper operating characteristics.
      3) Correct deficiencies to the requirements of the Project Representative.
      4) Disassemble and inspect equipment which exhibits unusual or unacceptable operating characteristics. Repair or remove from the site and replace with new. Test until the equipment meets the requirements of the Specifications.
   c. Field test to verify performance requirements:
      1) As part of system test phase, completely field test each Equipment item specified in Division 43 over the entire range of operating conditions.
      2) Record flow, suction pressure, and discharge pressure in field testing report.
      3) Perform vibration tests where specified in individual equipment specification. .
      4) Provide necessary pressure and flow measuring equipment. Calibrate prior to use.
      5) Provide a complete field testing report on each equipment item and include in system Test Package.
   d. System test procedures include, but are not limited to:
      1) Provide and complete a checklist to demonstrate discrete and analog points are displayed on all local graphical Operator Interface(s) (OIs) and on the SPCS system at main control.
      2) Provide and complete a checklist to demonstrate operator entries via the SPCS are communicated to PLC memory.
      3) Provide and complete a checklist to demonstrate entries via Control System interface for the Equipment and Systems as described in Division 40.
      4) Provide and complete a checklist to verify discrete and analog inputs from field devices update in the OI(s).
      5) Provide and complete a checklist to demonstrate operator entries via the OI(s) as described in Division 40.

6) Actuate all alarms from field devices by physically changing state of field device to cause alarm. Do not simulate conditions. Provide and complete a checklist to demonstrate that all alarms are received on annunciators, PLC interface, and the SPCS.
7) Test systems to the Project Representative requirements prior to proceeding to Operational Test Phase.

4. Operational Test Phase:
   a. General:
      1) Unless otherwise specified or impractical, Operational Testing for wastewater processing and handling equipment is performed with clean water. Testing for other equipment is performed with the service medium.
      2) Provide one week notice to Project Representative prior to starting Operational Test in order than County staff may be coordinated to observe and provide support as needed.
      3) Coordinate activities to ensure the County's operation is not compromised.
      4) After completion of the System Test Phase and approval by the Project Representative that systems and equipment comply with the requirements of the Specifications, configure all systems for complete automatic operation as required by Division 40.
      5) Coordinate and schedule flows prior to starting Operational Test.
      6) Repeat the operational testing until the specified operating modes have been accomplished without interruption. Should the operational test mode be halted for any reason related to the facilities or the equipment constructed under this Contract, or the Contractor's temporary testing of systems, the operational testing mode shall be repeated until it has been accomplished without interruption.
      7) Bring process units to full operating conditions, including temperature, pressure, and flow.
      8) Test in a step-by-step method, in accordance with the Contractor's approved written testing procedures. Accomplish the testing work in an orderly, systematic testing of equipment, systems, structures, and the complete Facility as a unit. Project Representative to witness each individual step in the procedures.
      9) Operate Equipment and Systems during the operational testing phase, to the greatest extent practical, at conditions which represent the full range of operating parameters as defined in the Contract Documents.
      10) A time period of 4 days is to be allocated for the operational test phase. Unless otherwise noted, the facility shall perform through its complete design range for a period of four consecutive 24-hour days. Operational testing shall be sequenced in coordination with the criteria specified in Section 01 14 00 and this Section.
      11) Supply operational manpower for testing during the required 24-hour operations.
      12) Submit operations phase test results in three compiled volumes (original and two copies) within 14 days of completion of this testing phase.

3.05 COMMISSIONING

A. After completion of the Operational Test Phase and certification by the Project Representative that System and Operational tests meet performance requirements, that the required training is complete and that all required documents are submitted, the transfer to fully functional facility may begin and the County will begin operating the facility for the Commissioning Period. Note, any time wastewater is being conveyed or processed, the process operation must be under the direction of the County staff.

B. Prior to start of Commissioning, remove temporary piping, plugs and other apparatus that may have been in use during the operational tests.

C. Provide required support to the County to insure the facility attains its fully operational mode.

D. During commissioning the County's operations personnel will be responsible for operation of the facility or portion thereof. The facility will be required and capable of operating in its intended service and perform the intended process. The facility shall be fully operational, capable of accepting design flows and performing functions as designed.

E. The County is responsible for costs of continuous normal operation including, but not limited to supplies, electricity, and chemicals.

F. Be responsible for all costs of necessary maintenance, repairs or replacements required to keep the facility operational. Failures of equipment will require restart of Commissioning Period.

G. Be available to provide immediate assistance 24 hours per day, seven days per week, in case of failure of a portion of the system being operated.

H. The Commissioning Period is defined as 30 continuous days of full operation without equipment failures for all systems being commissioned. During this period the facility may be required to operate throughout its specified operating and performance ranges.

3.06 TRAINING

A. Conduct all personnel training after completion of Component Test Phase for the equipment for which training is being conducted, but no later than five (5) working days after System Test Phase begins:
   1. Personnel training on individual Equipment or System will not be considered completed unless:
      a. All training deliverables are received and approved before commencement of training on the individual equipment or system.
      b. No system malfunctions occur during training.
      c. All provisions of field and classroom training are met.
      d. Training not in compliance with the above shall be performed again in its entirety by the Contractor.
      e. Training for Temporary Pumping Station variable frequency drive and custom engineered submersible non-clog pumps shall occur prior to start-up of the pumps.
      f. Field and classroom training requirements are defined in the specific Specifications, as required:
         1) Hold classroom training on-site.
         2) Training instructor: Factory trained and familiar with giving both classroom and hands-on instructions.
         3) Training instructors: Be at class on time. Session beginning and end times to be coordinated with the Project Representative and to be indicated on the master schedule. Normal time lengths for class periods can vary, but brief rest breaks shall be scheduled and taken.
         4) Organize training into separate maintenance and operation sessions and identify on schedule.
         5) Plan for minimum class attendance of 12 people at each session and provide sufficient classroom materials, samples, and handouts for those in attendance.
         6) Instructors to have a typed agenda and well prepared instruction material. The use of visual aids, e.g. films, pictures, and slides is recommended for use during the classroom training programs.
         7) Provide Equipment required for presentation of films, slides and other visual aids.
         8) Maintain a classroom training log including: instructors, topics, dates, time, and attendance.
      g. Make available experienced factory-trained representatives of the manufacturers of the various pieces of equipment to train the County's personnel in the operation and maintenance thereof. The time required for this training is as specified for each piece of equipment and as specified in this Section.
      h. Notify the Project Representative of the time of the training at least ten (10) days prior to the day of the training.
      i. Training sessions may be recorded by King County staff.

3.07 PAYMENT

A. Payment for work specified in this Section shall be listed as a line item in the Schedule of Values as not less than 2 percent of the Contract Price and paid monthly as completed portions of the system testing and training work are completed. Submit a representative breakdown of the 2 percent by system testing and training to the Project Representative for determining appropriate progress payments to be made monthly as work is completed.

END OF SECTION

SECTION 02 26 00

HAZARDOUS MATERIAL ASSESSMENT

PART 1 GENERAL

1.01 SUMMARY

A. This Section provides information pursuant to 29 CFR 1926.1101, WAC 296-62-077, WAC 296-65, WAC 296-155-176 and to all other applicable requirements concerning working on, working around and reporting on asbestos and lead containing materials.

B. The information in this Section is based on the results of a good faith review of the Contract Work requirements and a site inspection of the proposed work areas to determine the presence of asbestos or lead containing materials. This review and inspection were performed by King County's AHERA Certified Building Inspector in strict accordance with 29 CFR 1926.1101, WAC 296-62-077, WAC 296-65, WAC 296-155-176, and with the accepted principles and protocol mandated by AHERA.

C. The reports are of investigations of piping, painted surfaces, building and structural materials. The reports do not apply to lead or asbestos which may be found in soils, vegetation or other environments.

D. Notify all employees and subcontractors who are on site or perform work subject to this Section of the contents of this Section.

1.02 REFERENCED STANDARDS

A. This Section incorporates by reference the latest revisions of the embedded standard referenced herein. In case of conflict between the requirements of this Section and those of a listed document, the requirements of this Section shall prevail.

Reference	Title
AHERA	(Federal) Asbestos Hazard Emergency Response Act
29 CFR 1926.1101	Safety and Health Regulations for Construction: Asbestos
WAC 296-62-077	Occupational Health Standards: Asbestos, Tremolite, Anthrophyllite and Actinolite
WAC 296-65	WISHA Asbestos Standards
WAC 296-155-176	Safety Standards for Construction Work - Lea

1.03 ASBESTOS INSPECTION

A. The County's Inspection has determined to the best of its ability that the proposed construction areas under this Contract and the materials therein, do not contain asbestos.

B. A copy of the report documenting the review and inspection and the findings is located at the end of this Section.

1.04 LEAD INSPECTION

A. The County's Inspection has determined to the best of its ability that the proposed construction areas, under this Contract and the materials therein, do not contain lead.

B. A copy of the report documenting the review and inspection and the findings is included at the end of this Section.

1.05 CONTRACTOR'S RESPONSIBILITIES

A. Should suspect material not identified in this Section be encountered, immediately suspend all work that could disturb said material and notify the Project Representative who will implement the proper action. Do not proceed with work that could disturb the material until authorized by the Project Representative, in writing, to do so.

B. Take the necessary precautions for compliance with Local, State and Federal regulations.

C. When regulated substances are present, submit an abatement and disposal plan for review and approval by the Project Representative.

D. Comply with Section 01 35 29.

E. Fully inform workers of the presence of hazardous materials.

1.06 COUNTY'S RESPONSIBILITIES

A. Upon notification by the Contractor of the existence of suspect material not identified in this Section, the Project Representative will have said material inspected and analyzed for the presence of asbestos or lead, as required.

B. If the results of the inspection and analysis confirm the presence of asbestos in the suspect material, the County will take the necessary actions for compliance with 29 CFR 1926.1101 and WAC 296-62-077. After compliance is obtained, the Project Representative will notify the Contractor in writing so that work suspended can proceed.

C. If the results of the inspection and analysis confirm the presence of lead in the suspect material, the County will take the necessary actions for compliance with WAC 296-155-176. After compliance is obtained, the Project Representative will notify the Contractor in writing so that work under this Contract can proceed.

D. If the results of the inspection and analysis confirm the presence of other dangerous, hazardous or regulated substances in the suspect material, the County will take the necessary actions for compliance with State and Federal regulations. After compliance is obtained, the Project Representative will notify the Contractor in writing so that work under this Contract can proceed.

E. If the results of the inspection and analysis confirm that the suspect material is free of asbestos, lead, or other regulated substances, the Project Representative will notify the Contractor in writing so that work suspended can proceed.

PART 2 PRODUCTS [NOT USED]

PART 3 EXECUTION

3.01 HEALTH AND SAFETY

A. Comply with Section 01 35 29.

END OF SECTION

King County

Wastewater Treatment Division
KSC-NR-0509
201 S. Jackson St.
Seattle, WA. 98104-3855

November 7, 2019

TO: JR Meksavanh

FROM: Darrell Myers

SUBJECT: Inspection Report: Asbestos and Lead
WPTP Mixed Liquor Blower Replacement
C01397C20

This project has been reviewed by Darrell Myers, AHERA Building Inspector Certificate #170802, (expires December 19, 2019). A good faith review of the drawings and site visit have indicated no asbestos or lead based paint in the area of work.

SECTION 02 41 00

DEMOLITION AND SALVAGE

PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies demolition, equipment salvage, cutting, and patching.

B. For documentation requirement, refer to Section 01 74 19, Construction and Demolition Material Management; and Section 01 78 40, Assets Attribute Collection.

1.02 SUBMITTALS

A. Procedures: Section 01 33 00.

B. Schedule of work planned, schedule to avoid interference with facility operations.

C. Shop drawings for items to be repaired or replaced.

1.03 SALVAGE DISPOSITION, STORAGE AND HANDLING

A. Salvage Equipment:
   1. Refer to Section 01 78 40 for the identification and documentation procedures for equipment identified for salvage. As designated in Section 01 78 40, equipment to be removed from the project shall be:
      a. Delivered to the County's possession or
      b. Removed by the Contractor for Contractor's possession and recycling.
      c. Final disposition of the asset will be documented on form 01 78 40-A.

B. Materials disposal:
   1. Unless otherwise identified, all materials removed from the project become the property of the Contractor and shall be recycled per Section 01 74 19.

C. Delivery of Salvage Items to the County
   1. Remove, as a unit, items designated for removal and salvage or reuse.
   2. Clean, condition, tag, and protect from damage.
   3. Coordinate delivery with Project Representative.

D. Recycled by Contractor:
   1. Removal and recycling of equipment and materials shall not occur until the Project Representative has been notified of this work.
   2. Refer to Specification 01 74 19 for coordination and documentation of recycled equipment and materials.
   3. Upon completion of review, promptly remove from site.
   4. Do not store or sell Contractor salvaged items or materials on site.

1.04 SALVAGED EQUIPMENT LIST

A. See Section 01 78 40 for the list of equipment to be removed from the project and disposition of that equipment. Any changes or additions to this list shall be relayed to the Project Representative before removal. Final disposition column will be completed /verified by Contractor and form submitted to the Project Representative prior to Commissioning.

1.05 JOB CONDITIONS

A. Protection:
   1. Remove salvaged equipment in a manner that protects adjacent equipment and piping.
   2. If chipping of concrete is required, perform work in a manner that contains and exhausts concrete dust to a bag filter or other means of complete containment and capture.
   3. Repair or replace property that is damaged.
   4. Typical enclosure required for dust control shall be as shown on Drawings.

B. Proper Approval:
   1. Obtain approval of authorities having jurisdiction for work which affects existing exit ways, exit stairs, means of egress, or access to or exit from such areas.
   2. Review with and obtain approval of authorities for temporary construction which affects such areas.
   3. Special attention is directed to approvals by fire authorities.

C. Special Requirements:
   1. Clean as required and cut in pieces pressure vessels and closed containers which may have contained hazardous or contaminated materials. Disposal of equipment shall not occur until the Project Representative has approved.

1.06 VERIFICATION OF ASSET REMOVAL

A. Document disposal or salvage of assets removed from the project by completing the Final Disposition column for removed assets in Form 01 78 40- A. The finalized form shall be submitted to the Project Representative prior to final acceptance.

B. Document salvage of assets per Section 01 78 40.

1.07 VERIFICATION OF DEMOLITION MATERIALS

A. Document salvage, reuse, disposal, and recycling of demolition materials per Section 01 74 19.

PART 2 PRODUCTS [NOT USED]

PART 3 EXECUTION

3.01 GENERAL

A. Notify the Project Representative prior to beginning salvage work so that the proper salvage items are identified and the condition of the salvage item and adjacent equipment, piping and structures can be documented. Refer to prepopulated form 01 78 40-A provided by Project Representative for assets to be removed. Notify the Project Representative if there are any changes to, additions to, or discrepancies in the list.

3.02 OPERATION PROCEDURES

A. Start and complete work in order of precedence as established by approved schedule. The sequence of work may be adjusted with prior approval by the Project Representative, as long as the work does not infringe upon or violate the schedule.

B. Execute work to protect County employees, County Representatives and the public from injury. Provide protection to persons and property. Conduct work to ensure minimum interference with roads, walks, entrances, exits, and other adjacent occupied facilities as approved by the Project Representative.

C. Where temporary partitions are required in public areas, construct partitions of clean, painted, minimum 1/2-inch thick, plywood. In interior areas, adequately braced 1/4-inch pre-finished paneling may be used. Provide the following:
   1. Passageways where necessary to ensure safe passage of persons in or near areas of work.
   2. Substantial barricades and safety lights as required.
   3. Temporary dust proof partitions as necessary to prevent infiltration of dust into occupied areas or the atmosphere.
   4. Temporary weather protection as necessary to prevent damage to existing facilities and discomfort to persons in occupied areas.

3.03 CUTTING AND REMOVAL

A. Neatly cut and remove materials and prepare openings to receive new work.

B. Remove masonry or concrete in small sections.

C. Provide shoring, bracing, and other supports to prevent movement, settlement, or collapse of remaining or adjacent wall areas, structure, or facilities. Arrange shoring, bracing, and supports to prevent overloading of structure.

D. Take precautions necessary to prevent damage to existing remaining work or to adjacent facilities. Execute work using methods that will prevent interference with use of remaining and adjacent facilities by the County, utilities, or the public.

E. Properly disconnect salvaged items to retain their full salvage value, remove from their foundations when applicable, and carefully store at location(s) specified.

3.04 MATCHING AND PATCHING

A. Where items are removed from existing walls, ceilings, floors, or partitions to remain, repair wall, ceiling, floor, or partition disturbed by removal.

B. Where walls, ceilings, floors, or partitions are removed, repair abutting walls, ceilings, or floors disturbed by removal.

C. Where existing construction is cut or otherwise disturbed to permit installation of new work, match and patch existing disturbed construction.

D. Use methods and materials identical in appearance and equal in quality to areas or surfaces being repaired.

E. Remove areas, surfaces, or items which cannot be satisfactorily matched, patched and replaced as approved by the Project Representative.

3.05 CLEANUP

A. Remove debris, rubbish and materials resulting from cutting, demolition or patching operations.

B. Transport materials and legally recycle or dispose of offsite.

END OF SECTION

SECTION 03 30 01

CAST-IN-PLACE CONCRETE (SMALL JOBS)

PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies cast-in-place reinforced concrete, including embedded material and formwork.

1.02 QUALITY CONTROL

A. Referenced Standards: This Section incorporates by reference the latest revision of the following document. It is a part of this Section as specified and modified. In case of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

Reference	Title
IBC	International Building Code
ACI 301	Specifications for Structural Concrete
ACI 308.1	Specification for Curing Concrete
ACI 309R	Guide for Consolidation of Concrete
ACI 318	Building Code Requirements for Structural Concrete
ASTM A615	Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
ASTM C1059	Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete
ASTM C33	Standard Specification for Concrete Aggregates
ASTM C39	Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C94	Standard Specification for Ready-Mixed Concrete
ASTM C150	Standard Specification for Portland Cement
ASTM C685	Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing
ASTM C881	Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete
ASTM E329	Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection
CRSI	Manual of Standard Practice

B. Testing:
   1. Perform materials testing to demonstrate conformance with the specifications.
   2. Perform Quality Control per Section 01 15 00.

C. Be responsible for controlling the quality of the materials and work.

D. Obtain services of an independent testing laboratory to perform required tests to document compliance with the Contract requirements.

E. Perform work of this section in accordance with the Referenced Standards.

F. Be responsible for results of the cured concrete specified and placed per the requirements of this Section, and perform required repair and remediation to meet the Contract Documents.

1.03 SUBMITTALS

A. Procedures: Section 01 33 00.

B. Concrete-Mix Designs.

C. Reinforcing Steel.

D. Concrete Placement Drawings.

E. Submit manufacturer’s data on specified products showing compliance with requirements.

F. Submit manufacturers' data on contractor selected products showing quality and suitability for the application. Contractor selected products are to be standards typically used in the industry for similar applications.

G. On a project-wide basis, provide the following:
   1. Total cement used, in pounds
   2. Total cement substitutes used, in pounds

1.04 CONCRETE MIX DESIGNS

A. Compressive Strengths: unless otherwise specified, provide the following as minimum:
   1. Concrete compressive strength at 28-days: 4000 psi.

PART 2 PRODUCTS

2.01 REINFORCEMENT

A. Comply with the following as minimums:
   1. Bars - ASTM A615, grade 60, unless otherwise shown, using deformed bars for Number 3 and larger.
   2. Welded Wire Fabric - ASTM A1064.
   3. Bending - ACI 318.

B. Fabricate reinforcement to the required shapes and dimensions, within fabrication tolerances stated in the Concrete Reinforcing Steel Institute (CRSI) Manual of Standard Practice.

C. Do not use reinforcement having any of the following defects:
   1. Bar lengths, depths, or bends exceeding the specified fabricating tolerances.
   2. Bends or kinks not indicated on the Drawings or required for this work.
   3. Bars with cross-section reduced due to excessive rust or other causes.

2.02 CONCRETE

A. Minimum Requirements:
   1. Portland Cement: ASTM C150, Type I or II, low-alkali.
   2. Aggregate, General:
      a. ASTM C33 uniformly graded and clean.
      b. Do not use aggregate known to cause excessive shrinkage.
   3. Aggregate, Coarse: crushed rock or washed gravel with maximum size between 3/4-inch and 1-1/2 inches.

4. Aggregate, Fine: natural washed sand of hard and durable particles varying from fine to particles passing a 3/8-inch screen, of which at least 12 percent shall pass a 50-mesh screen.
5. Water: clean and potable.

2.03 OTHER MATERIALS

A. Provide other materials, not specifically described but required for a complete and proper installation as selected by the Contractor.

B. Form Release Agent:
1. Material: Release agent shall not bond with, stain, or adversely affect concrete surfaces, and shall not impair subsequent treatments of the concrete surfaces. A ready-to-use water based material formulated to reduce or eliminate surface imperfections, containing no mineral oil or organic solvents. Release agent shall be environmentally safe, and shall meet the requirements of the referenced standards.
2. Acceptable Products:
   a. BASF: MasterFinish RL 211.
   b. Cresset Chemical Company: Crete-Lease 20-VOC or Crete-Lease 880-VOC.
   c. US Mix Products Company: US SPEC Ezkote Green.
   d. Approved Equal.

C. Bonding Agent:
1. Epoxy resin bonding compounds shall be used to bond all fresh concrete to existing concrete unless otherwise noted on the drawings. Epoxy Bonding Systems shall comply with ASTM C881, Type V Grade 1 or Grade 2.
   a. Prepare existing concrete by roughening, cleaning and applying bonding agent in accordance with manufacturer's instructions.

D. Corners: Filleted, rigid plastic type; 3/4 x 3/4 inch size; maximum possible lengths

PART 3 EXECUTION

3.01 EXISTING CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected meeting approval of the Project Representative.

3.02 EMBEDDED ITEMS

A. Do not embed piping in structural concrete unless indicated on the drawings.

B. Electrical Conduit:
1. Locate to maintain maximum strength of the structure.
2. Increase the thickness of the concrete if the outside diameter exceeds 30 percent of the thickness of the concrete. Obtain written approval of the Project Representative prior to increasing the thickness of the concrete.
3. Electrical conduit to be embedded in concrete shall be rigid galvanized steel conduit. Aluminum conduit is prohibited for embedment in concrete.

C. Set and secure bolts, inserts, and other required items in the precise locations needed so they are not displaced. Take photos to document locations of embedded items.

D. Prior to concrete placement, assure the actual locations of embedded items are noted on the as-built set of drawings.

3.03 FORMS

A. Design, erect, support, brace, and maintain formwork to safely support vertical and lateral loads, which will be applied until such loads can be supported safely by the concrete structure.

B. Construct forms to the exact sizes, shapes, lines, and dimensions shown, and as required to obtain accurate alignment, location, grades, and level and plumb work in the finished structure.

3.04 MIXING CONCRETE

A. On Site Mixing of the concrete shall be in accordance with provisions of ACI 301. Mix in drum type batch mixer, complying with ASTM C685.

B. Transit Mixers: Concrete mixing shall be in accordance with ACI 301. Ready mix concrete shall conform to ASTM C94.

C. Do not use concrete that has stood for over 30 minutes after leaving the batch plant, or concrete that is not placed within 90 minutes after water is first introduced into the mix.

D. Do not add additional water to the concrete mix after it has left the batch plant unless prior approval is obtained from the Project Representative.

3.05 PLACING CONCRETE

A. Preparation:
   1. Remove foreign matter accumulated in the forms.
   2. Rigidly close openings left in the formwork.
   3. Wet wood forms sufficiently to tighten up cracks; wet other material sufficiently to maintain workability of the concrete.
   4. Use only clean tools.

B. Conveying:
   1. Perform concrete placing at such a rate that concrete, which is being integrated with fresh concrete is still plastic.
   2. Deposit concrete as nearly as practicable in its final location so as to avoid separation due to re-handling and flowing.
   3. Do not use concrete, which becomes non-plastic and unworkable, or does not meet required quality control limits, or has been contaminated by foreign materials.
   4. Remove concrete from the work site that does not meet specifications.

C. Placing Concrete In Forms:
   1. Deposit concrete in horizontal layers not deeper than 24 inches, and avoid inclined construction joints.
   2. Remove temporary spreaders in forms when concrete has reached the elevation of the spreaders.

D. Placing Concrete Slabs:
   1. Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until the placing of a panel or section is completed.
   2. Bring slab surfaces to the correct level with a straightedge, and then strike off.
   3. Use bullfloats or darbies to smooth the surface, leaving the surface free from bumps and hollows.
   4. Do not sprinkle water on the plastic surface.
   5. Do not disturb the slab surface prior to start of finishing operations.

E. Place all concrete in accordance with ACI 301.

3.06 CONSOLIDATION

A. Comply with recommendations of ACI 309R.

B. Consolidate each layer of concrete while placing by use of internal concrete vibrators and supplemented by hand spading, rodding, or tamping.

C. Do not vibrate forms or reinforcement.

D. Do not use vibrators to transport concrete inside the forms.

3.07 JOINTS

A. Construction Joints:
   1. Unless shown otherwise, do not use horizontal construction joints.
   2. If construction joints are found to be required, submit for the Project Representative's approval of joint design and location prior to start of concrete placement.
   3. Extend all reinforcing continuous through construction joints or provide dowels with proper lap lengths at construction joints, unless indicated otherwise on the Drawings.

B. Expansion Joints:
   1. Do not permit reinforcement or other embedded metal items that are being bonded with concrete (except dowels in floors bonded on only one side of the joints) to extend continuously through any expansion joint.
   2. Fill expansion joints full depth with expansion joint material.

3.08 CONCRETE FINISHING

A. Unless otherwise indicated, provide the following finishes at the indicated locations.
   1. Float finish: apply to surfaces that are to receive trowel finish and other finishes specified hereinafter.
   2. Trowel finish: apply to surfaces that are to be exposed to view, unless otherwise shown.
   3. Non-slip broom finish: apply to equipment pads, walks, stairs, drives, ramps and similar pedestrian and vehicular areas.

3.09 CURING AND PROTECTION

A. Comply with requirements of ACI 308.1. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
   1. Normal concrete: Not less than 7 days.
   2. High early strength concrete: Not less than 4 days.

C. Formed Surfaces: Cure by moist curing with forms in place for full curing period.

D. Surfaces Not in Contact with Forms:
   1. Start initial curing as soon as free water has disappeared and before surface is dry. Keep continuously moist for specified curing period by water ponding, water-saturated sand, water-fog spray, saturated burlap, or special blankets designed for curing concrete and maintaining moist condition.
   2. Begin final curing after initial curing but before surface is dry.

E. After completion of curing process, finished surface where indicated shall be protected by use of protection boards from workman, equipment, scaffolding, and any other form of damage throughout subsequent construction. Size, thickness, and material of board shall be determined by Contractor. Contractor is responsible for maintaining integrity of slab finish throughout construction.

3.10 FIELD QUALITY CONTROL

A. Be responsible for Quality Control of Work for materials, placement, curing, and finishing.

B. Perform tests of concrete and concrete materials to ensure conformance with specified requirements per ACI 318. County may perform spot checks. County testing does not relieve the Contractor for quality control and documentation of its Work.

C. Compressive Strength Tests: ASTM C39. For each test, mold and cure three concrete test cylinders. Obtain test samples for every 50 cu yd or less of concrete placed per day.

END OF SECTION

SECTION 03 60 00

GROUTING

PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies non shrink grout and epoxy grout for use in applications including but not limited to grouts for leveling machine bases to equipment pads. Epoxy adhesives for concrete applications including, but not limited to pressure injection of cracks and doweling of anchor bolts, threaded rod anchors and reinforcing bar dowels.

1.02 QUALITY CONTROL

A. Referenced Standards: This Section incorporates by reference the latest revision of the following documents. These references are a part of this Section as specified and modified. In case of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

Reference	Title
ASTM C33	Standard Specification for Concrete Aggregates
ASTM C40	Standard Test Method for Organic Impurities in Fine Aggregates for Concrete
ASTM C88	Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM C117	Standard Test Method for Materials Finer than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C136	Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM C150	Standard Specification for Portland Cement
ASTM C494	Standard Specification for Chemical Admixtures for Concrete
ASTM C881	Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete
ASTM C1017	Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete
ASTM C1107	Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
ASTM D2419	Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate
ASTM E329	Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection
CRD-C-621	Corps of Engineers Specification for Non-shrink Grout

1.03 SUBMITTALS

A. Procedures: Section 01 33 00.

B. Manufacturer's Data for the following:
1. Non-shrink cementitious grout.
2. Epoxy grout.
3. Admixtures for cement grout.
4. Adhesive for pressure injection of cracks.
5. Adhesive for doweling.
6. Retardants.
7. Bonding compounds.

C. Certified Test Reports: Before delivery of materials or grout, submit certified reports of the tests specified herein. Accompany the certified reports on previously tested materials with the manufacturer's certified statement that the previously tested material is of the same type, quality,

manufacture, and make as that proposed for use in this Contract. Certified test reports are required for all cement grout constituents, including cement and aggregates.

D. On a project-wide basis, provide the following:
   1. Total cement used, in pounds
   2. Total cement substitutes used, in pounds

PART 2 PRODUCTS

2.01 GENERAL

A. Grout mixes and admixtures shall not contain more than 0.05 percent chloride ions.

B. Water for washing aggregate, for mixing, and for curing:
   1. Shall be free from oil and deleterious amounts of acids, alkalis, and organic materials
   2. Shall not contain more than 1,000 mg/L of chlorides as Cl, nor more than 1,300 mg/L of sulfates as SO4.
   3. Shall not contain an amount of impurities that may cause a change of more than 25 percent in the setting time of the cement nor a reduction of more than 5 percent in the compressive strength of the grout at 14 days when compared with the result obtained with distilled water.
   4. Water used for curing shall not contain an amount of impurities sufficient to discolor the grout.

2.02 GROUT

A. Non-shrink cementitious grout:
   1. Cementitious grout that conforms to ASTM C1107, CRD-C-621, "Corps of Engineers Specification for Non-Shrink Grout", and the following requirements:
      a. Non-metallic aggregate.
      b. Acceptable manufacturers:
         1) US SPEC, “MP GROUT”
         2) BASF, “Masterflow 928”
         3) Five Star Products, Inc., “High Strength Grout”
         4) Approved Equal.

B. Epoxy Grout:
   1. Multi-component, 100 percent solids compound conforming to the following requirements:
      a. Suitable for use on dry or damp surfaces.
      b. Comply with ASTM C881.
      c. Acceptable manufacturer:
         1) Euclid Chemical Co., "E3-Flowable Epoxy Grout"
         2) Sika Chemical Co, “Sikadur 42”
         3) BASF, "Masterflow 648".
         4) Approved Equal.

C. Cement grout:
   1. A mixture of one part Portland cement, 1 to 2 parts fine aggregate, and with sufficient water to impart workability but not such that the grout will flow.
      a. Cement shall be Portland cement, ASTM C150 Type II or Type V, and shall be low alkali cement, containing less than 0.60 percent alkalis.
      b. Fine aggregate shall conform to ASTM C33 and to the following requirements:
         1) Non-reactive and washed before use.
         2) When sources of aggregate are changed, provide test reports for the new material. Perform the tests specified prior to commencing grout work.
         3) Fine aggregate shall be hard, dense, durable particles of either sand or crushed stone regularly graded from coarse to fine.
         4) When tested in accordance with ASTM C136, gradation of fine aggregate shall be such that 100 percent by weight will pass a standard No. 8 mesh sieve and no less than 45 percent by weight will pass a standard No. 40 mesh sieve.

5) Variation from the specified gradations in individual tests of fine aggregates will be accepted if the average of 3 consecutive tests is within the specified limits and the variation is within the permissible variation listed below.
6) Comply with ASTM C33 as modified herein.

U.S. Standard Sieve Size	Permissible Variation, Percent
30 or coarser	2
50 or finer	0.5

7) Other tests shall be in accordance with the following specifications:

Test Method	Test	Requirements
ASTM C40	Organic Impurities	Color lighter than standard
ASTM C117	Passing 200 sieve	3 percent max.
ASTM D2419ASTM C289	Sand Equivalent Reactivity	Minimum 80Innocuous aggregate
ASTM D2419	Sand Equivalent	Minimum 80

D. Admixtures:
1. Admixtures shall be compatible with the grout and shall conform to the following requirements:
   a. Calcium chloride, thiocyanates or admixtures containing more than 0.05 percent chloride ions are not permitted.
   b. Use admixtures in accordance with the manufacturer's recommendations and add separately to the grout mix.
   c. Chemical admixtures for flowing concrete grout shall comply with ASTM C1017.
   d. Water reducing, retarding admixture:
      1) The admixture shall comply with ASTM C494 Type D requirements and not contain more chloride ions than are present in municipal drinking water.
      2) Acceptable manufacturers:
         a) Euclid Chemical Co., "Eucon Retarder-75".
         b) BASF, "MasterSet R 100".
         c) Sika Corporation, “Plastiment".
         d) Approved Equal.

2.03 ADHESIVES

A. Adhesive for pressure injection of cracks in concrete:
1. A two-component, moisture tolerant, low viscosity, liquid epoxy adhesive conforming to ASTM C881 for load-bearing applications.
2. Acceptable manufacturers:
   a. BASF, "Masterinject 1380”.
   b. Sika Chemical Co, “Sikadur 35 Hi-Mod LV”.
   c. Euclid Chemical Co., "Eucopoxy Injection Resin".
   d. Approved Equal.

B. Adhesive for doweling of anchors and reinforcing bars in concrete:
1. A two-component, moisture tolerant, epoxy gel conforming to ASTM C881 for load-bearing applications.
2. Acceptable manufacturers:
   a. Sika Corporation, "Sikadur Anchor Fix-4"
   b. Simpson Strong Tie., "Set XP"
   c. Hilti, “HIT RE 500 V3”.
   d. Powers Fasteners, Inc., “PE 1000+”
   e. Approved Equal

PART 3 EXECUTION

3.01 GENERAL

A. Mix, place and cure in accordance with the manufacturer's instructions.

B. For grouting of equipment base plates, refer to manufacturer's instructions for appropriate procedures.

3.02 EXAMINATION

A. Inspect concrete surfaces to receive grout or mortar and verify that they are free of ice, frost, dirt, grease, oil, curing compounds, paints, impregnations, and all loose material or foreign matter likely to affect the bond or performance of grout or mortar.

B. Inspect base plate and anchor systems for rust, oil, and other deleterious substances that may affect the bond or performance of grout.

C. Confirm that newly placed concrete has been cured sufficiently to attain its design strength and limit further shrinkage.

D. Verify that temperature of cementitious or epoxy grout does not exceed manufacturer's recommendations.

3.03 PREPARATION

A. Surface Preparation:
   1. Roughen all concrete surfaces by heavy sandblasting, chipping, or other mechanical means to assure bond. Loose or broken concrete shall be removed.
   2. All grease, oil, dirt, curing compounds, laitance, and other deleterious materials that may affect bond that were identified in the inspection process shall be completely removed from concrete and bottoms of base plates. All metal surfaces should have a 2 to 3 mil peak-to-valley profile for epoxy grouts.
   3. For cementitious mortars and grouts, concrete shall be saturated surface damp. Any standing water shall be removed prior to placing grouts.
   4. For epoxy grouts, do not wet concrete surfaces with water. Instead, where required, wet surfaces with epoxy for horizontal work or epoxy gel for vertical or overhead work prior to placing epoxy grouts.

B. Forms and Headboxes for Cementitious or Epoxy Grouts:
   1. Forms for grouts shall be built of material with adequate strength to withstand the placement of grouts.
   2. Forms must be rigid and liquid tight. All cracks and joints shall be caulked with an elastomeric sealant. All forms shall be lined with polyethylene for easy grout release. Forms carefully waxed with two coats of heavy-duty paste wax shall also be acceptable.
   3. Forms shall be 4 to 6 inches higher than the base plate on one side of the base plate configuration when using head pressure for placement.
   4. A sufficient number of headboxes shall be built to facilitate placement of grouts.
   5. Air relief holes a minimum 1/8 inch in diameter shall be provided when required by a base plate configuration to avoid entrapping air underneath.

3.04 NON-SHRINK CEMENTITIOUS GROUT

A. Prepare concrete surfaces in accordance with the grout manufacturer's instructions.

B. Do not retemper grout by adding more water after stiffening.

3.05 EPOXY GROUT

A. Prime concrete in accordance with the grout manufacturer's instructions.

B. Epoxy grouts shall be mixed in complete units. Do not vary the ratio of components or add solvent to change the consistency of the mix.

C. Mix until aggregate is uniformly wetted. Over mixing will cause air entrapment in the mix.

3.06 DOWEL INSTALLATION

A. Install per adhesive manufacturer’s instructions.

B. Obstructions in Drill Path.
   1. Locate holes in existing concrete to miss existing reinforcing. Prior to drilling holes, field verify and mark the location of existing reinforcing using a pachometer or other approved locating equipment.
   2. When reinforcing steel is encountered in the drill path, slant drill to clear obstruction. Drill shall not be slanted more than 10 degrees. Where slanting the drill does not resolve the conflict the Contractor shall stop and notify the Project Representative and resolve the conflict to the satisfaction of the Project Representative. For threaded anchor rods intended to be installed plumb, drilled holes shall not be slanted unless approved by Project Representative prior to drilling the holes. For threaded anchor rods that encounter an obstruction, the solution shall be one approved by the Project Representative.
   3. Abandoned dowel or anchor holes shall be completely filled with non-shrink grout and struck off flush with the adjacent surface.

3.07 CURING

A. Cementitious Grouts:
   1. Clean equipment and tools as recommended by the grout manufacturer.
   2. Cure Grouts in accordance with manufacturer's specifications and recommendations. Keep grout moist for a minimum of 3 days. The method needed to protect grouts will depend on temperature, humidity, and wind. Wet burlap, a soaker hose, sun shading, ponding, and, in extreme conditions, a combination of methods shall be employed.
   3. Grouts shall be maintained above 40 degrees Fahrenheit until they have attained a compressive strength of 3,000 pounds per square inch, or above 70 degrees Fahrenheit for a minimum of 24 hours to avoid damage from subsequent freezing.

B. Epoxy Grouts:
   1. Cure grouts in accordance with manufacturers' specifications and recommendations. Do not wet cure epoxy grouts.
   2. Consult the manufacturer for appropriate cure schedule. In no case should any surface in contact with epoxy grout be allowed to fall below 50 degrees Fahrenheit for a minimum of 48 hours after placement.

3.08 TESTING

A. To ensure compliance with the specified requirements for grout, provide the services of an independent testing laboratory that complies with the requirements of ASTM E329, ASTM C109, and ASTM C579, Method B.

B. The testing laboratory will sample and test grout materials and submit results to the Project Representative.

C. During the course of construction, the Project Representative may take separate field samples of the following materials for confirming tests:
   1. Cement.
   2. Aggregates.
   3. Cement grout mixture.
   4. Commercially manufactured grout products.

END OF SECTION

SECTION 03 83 00

CONCRETE CUTTING AND PATCHING

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes the requirements and limitations for cutting and patching of work, including but not limited to the following:
   1. Saw-cutting of new rectangular openings in existing concrete slabs and walls.
   2. Core drilling of new circular openings in existing concrete slabs and walls.
   3. Chipping of existing concrete to provide for construction of new concrete and/or placement of new patching material for building up or resurfacing of existing concrete.
   4. Providing support for the cored and/or sawcut concrete, and removal and disposal of the cored and/or sawed concrete, control of drilling water and cleaning all slurry and debris that results from the operations.
   5. Cutting of existing reinforcing bars and/or anchors and patching over locations where bars have been cut.
   6. Preparation of concrete surface to receive new patching material and installation of new patching material.

1.02 REFERENCED STANDARDS

A. This Section incorporates by reference the latest revisions of the embedded standard referenced herein. In case of conflict between the requirements of this Section and those of a listed document, the requirements of this Section shall prevail.

Reference	Title
ACI 117	Standard Tolerances for Concrete Construction and Materials
International Concrete Repair Institute (ICRI)	110.1 - Guide Specifications for Structural Concrete Repair

1.03 SUBMITTALS

A. Procedures: Section 01 33 00.

B. Submit written request in advance of cutting or altering elements which affects the following:
   1. Structural integrity of the element.
   2. Integrity of weather exposed or moisture-resistant elements.
   3. Visual qualities of elements exposed to sight.
   4. Operations of the facility.

C. Cutting and Patching Proposal: Submit a proposal describing procedures at least 2 weeks before the time cutting and patching will be performed, requesting approval to proceed. Include the following information:
   1. Extent: At each occurrence indicated on the Drawings, describe cutting and patching, show how they will be performed, and indicate what construction equipment will be employed to complete the work, and equipment to be used to locate embedded reinforcing bars, pipe, and conduits.
   2. Products: List products to be used and firms or entities that will perform the Work.
   3. Dates: Indicate when cutting and patching will be performed.
   4. Utility Services and Mechanical/Electrical Systems: List services/systems that cutting and patching procedures will disturb or affect. List services/systems that will be relocated and those that will be temporarily out of service. Indicate how long services/systems will be disrupted.

5. Method to control drilling water and spoils.
6. Method to support and remove concrete cores and saw-cut debris.
7. Project Representative's Review: Obtain review of cutting and patching proposal before cutting and patching.

1.04 QUALITY ASSURANCE

A. Qualifications: Employ skilled and experienced installer to perform cutting and patching work. Contractor performing cutting and patching work shall have at least 3 years prior experience performing similar work.

PART 2 PRODUCTS

2.01 ACCEPTABLE PRODUCTS

A. Acceptable products for patching and/or resurfacing of damaged surface areas on existing concrete slabs and/or defective and non-conforming work:
   1. Transpatch Concrete as manufactured by US Spec Company.
   2. Sikagard 75 EpoCem epoxy/cement combination mortar as manufactured by Sika Corporation.
   3. Approved Equal.

PART 3 EXECUTION

3.01 GENERAL

A. Execute cutting, fitting, and patching to complete the work and to:
   1. Fit several parts together, to integrate with other work.
   2. Provide openings in elements of work for penetrations of mechanical and electrical work.
   3. Restore existing surfaces exposed by removal of work.
   4. Uncover work to install or replace ill-timed work.
   5. Remove and replace defective and non-conforming work.

B. Execute work by methods which will avoid damage to other work, and provide proper surfaces to receive patching and finishing. Inspect all cut surfaces to ensure that no electrical conduits or other piping (air, water, etc.) has been cut during the cutting operation. Report any issues to the Project Representative immediately. For patching of existing concrete surfaces, comply with all recommendations of patching material manufacturer and ICRI Guide Specifications for Structural Concrete Repair, including bring the underlying surface to the proper moisture content, preparation and roughening of the surface to receive the new material, application of scrub coats or primer as recommended by the manufacturer and curing of the new material after it has been placed. As a minimum, conform to tolerances listed in ACI 117.

C. Cut rigid materials using masonry saw or core drill. When cutting rectangular openings in concrete slabs and walls, use method that will not overcut the opening dimensions at the corners of the opening. Acceptable methods may include the following:
   1. Cut the opening with a concrete chain saw and avoid any overcut at the corners.
   2. Prior to cutting the opening, core drill each corner and sawcut only up to the cored opening, and chip the remaining concrete at each corner.

D. Restore work with new products in accordance with requirements of Contract Documents.

E. Fit work tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces. Integrity of wall, ceiling, or floor construction: completely seal voids.

F. Refinish surfaces to match adjacent finishes. For continuous surfaces, refinish to the nearest intersection; for an assembly, refinish the entire unit.

G. Water, slurry and debris from the core drilling and saw-cutting shall not be permitted to flow away from the immediate area of the work.

H. Cut cores and sawed concrete sections shall be supported on scaffolding or similar means of support placed beneath the work. The cut sections shall not be permitted to drop free.

I. The concrete cores and debris shall be removed and disposed of offsite without damage to existing facilities.

J. The concrete slurry and debris shall be removed and disposed of offsite without damage to existing structures, paving, utilities, plantings or other improvements at the site.

3.02 NEW OPENINGS IN EXISTING CONCRETE SLABS AND WALLS

A. New rectangular openings in existing concrete slabs and walls shall be cut using the following procedure or a similar procedure proposed by the Contractor that will avoid overcutting at the corners of the opening:
   1. Prior to sawcutting the opening in the slab or wall, a round hole shall be core-drilled at each corner of the rectangle to create a stopping point for the sawcut. The core-drilled hole shall be of sufficient diameter to allow the concrete saw to cut the slab to the hole without having the saw blade extend beyond the hole.
   2. The sides of the opening shall be sawcut from hole to hole at all four sides of the rectangle, using care to stop the cut at the core-drilled hole so as to not overcut at the corners of the opening.
   3. After removing the concrete that was cut in (ii) above, the remaining concrete at the corners of the rectangular opening shall be removed by chipping hammer to create the 90-degree corners required to complete the opening.

B. New circular openings in existing concrete slabs and walls shall be cut using standard core-drilling methods unless approved otherwise.

3.03 CUTTING OF EXISTING REINFORCING BARS

A. Existing reinforcing bars that become exposed due to demolition and/or removal of portions of existing concrete shall be treated as follows depending on the applicable condition:
   1. Reinforcing bars designated to be saved and protected and incorporated into new concrete pours shall be protected from damage as much as practical. Bars shall not be field bent from their existing configuration in order to facilitate concrete removal unless approved by the Project Representative or noted on the design drawings.
   2. Projecting reinforcing bars that are not to be incorporated into new concrete pours shall be cut off one-half inch below the concrete surface and the hole patched with epoxy grout.
   3. Reinforcing bars that are cut through by saw-cutting operations and are flush with the cut surface of the concrete shall have the cut ends coated with two coats of an approved liquid epoxy coating material to prevent corrosion except for the following condition. If the cut ends of the bars are exposed on the top surface of a slab or on the exposed face of a wall, then the bars shall be cut or ground down one-half inch below the finished concrete surface and the hole filled with epoxy grout.

3.04 EXISTING ANCHOR BOLTS OR ANCHOR RODS

A. Existing anchor bolts or anchor rods projecting from the finished face of concrete due to removal of existing equipment or other installations and no longer needed shall be cut off one-half inch below the finished face of concrete and the hole filled with epoxy grout.

END OF SECTION

SECTION 05 05 19

POST-INSTALLED CONCRETE ANCHORS

PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies post-installed anchorage to concrete, complete with washers and nuts.

B. Post-installed concrete anchorage systems required to secure the various parts together and provide a complete installation are generally indicated on the Drawings. Where the anchorage design is absent, or insufficiently detailed to complete the installation, provide the anchorage design and submit for approval.

C. The tabulation of items herein is not intended to be all inclusive, and it shall be the Contractor's responsibility to provide all metalwork and castings shown, specified, or which can reasonably be inferred as necessary to complete the project.

1.02 REFERENCED STANDARDS

A. This Section incorporates by reference the latest revisions of the embedded standard referenced herein. In case of conflict between the requirements of this Section and those of a listed document, the requirements of this Section shall prevail.

Reference	Title
ASTM A194	Standard Specification for Carbon Steel, Alloy Steel, and Stainless Steel Nuts for Bolts for High-Pressure and High-Temperature Service, or Both
ASTM C881	Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete
ASTM C882	Standard Test Method for Bond Strength of Epoxy-Resin Systems Used With Concrete By Slant Shear
ASTM D648	Standard Test Method for Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position
ASTM D695	Standard Test Method for Compressive Properties of Rigid Plastics
ASTM F593	Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs
ASTM F594	Standard Specification for Stainless Steel Nuts
AC 193	Acceptance Criteria for Mechanical Anchors in Concrete Elements
AC 308	Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements
ACI 355.2	Qualification of Post-Installed Mechanical Anchors in Concrete and Commentary
ACI 355.4	Qualification of Post-Installed Adhesive Anchors in Concrete and Commentary
IBC	International Building Code, Current Edition

1.03 SUBMITTALS

A. Procedures: Section 01 33 00.

B. Provide the following submittals:
   1. Manufacturer's product data.
   2. Manufacturer's information showing the recommended installation equipment and procedures for the following:
      a. Mechanical anchors (expansion, undercut, screw etc.).
      b. Adhesive anchor shall include instructions for the safe handling of adhesives.

1.04 QUALITY ASSURANCE

A. The diameter and capacity of post-installed concrete anchors shall be as recommended or required by the equipment or machinery manufacturer, including any recommended or required adjustment for seismic conditions listed in Section 01 73 00. In case of conflicting or ambiguous recommendations or requirements, the most stringent shall apply.

1.05 EXPOSURE CONDITIONS

A. Dry: indoor spaces not subject to moisture, washdown, hydrogen sulfide gas or chemicals.

B. Wet and/or corrosive: outdoor areas, or indoor areas subject to moisture, washdown, hydrogen sulfide gas or chemicals.

C. Submerged: at or below a point 1.5 foot above maximum fluid surface.

D. Unless otherwise indicated, all non-submerged surfaces shall be considered wet or corrosive.

PART 2 PRODUCTS

2.01 MATERIALS

A. Unless otherwise specified, materials shall conform to the following:
   1. Anchor bolts and anchor rods:
      a. Stainless steel: ASTM F593 Alloy Group 2 (AISI 316), Condition CW1 or CW2 as appropriate.
   2. Threaded rod:
      a. Stainless steel: ASTM F593 Alloy Group 2 (AISI 316), Condition CW1 or CW2 as appropriate.
   3. Nuts: (Heavy Hex)
      a. Stainless steel: ASTM F594 Alloy Group 2 (AISI 316), Condition CW1 or CW2 as appropriate.
   4. Washers:
      a. Stainless steel: ASTM A194 Type 316.

B. Fasteners: all components of mating fasteners, bolts, nuts and washers, of the same material and coated by the same process.

2.02 CONCRETE ANCHORS

A. Mechanical anchors:
   1. Mechanical anchors shall have an ICC Evaluation Service Report (ESR) indicating compliance with the requirements of IBC for use in cracked and uncracked concrete for the anchor type and concrete strength conditions for which the anchor will be used. The ESR shall indicate IBC compliance for use under seismic loading conditions. The basis of the ESR shall be Acceptance Criteria for Mechanical Anchors in Concrete Elements (AC193).
   2. Acceptable Manufacturers
      a. Simpson Strong-Tie Company, Inc., “STRONG-BOLT 2” (expansion), and Torq-Cut (undercut)
      b. Hilti, Inc., Kwik-Bolt KB-TZ (expansion), and HAD (undercut)
      c. Powers Fasteners, Inc., “Power-Stud+ SD2” carbon steel anchors and “Power-Stud+ SD6” stainless steel anchors (expansion), and Atomic+Undercut
      d. Approved Equal

B. Adhesive Anchors:
   1. Adhesive anchors shall have an ICC Evaluation Service Report (ESR) indicating compliance with the requirements of IBC for use in cracked and uncracked concrete for the anchor type and concrete strength conditions for which the anchor will be used. The ESR shall indicate IBC

compliance for use under seismic loading conditions. The basis of the ESR shall be Post-Installed Adhesive Anchors in Concrete Elements (AC308).

2. Do not use where fire or elevated temperatures exceeding 150 degrees F can occur, unless specifically shown otherwise.
3. Adhesive anchors installed horizontally or upwardly inclined shall be qualified in accordance with ACI 355.4 requirements for sensitivity to installation direction.
4. Epoxy Adhesive:
   a. Meet ASTM C881, Type 1, Grade 3, Class A, B, or C.
   b. Two-component, 100 percent solids, non-sag, paste, insensitive to moisture, designed to be used in adverse freeze/thaw environments, and gray in color. Cure Temperature, Pot Life, and Workability: Compatible for intended use and environmental conditions.
5. Mixed Epoxy Adhesive: Non-sag paste consistency holding the following properties:
   a. Slant Shear Strength, ASTM C881 and ASTM C882, No Failure in Bond Line, Dry/Moist Conditions: 5,000 psi.
   b. Compressive Strength, ASTM D695: 14,000 psi minimum.
   c. Tensile Strength, ASTM D695: 4,500 psi.
   d. Heat Deflection Temperature, ASTM D648: 135 degrees F, minimum.
6. Epoxy Adhesive Packaging:
   a. Disposable, self-contained cartridge system capable of dispensing both epoxy components in the proper mixing ratio and fit into a manually or pneumatically operated caulking gun.
   b. Dispense components through a mixing nozzle that thoroughly mixes components and places epoxy at base of predrilled hole.
   c. Mixing Nozzles: Disposable, manufactured in several sizes to accommodate sizes of anchor rods.
   d. Cartridge Markings: Include manufacturer's name, batch number, mix ratio by volume, product expiration date, ANSI hazard classification, and appropriate ANSI handling precautions.
7. Storage of Epoxy adhesive:
   a. Store epoxy cartridges on pallets or shelving in a covered storage area.
   b. Control temperature above 60 degrees F and dispose of cartridges if shelf life has expired. If stored at temperatures below 60 degrees F, test adhesive prior to use to determine if adhesive meets specified requirements.
8. Acceptable manufacturers:
   a. Simpson Strong Tie, “Set-XP”
   b. Hilti, "HIT-RE 500 V3”
   c. Powers Fasteners, Inc., "PE1000+"
   d. Approved Equal.

C. Post-installed concrete anchors shall be qualified for earthquake loading in accordance with ACI 355.2 or ACI 355.4.

D. Provide concrete anchors for the exposure conditions as noted below:
   1. Equipment and machinery:
      a. Dry exposure: stainless steel.
      b. Wet or submerged exposure: stainless steel.

E. Coated concrete anchors shall be coated by fusion bonding. Coating of threads is not required. Where threads are covered with a fusion bonded coating, provide the nut of proper size to fit and provide a connection of equal strength to the embedded anchor.

2.03 STAINLESS STEEL FASTENER LUBRICANT (ANTI-SEIZING)

A. Where stainless steel nuts and threaded fasteners are used, apply anti-seizing lubricant to the threads prior to making up the connections. Lubricant shall be manufactured and labeled for use with stainless steel and shall contain substantial amounts of molybdenum disulfide, graphite, mica, talc, or copper.

PART 3 EXECUTION

3.01 GENERAL

A. Install per manufacturer's recommendations.

B. All machinery or equipment with moving parts and all structural steel shall be anchored using adhesive or cast-in anchor bolts.

C. Cutting and welding: not permitted.

D. Protect dissimilar metals from galvanic corrosion by means of pressure tapes, coatings, or isolators.

E. Provide beveled washers where mating surface is not square with the anchor bolt.

3.02 ANCHOR BOLT HOLES IN EQUIPMENT

A. Shall not exceed the bolt diameters by more than:
   1. Bolts smaller than 1-inch: 25 percent.
   2. Bolts 1-inch and larger: 1/4-inch.

3.03 ANCHOR INSTALLATION

A. Installation shall not begin until the concrete or masonry receiving the anchors has attained its design strength.

B. Install in strict conformance with manufacturer's written instructions.

C. Use manufacturer's recommended drills and equipment.

D. Unless otherwise specified, embedded length shall not include housekeeping pads or fill grout.

E. Adhesive anchors shall not be installed when the temperature of the concrete is below 35 degrees F or above 110 degrees F.

F. Installation of adhesive anchors horizontally or upwardly inclined to support sustained tension loads shall be performed by personnel certified by an applicable certification program. Certification shall include written and performance tests in accordance with the ACI/CRSI Adhesive Anchor Installer Certification program, or equivalent.

G. Adhesive anchors installed in horizontal or upwardly inclined orientations to resist sustained tension loads shall be continuously inspected during installation by an inspector specially approved for that purpose by Project Representative. The special inspector shall furnish a report to the licensed design professional and Project Representative that the work covered by the report has been performed and that the materials used, and the installation procedures used conform with the approved construction documents and the Manufacturer’s Printed Installation Instructions (MPII).

H. Furnish manufacturer's representative, for each type of concrete anchor used, to the jobsite to conduct jobsite training for proper installation, handling, and storage of each anchor system for personnel as required. Notify Project Representative of training session schedule.

END OF SECTION

SECTION 09 90 00

COATING SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies coatings and their surface preparation for field and shop-applied coating systems.

B. Furnish all labor, equipment, including safety equipment, superintendence, materials, tools and incidentals necessary to prepare and coat the work as specified in this Section.

1.02 DEFINITIONS

A. Coating systems: Includes surface description, surface preparation, required dry film thickness, and the number and application procedure of the prime and finish coatings. Systems are as specified within this Section on the Coating System Specification Sheets (COATSPEC).

B. Field coating: The application of the coating system after installation of the surface at the work site.

C. Dry film thickness (DFT): The thickness of a fully cured coating or coating system.

D. Wet film thickness (WFT): The thickness of a coating while wet.

E. Volatile organic content (VOC): The portion of the coating that is a compound of carbon, is photo-chemically reactive and evaporates during drying or curing, expressed in grams per liter or pound per gallon as defined in ASTM D3960.

F. Shop coat: One or more coats applied in a shop or plant prior to shipment to the site.

G. Lead containing: Any coating that contains any detectable amount of lead.

H. Stripe coat: A coat of the specified coating, applied prior to the final coat by brush to all edges (cut or fabricated) on steel shapes, crevices, projections, welds, nuts, bolts, pits, flanges, and splice plates.

I. Hard to reach: Areas that may not be accessible with spray equipment but can be reached by brush, mitt or roller.

J. Inaccessible areas: Areas such as back-to-back angles, skip welds, and other areas that a brush, mitt, or roller cannot contact the surface.

K. pH: A measure indicating whether a solution is acidic, neutral, or alkaline.

1.03 REFERENCED STANDARDS

A. This Section incorporates by reference the latest revisions of the embedded standard referenced herein. In case of conflict between the requirements of this Section and those of a listed document, the requirements of this Section shall prevail.

Reference	Title
ASTM D3359	Standard Test Methods to Measure Adhesion by Tape Test

Reference	Title
ASTM D3960	Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings
ASTM D4138	Standard Test Methods for Measurement of Dry Film Thickness of Protective Coating Systems by Destructive Means
ASTM D 4258	Standard Practice for Surface Cleaning Concrete for Coating
ASTM D 4259	Standard Practice for Abrading Concrete
ASTM D4263	Standard Test Method Indicating Moisture in the Concrete by the Plastic Sheet Method
ASTM D4285	Standard Test Method for Indicating Oil or Water in Compressed Air
ASTM D4417	Standard Test Method for Field Measurement of Surface Profile of Blast Cleaned Steel
ASTM D4541	Standard Test Method for Pull-off Adhesion
ASTM D7234	Standard Test Method for Pull-Off Adhesion Strength of Coatings on Concrete Using Portable Pull-Off Adhesion Testers
ASTM E337	Standard Test Method for Measuring Humidity with a Psychrometer
ICRI	International Concrete Repair Institute, Technical Guidelines
MIL-A-22262A (SH)	Military Specification, Abrasive Blasting Media, Ship Hull Blast Clean
NACE SP0188-2006	Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates
NACE SP0274-2011	High Voltage Electrical Inspection of Pipeline Coatings
NAPF 500-03	Surface Preparation Standard For Ductile Iron Pipe And Fittings In Exposed Locations Receiving Special External Coatings And/Or Special Internal Linings
SSPC	Steel Structures Painting Council, Volume 1 - Good Painting Practices
SSPC-Paint Application-PA-2	Measurement of Dry Paint Thickness with Type 2 Gauges
SSPC-SP 1	Solvent Cleaning
SSPC-SP 2	Hand Tool Cleaning
SSPC-SP 3	Power Tool Cleaning
SSPC-SP 7	Brush-Off Blast Cleaning
SSPC-SP 10	Near-White Metal Blast Cleaning
SSPC-SP 11	Power Tool Cleaning to Bare Metal
SSPC-SP 13/NACE 6	Surface Preparation of Concrete
SSPC-SP 16	Brush-Off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals
SSPC-VIS 1-67T	Visual Plates Used to Determine Blasting Standards
SSPC	Good Painting Practice Volume 1
SSPC - Guide 6	Guide for Containing Debris Generated During Paint Removal Operations
SSPC - Guide 15	Field Methods for Retrieval and Analysis of Soluble Salts on Substrates
SSPC Publication 91-12	Coating and Lining Inspection Manual

1.04 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC) FOR SHOP AND FIELD

A. General:
   1. Manufacturer's printed instructions: Deviations from the manufacturer's printed instructions will not be allowed unless approved in writing by the manufacturer's representative and the Project Representative before execution of said change.
   2. In the event of a disagreement between the manufacturer's printed instructions and the provisions of Section 09 90 00 the provisions of Section 09 90 00 shall prevail.
   3. Test result disagreement: In the event of a discrepancy between the Contractor and Project Representative's testing equipment, both parties shall check equipment in question for proper function and calibration.

4. Make available all locations and phases of the work for access for inspection by the Project Representative or the manufacturer's representative. Contractor shall provide ventilation, egress, staging and whatever other means are required to access the work area.
5. Contractor QC personnel shall be certified as National Association of Corrosion Engineers, (NACE) CIP, Level 1, for coating work performed at the project site. Contractor QC personnel shall be certified as National Association of Corrosion Engineers, (NACE) CIP, Level 3 with Peer Review, for coating work performed away from the project site.
6. The Project Representative may approve the application of coatings specified under this section by the Contractor’s fabricators and other suppliers without direct inspection by the County provided that the fabricators and suppliers meet the requirements of 1.04A.4 and 1.04B.

B. Contractor's responsibilities:
1. Quality control: responsible for the quality control of the coatings applied and performing check points as specified in this Section.
2. Schedule: prepare a schedule that is updated weekly or as necessary to show QC and QA Check Points as specified herein, and distribute to all parties related to installation of the coating system. The schedule shall allow time for remedial work to be completed as identified by inspection at the given checkpoints. The Project Representative shall be informed within 24 hours prior to the Contractor performing the tests specified.
3. Reports: prepare daily inspection reports when any work is performed on site. Project Representative may require ambient conditions to be recorded as often as needed to insure specified application conditions are met, but not less than twice daily. Tests shall be conducted in accordance with ASTM E337 or surface temperature instrument and dew point instrument manufacturer's instructions. Use the “Daily Inspection Report” form found in Section 01 33 10. Submit copies of this report within 24 hours of coating application to the Project Representative for signature to acknowledge the report was produced in a timely manner. Submit all reports in bound form at the completion of coating work.
4. Over coating: verify coating compatibility and primer quality to be equal to the specified primer when over-coating a primer or coating that was applied by others. Follow the coating manufacturer’s recommendations for over coating primers beyond the recoat window.
5. Provide testing equipment required in this Section and as required to verify compliance with the Specifications. Record of equipment calibration must also be provided.

C. Project Representative's responsibility:
1. QA: determine acceptance or rejection of a coating based on the given specifications.
2. Testing: may conduct tests on ambient conditions, surface temperature, coating(s) applied, target mil thickness, coating type (i.e. stripe coat), and coating batch numbers in accordance with SSPC Publication 91-12.

D. Checkpoints: Contractor is responsible to perform the checkpoints specified below and as required in COATSPEC. The Project Representative may perform any or all of the checkpoints listed in addition to, but not replacement of, the requirement for the Contractor to perform the inspection checkpoints as specified below.
1. Blotter test: Upon start-up of abrasive blasting, compressed air shall be checked daily for oil and water by blotter test per ASTM D4285.
2. Anchor profile: Anchor profile of an abrasively blasted surface shall be tested using Testex tape per ASTM D4417 or with a calibrated digital surface profile gauge. Test shall be conducted on the start-up of the blasting operation to insure proper selection of blast media and prior to prime coat application.
3. Intermediate DFT readings: DFT readings shall be taken between coats to check consistency of the application and progress toward total system thickness.
4. Final DFT readings: DFT readings shall be taken per SSPC PA-2 on total system thickness as criteria for final acceptance of a coating. If recoat time has been exceeded or if recommended by the manufacturer, deficient areas shall be scarified prior to top coating. Dry film thickness measurements in excess of the amounts specified in SSPC PA-2 may be acceptable if approved by the Project Representative.

5. Holiday testing: Perform for the entire coating per NACE SP0188-2006 in the presence of the Project Representative except for coating system M-1 and M-2. Any holidays detected shall be repaired and retested after cure of the coating is complete. For coating system M-1 test for holidays in accordance with NACE SP0274-2011 High Voltage Electrical Inspection of Pipeline Coatings and manufacturer's instructions. In cases of conflicting holiday testing requirements for M-1, the manufacturer's instructions shall prevail.
6. Surface preparation: Shall be accepted by the Project Representative prior to the application of a coating.
7. Ambient conditions: Perform tests for relative humidity, surface temperature, dew point and ambient temperature to ensure compliance for materials applied. Tests shall be conducted in accordance with ASTM E337 or surface temperature instrument and dew point instrument manufacturer's instructions.
8. Adhesion: perform adhesion tests per ASTM D4541, ASTM D3359 Test Method B, or ASTM D7234 depending upon the substrate. It is the responsibility of the Contractor to repair any damage to the coating resulting from adhesion testing.
    a. Minimum adhesion values for coating systems A-1, A-2, and A-3: 400 psi with 20 mm dolly or 64 psi with 50 mm dolly.
    b. The minimum adhesion score for coating system L-1a using ASTM D3359 Test Method B shall be Classification 2B.
9. Test to Determine Salt Contamination: Using the Bresle Method, the Contractor shall take 3 tests each day at randomly selected locations during surface preparation prior to coating application. For immersed surfaces, the reading shall not exceed 30 microsiemens/cm (30 us/cm). For non-immersed surfaces, the reading shall not exceed 70 microsiemens/cm (70 us/cm). If conductivity measurements exceed the respective values, the affected surfaces shall be cleaned until conductivity levels are acceptable. Tests shall be conducted in accordance with SSPC - Guide 15 or soluble salt test kit manufacturer's instructions. This test may be waived by the Project Representative if initial tests indicate low salt concentrations.
10. Moisture in Concrete: perform ASTM 4263-88, Standard Test Method Indicating Moisture in the Concrete by the Plastic Sheet Method. If the presence of moisture is indicated, dry the substrate prior to coating application. Perform this test once for every 200 square feet of area to be coated and more frequently at darkened concrete areas. Perform Calcium Chloride Moisture Vapor Emissions Tests in accordance with ASTM F-1869 for all floors, containment, below grade applications or any other moisture tests required by the manufacturer. The Project Representative may approve adhesion testing of a small coating test patch per ASTM D7234 in lieu of moisture testing.
11. Test for de-passivation of galvanized steel: After cleaning galvanized steel by pressure wash and soap or other manufacturer-approved method, test every 100 square feet by applying a drop of Copper Sulfate test solution. Black color indicates that the galvanized steel has been de-passivated. Refer to Section 09 90 00 3.01 B.5.
12. Pressure washing QA/QC:
    a. Wash water temperature verification: Dispense wash water into a 5 gallon bucket. Verify that wash water is between 120F and 130F with a calibrated infrared thermometer.
    b. Pump flow rate- Spray wash water into a 5 gallon bucket. Water level shall rise to 3 gallon mark in 60 seconds or less.
    c. Pump pressure- For a 3,000 PSI rated machine, the pressure at spray gun inlet shall be not less than 2,900 PSI with the trigger pulled and nozzle discharging water on a calibrated pressure gauge.
    d. Nozzle orifice size: Example: A properly sized new #3.5 (.048") pressure washing nozzle will pass a # 56 (.0465") drill bit or drill blank but will not pass a # 55 (.052") drill bit or drill blank. A nozzle shall be replaced when its orifice passes a drill bit or drill blank .004" larger than the original orifice diameter.

E. Disputes: If questions arise concerning the acceptability of an applied coating, Tooke, adhesion, and other destructive/non-destructive tests per ASTM D4138 may be performed to aid in resolution of the dispute. If the coating is determined to be defective, the Contractor will be responsible for the cost of

repairs resulting from testing. If the coating is shown to be properly applied, the County will be responsible for the cost of inspection repairs.

1.05 SUBMITTALS

A. Procedures: Section 01 33 00.

B. Contractor QC personnel.

C. A list of materials shall be provided before materials are delivered to the worksite.

D. A Waste Disposal Plan.

E. For each primer and finish coating, provide the manufacturer's application instructions, which shall include the following:
   1. Surface preparation recommendations.
   2. Primer type, where required.
   3. Maximum dry and wet mil thickness per coat.
   4. Minimum and maximum curing time between coats, including atmospheric conditions for each.
   5. Curing time before submergence in liquid.
   6. Thinner to be used with each coating.
   7. Ventilation requirements.
   8. Allowable application methods.
   9. Maximum storage life.
   10. Material safety data sheets.
   11. Interpretation of batch code numbers.
   12. Minimum and maximum relative humidity requirements.
   13. Minimum and maximum surface temperature requirements.
   14. Minimum and maximum ambient temperature requirements.
   15. Manufacturers recommended application procedure.
   16. LEED Submittal.
   17. When color is not specified, provide manufacturer's range of standard colors.
   18. Contractor QC personnel qualifications.

F. Provide information on blasting media including coating manufacture's recommended grit/shot size for coating systems specified.

G. Field and/or draw-down samples may be requested by the Project Representative.

H. For Systems A-2 and C-3, submit manufacturer's details for construction joints, penetrations, crack repair, and details at floor penetrations, wall bases, equipment bolts, embedded angle frames, transitions and terminations of the system and all other details specific to the structure being coated.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver materials for field application to the job site in their original, unopened containers. Each container shall bear the manufacturer's name brand, batch number, date of manufacture, and storage life.

B. Coatings shall be stored in enclosed structures and shall be protected from weather and excessive heat or cold. Coatings, exceeding storage life recommended by the manufacturer or that have been visibly damaged shall be removed from the site. Flammable materials shall be stored in accordance with state and local codes.

1.07 SITE CONDITIONS

A. Coatings shall be applied only to surfaces that are dry, and only under such combination of humidity and temperatures of the atmosphere and surfaces to be coated as will cause evaporation rather than condensation.

B. During coating and for a period of at least 8 hours after the coating has been applied, the temperature of the surface and the atmosphere shall be maintained at a minimum of 5 degrees above the dew point unless the curing schedule for the coating permits otherwise.

C. Provide environmental controls such as heaters and/or dehumidification if atmospheric requirements as specified in this Section are not met or workdays are lost due to weather.

D. Provide ventilation if the cure time of the coating is slowed by the presence of coating or solvent vapor.

1.08 CONTAINMENT

A. Containment shall conform to SSPC-Guide 6. Level of containment shall be as specified to capture debris, contain dust, protect from adverse weather, control overspray, and provide means to control ambient conditions, and shall be as specified for the material and service conditions in the COATSPEC.

B. Containment is required whenever abrasive blasting is performed. The Contractor is responsible for any damage resulting from surface preparation or painting operations.

SSPC-GUIDE 6 - TABLE A
COMBINATIONS OF CONTAINMENT AND VENTILATION SYSTEMS COMPONENTS

Containment Classification	CONTAINMENT SYSTEM (5.3 of Guide)						VENTILATION (5.4 of Guide)				
	5.3.1 Containment Materials	5.3.2 Penetrability	5.3.3 Support Structure	5.3.4 Joints	5.3.4 Joints	5.3.5 Entryway	5.4.1 Make-up	5.4.2 Input Air Flow	5.4.3 Air Pressure	5.4.4 Air Movement	5.4.5 Exhaust Dust Filtration
Class 1A		B1-Air Impenetrable	C1-Rigid C2-Flexible	D1-Full Seal	D1-Full Seal	E1-Airlock E2-Resealable	F1-Controlled	G1-Forced G2-Natural	H1-Instrument Verification H2-Visual Verification	I1-Minimum Specified	J1-Air Filtration
Class 2A	A1-Rigid 2-Flexible	B1-Air Impenetrable	C1-Rigid C2-Flexible	D1-Full Seal	D1-Full Seal	E2-Resealable E3-Overlap	F1-Controlled F2-Open	G1-Forced G2-Natural	H2-Visual Verification	I1-Minimum Specified	J1-Air Filtration
Class 3A	A1-Rigid A2-Flexible	B1-Air Impenetrable B2-Air Penetrable	C1-Rigid C2-Flexible	D1-Full Seal D2-Partial Seal	D1-Full Seal D2-Partial Seal	E4-Open Seam	F1-Controlled F2-Open	G1-Forced G2-Natural	H3-Not required	I2-Not specified	J1-Air Filtration
Class 4A	A1-Rigid A2-Flexible	B1-Air Impenetrable B2-Air Penetrable	C3-Minimal	D2-Partial Seal	D2-Partial Seal	E4-Open Seam	F2-Open	G2-Natural	H3-Not required	I2-Not specified	J2-No Controls on Exhaust

Note:

1. *The information in this table is provided for guidance only and does not guarantee that any specific levels of containment will be achieved by following the suggestions. The type of structure, wind conditions, soundness of the materials of construction, and many other factors play a role in containing dust and debris.*
2. *The table occasionally identifies two options for a given component. For example, containment materials (5.3.1) are shown as being either rigid or flexible. If the specifier requires the use of rigid materials only, this restriction must be specified separately.*
3. *The design suggestions made in this table are based on the use of open abrasive blast cleaning inside containment. The classifications are ordered from the greatest degree of dust and debris containment (Class 1A). Normally, the higher the degree of containment, the higher the cost.*
4. *Many other combinations of the components beyond those suggested above can be used to provide similar results. The method preparation can also be adjusted to reduce or eliminate dust emissions.*

5. *Certain combinations of components within which each class may not be suitable when removing hazardous paints (e.g., forced air input in combination with penetrable containment materials in Class 3A).*
6. *When designing a ventilation system, care must be taken to balance the static pressure with the input air flow to avoid collapsing the containment due to high negative pressure.*

1.09 WARRANTY

A. For the Work of this Section, provide all warranties as described in the General Conditions 00700, and special warranties as specified in the Technical Specifications.

PART 2 PRODUCTS

2.01 MATERIALS

A. Standardization:
   1. Materials, supplies, and articles provided shall be the standard products of manufacturers. Coatings in a particular system shall be the products of a single manufacturer.
   2. The standard products of manufacturers other than those specified may be accepted when it is demonstrated that they are equal in composition, durability, usefulness, and convenience for the purpose intended. Requests for substitutions will be considered when submitted per Section 01 33 00 provided the following minimum conditions are met:
      a. The proposed coating system shall use an equal or greater number of separate coats to achieve the required dry film thickness.
      b. The proposed coating system shall use coatings of the same generic type. The directions for application and descriptive literature which includes generic type, non-volatile content by volume, material safety data sheets, VOC's by grams per liter, and other information confirms that the substitution is equal to the specified coating system.

B. All coating materials shall be benzene and lead free and shall not, exceed 250 grams per liter of volatile organic compounds (VOC).

C. Blasting material shall meet MIL-A-22262A (SH) and shall be arsenic-free and contain no free silica. Blasting material shall not be reused. The Contractor is responsible for removing and legally disposing of the spent blasting material from the job site. The Contractor shall provide a copy of total characteristic leaching procedure (TCLP) results of the spent blast material to the Project Representative prior to Final Acceptance of the work.

D. Nonskid additive shall be 20 to 40 mesh alumina oxide, unless alternate nonskid media is recommended by the manufacturer.

2.02 EQUIPMENT

A. The Contractor is responsible for ensuring that all King County equipment including mechanical working parts and/or moving parts within the work area are protected from damage. Protection of equipment will be coordinated with the Project Representative.

PART 3 EXECUTION

3.01 PREPARATION

A. General:
   1. The surface preparation instructions Section 09 90 00-3.01 are general only and are not intended to replace the specific requirements of the individual COATSPECS or coating manufacturer’s requirements.

2. Surfaces to be coated shall be clean. Before applying coating, oil and grease shall be removed per SSPC-SP 1. All dirt, rust, loose mill scale, old weathered coatings, and other foreign substances shall be cleaned according to the SSPC standards specified in the COATSPEC. Oil and grease shall be removed before mechanical cleaning is started. Where mechanical cleaning is accomplished by blast cleaning, the abrasive used shall be washed, graded, and free of contaminants, which might interfere with the adhesion of the coatings.
3. Clean cloths and clean fluids shall be used in solvent cleaning. Cleaning and coating shall be scheduled so that dust and spray from the cleaning process will not fall on wet, newly coated surfaces. Ensure that field coating is compatible with factory applied or existing coatings.

B. Metallic surfaces:
1. Metallic surfaces shall be prepared in accordance with applicable portions of the NACE, SSPC, or ASTM surface preparation specifications. Specific applicable standards are specified in each coating system. The solvent in solvent cleaning operations shall be as recommended by the manufacturer.
2. Preparation of metallic surfaces shall be based upon comparison with SSPC-VIS-1-67T, or as described herein. To facilitate inspection on the first day of sandblasting operations, sandblast a sample area to the standards specified. Plates of light metal steel shall measure a minimum of 8-1/2 inches x 11 inches. The blasted sample area meeting the requirements of the Specifications shall be initialed by the Contractor and the Project Representative and covered with clear plastic and tape. One of these sample areas shall be prepared for each type of sandblasting and shall be used as the comparison standard throughout the work.
3. Profile of blasted surfaces of new steel or previously coated steel shall be per the manufacturer's recommendation for each coating system but be no less than two mils. Tightly adhered, existing coating remaining on surface following SSPC-SP-7, cleaning shall have a minimum surface profile of 2 mils.
4. Surface preparation for aluminum, copper, brass, and stainless steel shall be as specified for the coating in the COATSPEC.
5. Surface preparation for galvanized metal shall include a pressure wash with a cleaning solution recommended by the coating manufacturer, mixed and rinsed with 130-degree water and applied at 3000 psi, 2.8 GPM minimum. When the surface is dry, prepare for coating application by providing a cleaning per SSPC-SP 2 or 3. Alternative surface preparation methods shall be per the manufacturer’s written direction for profile and surface cleanliness for the given application. Perform de-passivation test listed in Section 09 90 00 1.04 D.11.
6. Areas not accessible or appropriate for blast cleaning may be hand or power tool cleaned with written approval of the Project Representative.
7. Surface preparation for bollard shall follow SP-5, White Metal Blast Cleaning: Removal of visible oil, grease, dust, dirt, mill scale, rust, coatings, oxides, corrosion products, and other foreign matter by blast cleaning.

C. Concrete, masonry and plaster surfaces:
1. Surfaces, which are to be coated shall be allowed to age for at least 28 days or longer, to dry to the moisture content recommended by the coating manufacturer. Moisture content shall be tested per ASTM D4263. The presence of moisture indicates additional cure time will be required. Retest as required until concrete is sufficiently dry for coating.
2. Muriatic acid solution shall not be used.
3. Loose concrete and laitance shall be removed by blasting or chipping. Voids and cracks shall be repaired as specified in Section 03 30 01 or applicable COATSPEC. When repair work in Section 03 30 01 is complete, prepare the surface per the following:
   a. Concrete floors shall be prepared with “blast track” style equipment or an Approved Equal.
   b. All concrete surfaces shall be inspected per SSPC-SP 13 to ICRI Technical Guideline #310.2 and per the manufacturer’s recommendations.
4. Surfaces shall be dry and clean and free from grit, loose plaster, and surface irregularities.
5. Cracks and holes shall be repaired with acceptable patching materials, keyed to existing surfaces, and sanded smooth. Surfaces may require additional repair to provide a smooth surface prior to application of final coat.

6. The pH of the surface shall register a '7', which indicates a neutral surface condition, before coating is applied. If indicator reads above '7', the alkali shall be neutralized.
7. Surfaces shall be cleaned with clear water by washing and scrubbing to remove foreign and deleterious substances.
8. Steam cleaning shall be used to clean wall surfaces of existing process channels, structures and tanks to be coated.
9. Surfaces to be coated shall be repaired as specified in the COATSPEC, and cleaned and finished to the standards as specified herein.

D. Plastic surfaces:
   1. Clean with solvent compatible with the specified primer and hand sanded with a medium grit sandpaper to provide sufficient profile for the coating system.
   2. Large areas may be power sanded or brush off blasted provided sufficient controls are employed so the surface is roughened without removing excess material.

3.02 APPLICATION

A. Workmanship: Coating shall be conducted in accordance with the requirements of SSPC, Good Painting Practice Volume 1.
   1. Coated surfaces shall be free from runs, drips, ridges, waves, laps and brush marks. Coats shall be applied so as to produce an even film of uniform thickness.
   2. Coating equipment shall be designed for application of the materials specified.
      a. Compressors shall have traps and filters to remove water and oils.
      b. Spray equipment shall be equipped with mechanical agitators, pressure gages, and pressure regulators, and spray nozzles of the proper sizes and functioning in a manner suitable to perform the work.
   3. Each coat of paint shall be applied evenly and sharply cut to line.

B. Coating properties, mixing, and thinning:
   1. Coating shall provide a satisfactory film with smooth even surface. Glossy undercoats shall be lightly sanded to provide a surface suitable for the proper application and adhesion of subsequent coats. Orange Peel, overspray, pinholes and other surface defects shall be repaired.
   2. Coating shall be thoroughly stirred, strained, and kept at a uniform consistency during application.
   3. Coatings shall be mixed in accordance with the manufacturer's instructions.

C. Method of coating application:
   1. Prime coatings may be shop or field applied. Shop-applied primer shall be as specified in each system.
   2. Provide mechanical equipment, including, but not limited to, pumps, valves, pipe, blowers, fittings, and miscellaneous appurtenances, with shop-applied primer and shop-applied finish coats.
   3. If the shop coating meets the requirements of this Section, the field coating may consist of touching up the shop prime coat to achieve the film thickness, continuity, and coating specified in the COATSPEC. Damaged and poorly applied shop coatings that do not meet the specified requirements shall be removed, surface prepared, and then recoated in accordance with the COATSPEC.
   4. Where two or more coats are required, alternate coats shall contain sufficient compatible color additive, to act as indicator of coverage or the alternate coats shall be of contrasting colors.
   5. Mechanical equipment on which the manufacturer's shop-applied coating is acceptable shall be touch-up primed and coated with the specified coating system to match the color scheduled.
   6. Coating shall not be applied to a surface until it has been prepared as specified.
   7. A stripe coat shall be applied by brush to all edges (cut or fabricated), crevices, projections, nuts, bolts, pits, welds, flanges and splice plates. Subsequent coats may be either brush or spray applied.
   8. Where nonskid surface is scheduled, broadcast nonskid additive at 5 pounds per 30 square feet. Back-roll on horizontal surfaces.

D. Film thickness and continuity:
   1. Coating system thickness is the total thickness of primer and finish coats and does not include sealers, patching mortars or galvanized coatings.
   2. Coatings shall be applied to the thickness specified. No less than two coats shall be applied.

E. Unsatisfactory Application:
   1. If an item has an improper finish color or insufficient film thickness, clean surface and topcoat with specified paint material to obtain specified color and coverage. Obtain specific surface preparation information from coating manufacturer.
   2. Evidence of runs, bridges, shiners, laps, or other imperfections is cause for rejection.
   3. Repair defects in accordance with written recommendations of coating manufacturer.

F. Damaged Coatings, Pinholes, and Holidays:
   1. Feather edges and repair in accordance with recommendations of paint manufacturer.
   2. Hand or power sand visible areas of chipped, peeled, or abraded paint, and feather the edges. Follow with primer and finish coat. Depending on extent of repair and appearance, a finish sanding and topcoat may be required.
   3. Apply finish coats, including touchup and damage-repair coats in a manner that will present a uniform texture and color-matched appearance.

3.03 CLEANUP AND WASTE DISPOSAL

A. At the end of each shift, remove surplus materials, protective coverings, and accumulated rubbish.

B. Thoroughly clean all surfaces and repair any overspray or other paint-related damage when the work is complete.

C. All solvents, unused coatings and cleaning solutions shall be removed from the site and disposed of legally when coating work is complete or if directed by the Project Representative.

D. Prepare a Waste Disposal Plan to demonstrate all waste material is to be properly disposed; Include:
   1. Specify the Contractor is the generator of all waste materials generated by their business activities.
   2. Provide details on procedures to be used for properly managing and disposing of waste materials in accordance all applicable laws and regulations.
   3. Procedures to document waste types and quantities generated and their disposition.
   4. Appoint an employee who is qualified and authorized to enforce proper waste disposal and document the disposal.

E. Submit completed Waste Disposal Plan and supporting documentation to demonstrate quantities and proper disposal of wastes.

3.04 PROTECTION

A. Where protection is provided for coated surfaces, such protection shall be preserved in place until the coating film has properly dried, and removal of the protection is authorized by the Project Representative. Items, which have been coated shall not be handled, worked on, or otherwise disturbed, until the coating is completely dry and hard.

B. Hardware, electrical fixtures, nameplates, shims and similar accessories shall be removed or masked during preparation and coating operations or shall otherwise be satisfactorily protected. Equipment adjacent to walls shall be disconnected and moved to permit cleaning and coating of equipment and walls and, following coating, shall be replaced and reconnected. Any removal or disconnecting of equipment shall be coordinated with the Project Representative.

3.05 MANUFACTURER'S SERVICES

A. Coating manufacturer's representative shall be present at site as follows:
   1. Within 48 hours of first application of any coating system.
   2. As required to resolve field problems attributable to or associated with manufacturer's product.
   3. To verify full cure of coating prior to coated surfaces being placed into immersion service.

3.06 COATING SYSTEMS – NOT USED

3.07 COATING SYSTEM SPECIFICATION SHEET - COATSPEC

A. Coating Systems specified for use appear on the following pages. Each of the Coating Systems and their requirements appear on individual pages.

Coating System Identification:	B-1
Coating Material:	Surface Tolerant Epoxy, 8 mils DFT nominal, 250 g/l max VOC
Surfaces:	Metal, concrete, masonry, previously painted surfaces, except steel air header pipe specified in Section 40 05 24
Available Colors:	Gray, White, or Beige
Service Condition:	Interior, mild corrosion service or washdown areas
Surface Preparation:	
Ferrous Metal:	Ferrous metal surfaces shall be prepared in accordance with SSPC-SP 2 or SP 3.
Galvanized Metal:	Non-ferrous and galvanized metal shall be cleaned using a 3,000 PSI minimum, 2.8 GPM minimum, 110F minimum (130F maximum) hot water pressure washer using a new 15 degree or 25 degree fan tip held at 12” or less from the surface. Use a phosphate-free biodegradable cleaner in the wash water such as Simple Green House & Siding Cleaner Pressure Washer Concentrate, Hotsy Enviro-Clean, or Krud Kutter House & Siding Pressure Washer Concentrate. Hard to reach areas shall be cleaned using a solvent wipe or scrubbing with a firm bristle deck brush using 110F minimum wash water mixed with biodegradable cleaner. When the surface is dry, prepare for coating application by providing an SSPC-SP 7, 11, or 16. Alternative surface preparation methods shall be per the manufacturer’s written direction for profile and surface cleanliness for the given application.
Non-Ferrous Metal:	Prepare surfaces in accordance with SSPC-SP 7, 11, or 16. Alternative surface preparation methods shall be per the manufacturer’s written direction for profile and surface cleanliness for the given application.
Concrete and masonry	Prepare surfaces in accordance with ASTM D4258 Surface Cleaning of Concrete and ASTM D4259 Abrading Concrete. The prepared surface shall be as described in ASTM D 4259.
Previously painted surfaces	Previously painted surfaces shall be prepared in accordance with SSPC-SP 2 or SP 3.
Inspection Check Points:	Check points 6, 7, and 10-12.
Application:	Shop or field.
General:	Drying time between coats shall be specified by the manufacturer for the site conditions.
Inspection Check points:	Check points 3, 4, and 7.
System Thickness:	8 mils dry film minimum.
Level of Containment:	Refer to 1.08.

Coatings:	
ALTERNATIVE 1	
Primer:	One coat of Carboline Carboguard 60 Epoxy
Finish:	One or more coats of Carboline Carboguard 635 VOC Epoxy
ALTERNATIVE 2	
Primer:	One coat of Devoe Devran 203 Epoxy
Finish:	One or more coats of Devoe Bar Rust 236 Multi-Purpose Epoxy
ALTERNATIVE 3	
Primer:	One coat of Sherwin Williams Macropoxy 920 Preprime
Finish:	One or more coats of Sherwin Williams Macropoxy HS
ALTERNATIVE 4	
	Approved Equal.

Coating System Identification:	C-1
Coating Material:	Epoxy primer, polyurethane finish, color required.
Surfaces:	Metal
Available Colors:	OSHA Safety Yellow
Service Condition:	Non-immersed, exposure to moisture and sunlight, color required.
Surface Preparation:	
Ferrous Metal:	1. Ferrous metal surfaces shall be prepared in accordance with SSPC SP-5. 2. Shop primed surfaces which are to be incorporated in the work shall be prepared in the field by cleaning all surfaces in accordance with SSPC SP-2. Damaged shop coated areas shall be cleaned in accordance with SSPC SP-11 and recoated with the primer specified. Previously coated surfaces shall be feathered in at the edges. 3. Shop primed surfaces shall receive light abrasive blasting prior to application of finish coasts,
Inspection Check Points:	Check points 1, 2, 6, 7, 11 and 12.
Application:	Shop or field.
General:	Drying time between coats shall be as specified by the manufacturer for the site conditions.
Inspection Check points:	Check points 3, 4, and 7…
System Thickness:	8 mils dry film, minimum.
Level of Containment:	See 1.08
Coatings:	
ALTERNATIVE 1	
Primer:	One coat of Devoe 203 VOC Epoxy
Finish:	Two coats of Devoe Devthane 379H Polyurethane
ALTERNATIVE 2	
Primer:	One coat of Carboline Carboguard 635 VOC Epoxy
Finish:	Two coats of Carboline Carbothane 8845 Polyurethane
ALTERNATIVE 3	
Primer:	One coat of Sherwin Williams' Macropoxy 646
Finish:	Two coats of Sherwin Williams' Hi-Solids Polyurethane
ALTERNATIVE 4	
	Approved Equal.

END OF SECTION

SECTION 26 05 00

COMMON WORK RESULTS FOR ELECTRICAL

PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies general requirements for electrical work. Detailed requirements for specific electrical items specified in other sections are subject to the requirements of this Section. The Electrical Drawings and Schedules included in the specification are functional in nature and do not specify exact locations of equipment or equipment terminations.

B. All electrical Work included in this Contract including pre-fabricated assemblies shall conform to the requirements of this Section.

1.02 REFERENCED STANDARDS

A. This Section incorporates by reference the latest revisions of the embedded standard referenced herein. In case of conflict between the requirements of this Section and those of a listed document, the requirements of this Section shall prevail.

Reference	Title
ANSI A58.1	Minimum Design Loads for Buildings and Other Structures
NFPA 70	National Electrical Code (NEC) and local amendments
NEMA	National Electrical Manufacturers Association
ICEA	Insulated Cable Engineers Association
IBC / IBO	International Building Code
UL	Underwriters Laboratories

1.03 SUBMITTALS

A. Procedures: Section 01 33 00.

B. Catalog cuts of equipment, devices, and materials requested by the specification sections.
   1. Catalog information includes technical specifications and application information, including ratings, range, weight, accuracy, etc.
   2. Catalog cuts shall be edited to show only the items, model numbers, and information which apply to the submittal requirements.
   3. Catalog cuts shall be assembled in a folder. Each folder shall contain a cover sheet, indexed by item, and cross-referenced to the appropriate specification paragraph.

C. Applicable operation and maintenance information on an item-by-item basis in accordance with Section 01 78 23. Operation and maintenance information shall be provided at the time of equipment, device, or material site delivery, or at a certain stage of project completion as required by Section 01 78 23, whichever is the earlier. Full-size drawings shall be reduced to 11 x 17 inches.

D. Test results for motors and electrical systems on the forms specified in Section 26 08 00 and found in Section 01 33 10. Maintain a file of the original test results and submit to the Project Representative prior to Final Acceptance.

E. Description of functional checkout procedures, specified in this specification, 30 days prior to performing functional checkout tests.

F. Interconnection diagrams depicting all cable requirements together with their actual terminations.

G. Electrical room plan and elevation drawings showing conformance with electrical working clearances and installation clearances required by selected manufacturer.

1.04 QUALITY ASSURANCE

A. Identification of Listed Products:
   1. Electrical equipment and materials shall be listed and labeled for the purpose for which they are to be used, by UL or equivalent NRTL agency approved lab as the independent testing laboratory. Independent testing laboratory shall meet the requirements of the local or state inspection authority having jurisdiction.
   2. When a product is not available with a testing laboratory listing for the purpose for which it is to serve, the product may be required by the inspection authority to undergo a special inspection. All costs and expenses incurred for such inspections shall be included in the original contract price.
   3. When the product is an assemblage of individual parts, whether the individual parts are listed or not, the entire assemblage shall be listed and labeled as a complete unit for the purpose for which it is to be used.

B. Factory Tests: Where specified in the specification section, perform factory tests at the place of fabrication. Perform on completion of manufacture or assembly.

1.05 DEFINITIONS

A. Elementary or Schematic Diagram: A schematic (elementary) diagram shows, by means of graphic symbols, the electrical connections and functions of a specific circuit arrangement. The schematic diagram facilitates tracing the circuit and its functions without regard to the actual physical size, shape, or location of the component devices or parts.

B. One-Line Diagram: Shows by means of single lines and graphical symbols the course of an electrical circuit or system of circuits and the components, devices, or parts used therein. Physical relationships are usually disregarded.

C. Block Diagram: A diagram of a system, instrument, computer, or program in which selected portions are represented by annotated boxes and interconnecting lines.

D. Wiring Diagram or Connection System: A wiring or connection diagram includes all of the devices in a system and shows their physical relationship to each other including terminals and interconnecting wiring in an assembly. This diagram shall be (a) in a form showing interconnecting wiring only by terminal designation (wireless diagram), or (b) a panel layout diagram showing the physical location of devices plus the elementary diagram.

E. Interconnection Diagram:
   1. Show all external connections between terminals of equipment and outside points, such as motors and auxiliary devices.
   2. References shall be shown to all connection diagrams which interface to the interconnection diagrams.
   3. Interconnection diagrams shall be of the continuous line type.
   4. Bundled wires shall be shown as a single line with the direction of entry/exit of the individual wires clearly shown. Wireless diagrams and wire lists are not acceptable.
   5. Each wire identification as actually installed shall be shown.
   6. The wire identification for each end of the same wire shall be identical.
   7. All devices and equipment shall be identified.
   8. Terminal blocks shall be shown as actually installed and identified in the equipment complete with individual terminal identification.

9. All jumpers, shielding and grounding termination details not shown on the equipment connection diagrams shall be shown on the interconnection diagrams.
10. Wires or jumpers shown on the equipment connection diagrams shall not be shown again on the interconnection diagram.
11. Signal and DC circuit polarities and wire pairs shall be shown.
12. Spare wires and cables shall be shown.

F. Arrangement, Layout, or Outline Drawings: An arrangement, layout, or outline drawing is one which shows the physical space and mounting requirements of a piece of equipment. It may also indicate ventilation requirements and space provided for connections or the location to which connections are to be made.

1.06 DRAWINGS

A. Prepare drawings specified as part of the work per Section 01 78 39 and submit per Section 01 33 00.

B. Drawings shall be complete with borders and title blocks clearly identifying Contract name, equipment, and the scope of the drawing.

C. Drawing standard requirements will be supplied by King County.

1.07 SITE CONDITIONS

A. General: Unless otherwise indicated, size and derate equipment and materials for the ambient conditions, but not less than an ambient maximum temperature of 40 degrees C at an elevation ranging from sea level to 3000 feet without exceeding the manufacturer's stated tolerances.

B. Seismic:
1. Electrical equipment and supports: Braced per IBC requirements and Section 01 73 00.
2. Provide calculations for overturning moment and design of the embedded anchors for securing free-standing equipment to the building structure.
3. Fasten equipment that is front-accessible only to the wall or ceiling as well as the floor.

C. Electrical Classification: Area electrical classifications are generally shown on Drawings. The Electrical Room and Blower Room IPS are defined as unclassified spaces.

1.08 STORAGE OF MATERIALS AND EQUIPMENT

A. Store materials and equipment per Section 01 67 00.

B. Store indoor equipment and materials to be permanently located indoors and seal with plastic film wrap.

PART 2 PRODUCTS

2.01 EQUIPMENT AND MATERIALS

A. General:
1. Equipment and materials shall be new and free from defects.
2. All material and equipment of the same or a similar type shall be of the same manufacturer throughout the work.
3. Standard production materials shall be used wherever possible.

B. Equipment Finish: Unless otherwise indicated, electrical equipment and materials shall be painted by the manufacturer as specified per Section 09 90 00.

2.02 CONDUCTOR / WIRE MARKERS

A. Identify each power and control conductor at each end of each terminal to which it is connected.

B. Conductors size No. 10 AWG or smaller shall have identification sleeves.

C. Conductors:
   1. Identify each end as shown on the Drawings.
   2. If not shown on the Drawings, identify conductor ends with the Equipment number, followed by -Cxx, where xx is a unique number for that wire.

D. Machine print on sleeves with permanent black ink the letters and numbers that identify each wire.

E. Figures: 1/8-inch high.

F. Sleeves: Yellow or white tubing, sized to fit the conductor insulation.

G. Acceptable Manufacturer:
   1. TMS Thermofit Marker System by Raychem Co.
   2. Sleeve style wire marking system by W. H. Brady Co.
   3. Or Approved Equal.

H. Adhesive strips are not acceptable.

I. Use cable markers of the locking tab type for conductors No. 8 AWG and larger.

J. Tabs: white plastic with conductor identification number permanently embossed.

2.03 NAMEPLATES

A. Laminated phenolic plastic.

B. Nominal Size: 3/4 inch high by 2 inches long.

C. Black backgrounds with 3/16-inch white letters.

D. If abbreviations are required because of space limitations, submit to the Project Representative prior to manufacture.

E. Fastened using self-tapping stainless steel screws. The use of adhesives will not be permitted on the outside of enclosures.

2.04 TERMINAL BLOCKS

A. Unless otherwise indicated, panhead strap screw type.

B. Terminals shall be provided with integral marking strips which shall be permanently identified with the connecting wire numbers as shown on the Drawings.

C. Terminal blocks for P-circuits (power 208-600 volts): Rated not less than the conductor current rating and less than 600 VAC.

D. Terminal blocks for C-circuits (control and/or power 120 volts or less power) and S-circuits (signal): Rated not less than 20 amperes and less than 600 VAC.

E. Terminals: Tin-plated.

F. Insulating material: Nylon.

2.05 PROGRAMMING AND SOFTWARE FOR SUPPLIED EQUIPMENT

A. For any device that requires programming, the Contractor shall provide licensed programming software and documentation. License shall include updates for duration of contract and warranty period.

B. Contractor shall provide final documented application program and software for each programmable device.

C. Contractor shall provide any special hardware programming interfacing (i.e cable, dongles, etc.) required for programming devices.

D. Submit in accordance with paragraph 1.03.

PART 3 EXECUTION

3.01 GENERAL

A. Construction:
   1. Unless otherwise indicated, electrical layout drawings are diagrammatic.
   2. Coordinate the location of electrical material or equipment with other equipment and work.
   3. Make necessary minor changes in location of electrical material or equipment to avoid interferences with other work prior to installation.

B. Housekeeping:
   1. Protect electrical equipment from dust, water and damage.
   2. Wipe motor control centers, switchgear, and buses free of dust and dirt on the outside keep dry and vacuumed on the inside within 30 days of Substantial Completion.
   3. Touch up any scratches on equipment as specified in Section 09 90 00.
   4. During construction, allow no electrical equipment to be temporarily exposed to weather, debris, liquids, or damage.

C. Dust Free Areas:
   1. Protect electrical, instrumentation and control equipment from dust by wrapping the equipment in plastic film wrap until installed to prevent dust from entering the equipment.
   2. Once electrical, instrumentation and control equipment is installed, protect from dust. Rewrap the equipment if necessary to keep the equipment dust free.

3.02 RECORD DOCUMENTS

A. Provide record drawings in accordance with Section 01 78 39. Include the following schedules, lists, and drawings:
   1. Interconnection diagrams (Section 26 05 00).
   2. Original submittal drawings (Section 26 05 00).

END OF SECTION

SECTION 26 05 19

600 VOLT CONDUCTORS AND CABLES

PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies conductors and cables rated 600 volts used for power, lighting, receptacle, signal, and control circuits.

1.02 REFERENCED STANDARDS

A. This Section incorporates by reference the latest revisions of the embedded standard referenced herein. In case of conflict between the requirements of this Section and those of a listed document, the requirements of this Section shall prevail.

Reference	Title
ASTM B3	Soft or Annealed Copper Wire
ASTM B8	Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
ASTM B33	Tinned Soft or Annealed Copper Wire for Electrical Purposes
ASTM B189	Lead-Coated and Lead-Alloy-Coated Soft Copper Wire for Electrical Purposes
ICEA S-68-516	Ethylene-Propylene-Rubber-Insulated Wire
IEEE 383	Type Test of Class IE Electric Cables, Field Splices, and Connections for Nuclear Power Generating Stations
NEMA WC7	Cross-Linked-Thermosetting Insulated Wire and Cable for the Transmission and Distribution of Electric Energy
NEMA WC57/ICEA S-73-532	Standard for Control Cables
NEMA WC70/ICEA S-95-658	Non-Shielded Power Cables Rated 2000 V or less
NEC 310-12	General Conductors Color Code
NFPA 820	Fire Protection in Wastewater Treatment and Collection Facilities
NFPA 70	National Electric Code (NEC)
UL 44	Rubber-Insulated Wires and Cables
UL 83	Thermoplastic-Insulated Wires and Cables
UL 1277	Type TC Power and Control Tray Cable
UL 1581	Reference Standards for Electrical Wires, Cables, and Flexible Cords

1.03 SUBMITTALS

A. Procedures: Section 01 33 00.

B. Catalog cuts showing general information of the conductors and cable.

PART 2 PRODUCTS

2.01 GENERAL

A. Unscheduled Conductors and Cables:
   1. With the exception of lighting, communication, paging, security and receptacle circuits, the type, size and number of conductors shall be as specified on the Drawings.

2. Lighting and receptacle circuit conductors are not shown on the Drawings and shall be sized by the Contractor in accordance with the NEC to limit voltage drop to 3 percent.
3. Minimum size of lighting and receptacle circuits shall be 12 AWG.
4. Number and types of communication, paging, and security cables shall be as required for the particular equipment provided.
5. Unless otherwise indicated, provide lighting and receptacle circuit conductors in accordance with CABLESPEC "XHHW-2".

B. Cable Specification Sheets (CABLESPEC): General requirements for conductors and cables specified in this Section are listed on CABLESPEC sheets in this Section.

2.02 COLOR CODING

A. General:
1. Multiconductor power and control cable colors shall be manufacturer's standard.
2. Single conductor control conductor color shall be yellow, except for the grounded conductor which shall be white.

B. Power Conductors:
1. Single-conductor power conductors shall be color coded in accordance with the following:

Use	Cable	Color
Three-phase, 480-volt power or 480/277	Phase A	Brown
	Phase B	Orange
	Phase C	Yellow
	Ground	Green
	Neutral	Gray
Three-phase, 120/208-volt power	Phase A	Black
	Phase B	Red
	Phase C	Blue
	Neutral	White
	Ground	Green
Single-phase, 120/240-volt power	Line 1	Red
	Line 2	Black
	Neutral	White
	Ground	Green

2. Cables sized No. 4 AWG and larger may be black with colored 3/4-inch vinyl plastic tape applied in 3-inch lengths around the cable at each end.
3. Tag the cables at terminations and in pull boxes, handholes, and manholes.

C. Signal Conductors: Unless otherwise indicated, cables shall be color coded black and white for pairs or black, red, and white for triads.

D. Control Conductors: Control conductors color coding shall be manufacturer's standard.

2.03 POWER AND CONTROL CONDUCTORS AND CABLE, 600 VOLT

A. Single Conductor:
1. Stranded and used in conduits for power and control circuits.
2. Unless otherwise indicated, provide in accordance with CABLESPEC "XHHW-2".

B. Multiconductor Cable:
   1. Used for power and control circuits routed in cable tray.
   2. Cables shall be UL labeled, Type TC, designed for cable tray installation in accordance with NEC 340.
   3. The type of insulation, number of conductors, and size of conductor shall be as specified.
   4. Unless otherwise indicated, provide multiconductor power and control cable in accordance with CABLESPEC "MC".
   5. Power Cable: Containing three or four conductors, as specified, plus an equipment grounding conductor.
   6. Control Cable: Unless otherwise indicated, shall be size 14 AWG.

2.04 SIGNAL CABLES

A. General:
   1. Provide signal cable for instrument signal transmission, alarm, communication and other circuits as specified. Circuit shielding shall be provided in addition to cable shielding.
   2. Provide circuits for Type A and B signals specified in Section 40 61 13 in compliance with the instrument manufacturer's recommendations.
   3. Unless otherwise indicated, provide single circuit signal cable in accordance with CABLESPEC "SIC".
   4. Unless otherwise indicated, provide multicircuit signal in accordance with CABLESPEC "MIC".

B. Communication System Cables: Communication, system cables shall be as specified in Article Cable Specification Sheets (CABLESPEC).

2.05 PORTABLE CORD

A. Unless otherwise indicated, provide portable cord in accordance with CABLESPEC "CORD".

B. Cords shall contain an equipment grounding conductor.

2.06 SPLICING AND TERMINATING MATERIALS

A. Connectors:
   1. Tool applied compression type of correct size and UL listed for the specific application.
   2. Tin-plated high conductivity copper.
   3. For wire sizes No. 10 AWG and smaller: Nylon self-insulated, ring tongue or locking-spade terminals.
   4. For wire sizes No. 8 AWG and larger: One-hole lugs up to size No. 3/0 AWG, and two-hole or four-hole lugs for size No. 4/0 and larger.
   5. Mechanical clamp, dimple, screw-type connectors are not acceptable.

B. Motor Connection Kits:
   1. Shall consist of heat-shrinkable, polymeric insulating material over the connection area and a high dielectric strength mastic to seal the ends against ingress of moisture and contamination.
   2. Shall accommodate a range of cable sizes for both in-line and stub-type configurations.
   3. Shall be independent of cable manufacturer's tolerances.

C. Splicing is not allowed without prior approval from the Project Representative.

PART 3 EXECUTION

3.01 GENERAL

A. Identify each power and control conductor at each terminal to which it is connected. The marking system shall comply with Section 26 05 00.

B. Specific cable types and applications are indicated in the Drawings and in the conduit and cable schedules. When not indicated in the Drawings and in the schedules, Table A specifies the type of cable required for each location and application by CABLESPEC sheet. Unless otherwise indicated, in Table A, unscheduled cable shall be CABLESPEC XHHW-2.

TABLE A

Application/Condition	CABLESPEC
Single Conductor Power Cable	XHHW-2
Single Conductor Control Cable	XHHW-2
Multiconductor Power & Control Tray Cable	TC
Single Twisted, Shielded Pair or Triad	SIC (TSP or TST)
Multiple Twisted, Shielded Pairs or Triads	MIC (MTSP or MTST)
Cord.No. 10 AWG & smaller Type SO; 10 AWG & larger Type G	CORD
Ethernet Cable	ENET

C. Provide and leave a pull string in each empty conduit installed.

D. Wire Pulling:
1. Complete the pulling of wire and cable into conduit or cable trays without damaging or putting undue stress on the cable insulation.
2. Soapstone, talc or UL listed pulling compounds are acceptable lubricants for pulling wire and cable.
3. Grease is not acceptable.
4. Raceway construction shall be complete, cleaned, and protected from the weather before cable is placed.

E. Whenever a cable leaves a raceway, provide a cable support.

F. When flat bus bar connections are made with unplated bar, scratch-brush the contact areas. Torque bolts to the bus manufacturer's recommendations.

G. Feeder, branch, control and instrumentation circuits shall not be combined in a raceway, cable tray, junction or pull box, except as permitted in the following:
1. Where specifically indicated in the Drawings.
2. Where field conditions dictate and written permission is obtained from the Project Representative.
3. Control circuits shall be isolated from feeder and branch power and instrumentation circuits, but combining of control circuits with power is permitted as noted below.
    a. The combinations shall comply with the following:
        1) 12 Vdc, 24 Vdc and 48 Vdc may be combined.
        2) 125 Vdc shall be isolated from other DC circuits.
        3) AC control circuits shall be isolated from DC circuits.
        4) Control (discrete) conductors are allowed to be routed in the same conduit with power conductors or cable where the power conductors are less than or equal to #8 AWG and both shall homerun to the same panel. A maximum of eight (8) control conductors and four (4) power conductors sized at #8 AWG may be combined in a single conduit.
4. Instrumentation circuits shall be isolated from feeder and branch panel and control circuits, but combining instrumentation circuits is permitted.
    a. The combinations shall comply with the following:
        1) Analog signal circuits may be combined.
        2) Digital signal circuits may be combined but isolated from analog signal circuits.
5. Multiple branch circuits for lighting, receptacles and other 120 V ac circuits are allowed to be combined into a common raceway.
    a. Be responsible for making the required adjustments in conductor and raceway size, in accordance with requirements of the NEC, including:
        1) Up sizing conductor size for required ampacity de-ratings for the number of current carrying conductors in the raceway.

2) The neutral conductors may not be shared.
3) Up sizing raceway size for the size and quantity of conductors.

3.02 600 VOLT CONDUCTOR AND CABLE

A. Lacing and Bundling:
1. Lace and bundle conductors in panels and electrical equipment, No. 6 AWG and smaller, at intervals not greater than 6 inches, spread into trees and connected to their respective terminals.
2. Lacing shall be made up with plastic cable ties.
3. Lacing is not necessary in plastic panel wiring duct.
4. Bundle conductors crossing hinges into groups not exceeding 12 and arrange so that they will be protected from chafing when the hinged member is moved.

B. Slack:
1. Provide slack in junction and pull boxes, handholes and manholes.
2. Slack shall be sufficient to allow cables or conductors to be routed along the walls of the box.
3. Amount of slack shall be equal to largest dimension of the box.
4. Where plastic panel wiring duct is provided for wire runs, lacing is not required.
5. Do not use plastic panel wiring duct in manholes and handholes.

C. Stranded Conductors:
1. Terminate as described in this Section, except where terminals will not accept such terminations.
2. In these cases, terminate the conductors directly on the terminal block.
3. Install compression lugs and connectors using manufacturer's recommended tools.

D. Raceway fill limitations shall be as defined by NEC and the following:
1. Lighting and receptacle circuits may be in the same conduit in accordance with derating requirements of the NEC.
2. However, lighting and receptacle circuits shall not be in conduits with power or control conductors.

E. Make terminations at solenoid valves, 120 volt motors, and other devices provided with pigtail leads using self-insulating tubular compression connectors.

3.03 SIGNAL CABLE

A. Circuits:
1. Run as individually shielded twisted pairs or triads.
2. Do not, in any case, make up a circuit using conductors from different pairs or triads.
3. Use triads wherever 3-wire circuits are required.
4. Unless otherwise indicated, provide terminal blocks at instrument cable junctions, and identify circuits at such junctions.
5. Run signal circuits without splices between instruments, terminal boxes, or panels.

B. Shields are not acceptable as a signal path, except for circuits operating at radio frequencies and utilizing coaxial cables.

C. Common grounded return conductors for two or more circuits are not acceptable.

D. Unless otherwise indicated, bond shields to the signal ground bus at the control panel and isolated from ground and other shields at other locations. Provide terminals for running signal leads and shield drain wires through junction boxes.

E. Shield Drain Wire:
1. Terminate spare circuits and the shield drain wire on terminal blocks at both ends of the cable run and cause to be electrically continuous through terminal boxes.
2. Do not ground shield drain wires for spare circuits at either end of the cable run.

F. Terminal Boxes:
   1. Provide at instrument cable splices.
   2. If cable is buried or in raceway below grade at splice, provide an instrument stand as specified with terminal box mounted approximately 3 feet above grade.

G. Install and terminate cable for Data systems in compliance with the manufacturer's recommendations.

3.04 PORTABLE CORD

A. Portable cord feeding permanent equipment, such as pendant cords, pumps, cranes, hoists, and portable items shall have a wire mesh cord grip of flexible stainless steel wire to take the tension from the cable termination.

B. Connect portable cords to permanent wiring with the use of terminals.

C. Use in-line taps and splices only where specified.

3.05 DATA NETWORK COMMUNICATIONS CABLE

A. Install and terminate cable for data network communications systems incompliance with the manufacture’s recommendation.

B. Ethernet, CAT 6+ cable, CMR or CMP jacket, 4 pair count.

3.06 TESTING

A. General: Test conductors and cable in accordance with Section 26 05 00 and Section 26 08 00.

B. Signal Cable:
   1. Test each signal pair or triad for electrical continuity.
   2. Test each shield drain conductor for continuity. Shield drain conductor resistance shall not exceed the loop resistance of the pair or triad.
   3. Test each conductor (signal and shield drain) for insulation resistance with all other conductors in the cable grounded.
   4. Instruments used for continuity measurements shall have a resolution of 0.1 ohms and an accuracy of better than 0.1 percent of reading plus 0.3 ohms. Use a 500 volt megohmmeter for insulation resistance measurements.

3.07 SCHEDULES

A. Cables are scheduled on the Drawings.

3.08 CABLE SPECIFICATION SHEETS (CABLESPEC)

A. General:
   1. Conductor and cable types for different locations, service conditions and raceway systems are specified on individual cable specification sheets (CABLESPECS).
      a. TC: Multiconductor power and control tray cable.
      b. XHHW-2: Single conductor power and control cable.
      c. SIC: Single twisted, shielded pair or triad, No. 16 AWG, instrumentation.
      d. MIC: Multiple twisted, shielded pairs or triads, No. 16 AWG, instrumentation cable.
      e. CORD: Cord, No. 10 AWG and smaller, UL listed, type SO; larger than No. 10 AWG, UL listed type G.
      f. ENET: Ethernet Cable.
   2. Install scheduled and unscheduled conductors and cables in accordance with the CABLESPECS.

B. CABLESPEC SHEETS: CABLESPEC sheets follow.

Cable System Identification:	**TC**
Description:	Multiconductor power and control cable, No. 14 AWG minimum through No. 1 AWG, approved for tray installation and in accordance with UL 1581.
Voltage:	600 volts.
Conductor Material:	Bare annealed copper; stranded in accordance with ASTM B8.
Insulation:	XHHW-2, 90 degree C dry, 75 degree C wet, crosslinked polyethylene in accordance with NEMA WC57 / ICEA S-73-532 (control cable), NEMA WC70 / ICEA S-95-658 (Power Cable), and UL 44.
Assembly:	Individual conductors cabled together with nonhydroscopic fillers and binding tape.
Jacket:	50 mil minimum, polyvinylchloride (PVC) in accordance with UL 1581.
Flame Resistance:	IEEE 383.
Acceptable Manufacturers:	Okonite, Houston Wire & Cable, Approved Equal.
Uses Permitted:	Cable tray, direct burial, encased in concrete in normal or Class I, Division 2 atmospheres.
Execution:	
Installation:	Install in accordance with this Section.
Testing:	Test in accordance with Section 26 05 00 and Section 26 08 00.

Cable System Identification:	**XHHW-2**
Description:	Single conductor Cross-linked polyethylene power and control cable for sizes No. 14 AWG through No. 1 AWG.
Voltage:	600 volts.
Conductor Material:	Bare annealed copper; stranded in accordance with ASTM B8.
Insulation:	XHHW-2, 90 degree C dry, 90 degree C wet, cross-linked polyethylene in accordance with NEMA WC57/ ICEA S-73-532 (control cable), NEMA WC70/ ICEA S-95-658 (power cable).
Jacket:	None.
Flame Resistance:	N/A.
Acceptable Manufacturers:	Okonite, American Insulated Wire Corporation, Cablec, BICC, Carol Cable, Anixter, Approved Equal.
Execution:	
Installation:	Install in accordance with this Section
Testing:	Test in accordance with Section 26 05 00 and Section 26 08 00.

Cable System Identification:	SIC
Description:	Single twisted, shielded pair or triad, 16 AWG, instrumentation cable, UL listed. NEC type TC.
Voltage:	600 volts.
Conductor Material:	Bare annealed copper; stranded in accordance with ASTM B8.
Insulation:	15 mil, 90°C Dry / 75°C Wet, Polyvinyl chloride (PVC) with 4 mil nylon conduit or jacket.
Lay:	Twisted on a 2-inch lay.
Shield:	100 percent, 1.35 mil aluminum-Mylar tape with 18 AWG 7-strand tinned copper drain wire
Jacket:	45 mil polyvinylchloride (PVC).
Flame Resistance:	UL 1277.
Acceptable Manufacturers:	Okonite, Okoseal-N type P-OS; Approved Equal.
Execution:	
Installation:	Install in accordance with this Section.
Testing:	Test in accordance with this Section.

Cable System Identification:	MIC
Description:	Multiple twisted, shielded pairs or triads, 16 AWG, instrumentation cable, UL listed.
Voltage:	600 volts.
Conductor Material:	Bare annealed copper; stranded in accordance with ASTM B8.
Insulation:	15 mil, 90°C Dry / 75°C Wet, Polyvinyl chloride (PVC) with 4 mil nylon conduit or jacket.
Lay:	Twisted on a 2-inch lay.
Shield:	100 percent, 1.35 mil aluminum-Mylar tape with 18 AWG 7-strand tinned copper drain wire.
Overall Shield:	2.35 mil aluminum-Mylar tape with a No. 20 AWG 7-strand tinned copper drain wire.
Jacket:	45 mil polyvinylchloride (PVC).
Flame Resistance:	UL 1277.
Acceptable Manufacturers:	Okonite, Okoseal-N type SP-OS; Approved Equal.
Execution:	
Installation:	Install in accordance with this Section.
Testing:	Test in accordance with this Section.

Cable System Identification:	**CORD**
Description:	Portable Cord, 3-conductor with ground, extra hard usage, oil, weather and water resistant. 10 AWG and smaller, UL listed, type SOOW; larger than 10 AWG, UL listed type G.
Voltage:	600 volts.
Conductor Material:	Type G - Flexible rope stranded as indicated in ASTM B189 and B33. Type SOOW – Soft bare annealed copper as indicated in ASTM B-3, flexible bunch strand ASTM B174.
Insulation:	Insulation shall be ethylene propylene (EPR) as indicated in ICEA S-68-516 and rated for continuous operation at 90 degrees C.
Jacket:	Heavy-duty neoprene as indicated in NEMA WC70/ICEA S-95-658.
Acceptable Manufacturers:	Type SOOW – Houston Wire HW250, Southwire Viper, Approved Equal Type G – Houston Wire HW258, Southwire Type G, Approved Equal.
Execution:	
Installation:	Install in accordance with this Section.
Testing:	Test in accordance with Section 26 05 00 and Section 26 08 00.

Cable System Identification:	ENET
Description:	Ethernet, CAT 6+ cable, CMR or CMP jacket, 4 pair count.
AWG (MM)	23 (0.57).
Conductor Material:	Solid annealed copper.
Insulation Colors:	Pair 1: ColorTip Light Blue, Blue. Pair 2: ColorTip Light Orange, Orange. Pair 3: ColorTip Light Green, Green. Pair 4: ColorTip Light Brown, Brown.
Separator:	Tape.
Jacket:	CMR: Flame retardant (FR) PVC. CMP: FR, low smoke PVC.
Characteristic Impedance (Ohms):	100 +/- 15.
Nominal Velocity of Propagation (%):	CMR: 70. CMP: 73.
Performance Compliance:	UL 444, CSA C22.2 No. 214-08, UL 1666, NFPA 262, ANSI/TIA 568-C.2, Article 800 NEC (NFPA 70), and RoHS-compliant.
Acceptable Manufacturers:	Superior Essex DataGain cable, Approved Equal.
Execution:	
NRTL Programs:	UL Verified CAT 6. UL c(UL) Listed CMR. UL c(UL) Listed CMP.
Installation:	Install in accordance with this Section and associated equipment per manufacturer's instruction.
Testing:	Test in accordance with this Section.

Sizing Cables: Cables shall be sized for loads to be served.

END OF SECTION

SECTION 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies the system for grounding electrical equipment, exposed non-energized metal surfaces of equipment, and metal structures.

1.02 REFERENCED STANDARDS

A. This Section incorporates by reference the latest revisions of the embedded standard referenced herein. In case of conflict between the requirements of this Section and those of a listed document, the requirements of this Section shall prevail.

Reference	Title
IEEE 81	Guide for Measuring Earth Resistivity, Ground Impedance, and Earth
NEC	National Electrical Code Article 250 Grounding and Bonding
NFPA 70	National Electric Code (NEC)

1.03 SUBMITTALS

A. Procedures: Section 01 33 00.

B. Product Data.

C. Grounding System Test Results.

1.04 QUALITY ASSURANCE

A. Comply with requirements of NEC Article 250.

PART 2 PRODUCTS

2.01 GROUND CABLE

A. Annealed bare copper, concentric stranded as specified. If cable sizes are not indicated, the minimum sizes shall be as follows:
   1. 480V switchgear: 4/0 AWG.
   2. 480V MCC and switchboards: 2/0 AWG.
   3. Lighting panels: 1/0 AWG.
   4. Exposed metal: 2 AWG.
   5. Grounding electrode conductor: 1/0 AWG

2.02 COMPRESSION CONNECTORS

A. Cast copper.

B. Acceptable Manufacturer:
   1. Thomas and Betts.
   2. Burndy.
   3. Approved Equal.

2.03 BOLTED CONNECTORS

A. Acceptable Manufacturer:
   1. Burndy.
   2. O. Z. Gedney.
   3. Approved Equal.

2.04 EXOTHERMIC CONNECTORS

A. Acceptable Manufacturer:
   1. Thermoweld.
   2. Cadweld.
   3. Approved Equal.

2.05 GROUNDING PLATE – CAST IN CONCRETE

A. Cast copper plate for use with future two-hole lug connection. Flush mounted in concrete.

B. Acceptable Manufacturers:
   1. Burndy.
   2. Erico.
   3. Approved Equal.

PART 3 EXECUTION

3.01 GENERAL

A. Make embedded and buried ground connections by compression connectors utilizing diamond or hexagon dies. Use a hand compression tool for wire sizes 2/0 AWG and smaller and a hydraulic pump and compression head for wire sizes larger than 2/0 AWG.

B. Tools and dies:
   1. Approved for purpose used.
   2. Dimple compressions are not acceptable.

C. Prepare compression connections in accordance with the manufacturer's instructions.

D. Unless otherwise indicated, make exposed ground connections to equipment by bolted clamps.

E. Do not use solder in any part of the ground circuits.

F. Cables:
   1. Securely attach embedded ground cables and fittings to concrete reinforcing steel with tie wires and prevented from displacement during concrete placement.
   2. As each part of the grounding system below finished grade is completed, notify the Project Representative a minimum of four hours prior to backfilling.

G. Extensions:
   1. Extend grounding conductors that are extended beyond concrete surfaces for equipment connection a sufficient length to reach the final connection point without splicing.
   2. Minimum extensions: 3 feet.

H. Conductors:
   1. Locate grounding conductors that project from a concrete surface as close as possible to a corner of the equipment pad, protected by conduit, or terminated in a flush grounding plate.

2. Terminate grounding conductors for future equipment using a two-hole copper flush mounted grounding plate.
3. Support exposed grounding conductors by non-corrosive metallic hardware at 4-foot intervals or less.
4. Ground conductors, except signal conductor shields entering enclosures:
   a. Bonded together to the enclosure if it is metallic and to metallic raceways within or terminating at the enclosure.
5. Grounding conductor shall not be used as a system neutral.

I. Use compression-type lugs in accordance with manufacturer's recommendations.

J. Directly connect lightning arresters to the ground system using copper conductors, sized as specified.

K. Metallic sheaths or shields of shielded power cable:
   1. Terminated by a copper grounding strip provided with cable connection for connection to the grounding system.

L. Prior to making ground connections or bonds, clean metal surface at the point of connection.

M. For all control devices with sealed cable connection, include a ground conductor in the control cable.

N. Prior to burying of the ground conductors, record location for Record Drawings.

3.02 RACEWAY GROUND

A. Metallic conduits:
   1. Assembled to provide a continuous ground path and bonded using insulated grounding bushings.
   2. Bond using insulated grounding bushings.

B. Non-metallic conduits: Insulated ground conductor sized in compliance with the NEC.

C. Grounding bushings: Connected to the grounding system using conductors sized in compliance with NFPA 70.

D. Cable trays:
   1. No. 2/0 AWG bare copper ground conductor run on the outside of each tray.
   2. Conductor to be connected to each section or fitting using a carriage bolt and clamp.

E. Every conduit shall contain an insulated green ground conductor sized in compliance with NEC.

F. Duct Banks:
   1. Run along the duct bank a continuous No. 2/0 AWG minimum bare copper conductor.
   2. Bond using insulated grounding bushings.

3.03 EQUIPMENT AND ENCLOSURE GROUND

A. Connect electrical and distribution equipment to the grounding system. Cables sized as indicated.

B. Connect non-electrical equipment with metallic enclosures to the grounding system.

C. Securely bond transformer yard fences and gates as specified.

3.04 ISOLATED GROUNDING

A. Where the manufacturer of equipment supplied from 120 volt instrument power panels requires an isolated ground, provide an additional isolated ground conductor from the equipment through the

instrument power panel for connection to a single point ground bus in the automatic transfer switch enclosure.

B. Conductor: Green insulation with a yellow stripe and run in the same raceway as the power and neutral conductors.

C. Neutral conductor from the ultra-isolation transformers:
   1. Grounded only at the single point ground bus in the automatic transfer switch.

3.05 GROUNDING SYSTEM TESTS

A. Test per IEEE 81 each grounding connection to determine the ground resistance.

B. Submit a plot of ground resistance readings for each isolated ground rod or ground mat on 8-1/2 by 11-inch size graph paper.

C. Current reference rod: At least 100 feet from the ground rod or grid under test.

D. Make measurements at 10-foot intervals beginning 25 feet from the test electrode, and ending 75 feet from it, in direct line between the ground rod or center of grid and the current reference electrode.

E. Consider a grounding system that shows greater than 2-ohm resistance for the flat portion of the plotted data inadequately grounded. Add additional parallel-connected ground rods and deeper driven rods until the ground resistance measurements meet the 2-ohm or less requirement.

F. Use of salts, water, or compounds to attain the indicated ground resistance is not acceptable.

END OF SECTION

SECTION 26 05 33

RACEWAYS, BOXES, AND SUPPORTS

PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies the electrical conduits, wireways, pull boxes, cable vault, cable trays, fittings, and supports.

1.02 REFERENCED STANDARDS

A. This Section incorporates by reference the latest revisions of the embedded standard referenced herein. In case of conflict between the requirements of this Section and those of a listed document, the requirements of this Section shall prevail.

Reference	Title
ANSI C80.1	Rigid Steel Conduit-Zinc Coated
ANSI C80.3	Electrical Metallic Tubing-Zinc Coated
ASTM A 48 REV A	Gray Iron Castings
ASTM A193 REV C	Alloy-Steel and Stainless Steel Bolting Materials for High Temperature Service
ASTM F512	Smooth-Wall Polyvinylchloride Conduit and Fittings for Underground Installation
FEDSPEC WW-C-581E	Conduit, Metal, Rigid and Intermediate; and Coupling, Elbow, and Nipple, Electrical Conduit; Zinc Coated
FEDSPEC W-C-1094A	Conduit and Conduit Fitting Plastic, Rigid
NEC 500	Classified Locations, Classes I, II, and III, Divisions 1 and 2
NEMA ICS 6	Industrial Control and Systems Enclosures
NEMA RN1	Polyvinyl Chloride (PVC) externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit
NEMA TC2	Electrical Plastic Tubing (EPT) and Conduit (EPC 40 and EPC 80)
NEMA TC6	PVC and ABS Plastic Utilities Duct for Underground Installation
NEMA VE-1	Metal Cable Tray Systems
NEMA 250	Enclosures for Electrical Equipment (1000 volts maximum)
NFPA 70	National Electrical Code (NEC)
NFPA 79	Electrical Standards for Industrial Machinery
UL 1	Flexible Metal Electrical Conduit
UL 6	Rigid Metal Electrical Conduit
UL 360	Liquid Tight Flexible Electrical Conduit
UL 651	Rigid Nonmetal Electrical Conduit

1.03 SUBMITTALS

A. Procedures: Section 01 33 00.

B. Include manufacturer's catalog cuts as specified by Section 26 05 00. Include general information and detailed specifications for the products specified in this Section.

C. Certifications and calculations that raceway supports meet the seismic requirements specified in Sections 26 05 00, 01 73 00, and this Section.

PART 2 PRODUCTS

2.01 RACEWAY

A. General requirements for raceway materials specified in this Section are listed in the RACESPECS sheets at the end of this Section. The type of raceway to be used for any given area and application shall conform to the requirements of Table A in this Section.

2.02 BOXES AND FITTINGS

A. Pull Boxes and Wiring Gutters:
   1. Device and junction boxes less than 6 inches square shall be Type FD galvanized cast ferrous. Boxes larger than FD boxes shall be constructed of sheet steel, galvanized after fabrication, or NEMA 4X stainless steel or nonmetallic.
   2. Outdoor boxes and enclosures shall be provided with neoprene gaskets on the hinged doors or removable covers.
   3. Conduit bodies shall be ferrous alloy with screw taps for fastening covers. Gaskets shall be made of neoprene.
   4. Boxes and enclosures in corrosive areas shall be NEMA 4X stainless steel or nonmetallic.
   5. Boxes in classified areas shall be NEMA Class 7 galvanized cast ferrous.
   6. Box and gutter sizes, metal thickness, and grounding shall comply with the National Electrical Code.
   7. Bolt-on junction box covers 3 feet square or larger, or heavier than 25 pounds, shall have a rigid handle.
   8. Covers larger than 3 by 4 feet shall be split.

B. Terminal Cabinets:
   1. Terminal cabinets located indoors shall be NEMA 4.
   2. Cabinets located outdoors and in corrosive areas shall be NEMA 4X.
   3. Cabinets shall be provided with hinged doors.
   4. Adjustable terminal strip mounting accessories shall be provided.
   5. Cabinets shall be provided with channel mounted terminal blocks rated 30 A, 600 Vac.
   6. Terminals shall be No. 8 minimum strap-screw type, suitable for ring tongue or locking spade terminals.

C. Conduit Seals:
   1. Install conduit seals in classified areas in conduit runs leaving the space. They shall be of the EYS or EZS type with male and female hubs.
   2. Use PVC-coated fittings with urethane interior coating for PVC-coated GRS; use copper free cast aluminum for rigid aluminum.
   3. The sealing compound shall be as prescribed by the manufacturer of the sealing conduit body.
   4. Use the sealant, such as Chico, in areas that are defined as classified and meet the NEC requirements for Article 500.

2.03 RACEWAY SUPPORTS

A. Conduit Supports:
   1. Provide hot-dip galvanized framing channel with end caps to support groups of conduit.
   2. Individual conduit supports shall be one-hole galvanized malleable iron pipe straps used with galvanized clamp backs and nesting backs where required.
   3. Conduit supports for PVC-coated rigid steel and PVC conduit systems shall be one-hole PVC-coated rigid steel or clamps conduit wall hangers.

B. Ceiling Hangers:
   1. Ceiling hangers shall be adjustable galvanized carbon steel rod hangers as specified. Straps or hangers of plumber’s perforated tape are not acceptable.

2. Unless otherwise indicated, hanger rods shall be 1/2-inch all-thread rod and shall meet ASTM A193.
3. Hanger rods in corrosive areas and those exposed to weather or moisture shall be stainless steel.

C. Suspended Raceway Supports (Racks):
1. Suspended raceway supports shall consist of concrete inserts, galvanized carbon steel rod hangers, and jamb nuts supporting hot-dip galvanized framing channel or lay-in pipe hangers as required.
2. Unless otherwise indicated, hanger rods shall be 1/2-inch all-thread rod and shall meet ASTM A193.
3. Brace all suspended raceway supports at 30-foot intervals (alternating from one side to the other) to meet specified seismic requirements.

D. Design by Professional Engineer:
1. Raceway supporting systems, structures, and elements shall be designed to meet seismic and other building structural requirements and to support the static and dynamic load of the wiring and raceways that they will carry. Systems to be installed shall be prepared by a Professional Structural Engineer registered in the state of Washington to ensure conformance with IBC seismic, building, and load requirements.

2.04 NAMEPLATES

A. Provide nameplates for all boxes in accordance with the requirements of Section 26 05 00. Nameplate wording shall be as indicated on the Drawings.

B. Where no wording is specified, the Contractor shall provide the functional description of the device on the nameplate.

2.05 FIRESTOPS

A. Apply in accordance with manufacturer's recommendations.

B. Acceptable Manufacturers:
1. 3M CP25WB+
2. Vimasco WC-5 FR
3. Flamemastic 77
4. Or Approved Equal.

C. Products which are affected by water are not acceptable.

PART 3 EXECUTION

3.01 GENERAL

A. Specific raceway types and applications are indicated on the drawings and/or in the raceway schedule. When not indicated on the Drawings and/or in the schedule Table A specifies the type of raceway required for each location and application by RACESPEC sheet. Use fittings, hubs and boxes as specified by the raceway type in RACESPEC. Unless otherwise indicated, in Table A, unscheduled conduit shall be galvanized rigid steel, RACESPEC type GRS.

TABLE A

Location	Application/Condition	RACESPEC
Indoor noncorrosive	Exposed	GRS
Indoor corrosive	Exposed	PGRS
Outdoor	Exposed	PGRS
Concealed	Embedded in concrete structure or beneath slab-on-grade	GRS
Underground	Instrumentation, communications and data signals encased in concrete, duct bank	GRS
Underground	Instrumentation, communications and data signals directly buried	PGRS
Underground	Power and control signals directly buried	PGRS
Underground	Power encased in concrete, duct bank	PVC8
Non-Classified	Final connection to equipment and light fixtures	LFS
Underground	Telephone service direct buried	PVC8
Architecturally finished areas	Final connection to light fixtures	FLEX
All Locations	Classified	PGRS

3.02 RACEWAY NUMBERING SYSTEM

A. General:
   1. Identify each conduit; rack shall be identified by a unique number shown in the Drawings.

B. Conduit Identification:
   1. Pressure stamp conduit numbers into a non-corrosive metal tag. Fix a tag with number to each end of each conduit and at each manhole, pullbox and handhole with Type 304 Stainless Steel wire.

3.03 CONDUIT

A. General:
   1. The number of directional changes of a conduit shall be limited to 270 degrees in any run between pull boxes.
   2. Conduit runs shall be limited to a maximum of 400 feet, less 100 feet or fraction thereof, for every 90 degrees of change in direction.
   3. Raceways shall be provided for lighting, receptacles, power, control, fire alarm, instrumentation, signaling, and grounding systems.

B. Indoor and Outdoor Conduit Systems:
   1. Unless otherwise indicated, in general, conduit inside structures shall be exposed.
   2. Unless otherwise indicated, the Contractor shall be responsible for determining conduit routing that conforms to the installation requirements set forth herein.
   3. Install conduit to conform to the requirements of the RACESPEC sheets and the following:
      a. Install exposed conduit either parallel or perpendicular to structural members and surfaces.
      b. Two or more exposed conduits in the same general routing shall be in parallel with symmetrical bends.
      c. Exposed conduit shall be run on supports spaced not more than 8 feet apart.
      d. Where three or more conduits are located in parallel run, space them out from the wall using framing channel.
      e. Where conduits are suspended from the ceiling, support systems shall comply with the requirements of this Section.
      f. Secure conduit rack supports to concrete walls and ceilings by means of cast-in-place anchors or framing channel concrete inserts.
      g. Conduits shall be at least 6 inches from high temperature piping, ducts, and flues with temperatures higher than 90 degrees C.

h. Install conduits between the reinforcing steel in walls or slabs which have reinforcing in both faces. In slabs which have only a single layer of reinforcing steel, place conduits under the reinforcement.
i. Route conduit clear of structural openings and indicate future openings.
j. Flash and seal watertight those conduits which pass through roofs or metal walls.
k. Neatly group conduit into any openings cut into concrete and masonry structures, and grout using non-shrink type grout.
l. During construction, cap conduits to prevent entrance of dirt, trash, and water.
m. Terminate exposed conduit stubs for future use with galvanized pipe caps.
n. Determine concealed conduit stubup locations from the manufacturer's shop drawings.
o. Terminate concealed conduit for future use in equipment or by galvanized couplings plugged flush with structural surfaces.
p. Where the Drawings indicate future duplication of equipment wired hereunder, provide concealed portions of conduits for future equipment.
q. Conduit installed horizontally shall allow headroom of at least 7 feet except where it may be installed along structures, piping, and equipment, or in other areas where headroom cannot be maintained because of other considerations.
r. Terminate all conduits that enter enclosures by fittings that ensure that the NEMA rating of the enclosure is not affected or changed.
s. Connect underground metallic or nonmetallic conduit that turns out of concrete, masonry or earth to a 90-degree elbow of PVC-coated rigid steel conduit before emergence.
t. Transitions from concealed or underground or embedded locations to exposed or aboveground or above-grade locations shall be made using type PGRS conduit for a distance of at least 12 inches on either side of transition.
u. Conduit across structural joints where structural movement is allowed shall have an OZ-Gedney "Type DX" or Crouse-Hinds "Type XD," bonded, weathertight expansion and deflection fitting of that conduit size.

C. Underground Conduit System:
1. All excavation, backfilling, and concrete work shall conform to respective Sections of these Specifications. Underground conduit shall conform to the following requirements:
a. Unless otherwise indicated, all underground conduits shall be concrete encased.
b. Concrete shall be Type C, per Section 03 30 01, with red dye mixed throughout mix.
c. Concrete encasement on exposed outdoor conduit risers shall continue to 3 inches above grade, with top crowned and edges chamfered.
d. Underground conduit bend radius shall be not less than 2 feet at vertical risers nor less than 3 feet elsewhere.
e. Unless otherwise indicated, underground conduits and conduit banks shall have 2 feet minimum earth cover.
f. Underground conduit banks through building walls shall be cast-in-place or concreted into boxouts with waterstops on all sides of the boxout. Waterstops shall be as specified in the Cast-in-Place Concrete Section 03 30 01.
g. Using a special rubber gasketed sleeve and joint assemblies, or with sleeves and modular rubber sealing elements, seal watertight those conduits not encased in concrete and passing through walls that have one side in contact with earth.
h. Immediately upon completion of pouring concrete, thoroughly swab conduits on the inside. After the concrete has set, and before backfilling, pull a mandrel, having a diameter equal to the nominal conduit inside diameter minus 1/2 inch, and not less than 4 inches long, through each conduit. If the mandrel showed signs of protrusions on the inside of the conduit, repair or replace the conduit.
i. Provide all spare raceways with a nylon pull rope.

3.04 RACEWAY SPECIFICATION (RACESPEC) SHEETS

A. The following RACESPECS are included in this Section:

RACESPEC Symbol	Raceway Description
FLEX	Flexible steel conduit
GRS	Galvanized rigid steel conduit
LFS	Liquidtight flexible steel conduit
PGRS	PVC coated rigid steel conduit
PVC8	Schedule 80 PVC conduit
WW	Wireway and auxiliary gutter

3.04 RACEWAY SPECIFICATION (RACESPEC) SHEETS

Raceway Identification:	**FLEX**
Description:	Flexible steel conduit.
Application:	Final connection to lighting fixtures in architecturally finished areas only.
Compliance:	UL 1.
Construction:	Spirally wound galvanized steel strip with successive convolutions securely interlocked.
Minimum Size:	1/2 inch.
Fittings:	Compression type.
Other:	FLEX shall be provided with an internal ground wire.
Installation	Flexible steel conduit shall be made up tight and with conductive “coppershield” thread compound.

3.04 RACEWAY SPECIFICATION (RACESPEC) SHEETS

Raceway Identification:	**GRS**
Description:	Galvanized rigid steel conduit.
Compliance:	ANSI C80.1, UL 6.
Finish:	Hot-dip galvanized after fabrication, inside and outside. Smooth finished surfaces.
Manufacturers:	Allied Tube and Conduit Corp., Wheatland Tube Co., or Approved Equal.
Minimum Size:	Unless otherwise specified, 3/4 inch for exposed, 1 inch for embedded, encased, or otherwise inaccessible.
Fittings:	Hubs: Insulated throat with bonding locknut, hot-dip galvanized. The hubs shall utilize a neoprene O-ring and shall provide a watertight connection. O-Z Gedney, CHM-XXT, or Approved Equal.
Unions:	Electrogalvanized ferrous alloy type Appleton UNF or UNY, Crouse-Hinds UNF or UNY, or equal. Threadless fittings are not acceptable.
Boxes:	
Indoor:	Type FD cast ferrous for all device boxes and for junction boxes less than 6 inches square. NEMA 12 welded steel 6 inches square and larger. Door shall have hinges with clamp locks. Boxes in process areas shall be NEMA 4 watertight.
	Conduit Bodies: Ferrous alloy type with screw taps for fastening covers. Gaskets shall be made of neoprene.
Outdoor and Wet Areas:	Type FD cast ferrous for all devices and for junction boxes less than 6 inches square. NEMA 4X stainless steel or nonmetallic for 6 inches square and larger.
Corrosive:	NEMA 4X stainless steel or nonmetallic.
Classified:	NEMA Class 7 cast ferrous.
Elbows:	
3/4″ through 1-1/2″:	Factory fabricated or field bent.
2″ through 6″:	Factory fabricated only.
Conduit Bodies:	
3/4″ through 4″:	Malleable iron, hot-dip galvanized, unless otherwise noted. Neoprene gaskets for all access plates. Tapered threads for all conduit entrances.
5″ and 6″:	Electrogalvanized iron or cast iron box.
Expansion Fittings:	Expansion fittings in embedded runs shall be watertight and shall be provided with an internal bonding jumper. The expansion material shall be neoprene and shall allow for 3/4-inch movement in any direction.
Manufacturers:	Appleton, Crouse-Hinds, Hubbel, O.Z. Gedney, Or Approved Equal.

Raceway Identification:	**GRS**
Installation:	Galvanized rigid steel conduit shall be made up tight and with conductive “coppershield” thread compound. Joints shall be made with standard couplings or threaded unions. Steel conduit shall be supported away from the structures using hot-dip galvanized malleable iron straps with nesting backs. Conduit entering boxes shall be terminated with a threaded hub with a grounding bushing. Exposed male threads on galvanized rigid steel conduit shall be coated with zinc-rich paint.

3.04 RACEWAY SPECIFICATION (RACESPEC) SHEETS

Raceway Identification:	**LFS**
Description:	Liquidtight flexible steel conduit.
Application:	Final connection to equipment subject to vibration or adjustment.
Compliance:	UL 360.
Construction:	Spirally wound galvanized steel strip with successive convolutions securely interlocked and jacketed with liquidtight plastic cover.
Minimum Size:	3/4 inch.
Fittings:	Cadmium-plated malleable iron body and gland nut with cast-in lug, brass grounding ferrule threaded to engage conduit spiral and O-ring seals around the conduit and box connection and insulated throat. Forty-five and 90-degree fittings shall be used where applicable.
Installation:	The length of flexible liquidtight conduit shall not exceed 15 times the trade diameter of the conduit. The length of liquidtight conduit shall not exceed 36 inches. Liquid-tight flexible steel conduit shall be made up tight and with conductive “coppershield” thread compound.

3.04 RACEWAY SPECIFICATION (RACESPEC) SHEETS

Raceway Identification:	**PGRS**
Description:	Galvanized rigid steel conduit, corrosion-resistant, polyvinyl chloride (PVC) coated.
Compliance:	ANSI C80.1, UL 6, NEMA RN1.
Finish:	PGRS shall be hot dipped galvanized rigid steel conduit. The inside and outside, as well as the threads shall be galvanized. A minimum 40-mil thick PVC coating shall be bonded to the outside of the conduit and the inside shall be coated with 2-mil urethane. Coating shall be free of pinholes. Bending of conduit shall not damage either the interior or exterior coating. Bond strength shall exceed the tensile strength of the PVC coat. Elbows shall be factory made and coated.
Minimum Size:	3/4 inch.
Fittings:	Similarly coated to the same thickness as the conduit and provided with Type 304 stainless steel hardware. A 2-mil urethane coating shall be applied to the interior, and the threads of all fittings and couplings. Conduit and fittings shall be manufactured by the same company.
Hubs:	Hubs for connection of conduit to junction, device, pull or terminal boxes shall be threaded and made of cast ferrous alloy. Hubs shall be galvanized steel and have insulating bushings with bonding locknuts. The hubs shall utilize a neoprene O-ring and shall provide a watertight connection.
Boxes:	
Non-Classified:	NEMA 250, Type 4X stainless steel or nonmetallic.
Classified:	NEMA 250, Type 7D cast ferrous.
Installation:	PVC-coated conduit shall be supported away from the structure using PVC-coated conduit wall hangers. All conduit threads shall be covered by a plastic overlap which shall be coated and sealed per manufacturer's recommendations. Plastic coated conduit shall be made tight with special wrenches and fittings designed for tightening PVC-coated conduit. All threads shall be protected against corrosion per NEC 300.6 (a) by liberally applying an approved electrically conductive, corrosion-resistant compound – "coppershield." Pipe wrenches and channel locks shall not be used for tightening plastic coated conduits. Damaged areas shall be patched, using manufacturer's recommended material. The area to be patched shall be built up to the full thickness of the coating. Painted fittings are not acceptable.

3.04 RACEWAY SPECIFICATION (RACESPEC) SHEETS

Raceway Identification:	**PVC8**
Description:	Rigid nonmetallic conduit, extra heavy wall thickness for all locations including direct bury under roadways and where exposed to physical damage.
Compliance:	NEMA TC2, UL 651.
Construction:	Schedule 80, high-impact, polyvinylchloride (PVC).
Minimum Size:	3/4 inch exposed; 1 inch embedded or encased.
Fittings:	PVC solvent weld type.
Boxes:	
Indoor:	NEMA Class 4, nonmetallic.
Outdoor and Corrosive:	NEMA Class 4X, nonmetallic.
Installation:	Exposed PVC conduit shall be run on supports spaced not more than 3 feet apart for conduits up to 1 inch 5 feet apart for conduits 1-1/4 inches to 2 inches and 6 feet apart for conduits 2-1/2 inches and larger. PVC conduit shall not be provided where it will be damaged by heat. PVC conduit shall have bell ends where terminated at walls.

3.04 RACEWAY SPECIFICATION (RACESPEC) SHEETS

Raceway Identification:	**WW**
Description:	Wireway and auxiliary gutter, flanged, oiltight type with hinged covers.
Compliance:	JIC EMP-1.
Minimum Size:	4-inch by 4-inch.
Finish:	Hot-dip galvanized after fabrication, inside and outside. Smooth finished surfaces.
Application:	As indicated on the Drawings.

END OF SECTION

SECTION 26 08 00

COMMISSIONING OF ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies the acceptance testing of electrical materials, equipment, and systems.

1.02 REFERENCED STANDARDS

A. This Section incorporates by reference the latest revisions of the embedded standard referenced herein. In case of conflict between the requirements of this Section and those of a listed document, the requirements of this Section shall prevail.

Reference	Title
ANSI	American National Standards Institute
ICEA	Insulated Cable Engineers Association
NEMA	National Electrical Manufacturer's Association
NETA	International Electrical Testing Association [NETA]

1.03 SUBMITTALS

A. Procedures: Section 01 33 00.

B. Draft Test Plan and Procedures in accordance with the latest NETA requirements, 90 days prior to initial functional checkout. Contractor shall use NETA Acceptance Testing Specifications for all new equipment installed under this contract and NETA Maintenance Testing Specifications for all existing equipment reused under this contract unless otherwise requested by the Project Representative.

C. Completed test report Forms 26 05 00-A, 26 05 00-B, 26 05 00-C, 26 05 00-D, and 26 05 00-K contained in Section 01 33 10.

D. Functional checkout procedures 45 days prior to performing initial functional checkout tests.

E. Final Test Report documenting test results and equipment and device settings.

F. NETA certification of Testing Contractor provided as part of test plan submittal.

1.04 QUALITY ASSURANCE

A. Qualifications: Testing Contractor shall be NETA certified.

1.05 APPLICATION

A. Where testing in accordance with this Section is required, the required tests, including correction of defects and retesting, shall be completed prior to energization of material, equipment, or systems.

1.06 TEST EQUIPMENT AND MATERIALS

A. Test instruments shall be calibrated to references traceable to the National Institute of Standards and Testing Technology and shall have a current sticker showing date of calibration, deviation from standard, name of calibration laboratory and technician, and date of recalibration.

PART 2 PRODUCTS [NOT USED]

PART 3 EXECUTION

3.01 TESTING

A. General:
   1. Prior to energizing the electrical circuits, perform the following tests. Unless otherwise indicated, a 1,000 volt megohmmeter shall be used for resistance measurements.
   2. Record test measurements on the Forms 26 05 00-A and 26 05 00-B.
   3. Submit a description of the proposed functional test procedures 45 days prior to the performance of functional checkout.

B. Insulation Resistance Measurements:
   1. General:
      a. Make general insulation resistance measurements on conductors and energized parts of electrical equipment.
      b. Unless otherwise indicated, minimum acceptable values of insulation resistance shall be in accordance with the applicable ANSI, ICEA, NEMA, or NETA standards for the equipment or material being tested.
      c. Record the ambient temperature at which insulation resistance is measured on the test form.
      d. Record insulation resistance measurements on Form 26 05 00-A.
      e. Insulation with resistance of less than 100 megohms is not acceptable.
      f. Document checks and measurements.

C. Conductor and cable tests:
   1. Measure phase-to-ground insulation resistance for all circuits 120 volts and above, except lighting circuits. Make measurements with motors and other equipment disconnected, except that solid state equipment shall be disconnected unless the equipment is normally tested by the manufacturer at voltages in excess of 1000 volts DC.
   2. Measure all removed unused power circuits , if insulation values are greater than 100 megohms cables shall be salvaged and handed to project representative on site.

D. Motor Tests:
   1. Complete Form 26 05 00-B for each motor after installation.
   2. Measure insulation resistance for all motors before being connected.
   3. Motors 50 HP and larger: Make insulation resistance measurements at the time of delivery and when connected.
   4. Insulation resistance values less than 100 megohms are not acceptable.
   5. Verify motor phase rotation.
   6. Verification may be accomplished by momentarily energizing the motor, provided the Contractor confirms that neither the motor nor the driven equipment will be damaged by reverse operation.
   7. Measure current on each phase with motor running at full load.

E. Distribution Equipment: Measure insulation resistance for transformers, panelboards, and other distribution equipment phase-to-phase and phase-to-ground.
   1. Functional Checkout:
      a. Perform functional testing in accordance with the manufacturer's requirements and the procedure provided in test plan and procedures.
      b. Prior to functional testing, adjust and make operational all protective devices.

c. Have Project Representative witness the testing.
d. Check that circuit breakers, meters and monitors are installed and function properly.
e. Check functional operation of switchboards, motor control centers, control panels, automatic transfer switches and other electrical equipment.
f. Prior to energization of equipment, perform a functional checkout of the control circuit. Checkout shall consist of energizing each control circuit and operating each control, alarm, or malfunction device and each interlock in turn to verify that the specified action occurs.
g. Document all test results and device settings in the final test report.

2. Prepare a Test Report summarizing the final test procedures and test results.

END OF SECTION

SECTION 26 09 11

INSTRUMENT TRANSFORMERS, METERS, SWITCHES, AND ACCESSORIES

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes accessories for switchboard assemblies.

1.02 REFERENCED STANDARDS

A. This Section incorporates by reference the latest revisions of the embedded standard referenced herein. In case of conflict between the requirements of this Section and those of a listed document, the requirements of this Section shall prevail.

Reference	Title
ANSI/IEEE C37.21	IEEE Standard for Control Switchboards
ANSI/IEEE C39.1	Requirements for Electrical Analog Indicating Instruments
ANSI/IEEE C57.13	Standard Requirements for Instrument Transformers

1.03 SUBMITTALS

A. Procedure: 01 33 00

B. Provide the following submittals:
1. Manufacturer's catalog cut sheets indicating the general features and dimensions of devices.
2. Interconnection requirements.
3. Burden, accuracy class and ratio data for instrument transformers.
4. Applicable operation and maintenance items: See Section 01 78 23.
5. Material list.

PART 2 PRODUCTS

2.01 INSTRUMENT TRANSFORMERS

A. Molded dry-type in accordance with ANSI/IEEE C57.13.

B. Volt-ampere rating suitable for carrying the specified load without overheating or exceeding the permissible accuracy for the transformer.

C. Potential Transformers: ANSI accuracy class of 0.3, equipped with current limiting fuses.

D. Current Transformers: Provided with the specified ratios with accuracy’s conforming to ANSI C37.21.

2.02 PANEL METERS

A. Indicating meters:
1. 4-1/2-inch square, semi-flush, mounted switchboard type.
2. Movement taut-band with an accuracy of plus or minus 1 percent of full scale.
3. Case: Black.
4. Scale: White with black markings with length of the scale greater than 7 inches over a deflection angle of 250 degrees.
5. Manufactured in accordance with applicable requirements of ANSI C39.1.

2.03 INDICATING LIGHTS

A. Switchboard Indicating Lights: PTT (Push To Test) LED type.

2.04 NAMEPLATES

A. Nameplates: Section 26 05 00.

2.05 POWER METERS

A. Digital Line Meter Analyzer and Protection (MA&P) Device.

B. See contract drawings for IP Addresses.

C. Features and functions specified below:
   1. Direct reading metered or calculated values of the items listed below and shall auto range between Units, kilo-units, and Mega-units for all metered values.
   2. Capable of displaying multiple parameters at once, including two user configurable custom screens displaying any seven of the parameters listed.
   3. Indicator LED shall status for safety and troubleshooting purposes.
   4. Time, date, software version and network address shall also be displayed.
   5. Accuracies indicated below to be of read or calculated values.
      a. AC Current (amperes) in A, B, and C phases, 3-Phase Average, Neutral (N) and Ground (G). Accuracy +0.2% (provide neutral and ground current transformer).
      b. AC Voltage (volts) for A-B, B-C and C-A, Phase Average, A-N, B-N and C-N, Average Phase to N, and N to G. Accuracy +0.2%.
      c. Real Power (watts), Reactive Power (vars), Apparent Power (VA) for each phase and system. Accuracy +0.4%.
      d. Real Energy (Whr), Reactive Energy (varhr), Apparent Energy (Vahr) for each phase and system. Accuracy +0.4%. Forward/Reverse/Net indication shall be provided.
      e. Frequency (hz). Accuracy +0.4%.
      f. Demand values for System Current (amperes), System Real Power (watts), System Reactive Power (vars) and System Apparent Power (VA).
      g. Power Factor both Displacement (60-cycle fundamental watts to VA) and Apparent (total watts to total vars including harmonics for A, B and C phases and system). Accuracy +0.8%.
      h. Current Percent Total Harmonic Distortion (THD) in A, B and C phases, and N.
      i. Voltage percent THD in A-B, B-C, and C-A phases, and A-N, B-N, C-N.
      j. K-Factor.
      k. Transformer Derating Factor (CBEMA Factor).
      l. Crest Factor.
      m. Available power at MCC is 480V, 3ph. Provide 120V transformer if needed.

D. Provide the following advanced analysis features:
   1. Trend Analysis Screens displaying the minimum and maximum values for each metered value, with all parameters time stamped to 1-second resolution.
   2. Demand Analysis screens displaying current (phases A, B, C and Average) and power (system real, reactive, and apparent, present demands and peak demands). Peak demands shall display time and date, stamped to within 1-second resolution. Demand Window Selection for metered demand values shall be selectable either as:
      a. A user selectable fixed window (programmable from 1 to 60 minutes).
      b. Sliding window method with programmable 1- to 60-minute subintervals, for power (kW, kvar, kVA) demand only.
      c. Initiated from a synch pulse for power (kW, kvar, kVA) demand only.
   3. Harmonic Analysis Screens shall be capable of being function key triggered to capture a high-speed wave form of 2 cycles of data sampled at 128 samples per cycle, simultaneously recording current in A, B and C phases, N, and G as well as all voltages A-B, B-C, and C-A phases, A-N, B-N

and C-N. Data captured shall include the magnitude or percent of the fundamental and the direction of harmonic source (phase angle) for all odd and even multiples of fundamentals from 2nd through the 50th.

4. Event Analysis Screens shall display data recorded for up to ten event conditions. The initiation level of the declaration of an event condition shall be field programmable for all measured parameters. For each event a description of the event, date, and time of event (1 - second resolution) shall be displayed. In addition, a capture shall be made of all metered values available and current and voltage distortion information harmonic.
5. Unit shall have logging capabilities, historical retrieval and removable storage media.
6. Capable of transmitting all data at time of the event via communications to the PLC or SCADA (Ovation) system interface for creating and displaying wave forms.
7. Event Condition Levels: Capable of being triggered when the programmed threshold is exceeded. All triggers shall have programmable time delays from 0.1 to 60 seconds except voltage disturbance, which shall be programmable from 2 to 3600 cycles.
8. Provide additional licensed copy of software to the county for programming and configuration.
9. Provide cables and other devices required for connection and communication with device.
10. Provide Ethernet patch cables at the power monitor end and the network switch end.
    a. Route cables neatly to the sides of the cabinet not to block ports.
    b. Patch cables shall not be of excessive length, field verify necessary length and obtain the proper length.
11. See drawings for IP addresses, patch cable location, patch cable color and switch port location.
12. Provide training for county staff on the set-up, programming and use of monitor.

E. Manufacturers:
    1. Schneider Electric – PowerLogic ION Meter
    2. Allen-Bradley – PowerMeter 5000
    3. Approved Equal

PART 3 EXECUTION

3.01 INSTALLATION

A. Install all accessories and devices per manufacturer's instructions.

B. Configuration of the Power Meters:
    1. Provide on-site configuration of the power meters including but not limited to:
        a. Providing functionality per Part 2.
        b. Communication with the Power Monitoring Ethernet network.

C. Configuration of Schneider’s EcoStruxure Power Monitoring Expert (PME) 9.0.
    1. Provide on-site configuration of the power monitoring server to add the new power monitors.
        a. The person that will be performing this configuration must be certified by Schneider as a EcoStruxure Power Monitoring Expert programmer with at least two years of experience.
    2. Work with King County’s West Point Operation’s System Engineering staff:
        a. Review changes to be implemented and system impact.
        b. Coordinate timing and changes to be implemented.

END OF SECTION

SECTION 26 09 16

MISCELLANEOUS ELECTRICAL DEVICES

PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies miscellaneous electrical control and power devices, relays, magnetic contactors, disconnect switches, manual starters, and overcurrent protection.

1.02 REFERENCED STANDARDS

A. This Section incorporates by reference the latest revisions of the embedded standard referenced herein. In case of conflict between the requirements of this Section and those of a listed document, the requirements of this Section shall prevail.

Reference	Title
NEMA 250	Enclosures for Electrical Equipment (1,000 volts maximum)
NEMA ICS 1	Industrial Controls and Systems: General Requirements
NEMA ICS 2	Industrial Controls and Systems: Controllers, Contactors, and Overload Relays, Rated 600 Volts AC
NEMA KS 1	Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum)

1.03 SUBMITTALS

A. Procedures: Section 01 33 00.

B. Product Data: Manufacturer's catalog data for products to be provided in the Work.

C. Applicable operation and maintenance information: Section 01 78 23.

PART 2 PRODUCTS

2.01 CONTROL DEVICES

A. Pushbuttons:
   1. Flush head, heavy-duty, with NEMA rating to match enclosure type.
   2. Operators: Red for stop functions and black for all other functions.
   3. Escutcheon legend as specified on the Drawings.
   4. Unless otherwise specified, use momentary contact type.
   5. Contact blocks:
      a. NEMA ICS 2 designation A600 except when switching circuits monitored by programmable controllers or other solid state circuits.
      b. Hermetically sealed, logic-read type for monitoring by solid state devices.
      c. Acceptable manufacturer:
         1) Allen-Bradley.
         2) Square D.
         3) Approved Equal.

B. Selector Switches:
   1. Heavy-duty, with NEMA rating to match enclosure type.
   2. Unless otherwise indicated, contact blocks and number of positions as required to perform the specified operations.
   3. Contact blocks: Rated as specified in this Section.
   4. Escutcheon legend: As indicated on the Drawings.

5. Acceptable manufacturer: Where solid state loads are switched, and the indicated contact development cannot be obtained with logic-read type contacts:
    a. Blue Line with Type D contacts.
    b. Approved Equal

C. Indicating Lights:
1. Indicating lights: 5 to 6 VDC light emitting diodes (LEDs) with push-to-test feature.
2. Testing: As a group using a common lamp test button.
3. Indicating light colors: Per Section 40 67 00.
4. Heavy-duty, with NEMA rated socket/wiring to match enclosure type.

D. Control Stations:
1. Classification, unless otherwise specified:
    a. Indoor locations: NEMA 12.
    b. Outdoor locations: NEMA 3R or 4.
    c. Corrosive areas: Nonmetallic NEMA 4X.
    d. Hazardous areas: NEMA 7.
2. Pushbuttons: Protective Hypalon boots, in wet or corrosive environments.
3. When indicating lights are specified, size to accommodate the transformer type lights.
4. Acceptable Manufacturer:
    a. Allen-Bradley, 800 H series.
    b. Crouse-Hinds, NCS series.
    c. Approved Equal.

2.02 CONTROL RELAYS

A. Load-switching Control Relays:
1. When used for switching loads (solenoids, actuators, contactors, motor starter coils, etc.): Heavy-duty machine tool type.
2. Relays that have contacts used for remote interlocking or when the switching load is not shown: Heavy-duty machine tool type.
3. Contacts: As a minimum, 4-pole and field interchangeable to either normally open or normally closed. Relay shall be capable of accepting a 4-pole adder.
4. AC relays: NEMA A600 contact ratings and electrical clearances for up to 600 volts.
5. DC relays: NEMA P300 contact ratings and electrical clearances for up to 250 volts.
6. Acceptable Manufacturer:
    a. Allen Bradley Bulletin 700.
    b. Square D Class 8501.
    c. Approved Equal.

B. Logic Level Switching Control Relays:
1. Minimum of three SPDT, gold-flashed, fine silver contacts rated 3 amps resistive at 120 VAC or 28 VDC.
2. Plug-in type with heavy-duty, barrier-protected screw terminal sockets and clear polycarbonate dust cover with clip fastener.
3. AC models: Neon lamp indicator wired in parallel with coil.
4. Acceptable manufacturer (Control relays used for switching solid-state logic and signal circuits):
    a. Allen Bradley or Potter Brumfield series KUP.
    b. Approved Equal.

C. Latching Relay:
1. Electrically actuated latching relay or an industrial relay with an electrically operated latching attachment.
2. Latching mechanism: One SET coil and one RESET coil rated for continuous duty on 120 VAC, or as otherwise shown on the Drawings.
3. Maintain the last state upon a power failure.
4. Contacts: Rated B300 and hermetically sealed in a glass envelope.

5. Normally open and normally closed as shown on the Drawings.
6. Acceptable manufacturer:
    a. Allen-Bradley.
    b. Cutler-Hammer.
    c. Approved Equal.

D. Timers:
1. Timing relays:
    a. Solid-state, pulse count type using a high frequency RC oscillator and integrated circuit counter for timing.
    b. Do not use electrolytic capacitors in the timing circuits.
    c. Time delays from 0.1 seconds to 48 hours, adjustable over a 20:1 range.
    d. Timing adjustment: Knob adjustment on the top of the unit.
    e. On-delay, off-delay, and single-shot timing models.
    f. Reset in 0.03 seconds or less.
    g. Timer accuracy: Plus or minus 2.0 percent under normal conditions.
    h. Two NEMA form-C timed contacts.
    i. Acceptable manufacturer:
        1) Agastat, STA series.
        2) Agastat BTSAIISC with locking bail STAOOI if equal socket.
        3) General Electric.
        4) Approved Equal.

2.03 MAGNETIC CONTACTORS

A. Motor contactors:
1. Designed for continuous operation of induction motors at 600 volts or less at 60 Hz and comply with NEMA ICS 2-321.
2. Minimum contactor size: Unless otherwise indicated, NEMA size 1.
3. Supply the contactor with a normally open auxiliary contact for use as a hold-in contact as a minimum. Provide additional contacts as indicated.
4. Additional contacts as needed.
5. The coil voltage, frequency, and number of poles to be as specified.

2.04 SAFETY DISCONNECT SWITCHES

A. Heavy-duty, safety type rated 600 volts AC complete with or without current limiting fuses sized to match switch ampere rating as shown on the Drawings.

B. Classification, unless otherwise specified:
1. Indoor enclosures: Unless otherwise indicated, NEMA 12. See Section 26 05 33.
2. Outdoor or corrosive areas: NEMA 4X, nonmetallic.
3. Hazardous areas: NEMA 7.
4. Classified areas: Suitable for the specified classification.

C. Operating handle: Capable of being padlocked in the "off" position.

D. Operator: Positive, quick-make, quick-break mechanism.

E. Switch Mechanisms: One auxiliary contact rated B150, per NEMA ICS 2-125, that opens before the switch blades.

F. Horsepower rated for motors and comply with NEMA KS 1.

G. Defeatable door interlocks that prevent the door from opening when the operating handle is in the "on" position.

H. Switches shall have line terminal shields.

I. Acceptable Manufacturer:
   1. Westinghouse Type H-600.
   2. Cuttler Hammer.
   3. General Electric.
   4. Siemens.
   5. Square D.
   6. Approved Equal.

2.05 MANUAL STARTERS

A. Manual starters:
   1. Horsepower rated quick-make, quick-break, toggle mechanism together with 1 or 2 overloads as specified.

2.06 OVERCURRENT PROTECTION

A. Circuit Breakers:
   1. Thermal magnetic, molded-case type with the ampere rating as specified.
   2. Unless otherwise indicated, circuit breaker interrupting rating:
      a. New breaker shall match MCC AIC rating.
      b. Shall be equipped with solid state trip settings.

2.07 ELAPSED TIME INDICATORS

A. Panel-mounted, non-resettable, six digit, hour indicator, rated 120 volts AC, 60 Hz.

2.08 TEMPERATURE TRIP RELAY

A. Capable of monitoring electric motor winding temperatures based on input signals from three 10 ohm copper 3-wire resistance temperature detectors (RTD).

B. Equipped with light emitting diodes (LED) to indicate which RTD is at the highest temperature. The highest temperature shall be internally compared to two trip settings to trip SPDT output relays. The output relays shall be settable at different temperatures and shall de-energize at the set point on increasing temperature.

C. Relay Contact Minimum Rating: 240 VAC, 5A non-inductive.

D. Output Signal: 0 to 1 mA, linearly proportional to the temperature of the hottest RTD.

E. Powered by 120 VAC, 60 Hz.

F. Acceptable Manufacturer:
   1. Allen Bradley.
   2. Cuttler Hammer.
   3. Approved Equal.

2.09 SPEED ADJUSTMENT POTENTIOMETER

A. Single-turn, heavy-duty potentiometer.

B. Molded resistance track rated at 2 watts 500 volts. Resistance value: As shown on the Drawings, or if not shown, then suitable for the application.

C. Equipped with a positive positioning feature to prevent backlash and movement due to vibration.

D. Bushing mounted using a NEMA Type 13 oiltight mounting. Include a legend plate with graduated markings from 0 to 100 percent and the word “SPEED.”

E. Acceptable Manufacturer:
   1. Cuttler Hammer
   2. Allen-Bradley 800T.
   3. Approved Equal.

2.10 SELECTOR SWITCHES

A. For Fans: 600V, heavy duty two-position, four-circuit, suitable for Class 1, Division 2 area.

B. Indicating plate markings as follows: “Enable-Stop.”

C. Acceptable Manufacturer:
   1. Appleton.
   2. Crouse-Hinds EDS 21272.
   3. Approved Equal.

2.11 NAMEPLATES

A. For all control stations, relays, timers, motor contactors and disconnect switches: Per Section 26 05 00.

PART 3 EXECUTION

3.01 GENERAL

A. Mount control stations, contactors, and safety disconnect switches 48 inches above finished floor.

3.02 FIELD CHECKOUT AND TESTING

A. Checkout each miscellaneous electrical device for:
   1. Proper mounting.
   2. Proper interconnections.
   3. Absence of shorts and grounds.
   4. Proper function of motor start and control equipment.
   5. Power supply.
   6. Field devices.

B. Checkout systems:
   1. Proper interconnections.
   2. Absence of shorts and grounds.

C. Field Testing – to be provided as part of the system and operational testing.
   1. Test all products per Section 26 08 00.

END OF SECTION

SECTION 26 43 20

ARC FLASH STUDY

PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies the arc flash study and report for MCC's 724-MCC02 ,724-MCC03 providing power to the electrical Turbo Blowers. The "electrical power system" starts at and includes the highest voltage buses. Arc flash study shall include the method and recommendation in determining proper Personal Protective Equipment (PPE) and proper labeling of equipment as specified in this Section.

1.02 QUALITY ASSURANCE

A. Referenced Standards: This Section incorporates by reference the latest revision of the following documents. These references are a part of this Section as specified and modified. In case of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

Reference	Title
IEEE 1584	IEEE Guide for Performing Arc-Flash Hazard Calculations
NFPA 70	National Electrical Code
NFPA 70E	Standard for Electrical Safety Requirements for Employee Workplaces
OSHA 29-CFR, Part 1910 Subpart S	Occupational Safety and Health Standards: Electrical

B. Qualifications:
   1. Manufacturer of the switchboard or electrical testing service preparing the report: Regularly engaged in power system studies.

C. Certification:
   1. Arc flash report shall be prepared, stamped, dated, and signed by a Professional Engineer registered in the state of Washington.

1.03 SUBMITTALS

A. Procedures: Section 01 33 00.

B. Certified arc flash report.

C. Templates of arc flash warning labels to be applied.

D. Copies of all actual arc flash warning labels applied to 724-MCC02, 724-MCC03 and Main Circuit Breaker at Turbo Blowers 1 and 2.

E. Electronic models, data and databases used to develop reports and studies. Electronic information shall be compatible with SKM Power Tools version 6.5 or newer.

1.04 ARC FLASH REPORT

A. Prepare a report summarizing the arc flash study and conclusions or recommendations which may affect the integrity of the electric power distribution system.

B. All calculations shall be prepared, stamped, dated, and signed by a Professional Engineer registered in the state of Washington.

C. Perform arc flash calculations to determine the incident energy, arc flash boundary, and minimum PPE requirements for locations throughout the power system.

D. Arc flash warning labels:
   1. Produced and attached to the electrical equipment.
   2. Indicate approach boundaries, incident energy level, and the minimum PPE that is required when servicing the equipment within the arc flash boundary.

E. As a minimum, include the following in the report:
   1. Equipment manufacturer's information used to prepare the study.
   2. Assumptions made during the study.
   3. Reduced copy of the one line drawing.
   4. Arc flash evaluations summary spreadsheet as specified in this Section.
   5. Bus detail sheets as specified in this Section.
   6. Arc flash warning labels printed in color on adhesive backed labels.

F. Submit report a minimum of 60 days before energizing electrical equipment.

1.05 ARC FLASH STUDY

A. Perform an arc flash hazard study after the short circuit and protective device coordination study has been completed.

B. Coordinate with Authority Having Jurisdiction (AHJ) for site-specific requirements.

C. For each major part of the electrical power system, determine the following:
   1. Flash hazard protection boundary.
   2. Limited approach boundary.
   3. Restricted approach boundary.
   4. Prohibited approach boundary.
   5. Incident energy level.
   6. PPE hazard/risk category.
   7. Type of PPE required.

D. Produce arc flash warning labels as indicated in PART 3.

E. Produce bus detail sheets that list the items in Paragraph 1.05B and 1.05C.1 through 7 and the following additional items:
   1. Bus name.
   2. Upstream protective device name, type, and settings.
   3. Bus line to line voltage.

F. Produce an arc flash evaluation summary sheet listing the following additional items:
   1. Bus name.
   2. Upstream protective device name, type, settings.
   3. Numbering to match existing and contract document identification numbers.
   4. Bus line-to-line voltage.
   5. Bus operating fault current.
   6. Protective device bolted fault current.
   7. Protective device arcing fault current.
   8. Protective device trip/delay time (SEC).
   9. Breaker opening time (SEC).
   10. Ground.
   11. Equipment type.
   12. Gap.
   13. Arc flash boundary (IN).
   14. Working distance (IN) per IEEE Table 3 default values.

15. Incident energy (CAL/cm^2).
16. Required protective fire rated clothing type and class (PPE).

G. Analyze the short circuit, protective device coordination, and arc flash calculations and highlight any equipment that is determined to be underrated or causes an abnormally high incident energy calculation. Propose approaches to reduce the energy levels.

H. Where the study and associated report is completed on equipment not installed under this contract the study and associated report shall be redone at the contractor's expense. The contractor and not the manufacturer of the electrical equipment or the electrical testing service is responsible to acquire the necessary equipment information for the electrical equipment the contractor is proposing to install. This information shall be provided to the manufacturer of the electrical equipment under the study or to the electrical testing service or to the Engineer performing the arc flash study for their use in the creation of the study and subsequent report.

PART 2 PRODUCTS

2.01 LABELS

A. Provide weatherproof labels for equipment mounted outdoors.

B. Provide following data on each arc flash hazard warning label:
1. Flash Hazard Protection Boundary.
2. Incident Energy Level.
3. Required Personal Protective Equipment (PPE) Category with brief description.
4. Shock hazard when cover is removed.
5. Limited Approach Boundary.
6. Restricted Approach Boundary.
7. Prohibited Approach Boundary.
8. Include date of calculation, utility short circuit capacity and voltage as of that date.

PART 3 EXECUTION

3.01 GENERAL

A. Provide a current up-to-date short circuit and protective device coordination.

B. The Contractor shall work with the Study Firm for implementing the Arc Flash Hazard sign installation requirements for electrical equipment as specified in NEC Article 110.16 Flash Protection and NFPA 70E (2012).

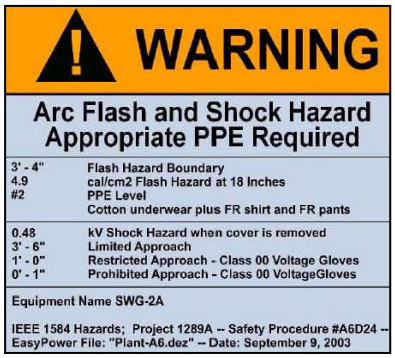
C. Perform the arc flash study in accordance with NFPA 70E, OSHA 29-CFR, Part 1910 Subpart S, and IEEE 1584 Standards.

D. Perform the studies using actual equipment data and the data from the same manufacturer of protective relay devices as being provided by the switchboard manufacturer.

E. Provide arc flash warning labels on equipment meeting standard ANSI Standard Z535.4-1998 and as approved by the Project Representative and the Local Authority Having Jurisdiction.

F. Labels: in color with adhesive backs. Labels to include all of the following:
1. WARNING - ARC FLASH HAZARD.
2. Date of Analysis.
3. Flash Hazard Category.
4. Incident Energy Level at 18 inches in cal per cm. sq.
5. Flash Hazard Boundary.
6. Personal Protection Equipment requirement within the Flash Hazard Boundary.

G. Provide a list of lockout and tagout devices that are compatible with the equipment.



END OF SECTION

SECTION 40 05 01

PIPING SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies:
   1. Process piping and ducting,
   2. General requirements for piping systems associated with mechanical systems,
   3. Piping and ducting generally exposed within built spaces, and/or
   4. Piping and ducting closely associated with a treatment or pumping facility.

B. More detailed specifications for the components listed in the Piping System Specification Sheets (PIPESPEC) may be found in other sections of Division 40. Use this Section in conjunction with those sections.

C. Fitting and Coupling Compatibility: To assure uniformity and compatibility of piping components, fittings and couplings for grooved end piping systems shall be furnished by the same manufacturer.

1.02 REFERENCED STANDARDS

A. This Section incorporates by reference the latest revisions of the embedded standard referenced herein. In case of conflict between the requirements of this Section and those of a listed document, the requirements of this Section shall prevail.

Reference	Title
ASME A13.1	Scheme for the Identification of Piping Systems
ASME B1.20.1	Pipe Threads, General Purpose
ASME B16.5	Pipe Flanges and Flanged Fittings, NPS ½ – NPS 24
ASME B16.9	Factory-Made Wrought-Steel Buttwelding Fittings
ASME B16.11	Forged Fittings, Socket Welding and Threaded
ASME B31.3	Process Piping
ASTM A53	Pipe, Steel, Black and Hot-Dipped Zinc-Coated, Welded and Seamless
ASTM A312	Seamless and Welded Austenitic Stainless Steel Pipes
ASTM A403	Wrought Austenitic Stainless Steel Piping Fittings
ASTM A774	As-Welded Wrought Austenitic Stainless Steel Fittings for General Corrosive Service at Low and Moderate Temperatures
ASTM A778	Welded, Unannealed Stainless Steel Tubular Products
AWWA C200	Steel Water Pipe - 6 Inches and Larger
AWWA C205	Cement-Mortar Protective Lining and Coating for Steel Water Pipe—4 In. and Larger--Shop Applied
AWWA C206	Field Welding of Steel Water Pipe
AWWA C207	Steel Pipe Flanges for Waterworks Services--Sizes 4 Inches Through 144 Inches
AWWA C208	Dimensions for Fabricated Steel Water Pipe Fittings
AWWA C209	Cold-Applied Tape Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Water Pipelines
AWWA C210	Liquid Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines
AWWA C214	Tape Coating Systems for the Exterior of Steel Water Pipelines

Reference	Title
AWWA C606	Grooved and Shouldered Joints
UPC	Uniform Plumbing Code

1.03 SUBMITTALS

A. Procedure: Section 01 33 00.

B. Provide the following submittals:
1. For each piping system, catalog cuts and other information for pipe, fittings, linings, coatings, and valving to be used for each pipe size category.
2. Certification that each length of pipe has been pressure tested and has satisfactorily passed such tests.
3. A copy of all related contract schematic, structural, and mechanical drawings with all piping, foundations, supports, and layout sizes and dimensions requiring Contractor confirmation marked.
4. Pipe hangers and supports including seismic bracing shall be contractor-designed. Provide submittals as specified in Sections 40 05 41 and Section 40 05 42.

1.04 DEFINITIONS

A. Pressure terms used in Section 40 05 01 and elsewhere in the technical specifications are defined as follows:
1. Maximum: The greatest continuous pressure at which the piping system operates.
2. Test: The hydrostatic pressure used to determine system acceptance.
3. PSI: Pressure above atmospheric; gauge pressure (PSIG).

PART 2 PRODUCTS

2.01 MATERIALS

A. Unless otherwise specified, provide piping materials listed in the PIPESPEC, including pipe, gaskets, fittings, joint assemblies, connections, linings and coatings, conforming to detailed specifications for each type of pipe and piping appurtenance specified in other sections of Division 40.

B. Where temporary piping and valving are required, piping material and accessories shall be selected by the Contractor and submitted to the Project Representative for review. Such piping shall be suitable for operation at the test pressure and maximum range of operating service temperature of the permanent piping system which the temporary piping is replacing, as specified in the PIPESPEC. Plastic, steel, RCP, ductile iron, and polyethylene pipe may all be used at the Contractor's discretion in both buried and exposed service. Temporary piping shall be provided with supports at intervals which prevent sagging or liquid accumulation.

2.02 PIPING IDENTIFICATION

A. Plastic Coding Markers:
1. Plastic markers for coding pipe shall comply with ASME A13.1. Markers shall be the precoiled type that is easily removable. Markers shall be resistant to petroleum based oils and grease and shall meet criteria for humidity, solar radiation, rain, salt-fog, and fungus, as specified by MIL-STD-810 and shall withstand a continuous operating temperature range of - 40 to 250 degrees F. Markers shall not be the individual letter type but shall be manufactured and applied in one continuous length of plastic including directional arrows. Legends and arrows shall be subsurface printed on polyester and overlaminated with Tedlar. Marking Services Style MS-995, Brady Style B-915, or approved equal.

2. Minimum marker lengths and letter heights:

Outside Diameter of Pipe or Covering	Minimum Length of Marker	Minimum Height of Letters
Less than 1½ inch	8 inch	½ inch
1½ to 3 inch	8 inch	1⅛ inch
Greater than 3 inch	12 inch	2¼ inch

   a. Outside diameter shall include insulation and protective wrapping.
   b. Pipe markers shall include uni- and bidirectional arrows in the same sizes and colors as the legend.
3. Color:
   a. Background color shall match existing or shall be as specified in the PIPESPEC.
   b. Legends and arrow color shall match existing or shall be white on blue, black, or red backgrounds; black on all other color backgrounds.

2.03 VALVES

A. Valves of the same size and service shall be provided by a single valve manufacturer. Packing shall be non-asbestos material. Actual length of valves shall be within 1/16 inch (plus or minus) of the manufacturer's specified length. Flanges shall meet the requirement of ASME B16.5. Push-on and mechanical joints shall meet the requirements of AWWA C111.

PART 3 EXECUTION

3.01 GENERAL

A. Location:
   1. Provide piping as specified except for adjustments to accommodate architectural and structural features.
   2. Coordinate with electrical construction.

B. Potable Water Connections: Not Used.

C. Pipe Support, Anchorage and Bracing:
   1. Provide pipe supports and seismic restraints in accordance with Section 40 05 41 and 40 05 42.

D. Bedding and Backfill: Not Used.

E. Joint and Fitting Options:
   1. Pipe connection (joint and fitting) options for a particular piping system shall be as specified on the particular system PIPESPEC sheet.
   2. Takedown couplings shall be provided for all piping systems in accordance with Section 40 05 40. Takedown couplings shall be provided around equipment and at standard pipe lengths for all straight runs of pipe.
   3. Continuous welding for straight runs of pipe is acceptable only where the individual PIPESPEC sheet allows welding as a connection option.
   4. Where connections are shown, the connections shall be specifically where shown; however, if several connection options are allowed for the particular piping system on the PIPESPEC sheet, then any option may be consistently used, for example, if flanged or grooved are acceptable and grooved are shown, then flanged may be substituted.
   5. Integrity of rigid, non-rotating connections must be maintained at all valves and other equipment.

F. Connections to Existing Piping:
   1. Isolation valves, as specified in this Section, shall be installed at every location where new pipes connect to existing piping systems.
   2. Isolation valves shall be used to minimize existing system shutdowns and existing system interference with new pipeline testing.

3.02 PIPING AND VALVE IDENTIFICATION

A. Pipe Coding:
   1. After application of the specified coating and insulation systems, label all exposed piping, including piping in ceiling spaces, pipe trenches, pipe chases and valve boxes with plastic markers as specified.
   2. Locate legend markers and directional arrows at each side of walls, floors and ceilings, at one side of each piece of equipment, at piping intersections, inside valve boxes and vaults, and at approximately 20-foot centers as required in Part 3.
   3. Attach with stainless straps, plastic straps are not acceptable.

B. Valves: Stainless steel tags or nameplates per Section 43 05 01 with the specified valve identification.
   1. Flanged valves: Install on valve flanges in a position visible from floor level.
   2. Flangeless valves 6 inches in diameter and smaller: Attach to the valve stem by 0.063-inch minimum stainless steel wire.
   3. Flangeless valves 8 inches in diameter and larger: Attach to the valve body by self-tapping corrosion resistant metal screws.

3.03 PIPE INSTALLATION

A. Protection of Work:
   1. Cover openings in piping, and temporarily seal to protect from contamination.
   2. Protect materials and equipment from damage due to environmental conditions. Use protective cover, and protect from surface water by using raised platforms.
   3. Protect unfinished work at end of each workday from damage, contamination and moisture by use of plugs, caps or covers.
   4. Protect piping and valves from damage pending performance of system tests.

B. Installation:
   1. Install piping parallel to walls. Clear obstructions, preserve headroom, and keep openings and passageways clear.
   2. Should structural difficulties or other work prevent running of pipes or setting of equipment at locations indicated, necessary minor deviations will be allowed, as approved by the Project Representative.
   3. Use couplings only where required pipe runs between fittings are longer than standard length of pipe being used.
   4. Make changes in direction only with fittings.
   5. Use proper length bolts for each size flange on flanged connections. Bolts with excessive length of exposed threads will not be permitted. Minimum of 3 full threads shall be exposed beyond nut after tightening assembly.
   6. Prevent entry of foreign matter during handling, assembling and installation. Use compressed air, wire brush, solvent and other acceptable means to remove residual scale, dirt and other foreign matter from interior of piping before final connections are made. Protect open ends of pipe by capping, plugging or other acceptable means.
   7. Install piping with sufficient pitch to ensure adequate drainage and venting.
   8. Provide unions or flanges in piping connections to equipment.
   9. Electrically isolate connections between dissimilar metal piping with dielectric couplings or fittings.
   10. Install class of piping as indicated.
   11. Do not run water piping over electric switchboards, transformers or electric motor starters.

C. Pipe Joints and Connections:
   1. Cut pipe with appropriate tool and deburr. Make joints tight. Test and remake leaky joints with new materials. Do not use thread cement or caulking to remake joints. Do not use sharp-toothed wrench in making up brass pipe or chrome-plated items.
   2. Provide thread forms and length in accordance with ASME standards. Use lubricant or sealant on male threads suitable for proposed pipe service.
   3. Clean joint before soldering. Use appropriate flux and alloy for operating temperature level as indicated.
   4. Apply standard rules for welding of pipe joints as contained in ASME Standard Code for pressure piping including welding procedures, qualification of welders and testing. Follow applicable local safety codes.
   5. Provide gasket coated with recommended lubricant between contact faces of flanges.

D. Unions, Flanges and Gaskets:
   1. Provide unions where indicated and at each threaded or soldered connection to equipment, tanks and valves with the following exceptions:
      a. Only 1 union is required at each manually operated threaded valve.
      b. None required at compression stops.
      c. Locate unions so piping can be easily disconnected for removal of equipment or valve.
      d. Provide flanges at each flanged connection to equipment and valves. Provide matching flange faces at each connection. Tighten fastener system to indicated torque.

E. Pipe Hangers and Supports:
   1. Provide piping systems with anchorages, sway braces, guides and supports as required by applicable portions of ASME B31.
   2. Provide support for vertical and horizontal loads, including vibration imposed loads.
   3. Necessary hangers and supports including beam and purlin clamps, rods, pipe rolls, angles, channels and plates as well as any changed from indicated design, shall have prior approval of the Project Representative.
   4. Use of building structural steel for supporting hangers will be permitted only where indicated or approved by Project Representative.
   5. Do not weld transversely across tension flange or any member under stress, use bracing, girts and other secondary members for support, nor burn or drill holes in building steel.
   6. Support vertical piping with approved steel brackets to prevent swaying, sagging, vibration and resonance.
   7. Allow for thermal expansion between supports or anchors.
   8. Do not use flat steel strap hangers.
   9. Do not support piping by wire, rope, strap, chain, wood or similar devices.
   10. Provide pipe hangers of same size, or nearest commercial size available, as pipe or tubing on which they are to be used. Allow for thickness of insulation in sizing hangers.
   11. Supporting structures, including supporting frames, anchors and guides common to mechanical and electrical work, shall be submitted and have the prior approval of the Project Representative.
   12. Use adjustable iron hangers for 1¼-inch and smaller pipe, and clevis type for 1½-inch and larger pipe.
   13. Protect dissimilar metals by wrapping pipe with 1/16 inch thick neoprene.

3.04 TESTING

A. General:
   1. Upon completion of piping, but prior to application of insulation on exposed piping, test the piping systems.
   2. Pressures, media and test durations shall be as specified in the PIPESPEC. Equipment which may be damaged by the specified test conditions shall be isolated.
   3. Testing shall be performed using calibrated test gages and calibrated volumetric measuring equipment to determine leakage rates. Each test gage shall be selected so that the specified test pressure falls within the upper half of the gage's range.

4. Unless otherwise specified, completely assemble and test new piping systems prior to connection to existing pipe systems.
5. Notify the Project Representative at least one hour prior to each test.
6. Unless otherwise specified, testing, as specified herein, shall include existing piping systems which connect with new pipe systems. Existing pipe shall be tested to the nearest existing valve.
7. Any piping which fails the test shall be repaired. Repair of existing piping will be considered and paid for as extra work.
8. Where testing existing chlorine and sulfur dioxide systems to the nearest isolation valve: first notify the Project Representative; the Contractor shall provide a tee in the new line adjacent to the valve. The branch outlet on the tee shall be valved and used for cleaning, pressure testing, draining, and drying the line. Unless otherwise indicated, the existing chlorine or sulfur dioxide system shall not be shut down during testing or connecting the tee and valve. Prior to placing the line in service, the valve on the branch outlet shall be plugged or sealed with a blind flange or threaded plug. Contractor shall be responsible for all damage to the existing system as a result of this work.
9. Testing of the ribbon anode and electrical isolation effectiveness should include the following. After installation of electrical isolation equipment, effectiveness shall be judged in accordance with NACE RP-0286. The magnesium ribbon anode installation shall be judged in accordance with NACE RP-0169. No practical testing of the zinc ribbon anode is possible because the anode is isolated from the environment until the polyethylene wrap is compromised.

B. Gas and Air Systems:
1. The allowable leakage rate for hazardous gas systems, insulated systems, and systems tested with water shall be zero at the specified test pressure throughout the specified test period. Hazardous gas systems shall include sulfur dioxide, chlorine, propane, sludge gas and natural gas systems. Unless otherwise specified for each pipe system, the allowable leakage rate for other systems tested with air shall be based on a maximum pressure drop of 5 percent of the specified test pressure for the duration of the period. Prior to starting a test interval using air, the air shall be at ambient temperature and specified test pressure.
2. Hydrostatic Testing: Not Used
3. Drying: Not Used
4. Nitrogen or Air Pressure Testing:
   a. The Contractor may use nitrogen gas or oil-free dry air to test steel lines. Testing consists of gradually introducing nitrogen gas or dry air up to 50 PSI and maintaining this pressure while testing the line for leaks with soapy water. When the system is free from leaks at this pressure, the test pressure shall then be increased in increments of 50 PSI up to a maximum of 150 PSI. At each stepped increase in pressure, the Contractor shall check for leaks and take corrective action as necessary. When the system is free from leaks at the final test pressure, the system shall then be depressurized, the test source disconnected, and the system capped to prevent the entrance of water.
   b. For testing with nitrogen gas, the Contractor shall use cylinders of dry high purity nitrogen gas, nitrogen-handling cylinder mounted pressure regulator 0 to 300 PSI, and necessary fittings and adapters to complete connection between the source and system header. Pressure regulator shall be self-relieving type which vents to the atmosphere and include a throttling valve.
   c. For testing with air, the Contractor shall provide oil-free air with a relative humidity of zero. All fittings, adapters, and accessories, pressure regulator and throttling valve shall be suitable for pressure testing with air and rated for 300 PSI service.

3.05 CLEANING AND FLUSHING

A. General:
1. Piping systems shall be cleaned following completion of testing and prior to connection to operating, control, regulating, or instrumentation equipment.
2. The Contractor may, at its option, clean and test sections of buried or exposed piping systems.
3. Use of this procedure, however, will not waive the requirement for a full pressure test of the completed system.

4. Unless specified otherwise, piping 24 inches in diameter and smaller shall first be cleaned by pulling a tightly fitting cleaning ball or swab through the system. Piping larger than 24 inches in diameter may be cleaned manually or with a cleaning ball or swab. Upon completion of the cleaning, connect the piping systems to related equipment and structures.

B. Gas and Air Systems:
   1. Unless otherwise specified, gas and air system piping 6 inches in diameter and smaller shall be blown out, using air or the testing medium specified.
   2. Piping larger than 6 inches shall be cleaned by having a swab or "pig" drawn through the separate reaches of pipe.
   3. After connection to the equipment or structure, it shall then be blown out using the equipment.
   4. Upon completion of cleaning, the piping shall be drained and dried with an air stream.
   5. Sludge gas, natural gas and propane systems shall be purged with nitrogen and a nitrogen pad maintained at 10 psi until put in service.

C. Liquid Systems: Not Used

3.06 PIPING SPECIFICATION SHEETS (PIPESPEC)

A. Piping and valves for groupings of similar plant processes or types of service lines are specified on individual piping specification sheets. Piping systems are grouped according to the chemical and physical properties of the fluid conveyed and/or by the temperature or pressure requirements. Each grouping of systems is identified by a piping system number. Piping systems specified and shown on the Drawings are arranged by designated symbols (abbreviations) as shown in paragraph 3.07 (Table A). Tables also indicates the system number, fluid category, and pipe marker background color of each service. The individual PIPESPECs are found in paragraph 3.07.

B. Unless otherwise shown on Drawings or Drawing schedule, piping system materials, fittings and appurtenances are subject to requirements of specific piping specification sheets.

3.07 PIPESPEC SHEETS

A. Table A: Process and Facility Piping Systems

Symbol	Service	System	Fluid Category	Pipe Marker
AA	Agitation Air	1	Air	Orange

PIPING SYSTEM 1

Piping Symbol/Service:	AA – Agitation Air PA – Preaeration Air
Test Requirements:	
Test Medium:	Air. Ref. Section 40 05 01
Pressure:	20 PSI
Duration:	120 minutes
Allowable leakage:	5% pressure drop. Ref. Section 40 05 01.
Gasket Requirements:	
Flanged:	Compressed gasketing consisting of organic fibers (Kevlar) and neoprene binder
Push-on/Mech Cpl:	EPDM
Exposed Pipes and Valves:	(See Drawings for pipe size an valve type)
(10" through 24")	
Pipe:	Steel: ASTM A53, ERW, Grade B, black, no lining or AWWA C200, 7 gauge, no lining. Ref. Section 40 05 24. Connections: butt weld, grooved mechanical pipe coupling, or flanged. Fittings: steel, ASTM A234; or fabricated steel, AWWA C208; ends to match pipe.
Valves:	Butterfly Valve: ref. Section 40 05 64.

END OF SECTION

SECTION 40 05 24

STEEL PROCESS PIPE

PART 1 GENERAL

1.01 SUMMARY

A. This section specifies steel pipe and fittings.

1.02 REFERENCED STANDARDS

A. This Section incorporates by reference the latest revisions of the embedded standard referenced herein. In case of conflict between the requirements of this Section and those of a listed document, the requirements of this Section shall prevail.

Reference	Title
ASME B16.3	Malleable Iron Threaded Fittings, Class 150 and 300
ASME B16.9	Factory-Made Wrought Steel Buttwelding Fittings
ASME B16.11	Forged Steel Fittings, Socket-Welding and Threaded
ASTM A36	Structural Steel
ASTM A47	Ferritic Malleable Iron Castings
ASTM A53	Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
ASTM A105	Forgings, Carbon Steel, for Piping Components
ASTM A106	Seamless Carbon Steel Pipe for High-Temperature Service
ASTM A197	Cupola Malleable Iron
ASTM A234	Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures
ASTM A283	Low and Intermediate Tensile Strength Carbon Steel Plates, Shapes and Bars
ASTM A570	Hot-Rolled Carbon Steel Sheet and Strip, Structural Quality
ASTM A572	High Strength Low Alloy Columbium-Vanadium Steels of Structural Quality
AWWA C200	Steel Water Pipe 6 Inches and Larger
AWWA C206	Field Welding of Steel Water Pipe
AWWA C207	Steel Pipe Flanges for Waterworks Services--Sizes 4 In. Through 144 In.
AWWA C208	Dimensions for Fabricated Steel Water Pipe Fittings
AWWA C210	Liquid Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipe
AWWA M11	Steel Pipe--A Guide for Design and Installation
SSPC-SP10	Near-White Blast Cleaning

1.03 SUBMITTALS

A. Procedures: Section 01 33 00.

B. Provide the following submittals:
1. Manufacturer's product data, catalog cuts, or shop drawings describing construction, dimensions, and materials. Indicate on the submittal each Piping System where the product will be used.
2. Affidavits of Compliance with AWWA C200, ASTM A53, or ASTM A106 as applicable.
3. Contractor's layout drawings as specified in Section 40 05 01.
4. Drawings showing cross-section of the pipe wall and joints for each size, pressure rating, and loading and drawings showing details, dimensions, and piece numbers of all fabricated fittings.

5. Calculations for fabricated fittings that indicate the adequacy of any required reinforcement. Calculations shall be in accordance with the procedures presented in AWWA M11.

PART 2 PRODUCTS

2.01 PIPE MATERIALS

A. Provide steel pipe and fittings in accordance with ASTM A53, ASTM A106, or AWWA C200 as specified in Section 40 05 01, Piping Systems.
   1. Steel for ASTM A53 and ASTM A106 pipe shall be Grade B.
   2. Steel for pipe fabrication to meet requirements of AWWA C200 shall conform to the requirements of ASTM A36; ASTM A572, Grade 42; ASTM A570, Grades 33 and 36; or ASTM A283, Grade D.

2.02 PIPE FABRICATION

A. ASTM A53 Pipe: Unless otherwise indicated:
   1. Type E, electric resistance welded or Type S, seamless pipe as indicated in Section 40 05 01.
   2. Minimum wall thickness for ASTM A53 or ASTM A106: Schedule 40 for pipe 10-inch diameter and less and 3/8 inch for pipe 12 inch through 24-inch diameter.

B. AWWA C200 Pipe:
   1. Straight or spiral seam.
   2. Minimum wall thickness:
      a. 16-inch and smaller: 1/4 inch
      b. 18-inch and larger: 3/8 inch

C. Increased shell thickness shall be provided where specified.

2.03 CONNECTIONS

A. As specified in Section 40 05 01 and in conformance with Section 40 05 40.

2.04 FITTINGS AND APPURTENANCES

A. Malleable Iron Threaded Fittings and Appurtenances: In conformance with the requirements of ASME B16.3 and either ASTM A47 or ASTM A197.

B. Steel Fittings and Appurtenances:
   1. Unless otherwise indicated, in conformance with the requirements of ASTM A234, ASTM A105, or ASME B16.11.
   2. Fabricated steel fittings and appurtenances: In conformance with AWWA C208.

C. Fittings for Grooved-End Piping Systems:
   1. Full flow cast fittings, steel fittings, or segmentally welded fittings with grooves or shoulders designed to accept grooved end couplings.
   2. Cast fittings: Cast of ductile iron conforming to ASTM A536 or malleable iron conforming to ASTM A47.
   3. Standard steel fittings, including large size elbows: Forged steel conforming to ASTM A106.
   4. Standard segmentally welded fittings: Fabricated of Schedule 40 carbon steel pipe.

D. Unless otherwise indicated, all fittings shall be rated for pressure and loadings equal to the pipe.

E. Pipes cut for groove coupling shall be as specified in the Section 40 05 40.

2.05 PIPE LINING – NOT USED

2.06 PIPE COATING

A. Epoxy:
   1. Unless otherwise indicated, pipe and fittings shall be coated with a liquid epoxy as specified in AWWA C210 with the following exceptions:
      a. No coal tar products shall be incorporated in the liquid epoxy.
      b. The curing agent may be an amidoamine as well as the other curing agents listed in AWWA C210.
   2. The coating shall be applied to a minimum thickness of 16 mils in not less than two coats.

B. Polyethylene Tape: - Not Used

2.07 FUSION EPOXY COATING

A. Where specified, steel pipe and fittings shall be fusion epoxy coated.

B. Application Method: Fluidized bed method, attaining 12 mils minimum dry film thickness.

C. Surface Preparation: In accordance with SSPC-SP 10 Near White Blast Cleaning.

D. Acceptable Manufacturer:
   1. 3M Scotchkote 206N
   2. Dupont Nap-Guard 7-2500
   3. Approved Equal.

E. Field welds, connections and otherwise damaged areas shall be coated and patched according to the manufacturer's instructions with a 2-part epoxy compound from the same manufacturer as the coating. Acceptable Manufacturer:
   1. 3M Scotchkote 306
   2. Dupont Nap-Guard 7-1847
   3. Approved Equal.

2.08 JOINT GASKETS

A. Joint gaskets shall be as specified in Section 40 05 40.

2.09 CORROSION PROTECTION – NOT USED

2.10 SOURCE QUALITY CONTROL

A. Factory testing shall conform to the requirements of ASTM A53, ASTM A106, or AWWA C200 as applicable.

PART 3 EXECUTION

3.01 INSTALLATION

A. General:
   1. Install pipe in accordance with AWWA M11. Weld joints in accordance with AWWA C206 and Section 40 05 40. Tie rods shall be used where required for thrust restraint.
   2. Provide sleeve-type mechanical pipe couplings in accordance with AWWA M11 and Section 40 05 40.
   3. Apply pipe coatings at field joints per 40 05 24.

B. Anchorage: - Not Used

3.02 TESTING

A. Pneumatic testing shall be in accordance with Section 40 05 01.

END OF SECTION

SECTION 40 05 40

PIPING CONNECTIONS

PART 1 GENERAL

1.01 SUMMARY

A. This section specifies the following methods of connecting metallic piping: flanges, threading, mechanical couplings, dielectric unions, and welding.

B. Contractor shall be responsible for the scheduling and planning investigation of compatibility, providing and testing all connections, including coordinating rating, sizes, diameters, bolt sizes and drill circle, gasket and flange facing and material, plus the use of dielectric insulation for dissimilar metals including connecting to existing facilities and equipment.

C. Unless otherwise specified, connections of piping at equipment shall comply with the requirements of this Section.

1.02 REFERENCED STANDARDS

A. This Section incorporates by reference the latest revisions of the embedded standard referenced herein. In case of conflict between the requirements of this Section and those of a listed document, the requirements of this Section shall prevail.

Reference	Title
ASME B1.1	Unified Inch Screw Threads (UN and UNR Thread Form)
ASME B1.20.1	Pipe Threads, General Purpose (Inch)
ASME B16.5	Pipe Flanges and Flanged Fittings
ASME B18.2.1	Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws (Inch Series)
ASME B18.2.2	Nuts for General Applications: Machine Screw Nuts, Hex, Square, Hex Flange, and Coupling Nuts (Inch Series)
ASME B31.1	Power Piping
ASME B31.3	Process Piping
ASME Section IX	Boiler and Pressure Vessel Code; Welding and Brazing
ASTM F37	Standard Test Methods for Sealability of Gasket Materials
ASTM F104	Standard Classification System for Nonmetallic Gasket Materials
ASTM F152	Standard Test Methods for Tension Testing of Nonmetallic Gasket Materials
ASTM F593	Stainless Steel Bolts, Hex Cap Screws, and Studs
ASTM F594	Stainless Steel Nuts
AWWA C206	Field Welding of Steel Water Pipe
AWWA C207	Steel Pipe Flanges for Waterworks Service-Size 4 in. through 144 in.
AWWA C219	Bolted, Sleeve-Type Couplings for Plain End Pipe
AWWA C606	Grooved and Shouldered Joints
AWWA M11	Steel Pipe-A Guide for Design and Installation

1.03 SUBMITTALS

A. Procedures: Section 01 33 00.

B. Provide the following submittals:
   1. Manufacturer's catalog data showing piping connection details for each piping system.
   2. Details for installation for each type of piping connection.
   3. A welder qualification certificate for each welder
   4. Statement by the supplier for each type of item that the materials provided are normally recommended for the liquid and piping materials and pressures as well as the installation situation and environment.

1.04 QUALITY ASSURANCE

A. Welding:
   1. Welding shall conform to the requirements of ASME B31.3, Normal Fluid Service Category or AWWA C206.
   2. Welding procedures shall be qualified by testing in accordance with ASME Section IX requirements.
   3. Welders shall be qualified by the Contractor or Fabricator in accordance with ASME Section IX.
   4. Contractor’s shop and field welding inspectors shall hold current AWS QC1 CWI certification.
   5. Each welder's certificate shall be provided to the Project Representative prior to that welder working on the job.

PART 2 PRODUCTS

2.01 GENERAL

A. Pipe connections (joint and fitting) options for a particular piping system shall be as specified on the particular system PIPESPEC sheet in Section 40 05 01.

B. Continuous welding for straight runs of pipe is acceptable only where the individual PIPESPEC sheet allows welding as a connection option. Where connections are shown, then the connections shall be specifically where shown, however, if several connection options are allowed for the particular piping system on the PIPESPEC sheet, then any option may be consistently used, i.e., if flanged or rigid grooved connections are acceptable and grooved are shown, then flanged may be substituted. Integrity of rigid, non-rotating connections must be maintained at all valves and other equipment.

2.02 FLANGE ASSEMBLIES

A. Flanges:
   1. General:
      a. Flanges shall either be flat flanges or convoluted ring flanges as specified in the following paragraphs.
      b. Plain faced flanges shall not be bolted to raised-face flanges.
   2. Flat Flanges:
      a. Ductile and Cast iron flanges: Faced in accordance with ASME B16.1. Where companion flanges are used, the flanges on pipe shall be refaced to be flush with the companion flange face.
      b. Class 150 and Class 300 forged steel flanges: Raised face conforming to ASME B16.5.
      c. Lightweight slip-on flanges: Plain face conforming to AWWA C207, Class B and ASME B16.5.
      d. Steel flanges: Unless otherwise specified, ASME B16.5, Class 150 or AWWA C207, Class D. Class E AWWA flanges shall be provided where test pressure exceeds 175 psi.
   3. Convoluted Ring Flanges:
      a. Ductile iron, forged steel or cast stainless steel, designed to bear on hubs welded to the pipe.
      b. Flange joints: Rated for not less than 150 percent of the test pressures listed in Section 40 05 01 and in conformance with the requirements of ASME B 16.5 and AWWA C207.
      c. The flange manufacturer shall be prepared to demonstrate, by certified pressure test that the flanges will meet these requirements.

B. Gaskets:
   1. Material: As specified in this section and Section 40 05 01.
   2. For plain faced flanges:
      a. Full face type.
      b. Thickness:
         1) Pipe 10 inches and less in diameter: 1/16 inch.
         2) Pipe 12 inches and larger in diameter: 1/8 inch.
   3. For raised face flanges:
      a. Unless otherwise indicated, shall match the raised face.
      b. Thickness:
         1) Pipe 3½ inches and less in diameter: 1/16 inch
         2) Pipe 4 inches and larger: 1/8 inch

C. Bolts, Washers and Nuts:
   1. ASME B18.2.1 standard square or hexagon head bolts with ASME B18.2.2 standard hexagon nuts.
   2. Threads: ASME Bl.1, standard coarse thread series; bolts shall be Class 2A, nuts shall be Class 2B.
   3. Length: In conformance with ASME B16.5.
   4. Unless otherwise specified, carbon steel machined bolts with hot pressed hexagon nuts.
   5. Bolts, nuts, and washers:
      a. For submerged service, over open basins, and in tank headspaces: Made of Type 316 stainless steel in conformance with ASTM F593 and ASTM F594, markings F593F and F594F. Use anti-seize compound for installation. Nuts for submerged service can be made of copper-silicon alloy bronze conforming to ASTM B98, alloy C65100 or C65500, designation H04.
      b. For buried service, including for use in vaults: Made of noncorrosive high-strength, low-alloy steel having the characteristics specified in AWWA C111, regardless of any other protective coating. Provide factory applied fluoropolymer coating: FluoroKote#1, Xylan 1424, or Approved Equal.

2.03 MECHANICAL COUPLINGS

A. Sleeve-Type Couplings: Not Used

B. Grooved End (Split Ring) Couplings:
   1. Couplings shall conform to AWWA C606.
   2. Unless otherwise specified, use model as recommended by the manufacturer for the application.
   3. Flexible-type couplings: all piping greater than 12 inches in diameter; pipe 12 inches in diameter and less in rack-mounted tunnel piping applications; and grooved joints adjacent to pump or blower suction and discharge where grooved couplings are used for noise and vibration control. All other applications for piping 12 inches in diameter and less: rigid-type couplings.
   4. Cut grooves are not permitted on fabricated or light wall pipe. Note that Ductile Iron pipe must meet minimum wall thickness for use of grooving, per AWWA C606.
   5. Housing: Ductile iron, ASTM A563
   6. Gasket: flush seal type designed for ductile iron pipe
   7. Bolts, nuts, and washers:
      a. Per AWWA C606. Bolts: ASTM A449 and ASTM A183. Nuts: ASTM A563.
      b. For submerged service: Type 316 stainless steel in conformance with ASTM F593 and ASTM F594, markings F593F and F594F.
      c. For buried service: Made of noncorrosive high-strength, low-alloy steel having the characteristics specified in AWWA C111, regardless of any other protective coating. Provide factory applied fluoropolymer coating: FluoroKote#1, Xylan 1424, or Approved Equal.
   8. Unless otherwise specified, use model as recommended by the manufacturer for the application
   9. Grooved end flexible-type couplings:
      a. Gruvlok Fig 7001.
      b. Victaulic 77/W77.
      c. Approved Equal.

10. Grooved end rigid-type couplings:
    a. Gruvlok Fig 7401.
    b. Victaulic 07/W07.
    c. Approved Equal.

2.04 GASKETS

A. Materials:
1. EPDM: Ethylene-propylene-diene-terpolymer.
2. Neoprene: Neoprene.
3. Nitrile: Nitrile (Buna N).
4. Viton.

B. Properties:
1. Compressed gasketing consisting of organic fibers (Kevlar) and neoprene binder; ASTM F104 (F712400), 2500 psi (ASTM F152), 0.2 ML/HR LEAKAGE FUEL A (ASTM F37).
2. Compressed gasketing consisting of organic fibers (Kevlar) and SBR binder; ASTM F104 (F712400), 2500 PSI (ASTM F152), 0.1 ml/hr leakage Fuel A (ASTM F37).
3. Gylon gasketing, Garlock Style 3500, 2000 psi (ASTM F152), 0.22 ml/hr Fuel A (ASTM F37).
4. Gylon gasketing, Garlock Style 3510, 2000 psi (ASTM F152), 0.04 ml/hr Fuel A (ASTM F37).
5. Gylon gasketing, Garlock Style 3504, 2000 psi (ASTM F152), 0.12 ml/hr Fuel A (ASTM F37).
6. TFE: Noncreeping tetrafluoroethylene (TFE) with insert filler.
7. TFE bonded EPDM: TFE bonded to EPDM in full-face gasket having concentric-convex molded rings.

2.05 THREAD

A. Pipe thread dimensions and size limits shall conform to ASME B1.20.1.

2.06 UNIONS

A. 2 inches and smaller: Ground joint screwed pattern unions.

B. 2½ inches and larger: Ground joint flange unions.

C. Dielectric unions: Match the pipe material except bronze may be used with copper piping. EPCO, Capitol Manufacturing, or approved equal.

D. Hydraulic power and petroleum conveying piping shall use flat-faced O-ring style unions, for both regular and dielectric unions. O-ring material shall be suitable for piped fluid.

2.07 COATINGS – NOT USED

PART 3 EXECUTION

3.01 PIPE CUTTING, THREADING AND JOINTING

A. Pipe cutting, threading and jointing shall conform to the requirements of ASME B31.1.

3.02 GROOVE COUPLING

A. Groove coupling pipe cuts or roll shall be per the pipe manufacturer's recommendations.

B. All pipe groove cuts shall be implemented from outside surface of the pipe. No pipe groove cutting equipment shall touch interior finish surface of pipes neither for alignment or support. No damages to the original interior surface of the pipes during groove coupling cuts or rolls.

3.03 PIPE WELDING

A. Pipe shall be welded by ASME-certified welders using shielded metal arc, gas shielded arc or submerged arc welding methods. Provide welding certification for each welder working on piping fabrication.

B. Make welds in accordance with the requirements of ASME B31.1 for piping Systems 8, 26, and 28 specified in Section 40 05 01. Make welds in accordance with the requirements of ASME B31.3 for piping System 20 specified in Section 40 05 01.

C. All welding shall be done in accordance with the requirements of the applicable, individual steel pipe specifications. Welds for piping systems not specified above shall be in accordance with AWWA C206.

3.04 TAKEDOWN COUPLINGS AND DISMANTLING CONNECTIONS – NOT USED

3.05 FLEXIBILITY – NOT USED

3.06 DIELECTRIC CONNECTIONS – NOT USED

END OF SECTION

SECTION 40 05 41

PIPE HANGERS AND SUPPORTS

PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies hangers and supports for all piping systems specified in Section 40 05 01.

B. This Section does not include pipe supports for fire sprinkler systems, pipe anchors, guides or seismic restraints.

1.02 REFERENCED STANDARDS

A. This Section incorporates by reference the latest revisions of the embedded standard referenced herein. In case of conflict between the requirements of this Section and those of a listed document, the requirements of this Section shall prevail.

Reference	Title
MFMA	Metal Framing Manufacturer's Association
MSS SP-58	Pipe Hangers and Supports – Materials, Design, Manufacture, Selection, Application, and Installation
AISC 325	Steel Construction Manual

1.03 OPERATING CONDITIONS:

A. The hangers and supports specified in this Section are provided to resist pipe vertical and horizontal gravity and seismic loads.

B. For the purpose of pipe hanger and support selection, this Section establishes pipe support classifications based on the operating temperatures of the piping contents. Pipe support classifications are as follows:
   1. Hot Systems:
      a. 120 degrees F to 450 degrees F
      b. 451 degrees F to 750 degrees F
      c. Over 750 degrees F
   2. Ambient Systems:
      a. 60 degrees F to 119 degrees F
   3. Cold Systems:
      a. 33 degrees F to 59 degrees F
      b. 20 degrees F to 32 degrees F

C. For the purpose of material selection, spaces are classified as:
   1. Dry Service Environment including offices, pipe galleries, and blower rooms
   2. Wet/Corrosive Service Environment including Wet wells, Pump Rooms, Odor Control Spaces, Chemical storage, storage and handling, battery rooms

1.04 HANGER AND SUPPORT SELECTION

A. Design:
   1. The Contractor shall be responsible for design of hanger and support systems by the design professional selected in accordance with Section 40 05 01 and in conjunction with design of seismic restraints and expansion control systems per Section 40 05 42. The pipe support system drawings shall show the hanger and support locations as well as the details of the seismic restraints and

expansion control systems. The pipe support design drawings and calculations shall be prepared and signed by the design professional and shall bear the design professional's registration seal in the state of Washington.

2. Supports, seismic bracing, and other piping system mounting elements for piping 30-inch diameter and less are generally not shown on the Drawings. Where a specific support, hanger, guide, structural attachment, anchor, joint, or seismic restraint detail for pipe 30-inch diameter or less is shown, it shall be to indicate the general arrangement to be developed by the Contractor's design professional.
3. Design, select, locate, and provide piping supports, pipe guides, seismic restraint, expansion joints, and anchors required for final piping layout. The Division 40 Reference Only Standard Details include King County's typical details for piping system mounting elements.

B. Select pipe hangers and supports in accordance with this specification. Selections shall be based upon the pipe support classifications specified in this Section and any special requirements which may be specified. Materials will be based on the service environment.

C. Review the piping layout in relation to the surrounding structure and adjacent piping and equipment before selecting the support to be used at each hanger point.

D. Hangers for the suspension of 2½ inches and larger pipe shall be capable of vertical hanger component adjustment under load.

E. The supporting systems shall provide for and control the free or intended movement of the piping including its movement in relation to that of connected equipment.

F. Where there is horizontal movement at a suspended type hanger location, hanger components shall be allowed for swing. The vertical angle of the hanger rod shall not, at any time, exceed 4 degrees.

G. There shall be no contact between a pipe and hanger or support component of dissimilar metals.

H. Unless otherwise indicated, existing pipes and supports shall not be used to support new piping.

I. Stock hanger and support components shall be used wherever practical and be compatible with any existing hanger hardware for system standardization.

1.05 SUBMITTALS

A. Procedures: Section 01 33 00.

B. Provide the following submittals:
1. Catalog information, including data on load capacity, and drawings of piping support system, locating each support, sway brace, seismic brace, hanger, guide, component, and anchor for piping 6 inches and larger. Identify support, hanger, guide, and anchor type by catalog number and Shop Drawing detail number.
2. Calculations for each type of pipe support, attachment and anchor.
3. Fabrication drawings for fabricated components.
4. Revisions to support systems resulting from changes in related piping system layout.
5. Seismic anchorage and bracing drawings, calculations, and cut sheets, as required by Section 40 05 42.

PART 2 PRODUCTS

2.01 GENERAL

A. Pipe supports shall conform to the requirements of MSS SP-58.

B. Metal framing system components shall conform to the Metal Framing Manufacturer's Association standard MFMA.

C. For system compatibility, support clips and attachments shall be compatible with Unistrut or B-Line.

D. Insulated pipe shall be provided with insulation shield at the supports.

E. Acceptable manufacturers:
   1. B-Line.
   2. Unistrut.
   3. Approved Equal.

2.02 MATERIALS

A. Service Environment: Pipe hangers and supports, structural attachments, fittings and accessories:
   1. Dry Service Environment: Zinc plated or mechanically galvanized after fabrication. Nuts, bolts and washers: galvanized or zinc-plated
   2. Wet or Corrosive Environment: Type 304 or 316 stainless steel, nuts, bolts and washers stainless.

B. Pipe Hangers and Supports:
   1. Type 1 – Clevis Pipe Hanger:
      a. Steel pipe (uninsulated):
         1) B-Line B3100.
         2) Grinnell Fig. 260.
         3) Approved Equal.
   2. Type 6 – Framing Channel Pipe Clamp:
      a. Pipe clamps shall be steel with galvanized finish.
      b. Steel pipe (uninsulated):
         1) Material thickness:

Pipe size	Material thickness
3/8 inch and 1/2 inch	16 gage
3/4 inch through 1¼ inches	14 gage
1½ inches through 3 inches	12 gage
3½ inches through 5 inches	11 gage
6 inches and 8 inches	10 gage

         2) Acceptable manufacturer:
            a) Michigan model 431.
            b) Powerstrut PS 1100.
            c) Unistrut P 1109 series.
            d) Approved Equal.
   3. Type 13 – Framing Channel Pipe:
      a. Steel pipe (uninsulated):
         1) Superstrut No. C-708-U.
         2) Powerstrut PS 3126.
         3) Kin-Line No. 477.
         4) Approved Equal.

C. Rack and Trapeze Supports:
   1. General: Unless otherwise indicated, trapeze and pipe rack components shall have a minimum steel thickness of 12 gage, or a minimum fiberglass thickness of 0.200 inch, with a maximum deflection 1/240 of the span.
   2. Type 20 – Trapeze Pipe Support:
      a. Trapeze pipe support cross members shall be framing channel, or fiberglass where specified.

b. Flat plate fittings shall be 1-5/8 inch square carbon steel of standard design manufactured by framing channel manufacturer.
c. Acceptable manufacturer:
1) Unistrut P2471.
2) B-Line B202-2.
3) Aickinstrut 2000 series.
4) Approved Equal.

3. Types 21 and 22 – Pipe Rack Supports:
a. Post and cross members shall be framing channel.
b. Pipe rack fittings shall be carbon steel, of standard design manufactured by framing channel manufacturer.
c. Ninety-degree fittings shall be gusseted.
d. Post base fittings shall be as specified in Section 40 05 41.
e. Acceptable manufacturer:
1) Unistrut P2484.
2) B-Line B844.
3) Approved Equal.

D. Structural Attachments:
1. Type A – Malleable Iron Concrete Insert:
a. Concrete inserts shall be malleable iron and comply with MSS Type 18.
b. Acceptable manufacturers:
1) Grinnell Fig. 282.
2) Carpenter & Patterson Fig. 108.
3) Approved Equal.

2. Type E – Framing Channel Post Base:
a. Post bases shall be carbon steel, and of standard design manufactured by framing channel manufacturer.
b. Single channels:
1) Unistrut P 2072A.
2) B-Line B280.
3) Approved Equal.
c. Double channels:
1) Unistrut P 2073A.
2) B-Line B281.
3) Approved Equal.

3. Type K – double channel bracket:
a. Wall channel shall be single framing channel, or fiberglass where specified.
b. Cantilever bracket shall be a carbon steel, double framing channel assembly.
1) Acceptable manufacturers:
a) Unistrut P2542 through P2546.
b) B-Line B297-12 through B297-36.
c) Aickinstrut 2000 series.
d) Approved Equal.

4. Type L – Single Channel Bracket:
a. Wall channel shall be single framing channel, or fiberglass where specified.
b. Cantilever bracket shall be a carbon steel single framing channel assembly.
1) Acceptable manufacturers:
a) Unistrut P2231 through P2234.
b) B-Line B198-6, B198-12, B196-18 and B196-24.
c) Aickinstrut 2000 series.
d) Approved Equal.

5. Type M – Wall Mounted Channel:
a. Wall channel shall be single framing channel, or fiberglass where specified.

E. Accessories:
   1. Hanger Rods:
      a. Rods shall be carbon steel or as specified on the drawings, threaded on both ends or continuous threaded and sized as specified.
   2. Weldless Eye Nut:
      a. Eye nut shall be forged steel and shall comply with MSS Type 17.
      b. Acceptable manufacturers:
         1) Grinnell Fig. 290.
         2) B-Line B3200.
         3) Approved Equal.
   3. Welded Eye Rod:
      a. Eye rod shall be carbon steel or as specified on the drawings with eye welded closed.
      b. Inside diameter of eye shall accommodate a bolt diameter 1/8 inch larger than the rod diameter.
      c. Acceptable manufacturers:
         1) Grinnell Fig. 278.
         2) B-Line B3211.
         3) Approved Equal.
   4. Turnbuckle:
      a. Turnbuckle shall be forged steel or as specified on the drawings and shall comply with MSS Type 15.
      b. Acceptable manufacturers:
         1) Grinnell Fig. 230.
         2) B-Line B3202.
         3) Approved Equal.
   5. Framing Channel:
      a. Framing channel shall be 1-5/8 inches square, roll formed, 12-gage carbon steel or as specified on the drawings.
      b. Channel shall have a continuous slot along one side with in-turned clamping ridges.
         1) Single channel:
            a) Unistrut P 1000.
            b) B-Line B22.
            c) Approved Equal.
         2) Double channel:
            a) Unistrut P 1001.
            b) B-Line B22A.
            c) Approved Equal.
         3) Triple channel:
            a) Unistrut P 1004A.
            b) B-Line B22X.
            c) Approved Equal.
      c. Embedded concrete insert framing channel shall be 1-5/8 inch wide by 1-3/8 inch deep.
      d. Provide end caps or end anchors as recommended by the manufacturer.
         1) Embedded concrete insert framing channel:
            a) Unistrut P 3200 series.
            b) B-Line B32I series.
            c) Approved Equal.
         2) End caps or end anchors:
            a) Unistrut P 3280 or P 3704.
            b) B-Line B206 or B3332.
            c) Approved Equal.

PART 3 EXECUTION

3.01 HANGER AND SUPPORT LOCATIONS

A. Locate hangers and supports as near as possible to concentrated loads such as valves, flanges, etc. Locate hangers, supports and accessories within the maximum span lengths specified in the Drawings to support continuous pipeline runs unaffected by concentrated loads.

B. Locate at least one hanger or support within 2 feet from a pipe change in direction.

C. For any valve 6 inches in size and greater, locate at least one hanger or support within 2 feet in either direction of the valve.

D. Locate hangers and supports to ensure that connections to equipment, tanks, etc., are substantially free from loads transmitted by the piping.

E. Where piping is connected to equipment, a valve, piping assembly, etc., which will require removal for maintenance, the piping shall be supported in such a manner that temporary supports are not necessary for this procedure.

F. Pipe shall not have pockets formed in the span due to sagging of the pipe between supports caused by the weight of the pipe, medium in the pipe, insulation, valves and fittings.

3.02 INSTALLATION

A. Welded and bolted attachments to the building structural steel shall be in accordance with the requirements of AISC 325. Unless otherwise indicated, do not drill or burn holes in the building structural steel.

B. Do not use hanger components for purposes other than that for which they were designed. Do not use them for rigging and erection purposes.

C. Install items to be embedded before concrete is poured. Fasten embedded items securely to prevent movement when concrete is poured.

D. Use embedded anchor bolts instead of concrete inserts for support installations in areas below water surface or areas normally subject to submerging.

E. Install thermal pipe hanger shields on insulated piping at required locations during hanger and support installation. Make butt joint connections to pipe insulation at the time of insulation installation in accordance with the manufacturer's recommendations.

F. Hanger and support components in contact with plastic pipe shall be free of burrs and sharp edges.

G. Rollers shall roll freely without binding.

H. Prior to grouting, rough finished floor beneath Type N structural attachments and framing channel post bases. Grout between base plate and floor shall be free of voids and foreign material.

I. Cut and drill baseplates to specified dimensions prior to welding stanchions or other attachments and prior to setting anchor bolts.

J. Provide plastic or rubber end caps at the exposed ends of all framing channels that are located up to 7 feet above the floor.

3.03 ADJUSTMENTS

A. Adjust hangers and supports to obtain required pipe slope and elevation.

B. Shims made of material that is compatible with the piping material may be used.

C. Adjust stanchions prior to grouting their baseplates.

3.04 ANCHOR BOLTS

A. Anchor bolt material and installation requirements shall conform to Specification Section 05 05 19.

END OF SECTION

SECTION 40 05 42

SEISMIC RESTRAINTS FOR PIPING

PART 1 GENERAL

1.01 SUMMARY

A. This section specifies seismic restraints for bracing all piping systems specified in Section 40 05 01. This section does not include seismic restraints for fire sprinkler systems.

1.02 DEFINITIONS:

A. Longitudinal direction: direction parallel to the pipe axis.

B. Lateral direction: direction perpendicular to the pipe axis.

1.03 REFERENCE STANDARDS

A. This Section incorporates by reference the latest revisions of the embedded standard referenced herein. In case of conflict between the requirements of this Section and those of a listed document, the requirements of this Section shall prevail.

Reference	Title
AISC 325	American Institute of Steel Construction, Steel Construction Manual
ANSI A58.1	Minimum Design Loads for Buildings and Other Structures
MFMA	Metal Framing Manufacturer's Association
MSS SP-58	Pipe Hangers and Supports - Materials, Design and Manufacture, Selection, Application, and Installation
SMACNA	Seismic Restraints Manual

1.04 OPERATING CONDITIONS

A. The seismic restraints specified in this section are provided to resist pipe movements and loads occurring as a result of an earthquake or other seismic event in accordance with the project drawings.

B. Unless otherwise specified, all piping shall have bracing to resist seismic loading caused by forces applied at the individual pipe's center of gravity.

C. Seismic loading: Section 01 73 00.

1.05 RESTRAINT SELECTION

A. Design:
   1. The Contractor shall be responsible for design of seismic restraints for piping in conjunction with preparation of the design of pipe hangers and supports and of expansion control systems by the design professional selected. The pipe system drawings shall show the seismic restraint locations as well as the details of the hangers, supports, and expansion control systems. The pipe system design drawings and calculations shall be prepared and signed by the design professional and shall bear the design professional's registration seal in the state of Washington.
   2. Supports, seismic bracing, and other piping system mounting elements for piping 30-inch diameter and less are generally not shown on the Drawings. Where a specific support, hanger, guide, structural attachment, anchor, joint, or seismic restraint detail for pipe 30-inch diameter or less is

shown, it shall be to indicate the general arrangement to be developed by the Contractor's design professional.
3. Design, select, locate, and provide piping supports, pipe guides, seismic restraint, expansion joints, and anchors required for final piping layout. The Division 40 Reference Only Standard Details include King County's typical details for piping system mounting elements.

B. Unless otherwise specified, the Contractor shall select, locate and provide seismic restraints for piping.

C. The Contractor shall review the piping layout in relation to the surrounding structure and adjacent piping and equipment before selecting the restraint to be used at each point.

D. Seismic restraints may be omitted from the following installations:
1. Gas piping less than 1-inch inside diameter.
2. Piping in boiler and mechanical rooms less than 1¼-inch inside diameter.
3. All other piping less than 2½-inch inside diameter.
4. All piping suspended by individual hangers 12 inches or less in length from the top of the pipe to the bottom of the support for the hanger.

E. Piping systems shall not be braced to dissimilar parts of a building or to dissimilar building systems that may respond in a different mode during an earthquake. Examples: wall and a roof; solid concrete wall and a metal deck with lightweight concrete fill.

F. Restraints shall be sized to fit the outside diameter of the pipe, tubing, or, where specified, the outside diameter of insulation.

G. There shall be no contact between a pipe and restraint component of dissimilar metals. The contractor shall prevent contact between dissimilar metals when restraining copper tubing by the use of copper-plated, rubber, plastic or vinyl coated, or stainless steel restraint components.

H. Branch lines shall not be used to brace main lines.

I. Seismic bracing shall not limit the expansion and contraction of the piping system.

1.06 SUBMITTALS

A. Procedures: Section 01 33 00.

B. Provide the following submittals:
1. Manufacturer's catalog data on pipe attachments, restraints, braces, fittings and accessories including load capacities. Drawings showing location and type of seismic bracing to be installed.
2. For each seismic restraint location, provide calculations substantiating the loads, in all directions, that the seismic restraint system must withstand. Calculations must be stamped, dated, and signed by a currently registered professional structural engineer in the State of Washington.
3. A legend to the piping support drawings required that gives load information and restraint component selection at each restraint location.
4. Fabrication drawings for fabricated components.

PART 2 PRODUCTS

2.01 GENERAL

A. Acceptable Manufacturer:
1. Carpenter & Patterson.
2. B-Line.
3. Kin-Line.
4. ITT Grinnell.

5. Michigan.
6. Pipe Shields Incorporated.
7. Superstrut.
8. Unistrut.
9. Approved equal.

B. Pipe restraints shall conform to the requirements of MSS SP-58 and MFMA.

2.02 MATERIALS

A. Service Environment: Pipe hangers and supports, structural attachments, fittings and accessories:
   1. Dry Service Environment: Zinc plated or mechanically galvanized after fabrication. Nuts, bolts and washers: galvanized or zinc-plated
   2. Wet or Corrosive Environment: Type 304 or 316 stainless steel, nuts, bolts and washers stainless.

2.03 PIPE ATTACHMENTS

A. Type 1s: Clevis Restraint Attachment:
   1. Type 1, clevis pipe hanger, as specified in Section 40 05 41.

B. Type 13s: Framing Channel Strap Restraint:
   1. Type 13, framing channel pipe strap, as specified in Section 40 05 41.

C. Type 14s: Pipe Clamp Restraint:
   1. Carbon steel, with configuration and components equivalent to MSS Type 4.
   2. Rod attachment and longitudinal brace connection stud shall be carbon steel, fabricated and welded by the manufacturer.
   3. Steel pipe (uninsulated):
      a. Superstrut No. S-720.
      b. Kin-Line No. S475.
      c. Approved Equal.

2.04 TRAPEZE RESTRAINTS

A. General: Unless otherwise indicated, trapeze members shall have a minimum steel thickness of 12 gage, with a maximum deflection 1/240 of the span.

B. Pipe attachments shall be Type 7s or 13s as specified in this section

C. Rod stiffeners, longitudinal and lateral braces shall be as specified in this section

D. Type 20s: Single Channel Lateral Restraint:
   1. Cross member shall be 1-5/8 inch square carbon steel framing channel.
   2. Acceptable manufacturer:
      a. Unistrut P1000
      b. B-Line B22
      c. Superstrut A-1200.
      d. Approved Equal.

E. Type 21s: Double Channel Lateral Restraint:
   1. Cross member shall be double channel manufactured assembly.
   2. Acceptable manufacturer:
      a. Unistrut P1001.
      b. B-Line B22A.
      c. Superstrut A-1202.
      d. Approved Equal.

F. Type 22s: Double Channel Longitudinal Restraint:
   1. Cross member shall be a double channel manufactured assembly.
   2. Acceptable manufacturer:
      a. Unistrut P1001.
      b. B-Line B22A.
      c. Superstrut A-1202.
      d. Approved Equal.

2.05 BRACES AND FITTINGS

A. Seismic Brace Fitting:
   1. Manufactured for use with industry standard framing channel.
   2. Carbon steel, welded construction, two-piece linked fitting.
   3. Provide a means to reduce noise and vibration transmission between the linked fitting parts.
   4. Acceptable manufacturer:
      a. Superstrut C-749N series seismic brace.
      b. Kin-Line No. 633 seismic connector fitting.
      c. Approved Equal.

B. Hanger Rod Stiffener Assembly:
   1. Rod stiffener channel shall be 1-5/8 inch square carbon steel framing channel.
   2. Rod stiffener channel shall be:
      a. Unistrut P1000.
      b. B-Line B-22.
      c. Superstrut A-1200.
      d. Approved Equal.
   3. Rod stiffener clamps shall be complete with channel nut.
   4. Rod stiffener clamps shall be:
      a. Superstrut ES-142.
      b. Kin-Line No. 635.
      c. Approved Equal.

C. Type A1 Seismic Brace:
   1. Shall be 1-5/8 inch square carbon steel framing channel.
   2. Acceptable manufacturer:
      a. Unistrut P1000.
      b. B-Line B22.
      c. Superstrut A-1200.
      d. Kin-Line No. 4112.
      e. Approved Equal.

D. Type A2 Seismic Brace:
   1. Shall be 1-5/8 inch wide by 3-1/4 inch deep carbon steel framing channel.
   2. Acceptable manufacturer:
      a. Unistrut P 5000.
      b. B-Line B-11.
      c. Superstrut H-1200.
      d. Kin-Line No. 8212.
      e. Approved Equal.

2.06 STRUCTURAL ATTACHMENTS

A. General:
   1. Structural attachments for longitudinal and lateral seismic braces including hanger rod structural attachments shall be as necessary and in accordance with the seismic restraint design as per Article 1.05.

2.07 ACCESSORIES:

A. Hanger Rods:
   1. Carbon steel, threaded on both ends or continuous threaded and sized as specified.

B. Framing Channel:
   1. Shall conform to MFMA standard.
   2. Roll formed, 12-gage carbon steel.
   3. Continuous slot along one side with in-turned clamping ridges.
   4. Acceptable manufacturer:
      a. Unistrut P1000 series.
      b. B-Line B22 series.
      c. Superstrut A-1200 series.
      d. Approved Equal.

C. Rod Coupling:
   1. Carbon steel, with sight hole in center of coupling body.
   2. Acceptable manufacturer:
      a. Grinnell Fig. 135.
      b. Superstrut H-119.
      c. Approved Equal.

D. Thermal Pipe Hanger Shield:
   1. Thermal shields shall be provided at seismic restraint locations on pipe requiring insulation. Thermal pipe hanger shields shall be as specified in Section 40 05 41.
   2. Stainless steel band clamps shall be provided on thermal shields at longitudinal pipe restraint locations.

PART 3 EXECUTION

3.01 PIPE RESTRAINT LOCATIONS

A. Locate the first seismic restraint on a piping system not more than 10 feet from the main riser, from an entrance to a building, or from a piece of equipment.

B. Brace cast iron pipe on each side of a change in direction of 90 degrees or more. Brace or stabilize joints in risers between floors.

C. Brace no-hub and bell and spigot cast iron soil pipe longitudinally every 20 feet and laterally every 10 feet.

D. Lateral bracing for one pipe section may also act as longitudinal bracing for the pipe section connected perpendicular to it, if the bracing is installed within 24 inches of the elbow or tee of the same size.

E. Seismic restraint locations and components shall be indicated on the piping layout drawings required by Section 40 05 01.

3.02 INSTALLATION

A. Use rod stiffener assemblies at seismic restraints for hanger rods over 6 inches in length. Use a minimum of two rod stiffener clamps on any rod stiffener assembly.

B. Install lateral and longitudinal bracing between 45 degrees above and 45 degrees below horizontal, inclusive, relative to the horizontal centerline of the pipe.

C. Welded and bolted attachments to the building structural steel shall be in accordance with the requirements of AISC 325. Do not drill or burn holes in the building structural steel without approval of the Project Representative.

D. Use embedded anchor bolts instead of concrete inserts for seismic brace installations in areas below water surface or normally subject to submerging.

E. Install thermal pipe hanger shields on insulated piping at required locations during restraint installation. Make butt joint connections to pipe insulation at the time of insulation installation in accordance with the manufacturer's recommendations.

F. Restraint components in contact with plastic pipe shall be free of burrs and sharp edges.

G. Rollers shall roll freely without binding.

H. Provide plastic or rubber end caps at the exposed ends of all framing channels that are located up to 8 feet above the floor.

END OF SECTION

SECTION 40 05 47

PIPING APPURTENANCES

PART 1 GENERAL

1.01 SUMMARY

A. This section specifies pipeline thermometers, flow and level gages, pressure devices, strainers, sight glasses, vents, and drains.

1.02 SUBMITTALS

A. Procedures: Section 01 33 00.

B. Provide the following submittals:
   1. Appurtenances shall be located on the piping layout drawings by plant area submitted in accordance with Section 40 05 01.
   2. Manufacturer's product data
   3. A list of any deviations or substitutions.

PART 2 PRODUCTS

2.01 GENERAL

A. Unless otherwise specified or shown on the Drawings:
   1. All equipment shall be the same size as the adjoining pipe.
   2. Body material of equipment shall match pipeline material.
   3. Pressure rating of equipment shall be no less than 150 PSI.
   4. Electrical housings shall be NEMA 4.

B. All units shall have the name of the manufacturer and the size of the unit cast on the body or shown on a permanently attached plate in raised letters.

C. All equipment provided shall be equipped with flanges, integral unions, or other functional take-a-parts.

2.02 PRESSURE DEVICES

A. Gage Cocks:
   1. The exposed threads of each gage cock shall be protected by a brass plug.
   2. Unless otherwise indicated, acceptable manufacturers:
      a. Robertshaw 1303.
      b. Ashcroft 1095.
      c. Approved Equal.

B. Pressure Gages:
   1. Unless otherwise indicated, pressure gage scales shall be selected so that the normal operating pressure falls between 50 and 80 percent of full scale.
   2. Diameter: 4½ inch.
   3. Movement: 270 degrees.
   4. Accuracy: 0.5 percent.
   5. Case: non-metallic case with a ½-inch NPT bottom connection.
   6. Type: premium grade, heavy duty Type 316 stainless steel bourdon tube units with plastic bushings and pinion, and stainless steel sector. Internal pulsation dampening system consisting of either a glycerin fill or a silicone fluid fill; snubbers or orifices are not acceptable.

7. All gauges shall be vertically oriented.
8. Bleed-off valves shall be bronze gage cocks pressure rated for 150 psi.
9. Acceptable manufacturers:
    a. Ashcroft Duragage 1279.
    b. Ametek 198 IL.
    c. Approved Equal.

C. Diaphragm Seals:
1. Type 1:
    a. Body and diaphragm material: Type 316 or Type 316L stainless steel.
    b. Flushing connection: ¼-inch
    c. Process connection: ½-inch
    d. Unless otherwise indicated, fill fluid shall be Silicone DC200.
    e. Acceptable manufacturers:
        1) Ashcroft Type 101.
        2) Ametek.
        3) Approved Equal.
2. Type 2:
    a. Type: flexible sleeve type.
    b. Size: 1-inch, unless otherwise indicated.
    c. Unless otherwise indicated, sleeve shall be Buna-N.
    d. Acceptable manufacturers:
        1) Red Valve Series 742.
        2) Ashcroft Type 85
        3) Approved Equal.

PART 3 EXECUTION

3.01 GAGE TAPS

A. Provide gage taps on the suction and discharge of pumps, fans, compressors, vacuum pumps and blowers.

B. Gage taps shall consist of a ¼-inch gage cock attached by a threaded nipple to the pipeline, duct or equipment.

END OF SECTION

SECTION 40 05 64

BUTTERFLY VALVES

PART 1 GENERAL

1.01 SUMMARY

A. This section specifies butterfly valves.

B. Valve List:

VALVE	VALVE NO.
Blower 1 Butterfly Valve	724-310403
Blower 2 Butterfly Valve	724-310503

1.02 REFERENCED STANDARDS

A. This Section incorporates by reference the latest revisions of the embedded standard referenced herein. In case of conflict between the requirements of this Section and those of a listed document, the requirements of this Section shall prevail.

Reference	Title
ANSI B16.1	Cast Iron Pipe Flanges and Flanged Fittings Class 25, 125, 250 and 800
ANSI B16.5	Pipe Flanges and Flanged Fittings ASTM A48-83 Gray Iron Castings
ASTM A108	Steel Bars, Carbon, Cold-Finished, Standard Quality
ASTM A126	Gray Iron Castings for Valves, Flanges, and Pipe Fittings
ASTM A216/A216M	Steel Castings, Carbon, Suitable for Fusion Welding, for High Temperature Service
ASTM A276	Stainless and Heat-Resisting Steel Bars and Shapes

1.03 SUBMITTALS

A. Procedures: Section 01 33 00.

B. Operation and maintenance information as specified in Section 01 78 23.

C. Shop drawings, illustrating valve component configuration, dimensions, material specifications (list ASTM designations) with certified leakage test results, pressure drop characteristics, and operator torque requirements.

1.04 TYPE USAGE:

A. Type B:
   1. System 1.

PART 2 PRODUCTS

2.01 MATERIALS

A. Type B:

Component	Material
Body	Cast iron, ASTM A126, Class B

Shaft	Stainless steel, ASTM A276, Type 316
Disc	Cast iron, ASTM A126, Class B
Seat sealing surface	Neoprene or Buna N (nitrile)--air and gas services
Disc edge	Nickel

2.02 FABRICATION

A. General:
   1. Valves shall be the stub or through shaft design.
   2. Valves shall be lug style or flanged.
   3. Unless otherwise indicated, valve flange drilling shall be per ANSI B16.1, Class 125.

B. Type B:
   1. Valves shall be rated at 175 psig and provide driptight shutoff up to the full valve rating on dead-end or isolation service.
   2. Seat shall be held in place mechanically and shall be field replaceable.
   3. Valve ends shall be as specified in Section 40 05 01.
   4. Valve seats:
      a. Type B valves, size 2 through 20 inches, shall have seats that are bonded to a rigid reinforcing ring.

2.03 MANUAL OPERATORS

A. General: Manual operators shall have a disc position indicator designating the opened and closed position of the valve.

B. Type B:
   1. Operators for valves 6 inches in diameter and smaller shall be latch lock levers. Valves shall be capable of being locked in at least five intermediate positions between fully open and fully closed.
   2. Operators for valves 8 inches in diameter and larger shall be the traveling nut or worm gear type. Operators for exposed service shall be gasketed for weatherproof service. A handwheel or chain wheel shall be provided for each operator.

2.04 OPERATORS – NOT USED

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions and as shown on the Drawings.

3.02 FIELD TESTS

A. Each valve, after installation and connection to the piping system, shall be cycled three times manually or utilizing the manual override to demonstrate proper operation.

B. Each valve, upon completion of installation of the piping system, shall be cycled to fully demonstrate proper operation and confirm that operating times, under both normal operating, and emergency closure conditions, are as specified.

C. Be responsible for all adjustments necessary to bring the equipment into conformance with the specifications.

END OF SECTION

SECTION 40 06 71

INSTRUMENT SCHEDULE

Tag No		Description	Range	Setpoint	Engr. Units	Specification	Instr ID	P-Dwg	Elec/Inst Wire Dwg	Location Plan Dwg	Inst Detl Dwg/Detail #	Notes
724	FIT31CA031	Blower #3 Lamson Smart Meter II - With two AO option AO1 - Flow	0 - 5,000	N/A	SCFM	40 78 73	XIS	J2443	E2493 / VA31CA03	E2420	N/A	Replaces existing Smart Meter in FP3153
--	--	Second AO - Power	0 - 150	N/A	KW	--	--	--	--	--	--	
724	FIT31CA041	Blower #4 Lamson Smart Meter II - With two AO option AO1 - Flow	0 - 5,000	N/A	SCFM	40 78 73	XIS	2444	E2494 / VA31CA04	E2420	N/A	Replaces existing Smart Meter in FP3154
--	--	Second AO - Power	0 - 150	N/A	KW	--	--	--	--	--	--	
724	PI31CA014	Blower #1 Discharge Pressure	0 - 10	N/A	PSIG	40 70 10	PG	N/A	N/A	M2415-A	170402	
724	PI31CA024	Blower #2 Discharge Pressure	0 - 10	N/A	PSIG	40 70 10	PG	N/A	N/A	M2415-A	170402	

SECTION 40 06 73

DCS I/O SCHEDULE

OVATION POINT NAME	SITE	FACILITY	TAG NAME	POINT TYPE	POINT ADDRESS	POINT DISCRIPTION 30 CHARACTER LIMIT	P&ID	LOOP #	OVATION PNL	I/O DWG	CHARACTER ISTICS	RESET DESCRIPTION	SET DESCRIPTION	UNITS	MINIMUM SCALE	MAXIMUM SCALE	DIGITS DISPLAYED	NOTES
WP724NDJ31CA011	WP	724	NDJ31CA011	DIGITAL IN	17/77:1,1,3,3	ML CHNL AIR BLWR 1 ON	N31-05	VA31CA01	724-ICP3101	J24200	B72401DI	OFF	ON					Modify
WP724XAD31CA011	WP	724	XAD31CA011	DIGITAL IN	17/77:1,1,3,4	ML CHNL AIR BLWR 1 FAIL	N31-05	VA31CA01	724-ICP3101	J24200	B72401DI	NORMAL	FAULTED					Modify
WP724NDJ31CA041	WP	724	NDJ31CA041	DIGITAL IN	17/77:1,1,3,5	ML CHNL AIR BLWR 4 ON	N31-05	VA31CA04	724-ICP3101	J24200	B72401DI	OFF	ON					Existing
WP724XAD31CA041	WP	724	XAD31CA041	DIGITAL IN	17/77:1,1,3,6	ML CHNL AIR BLWR 4 FAIL	N31-05	VA31CA04	724-ICP3101	J24200	B72401DI	NORMAL	FAULTED					Existing
WP724NDA31CA011	WP	724	NDA31CA011	DIGITAL IN	17/77:1,1,3,10	ML CHNL AIR BLWR 1 IN REMOTE	N31-05	VA31CA01	724-ICP3101	J24200	B72401DI	LOCAL	REMOTE					New
WP724ZSC31CA011	WP	724	ZSC31CA011	DIGITAL IN	17/77:1,1,3,11	ML CHNL AIR BLWR 1 VENT CLOSED	N31-05	VA31CA01	724-ICP3101	J24200	B72401DI	OPENED	CLOSED					New
WP724MNJ31CA011	WP	724	MNJ31CA011	DIGITAL OUT	17/77:1,2,1,7	ML CHNL AIR BLWR 1 CALL TO RUN	N31-05	VA31CA01	724-ICP3101	J24201	B72401DO	STOP	RUN					New
WP724JI31CA011	WP	724	JI31CA011	ANALOG IN	17/77:1,4,1,7	ML CHNL AIR BLWR 1 POWER	N31-05	VA31CA01	724-ICP3101	J24203	B72401AI			KW	0	150	1	New
WP724FI31CA011	WP	724	FI31CA011	ANALOG IN	17/77:1,4,1,8	ML CHNL AIR BLWR 1 FLOW	N31-05	VA31CA01	724-ICP3101	J24203	B72401AI			SCFM	0	6500	1	New
WP724JI31CA041	WP	724	JI31CA041	ANALOG IN	17/77:1,4,3,1	ML CHNL AIR BLWR 4 POWER	N31-05	VA31CA04	724-ICP3101	J24230	B72401AI			KW	0	150	1	New
WP724FI31CA041	WP	724	FI31CA041	ANALOG IN	17/77:1,4,3,2	ML CHNL AIR BLWR 4 FLOW	N31-05	VA31CA04	724-ICP3101	J24230	B72401AI			SCFM	0	5000	1	New
WP724SC31CA011	WP	724	SC31CA011	ANALOG OUT	17/77:1,4,5,6	ML CHNL AIR BLWR 1 SPEED SP	N31-05	VA31CA01	724-ICP3101	J24205	B72401AO			PCT	0	100	1	New
WP724NDJ31CA021	WP	724	NDJ31CA021	DIGITAL IN	18/78:1,1,3,2	ML CHNL AIR BLWR 2 ON	N31-05	VA31CA02	724-ICP3102	J24209	B72401DI	OFF	ON					Modify
WP724XAD31CA021	WP	724	XAD31CA021	DIGITAL IN	18/78:1,1,3,3	ML CHNL AIR BLWR 2 FAIL	N31-05	VA31CA02	724-ICP3102	J24209	B72401DI	NORMAL	FAULTED					Modify
WP724NDA31CA021	WP	724	NDA31CA021	DIGITAL IN	18/78:1,1,3,9	ML CHNL AIR BLWR 2 IN REMOTE	N31-05	VA31CA02	724-ICP3102	J24209	B72401DI	LOCAL	REMOTE					New
WP724ZSC31CA021	WP	724	ZSC31CA021	DIGITAL IN	18/78:1,1,3,10	ML CHNL AIR BLWR 2 VENT CLOSED	N31-05	VA31CA02	724-ICP3102	J24209	B72401DI	OPENED	CLOSED					New
WP724MNJ31CA021	WP	724	MNJ31CA021	DIGITAL OUT	18/78:1,2,1,9	ML CHNL AIR BLWR 2 CALL TO RUN	N31-05	VA31CA02	724-ICP3102	J24210	B72401DO	STOP	RUN					New
WP724JI31CA021	WP	724	JI31CA021	ANALOG IN	18/78:1,4,1,7	ML CHNL AIR BLWR 2 POWER	N31-05	VA31CA02	724-ICP3102	J24212	B72401AI			KW	0	150	1	New
WP724FI31CA021	WP	724	FI31CA021	ANALOG IN	18/78:1,4,1,8	ML CHNL AIR BLWR 2 FLOW	N31-05	VA31CA02	724-ICP3102	J24212	B72401AI			SCFM	0	6500	1	New
WP724SC31CA021	WP	724	SC31CA021	ANALOG OUT	18/78:1,4,5,6	ML CHNL AIR BLWR 2 SPEED SP	N31-05	VA31CA02	724-ICP3102	J24214	B72401AO			PCT	0	100	1	New
WP724NDJ31CA031	WP	724	NDJ31CA031	DIGITAL IN	19/79:1,1,3,1	ML CHNL AIR BLWR 3 ON	N31-05	VA31CA03	724-ICP3103	J24218	B72401DI	OFF	ON					Existing
WP724XAD31CA031	WP	724	XAD31CA031	DIGITAL IN	19/79:1,1,3,2	ML CHNL AIR BLWR 3 FAIL	N31-05	VA31CA03	724-ICP3103	J24218	B72401DI	NORMAL	FAULTED					Existing
WP724JI31CA031	WP	724	JI31CA031	ANALOG IN	19/79:1,4,1,7	ML CHNL AIR BLWR 3 POWER	N31-05	VA31CA03	724-ICP3103	J24221	B72401AI			KW	0	150	1	New
WP724FI31CA031	WP	724	FI31CA031	ANALOG IN	19/79:1,4,1,8	ML CHNL AIR BLWR 3 FLOW	N31-05	VA31CA03	724-ICP3103	J24221	B72401AI			SCFM	0	5000	1	New

SECTION 40 61 13

PROCESS CONTROL SYSTEM GENERAL PROVISIONS

PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies requirements for process instrumentation and control, which consists of hardware, software, and services necessary to provide the control functions specified.

B. The required control system uses information and requirements in other Contract Drawings, Schedules and Narrative/Specifications. The Drawings and Schedules depict application dependent data while the Narrative/Specifications define broader requirements such as overall quality and performance.

1.02 REFERENCED STANDARDS

A. This Section incorporates by reference the latest revisions of the embedded standard referenced herein. In case of conflict between the requirements of this Section and those of a listed document, the requirements of this Section shall prevail.

Reference	Title
API RP 551	Process Measurement Instrumentation
API RP 552	Transmission Systems
ISA S5.4	Instrument Loop Diagrams
ISA S20	Specification Forms for Process Measurement and Control Instrumentation, Primary Elements, and Control Valves
ISA S5.1	Instrumentation symbols and Identification
ISA S51.1	Process Instrumentation Terminology
ISA S5.3	Graphic Symbols for Distributed Control/Shared Display Instrumentation, Logic and Computer systems
ISA RP12.2.02	Recommendations for the Preparation, Content and Organization of Intrinsic Safety Control Drawings
NFPA 70	National Electric Code (NEC)
NFPA 79	Electrical Standards for Industrial Machinery
NFPA 820	Fire Protection in Wastewater Treatment and Collection Facilities
IBC 1632	International Building Code
UL 508	Industrial Control Equipment
UL 508A	Industrial Control Panels
UL 60947	Low Voltage Switchgear and Controlgear
King County	Ovation Installation and Programming Requirements

1.03 SUBMITTALS

A. Procedures: Section 01 33 00.

B. Catalog cuts of all furnished components and equipment.

C. Fabrication drawings with keyed Bills of Materials. Furnish hard copy as well as electronic format.

D. Seismic design information including a list of equipment weighing 400 pounds or more.

E. Certifications.

F. Factory test schedule and procedure including all test forms.

G. Field test schedule and procedure including all test forms.

H. Test Reports.

I. Operation and maintenance data per Section 01 78 23. Provide both paper copy and electronic copy of the as-built Control Strategies in the Operation and Maintenance manual.

J. Elementary Drawings and Loop Diagrams: Electronic format.

K. Connection Diagrams. Electronic format.

L. Interconnection Diagrams. Electronic format.

1.04 QUALITY ASSURANCE

A. Qualifications: The systems integration company which constructs and installs the process instrumentation and control system shall have the following minimum qualifications:
   1. A single systems integration company regularly engaged in the design and installation of Emerson Ovation Distributed Control Systems (DCS).
   2. The systems integration company and its personnel shall have demonstrated a history of successful execution Emerson Ovation DCS work commensurate with the scope of work of this Contract.
   3. A minimum of three years in the business of providing Emerson Ovation DCS Implementation and Programming.
   4. Completed the same type of work specified on at least five projects of equal or larger size. Local support within 50 miles of the work site.
   5. Has an electrical or controls engineer currently registered as a professional engineer in the state of Washington to supervise the work.
   6. The on-site Electrical or Control Systems engineer shall have a minimum of five years' experience installing wastewater control systems of similar scope and complexity.

B. Labeling:
   1. Contractor shall supply all new electrical control panels in conformance with UL 508A and shall bear the UL label.
   2. Contractor is responsible for suppling and coordinating on-site inspections of modified existing control panels or new control panels requiring field inspection and validation resulting in the control panels being provided with a UL 508A Label.

C. Perform detailed design for all interconnected components. Interconnected components shall include new and existing mechanical and electrical equipment specified in other sections of the Contract Documents, as well as new and existing process control system equipment.

D. Calibrate, configure, test, and start up the complete process instrumentation and control system.

E. Place the completed system in operation including tuning loops and making final adjustments to instruments and control parameters as required during plant system and Facility start-up.

F. Provide the services of skilled instrument technicians or engineers for testing, calibration, and adjustment activities under direct on site supervision of the Electrical or Control Systems engineer.

1.05 DEFINITIONS

A. Unless otherwise specified, the definitions of terminology used in Division 40 shall be as defined in ISA S51.1.

B. Electronic Format:
   1. Drawings shall be provided according to the requirements of Section 01 78 39.
   2. Tabular data shall be submitted in electronic format compatible with Microsoft Excel 2010®.
   3. Text data shall be submitted in electronic format compatible with Microsoft Word 2010®.

1.06 DESCRIPTION OF SYSTEM

A. Supervisory Process Control System (SPCS) consists of the following, installed in accordance to NFPA 70:
   1. The Supervisory Process Control System is an Emerson Ovation Distributed Control System (DCS).
   2. Redundant Ovation OCR400 controllers distributed around the facility that supports local, extended and remote I/O modules for connection of instruments and final elements.
   3. Conventional field instrumentation including primary elements, indicating transmitters, level, and pressure switches.
   4. Final control elements such as valve positioners and solenoids.
   5. OEM package systems that are supported by the manufacture have Rockwell RSLogix 5000 family PLCs that are interfaced with the DCS with hardwire connections for interlocking/controlling process data and Ethernet/IP for informational data.

B. The SPCS interfaces with variable frequency drives, motor control centers, and other auxiliary equipment:
   1. Control function and interlock I/O shall be hardwired to a local DCS controller I/O.
   2. Informational data may be interfaced with the DCS with Ethernet/IP utilizing the Emerson Ovation SCADA Servers.

C. Hierarchical Levels:
   1. A description of how each unit process is controlled within this control hierarchy is shown in the control strategies as described in Section 40 65 01 and as shown on the Drawings.
   2. In all cases, the control system shall be capable of controlling all processes as described in Division 40 and as shown on the Drawings.
   3. Generally, the process control system consists of three levels of control:
      a. The top level is generally fully automatic with the DCS used to control the process.
      b. The second level is DCS Manual operations.
      c. The third level is the local control with manual and sometimes automatic control independent of the DCS system.
   4. In all cases, equipment shall have Hand-Off-Remote local selector switches independent of the DCS for local hand control and lock-out verification.

D. Some areas of this Contract may involve classified areas and shall be handled per NFPA 820 and NFPA 70.

E. Development Ovation DCS System:
   1. The Owner has a development Ovation DCS system to initially program and complete FAT testing on. This system is on site at the West Point Treatment Facility.
   2. Ovation integrator shall utilize this system for all changes prior to implementation on the on-line system.

1.07 EXISTING CONDITIONS

A. Examine the Contract Document Drawings and Specifications to determine actual locations, sizes, materials and ratings of process connections.

B. Any "as-built" or record drawings of existing work presented in these Contract Documents are for information only and may not accurately represent existing conditions. Field-investigate all existing facilities modifications to ascertain the exact physical and electrical conditions in each case. After field investigation, revise as required installation and interface wiring drawings to conform to actual conditions and comply with codes and Contract requirements. Submit revisions to the Project

Representative. Provide a detailed design and implement the proper method for physical installation and interface wiring for the required modifications.

1.08 DESIGN AND PERFORMANCE REQUIREMENTS

A. Catalog Cuts:
   1. Include catalog information, technical specifications, and application information for each piece of equipment to be furnished.
   2. Edit catalog cuts to indicate only those items, models, or series of equipment to be furnished. Cross out or otherwise obliterate all extraneous materials information. Clearly identify all configuration options for the equipment to be furnished.
   3. Include data sheets in accordance to ISA S20 and a complete listing of all instruments to be furnished or modified, as well as any existing equipment that may be included in the work of this contract.

B. Drawings:
   1. The Contract Drawings are functional in nature and do not show exact locations of equipment and may not show all necessary interconnections between equipment.
   2. Fabrication drawings:
      a. Submit detailed interconnection diagrams, wiring diagrams, elementary diagrams, loop diagrams, and process and instrument diagrams with all electrical and electronic components clearly identified by tag number.
      b. Submit detailed construction drawings for all panel layouts and equipment enclosures with dimensions in inches. Show both exterior and interior views.
      c. Drawings shall utilize the drawing numbering system, and retain the drawing sequence used in the Contract Documents. If additional drawings need to be added, or the drawing sequence needs to be modified, clearly indicate those changes via the Submittal process.
   3. Wiring and loop diagrams shall carry a uniform and coordinated set of wire numbers and terminal block numbers in compliance with Divisions 26 and 40 to permit cross-referencing between contract documents and the drawings prepared by the Contractor.
   4. Each control circuit, control loop, control panel layout design, etc., shall be represented on a unique drawing. Control circuits, loop diagrams, and panel layouts referenced to typical diagrams are not acceptable.
   5. Drawing symbol format shall comply with NFPA 79, ISA 5.1, ISA 5.3 and where appropriate, ISA RP 12.2.02.
   6. Hardcopy plots shall be 11-inch by 17-inch (half-size) or 22 inch by 34 inch (full-size), as required.
   7. Minimum Text size: 0.125 inch for 22 x 34 inch drawings, 0.063 inch for 11 x 17 inch drawings.
   8. Drawings shall have borders and title blocks identifying the Contract, facility, system, and revisions to the drawing, and type of drawing. Borders and title blocks shall conform to current County drafting standards.
   9. Each release of a drawing shall carry a revision number, date, and a brief description of the changes. All changes associated with a given release shall be indicated on the drawing by a revision flag. Changes on the latest revision shall be indicated by clouding.
   10. Transfer record drawings per Section 01 78 39 to the County in electronic format on digital media and hard copy when work is completed.

C. Elementary and Loop Diagrams:
   1. Contract Drawings are functional in nature and may not show the exact wiring needed to achieve the required functions.
   2. Provide complete elementary diagrams for equipment control.
   3. Prepare loop diagrams in compliance with ISA S5.4 and provide for all analog loops.
   4. Comply with NFPA 79.
   5. Show circuits and devices of a system.
   6. Arrange to emphasize device elements and their functions as an aid to understanding the operation of a system and maintaining or troubleshooting that system.
   7. Show wire numbers, signal polarities, and terminal block numbers. Tables for wire numbers, signal polarity, and terminal block numbers are not acceptable.

8. Wiring between circuit elements shall terminate on terminal blocks, and shall not be connected from element to element. Exceptions are: common wires among contacts on a single circuit element (e.g., switch or relay contacts, but NOT the relay coil).

D. Wiring Diagrams:
   1. Panels: comply with NFPA79.
   2. Show components of a control panel in an arrangement similar to the actual layout of the panel.
   3. Show internal wiring between devices within the panel.
   4. Show all terminal blocks whether used for internal or field wiring. Those used for field wiring shall be clearly identified as such.
   5. Wiring diagrams shall indicate insulation color code, signal polarities, and show wire numbers and terminal block numbers.

E. Interconnection Diagrams:
   1. Submit complete interconnection diagrams for field wiring.
   2. Show each panel and field devices.
   3. Show wire numbers, cable numbers, raceway numbers, terminal box numbers, terminal block numbers, panel numbers, and field device tag numbers.
   4. Comply with NFPA79.

F. Certifications:
   1. Temperature: Test data certified by the manufacturer to demonstrate that field electronic devices are suitable for the specified ambient temperatures.
   2. Corrosion: Test data showing design features of the electronic equipment provided to protect against damage by the specified atmospheric contaminants and specific evidence that similarly protected electronic equipment has operated in similar environments for a period of not less than five years without failure due to corrosion.

G. Seismic Design:
   1. Procedure and submittals: per Section 01 73 00.
   2. Structures and equipment shall be braced to prevent damage from specified forces.
   3. Equipment shall not be required to function properly during periods of seismic disturbance, but shall be capable of manual restart without repair or modification following a disturbance.

H. Configuration Records:
   1. Configuration parameters shall be saved to electronic media and submitted with the Operation and Maintenance manual.
   2. Configuration parameters shall be saved to electronic media and locally stored at the facility. The location shall be coordinated with the Project Representative.

I. Control Strategies:
   1. Design to function per Control Strategies Section 40 65 01.

1.09 FACTORY TEST

A. Prior to factory test to be witnessed by the Project Representative and led by the Test Engineer (per Section 01 80 00), complete the following:
   1. Inspect and test the process instrumentation and control system including the main control panel, PLC, local control panels, etc., to ensure they are operational.
   2. Ensure that proper materials have been used during manufacture and assembly and parts and materials have been correctly assembled and wired.
   3. Complete an integrated test:
      a. Interconnect and test the process control and instrumentation system, except for primary elements, final control elements, and small control stations.
      b. Exercise and test all functions to ensure proper manufacture and assembly of the completed panel and/or system.
      c. Test all panels.

d. Simulate inputs and outputs for primary elements, final control elements, and small control stations excluded from the test.

B. Location: Coordinate Blower Manufacture factory test with Project Representative.

C. The Project Representative may elect to witness the factory test. Provide a written test schedule and notify the Project Representative no less than seven days prior to the test.

D. The factory test: Test and document the following functions:
1. Exercise and test all functions, including PLC software functions.
2. Provide test equipment to simulate discrete and analog inputs and outputs. All I/O shall be exercised.
3. Provide a testing simulation program to exercise all discrete and analog outputs to confirm proper loop operation.
4. Provide screens for the Operator Interface Terminal (OIT), if provided, to display and alarm simulated statuses and confirm system response to operator inputs.
5. Demonstrate that all panels and subsystems have the required spare capacity for expansion. Include test for I/O storage capacity and program memory capacity.

E. At a minimum, have the following at the test for review and use:
1. All applicable Drawings, Specifications, Addenda and Change Orders.
2. Factory test procedure including all test forms.
3. Shop drawings and hardware submittals for equipment being tested.
4. Software documentation.
5. Test Plan and supporting documentation.

F. Correct deficiencies and retest prior to shipment of the equipment to the work site.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Shipping:
1. Ship as a single unit to work site.
2. Anchor and brace equipment weighing 400 pounds or more to resist seismic forces per UBC 1632. Seismic criteria for the work site are listed in Section 01 73 00.
3. No internal wiring shall be disconnected for transportation.

B. Delivery Inspection: Notify the Project Representative and provide access for inspection upon arrival of any material or equipment to be incorporated into the work. Remove protective covers when required.

C. Control Panels:
1. Completely wired and tested in the factory prior to being shipped to the job site.
2. Shipped as a single unit to job site after testing is complete.
3. No internal wiring shall be disconnected for transportation.

1.11 MATERIALS AND QUALITY

A. The Instrument Schedule in Section 40 06 71 lists major instruments required to provide the process instrumentation system. Provide all functions specified in the Instrument Schedule. Provide additional instruments that may be required to complete the instrument loops because of certain characteristics of the particular equipment selected by the Contractor. Provide such additional instruments even though not specified in the Instrument Schedule or shown on the Drawings.

B. In some cases, it is possible to combine the functions of two or more instruments specified in the Instrument Schedule into a single instrument. An example of functions that may be ordinarily combined into a single instrument are multiple alarms derived from a common transmission signal. Alarm or safety functions derived directly from process measurements shall not be combined with instruments operating from transmission signals. Critical alarms or safety functions shall not be combined into any instrument used for process control, indication, or recording.

C. Material shall be new, free from defects, and of the quality specified. Each type of instrument, accessory, and device shall be by the same manufacturer.

D. Unless otherwise specified, electronic equipment shall be of solid-state construction. Components of standard electronic assemblies shall not be replaced with components of different characteristics in order to meet the performance requirements of the specification. Parts shall be as shown in the instruction manuals and shall be replaceable with standard commercial components of the same description without degrading the performance of the completed assembly.

PART 2 PRODUCTS [NOT USED]

PART 3 EXECUTION

3.01 INSTALLATION

A. General:
1. The Contractor's on site Electrical or Control Systems engineer shall supervise and coordinate all activities related to requirements of the process instrumentation and controls.
2. Equipment shall be located and protected so that it is readily accessible for operation and maintenance as required by NFPA 70. Equipment shall be located between 48 and 66 inches above the floor or a permanent work platform.
3. Provide instrument tags for all field instruments engraved with the equipment number as identified on the Process and Instrument Diagrams and/or the Instrument Schedule Section 40 06 71. Tags shall be stainless steel and affixed to the field equipment with stainless steel screws or stainless steel wire. Engraved text shall be not less than 0.125 inches high.
4. Use API RP 551 and PR 552 as a guide where installation procedures that are not specified herein.
5. Coordinate installation with other work to avoid interference with normal operation of on-line equipment and processes.
6. Provide the services of skilled instrument technicians for testing, calibration, and adjustment activities.
7. Unless otherwise specified, instrumentation support systems shall be constructed of stainless steel.
8. Instrument supports shall not be attached to handrails, process piping, or mechanical equipment unless required in order to perform the measurement function.
9. No instrument shall be mounted directly flush to walls without a minimum of 5/8” spacing.
10. Anchor and brace equipment per Section 01 73 00.

B. Signal Transmission:
1. Unless otherwise specified, signal transmission between electric or electronic instruments not located within a common panel shall be 4 to 20 milliamperes and shall have a loop resistance of at most 500 ohms.
2. Two-wire loop transmitters shall operate at 24 VDC.
3. Analog loops with power supplied by the Ovation DCS shall have their shield grounded at the Ovation I/O terminal block.
4. Analog loops with power supplied in the field at the transmitter shall have their shield grounded in the field at the transmitter and connected to the high resistance shield location on the Ovation I/O terminal block.
5. Separate grounded conductors shall be provided for each discrete control loop. Daisy chaining of grounded conductors from one loop to another is not allowed.
6. Provide isolating amplifiers for field equipment possessing a grounded input or output, or having a common mode voltage other than system ground.
7. Convert high frequency (greater than 50 Hz) pulse rate signals from field transmitters to analog 4-20 milliampere signals at the panel.
8. Convert platinum resistance temperature detector (RTD) outputs to 4-20 milliampere signals at the RTD, or where shown on the Drawings.
9. All other transmission systems, such as impulse duration, low frequency pulse rate, and voltage regulated, will not be permitted except where specifically noted in the Instrument Schedule, Section 40 06 71. When transmitters with non-standard outputs are specified, their output shall be converted to 4 to 20 milliamperes at the field instrument.

10. Equipment located in classified areas shall be explosion-proof or intrinsically safe. Provide intrinsic safety barriers approved by UL, CSA, or FM.

3.02 TESTS AND INSPECTIONS

A. General Requirements:
   1. Meet Section 01 80 00 requirements.
   2. All required tests beginning with the Factory Test, will be witnessed by the Project Representative or County-designated person unless a written exemption is provided.
   3. Notify the Project Representative of the test date seven days prior to the test.
   4. Submit a detailed step-by-step test procedure, complete with forms for the recording of test results, testing equipment used, and identification of the technician performing and witnessing the test. Test reports: Conform to the requirements of Forms below per Section 01 33 00 and ISA S20.

B. Test Equipment:
   1. Unless specified otherwise, provide all test equipment to complete all specified tests.
   2. Test equipment used to simulate inputs and read outputs shall have a rated accuracy at the point of measurement at least three times greater than the component under test.
   3. Each test instrument shall be calibrated prior to the commencement of a testing activity and checked after the completion of a testing activity.
   4. Submit dated and certified calibration reports traceable to the National Institute of Standards and Technology (NIST) with the test report. Calibration certification date shall be within three months of date of use on this Contract.
   5. Provide buffer solutions and reference fluids for tests of analytical equipment.

C. Test Stages:
   1. General:
      a. Test each instrument loop in the following sequence:

Form	Testing Sequence
40 61 13 - A	Loop wiring and insulation resistance test data form
40 61 13 - D	Panel indicator calibration test data form
40 61 13 – J	Individual loop test data form
40 61 13 - K	Loop commissioning test data form

   2. Testing of piping, wiring, and individual components shall be completed with certified test reports completed, which shall be provided to the Project Representative prior to commencement of individual loop testing.
   3. Un-witnessed factory test: It shall be performed by the Contractor prior to the County witnessed Factory Test. Refer to the Factory Test paragraph in this Section.
   4. Factory test: Refer to the Factory Test paragraph in this Section.
   5. Individual component calibration and test:
      a. Each instrument and final element shall be field calibrated in accordance with the manufacturer's recommended procedure. Instruments shall then be tested in compliance with ISA S51.1 and the data entered on the applicable test form.
      b. This test is to be witnessed by the Project Representative.
      c. Alarm trips, control trips, and switches shall be set to initial values specified in the Instrument Schedule in Section 40 06 71.
      d. Final elements shall be checked for range, dead-band, and speed of response.
      e. Any component that fails to meet the required tolerances shall be repaired by the manufacturer or replaced.
      f. Repeat above tests until the component is within tolerance.
   6. Loop test:
      a. Test each instrument loop as an integrated system. This test shall check operation from transmitter to signal receiving components, and from the main control panel to final control elements. This test is to be witnessed by the Project Representative.
      b. Inject signals at the field terminations to simulate primary measuring elements.

c. Output of each auto/manual station shall be manually varied from 0 to 100 percent, and correct operation of final control element verified.
d. Each alarm circuit shall be manually actuated at the field sensor.

7. Closed-loop test:
   a. Test shall demonstrate stable operation of the loop under actual Facility operating conditions. This test includes adjustment of loop tuning parameters and shall be witnessed by the Project Representative.
   b. Unless otherwise specified, adjust tuning parameters (proportional gain, integral time constant, and derivative time constant) for each control loop to provide ¼-amplitude damping or better.
   c. Prepare a chart recording showing loop response to a step disturbance for each loop.
   d. Make two charts for cascade loops, one showing the secondary loop response with its set point on manual, and the second showing overall loop response.
   e. Chart recordings shall be made at sufficient speed and amplitude to clearly show specified amplitude damping and shall be annotated to show loop number and title, and settings of parameters and set point.

END OF SECTION

SECTION 40 63 43

PROGRAMMABLE LOGIC CONTROLLERS

PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies the Programmable Logic Controller (PLC) hardware, programming software and system configuration requirements.
   1. Each PLC system shall consist of a PLC and input/output module system complete as per the Contract Drawings.
   2. Each PLC system shall receive inputs and transmit output to circuits and components as shown on the Contract Drawings.
   3. Each PLC system shall be programmable in industrial standard relay ladder logic symbols and be delivered fully programmed for the functions required as per Section 40 68 70.
   4. The PLC shall be delivered with a Graphical Operator Interface as per Section 40 63 63.

B. Section Work includes:
   1. Verifying that systems modified under this Contract operate as described in Section 43 11 40 Variable-Speed Turbo Air Blowers.
   2. Coordinating installation of the PLC equipment installed under this Contract, the hardwired interface to existing DCS system.
   3. Provide a complete and functional PLC system for each piece of equipment.
   4. Control system startup, testing and commissioning as defined in Section 01 80 00, Section 40 61 13 and Section 43 11 40.

1.02 REFERENCED STANDARDS

A. This Section incorporates by reference the latest revisions of the embedded standard referenced herein. In case of conflict between the requirements of this Section and those of a listed document, the requirements of this Section shall prevail.

Reference	Title
NEMA ICS 1	General Standards for Industrial Controls and Systems
NEMA ICS 1.1	Safety Guidelines for the Application of Industrial Control Systems
NFPA 70	National Electrical Code (NEC)
King County	PLC and OIT Programming and Installation Requirements

1.03 SUBMITTALS

A. Procedures: Section 01 33 00.

B. Manufacturer’s catalog information.

C. Shop drawings and dimensions of PLC System components and back panels.

D. PLC interconnection drawings: Organization, mounting, and interconnection of the PLC system components with a material list.

E. Wiring diagrams: Connections of the PLC System to new and existing equipment.

F. Software submittals: per Section 40 68 70.

G. Testing submittals: per Sections 01 80 00, 40 61 13 and 43 11 40.

H. Operation and Maintenance information: per Section 01 78 23.

1.04 QUALITY ASSURANCE

A. Listing: Equipment shall be listed for the purpose for which it is used by UL, FM or CSA.

1.05 DESIGN REQUIREMENTS

A. Each PLC system shall consist of one PLC Central Processing Unit (CPU) and one or more I/O chassis populated with I/O modules as shown in the Contract Drawings.

B. Each PLC system shall be programmed in industry standard relay ladder symbols and shall be delivered fully programmed for the functions required as per Section 40 68 70 and the latest King County's "PLC and OIT Programming and Installation Requirements" document.

C. Environmental Requirements:
1. Temperature: 10C to 60C (50 deg F to 140 deg F)
2. Humidity: 0 to 95%, non-condensing
3. Altitude: 0 to 500 feet (0 to 150 m) above Sea Level

PART 2 PRODUCTS

2.01 PLC HARDWARE

A. Provide PLC Systems, complete, in accordance with the Contract Documents.
1. Include all hardware required to provide a complete and operable PLC.
2. Ensure hardware is fully compatible with the software that is to operate on the hardware.
3. Provide components from the same manufacturer, model, part number and revision for any specified component.
4. Acceptable Manufacturers:
   a. Allen-Bradley ControlLogix or CompactLogix PLC products. No substitutions allowed.

B. Programmable Logic Controller Equipment
1. Provide all appurtenant hardware required to support the installation, operation and maintenance of the PLC.
2. Select only one type of PLC hardware based on the below equipment list:

PLC Family	Controller Family	I/O Module Family
ControlLogix	1756-L8x	1756 Series I/O Modules
CompactLogix	1769-L3x	1769 Compact I/O Modules

3. Provide the quantity of PLC equipment required to meet the Contract Specifications and Drawings.
4. Provide PLC slot covers in all empty slots.

2.02 PROGRAMMING SOFTWARE

A. Utilize software for programming the Allen-Bradley PLC as specified in Section 40 68 70

B. Utilize software for programming Operator Interface Terminal (OIT) as specified in Section 40 63 63.

2.03 PLC SYSTEM REQUIREMENTS

A. The processor models, I/O quantities and I/O configurations shall comply with the following general control requirements:
1. PLC CPUs shall not be required to be redundant.
2. Removal of any single I/O card shall not affect critical equipment.
3. Failure of any single I/O card shall not affect critical equipment.

4. Each station shall have an OIT as described in Section 40 63 63 for displaying and modifying specific PLC program parameters.
5. All programs loaded into the Allen-Bradley PLCs shall comply with Section 40 68 70 and shall be written in Ladder Logic or other approved program languages. Use of programming techniques other than approved program languages is prohibited without prior written approval by King County.

B. PLC Failure Relay:
1. Provide at least one Relay Output module in each PLC System to provide a hard-wired indication of PLC failure.
2. PLC failure circuit opens the equipment fault relay.
3. Program the PLC and configure the Relay Output card so that the PLC failure relay is normally energized and shall de-energize on detection of a fatal PLC error or upon PLC power failure. Fatal error detection shall include all diagnostics available in the PLC and custom error detection programming as required.

C. Communications Interface:
1. Provide communications interface for future connection to facility PLC network.
2. Protocol to be Rockwell Ethernet/IP.
3. Verify bi-directional data communications between the PLC System and a local laptop.

D. OIT:
1. Provide an OIT as specified in Section 40 63 63 for each PLC System.

2.04 SPARE PARTS

A. Provide at least 10% spare points of the following types:
1. Analog Inputs (1-5 VDC)
2. Analog Outputs (4-20 mA)
3. Discrete Inputs (120 VAC and/or 24VDC, as required)
4. Discrete Outputs (120 VAC, 24 VDC, and/or Relay Outputs, as required)

PART 3 EXECUTION

3.01 INSTALLATION

A. Install a PLC System with ladder logic programming based on control strategy narrative in Section 43 11 40 Variable-Speed Turbo Air Blowers.

B. Program the PLC System[s] to provide local equipment monitoring, local equipment control and serve as an interface between the facility systems and the existing SCADA System.

C. Install all equipment in strict accordance with the manufacturer’s installation documentation.

3.02 FIELD QUALITY CONTROL

A. Verify the correct program is installed in the PLC prior to connecting the PLC System to the field wiring.

B. Inspect the installed PLC and verify that the PLC System is mounted correctly and all wire polarities and wire terminations are correct.

C. Make final adjustments and perform preliminary check out to verify proper operation.

3.03 TESTING

A. Perform testing as specified in Sections 01 80 00, 40 61 13 and 43 11 40.

END OF SECTION

SECTION 40 63 63

GRAPHICAL OPERATOR INTERFACE

PART 1 GENERAL

1.01 SUMMARY

A. This Section defines the requirements and the communications options for the Graphical Operator Interface Terminals (OIT).

1.02 REFERENCED STANDARDS

A. This Section incorporates by reference the latest revisions of the embedded standard referenced herein. In case of conflict between the requirements of this Section and those of a listed document, the requirements of this Section shall prevail.

Reference	Title
NFPA 70	National Electrical Code
UL 508	Industrial Control Equipment

1.03 SUBMITTALS

A. Procedures: Section 01 33 00.

B. Catalog data sheet, including layout dimensions.

C. Local manufacturer's representative name, address, and telephone number.

D. Software programming submittals: In accordance with Section 40 68 70.

E. Operation and maintenance information: Section 01 78 23.

1.04 QUALITY ASSURANCE

A. Listing: Equipment shall be listed for the purpose for which it is used by UL, FM or CSA.

1.05 ENVIRONMENTAL REQUIREMENTS

A. Temperature: 10 degrees C to 55 deg C (50° F to 130° F).

B. Humidity: 0 to 95%, non-condensing.

C. Altitude: 0 to 500 feet above Sea Level.

PART 2 PRODUCTS

2.01 ACCEPTABLE PRODUCTS

A. General:
   1. The OIT shall be a single, self-contained, panel-mounted unit capable of meeting all of the required specifications without separate external modules.
   2. Enclosure shall be rated NEMA 4 when installed.

B. The OIT shall consist of the following major components:
   1. Color Graphic panel - 640 x 480 pixel min. resolution - 256 colors min.
   2. Touch screen - min. 16 touch sensitive positions.
   3. Function Keypad - min. 12 function keys, 4 arrow keys.
   4. Numeric Entry Keypad - min. 0-9 (d.p.) (-) <ENTER>.
   5. Communications interfaces: Ethernet/IP (IEEE 802.3).

C. The OIT shall utilize the following support components, provided according to the requirements of the application:
   1. Programming Software.
   2. Cables and Connectors.

D. Acceptable Manufacturer:
   1. OIT shall be Rockwell Automation PanelView Plus 7 Performance Terminal color graphic panel with touch screen, 22-key Function keypad, and PLC communications interface as specified.
      a. No Substitutions.
   2. Models shall be as specified below:

Screen size, Nominal	PLC Interface	Power	Model No.
15-inch diagonal	Ethernet/IP	24VDC	2711P-B15C22D9P
10-inch diagonal	Ethernet/IP	24VDC	2711P-B10C22D9P
7-inch diagonal	Ethernet/IP	24VDC	2711P-B7C22D9P
15-inch diagonal	Ethernet/IP	120VAC	2711P-B15C22A9P
10-inch diagonal	Ethernet/IP	120VAC	2711P-B10C22A9P
7-inch diagonal	Ethernet/IP	120VAC	2711P-B7C22A9P

E. Programming software: Rockwell Automation Factory Talk View Studio Machine Edition software, latest version.

2.02 POWER SUPPLY

A. The OIT shall operate from 24 VDC (21-27 VDC) power or 120VAC power. Power dissipation shall be less than 80 Watts. Provide one power source for each Operator Interface.

B. OIT shall be UL listed and/or CE certified for use in this application.

2.03 PROGRAMMABLE ACCESSORIES

A. Programming Software:
   1. Utilize software for programming, documentation, and diagnostic tools for the OIT as specified above. Software is capable of uploading and downloading programs to the OIT. Software features used for entering and editing programs includes programming utilities such as graphical “cut and paste” operations, creation and editing of graphic elements, text elements, and touch screen (if used) elements.
   2. Software enables the programmer to create display screens consisting of graphic elements, static and dynamic text displays. Software allows the linkage of status variables to colors and/or video attributes of text or graphic elements. Software has the ability to link keystrokes from the special function keypad or touch screen to the values of status variables and/or to the video attributes of text or graphical elements. Software provides the ability to display and enter numeric variables.
   3. Software has a library of pre-defined graphic elements including: push buttons, indicator lamps, bar graph displays, selector switches, numeric entry panels and dynamic messaging panels.
   4. Software has the ability to navigate to new operator display screens in a tree-shaped architecture based on special function or touch screen keystrokes.
   5. Documentation features allow editing of variable names and program comments, and printing or listing to a file of:
      a. Display screen definitions and/or screen captures.

b. Variable linkages, variable names and program comments.
c. Version number of the program, version comments, author, and date of last revision.

B. Programming Software operates under the Windows 10 operating systems.

2.04 TROUBLESHOOTING

A. The OIT module shall have built-in status checking software.
1. Errors shall be reported via error messages on the display.
2. Recoverable errors shall be resettable from the front panel.
3. Non-recoverable errors shall be resettable by cycling power off and on.

2.05 FACTORY TEST

A. The factory test shall comply with the requirements of Section 40 61 13.

PART 3 EXECUTION

3.01 INSTALLATION

A. Mounting:
1. The OIT's shall be mounted in control panels as indicated in the Drawings and in compliance with the manufacturer's requirements.

B. Programming:
1. The OIT systems shall be programmed in compliance with the latest version of King County's "PLC and OIT Installation and Programming Requirements" document.
a. Obtain document from the Project Representative.

3.02 SYSTEM PERFORMANCE TEST

A. The system test shall comply with the requirements of Sections 01 80 00, 40 61 13, and 43 11 40.

END OF SECTION

SECTION 40 65 01

CONTROL STRATEGY
CS724-01 - MIXED LIQUOR CHANNEL AERATION

PART 1 GENERAL

1.01 SUMMARY

A. The mixed liquor (ML) channel aeration system provides air mixing to maintain solids suspension and maintain a positive ML dissolved oxygen (DO) concentration in the mixed liquor channel.

1.02 REFERENCES

A. P&IDS: N31-05.

B. Related Control Strategies: None.

C. Control Diagrams: None.

D. Instrument Loop Diagrams: VA31CA01, VA31CA02, VA31CA03, VA31CA04 & VA03FD011.
   1. Instrument Index, Section 40 06 71
   2. Ovation I/O List, Section 40 06 73
   3. Ovation Alarm Schedule. Paragraph 1.05

1.03 SYSTEM DESCRIPTION

A. The mixed liquor (ML) channel at the West Point Treatment Plant (WPTP) conveys primary effluent and return activated sludge from the secondary aeration tanks to the secondary sedimentation tanks. Two variable speed turbo blowers and two constant-speed multistage centrifugal blowers located on the lower level of the Intermediate Pump Station provide air to the channel via coarse bubble diffusers. The blower system flow will be automatically adjusted based on wastewater flows through the secondary treatment system. For periods when plant flows are to be less than 80 mgd, blowers will provide a constant 10,000 standard cubic feet per minute (scfm), and for plant flows above 240 mgd, blowers will provide a constant 6,000 scfm. For plant flows between 80 and 240 mgd, required airflow will be a straight-line proportion between 10,000 and 6,000 scfm.

1.04 EQUIPMENT

Equipment No.	Equipment Name/Description	Status
724-B31CA011	Mixed Liquor Channel Aeration Blower #1	NEW
724-B31CA021	Mixed Liquor Channel Aeration Blower #2	NEW
724-B31CA031	Mixed Liquor Channel Aeration Blower #3	EXISTING
724-B31CA041	Mixed Liquor Channel Aeration Blower #4	EXISTING

1.05 ALARMS

A. Ovation Alarm Schedule:
   Note: Configure alarm points with Auto Return: On

Alarm Description – 40 CHARACTER LIMIT	Tagname	Trip Setting	Priority
ML CHNL AERATION BLWR 1 FAULTED	XAD31CA011	1 = FAULTED	3
ML CHNL AERATION BLWR 2 FAULTED	XAD31CA021	1 = FAULTED	3

Alarm Description – 40 CHARACTER LIMIT	**Tagname**	**Trip Setting**	**Priority**
ML CHNL AERATION BLWR 3 FAULTED	XAD31CA031	1 = FAULTED	3
ML CHNL AERATION BLWR 4 FAULTED	XAD31CA041	1 = FAULTED	3

1.06 INTERLOCKS

A. Local Hardwired:
   1. Blowers #1 and #2 OEM control equipment provides protection from surge induced high vibration conditions.

B. Ovation:
   1. None.

1.07 CONTROL OPERATION

A. The mixed liquor blower control system will normally always operate the two turbo blowers to supply the full range of airflow required. The two fixed-speed blowers will be available if one of the turbo blowers is not available. Operators will start and stop blowers as needed, an automatic sequencer to start and stop blowers is not included.

B. All ranges stated below are to be verified and updated during construction and commissioning.

C. Local Operation:
   1. Location of local control:
      a. Blower #1 and Blower #2 local controls are located in panels 724-FP3151 and 724 FP3152 in the blower housings 724-B31CA011 and 724-B31CA021.
      b. Blower #3 and Blower #4 local controls are located on field panels 724-FP3153 and 724-FP3154.
   2. Blowers #1 and Blower #2 have local and remote controls.
      a. When the Local/Remote switch is in Local OEM provided controls are used for:
         1) START
         2) STOP
         3) Speed Control
      b. Local display is also used for local monitoring of the blower.
   3. Blower #3 and Blower #4 are only local control with status monitoring on Ovation. Note that these blowers are constant speed blowers. Flow is adjusted in the field by manually modulating the blower's suction valve.
      a. Local OEM panels provide the following controls:
         1) START
         2) STOP
      b. Local OEM panel is also used for local monitoring of flow, electrical power, equipment temperature and vibration.

D. DCS Manual Operation:
   1. Mixed Liquor Channel Aeration Blower #1 – 724-B31CA011
      a. Pop-up window Diagram 24xxx is used to control Start/Stop and Speed functions of the blower. (Note: Update this strategy with the assigned diagram number when built.)
      b. Motor Start/Stop Control – See Level 1 Motor Start/Stop Control Macro for details.
         1) Inputs:
            a) IN REMOTE - WP724NDA31CA011
               (1) 1 = REMOTE
            b) ON - WP724NDJ31CA011
               (1) 1 = RUNNING
            c) FAIL - WP724XAD31CA011
               (1) 1 = FAULTED

d) VENT VALVE CLOSED - WP724ZSC31CA011
(1) 1 = CLOSED
2) Outputs:
a) RUN COMMAND - WP724MNJ31CA011
(1) 1 = BLOWER RUN COMMAND
3) Start Permissives:
a) HOR (on Blower panel) in REMOTE (WP724NDA31CA011)
b) DCS mode Manual/Auto in Manual
4) Stop Permissives:
a) HOR (on Blower panel) in REMOTE (WP724NDA31CA011)
b) DCS mode Manual/Auto in Manual
5) Start Control: If not running: Stop Button status indicator ON.
a) Start Button with status indicator will be available.
b) Selecting Start Button will start the motor.
6) Stop Control: If running: Start Button status indicator ON.
a) Stop Button with status indicator will be available.
b) Selecting Stop Button will stop the motor
7) Trips:
a) Motor Fault (WP724XAD31CA011)
8) Manual Rejects:
a) None

c. Flow Control - See Level 1 PID Control Macro for details.
1) Flow signal analog input from the blower (WP724FI31CA011)
a) Signal Calibration: 4 – 20 ma analog input signal = 0 – 6500 SCFM
b) Used in total flow calculation
2) Speed Command analog output to the blower (WP724SC31CA011)
a) Signal Calibration: 4 – 20 ma analog input signal = 0 – 100% (calibrated to 0 – 6500 SCFM).
3) Control Algorithm
a) PID
b) Modes – In DCS Manual
(1) Manual
(a) Operator sets Output Value
(2) Automatic - Output set by Algorithm to maintain PV on SP
(a) Operator enters required Flow Setpoint
(b) Rejects to Manual with Output = 0.0 if WP724NDJ31CA011 is OFF

d. Electrical Power Indication:
1) Electrical power signal analog input from the blower (WP724II31CA011)
a) Signal Calibration: 4 – 20 ma analog input signal = 0 – 150 KW

2. Mixed Liquor Channel Aeration Blower #2 – 724-B31CA021
a. Pop-up window Diagram 24xxx is used to control Start/Stop and Speed functions of the blower. (Note: Update this strategy with the assigned diagram number when built.)
b. Motor Start/Stop Control – See Level 1 Motor Start/Stop Control Macro for details.
1) Inputs:
a) IN REMOTE - WP724NDA31CA021
(1) 1 = REMOTE
b) ON - WP724NDJ31CA021
(1) 1 = RUNNING
c) FAIL - WP724XAD31CA021
(1) 1 = FAULTED
d) VENT VALVE CLOSED - WP724ZSC31CA021
(1) 1 = CLOSED
2) Outputs:
a) RUN COMMAND - WP724MNJ31CA021
(1) 1 = BLOWER RUN COMMAND

3) Start Permissives:
   a) HOR (on Blower panel) in REMOTE (WP724NDA31CA021)
   b) DCS mode Manual/Auto in Manual
4) Stop Permissives:
   a) HOR (on Blower panel) in REMOTE (WP724NDA31CA021)
   b) DCS mode Manual/Auto in Manual
5) Start Control: If not running: Stop Button status indicator ON.
   a) Start Button with status indicator will be available.
   b) Selecting Start Button will start the motor.
6) Stop Control: If running: Start Button status indicator ON.
   a) Stop Button with status indicator will be available.
   b) Selecting Stop Button will stop the motor
7) Trips:
   a) Motor Fault (WP724XAD31CA021)
8) Manual Rejects:
   a) None

c. Flow Control - See Level 1 PID Control Macro for details.
   1) Flow signal analog input from the blower (WP724FI31CA021)
      a) Signal Calibration: 4 – 20 ma analog input signal = 0 – 6500 SCFM
      b) Used in total flow calculation
   2) Speed Command analog output to the blower (WP724SC31CA021)
      a) Signal Calibration: 4 – 20 ma analog input signal = 0 – 100% (calibrated to 0 – 6500 SCFM)
   3) Control Algorithm:
      a) PID
      b) Modes – In DCS Manual
         (1) Manual
            (a) Operator sets Output Value
         (2) Automatic - Output set by Algorithm to maintain PV on SP
            (a) Operator enters required Flow Setpoint
            (b) Rejects to Manual with Output = 0.0 if WP724NDJ31CA021 is OFF

d. Electrical Power Indication:
   1) Electrical power signal analog input from the blower (WP724II31CA021)
      a) Signal Calibration: 4 – 20 ma analog input signal = 0 – 150 KW

3. Mixed Liquor Channel Aeration Blower #3 – 724-B31CA031
   a. No Pop-up window, only local control.
   b. Motor Status:
      1) Inputs:
         a) ON - WP724NDJ31CA031
            (1) 1 = RUNNING
         b) FAIL - WP724XAD31CA031
            (1) 1 = FAULTED
   c. Flow Indication:
      1) Flow signal analog input from the blower (WP724FI31CA031)
         a) Signal Calibration: 4 – 20 ma analog input signal = 0 – 5000 SCFM
         b) Used in total flow calculation
   d. Electrical Power Indication
      1) Electrical power signal analog input from the blower (WP724II31CA031)
         a) Signal Calibration: 4 – 20 ma analog input signal = 0 – 150 KW
4. Mixed Liquor Channel Aeration Blower #4 – 724-B31CA041
   a. No Pop-up window, only local control.
   b. Motor Status:
      1) Inputs:
         a) ON - WP724NDJ31CA041
            (1) 1 = RUNNING

b) FAIL - WP724XAD31CA041
(1) 1 = FAULTED

c. Flow Indication:
1) Flow signal analog input from the blower (WP724FI31CA041)
a) Signal Calibration: 4 – 20 ma analog input signal = 0 – 5000 SCFM
b) Used in total flow calculation

d. Electrical Power Indication:
1) Electrical power signal analog input from the blower (WP724II31CA041)
a) Signal Calibration: 4 – 20 ma analog input signal = 0 – 150 KW

E. DCS Automatic Operation:
1. Total Air Flow Calculation:
a. Total Air Flow = Summation of WP724FI31CA011 + WP724FI31CA021 + WP724FI31CA031 + WP724FI31CA041
1) Range: 0 – 12,000 SCFM
2. Mixed Liquor Channel Aeration Blower #1 – 724-B31CA011.
a. Motor Start/Stop Control
1) No DCS AUTO Functions
b. Flow Setpoint Calculation
1) DCS Auto Permissives:
a) Flow Control Algorithm PID mode is in Cascade
2) Flow Control Algorithm PID Setpoint
a) Below calculation results write to set point in DCS Auto with PID in Cascade
3) Three flow conditions, both 724-B31CA011 and 724-B31CA021 are ON
a) Primary Effluent Flow, WP724FI03FD011, is less than or equal to 80 MGD
(1) SP for 724-B31CA011 flow control PID = 5,000 SCFM
b) Primary Effluent Flow, WP724FI03FD011, is between 80 MGD and 240 MGD
(1) SP for 724-B31CA011 flow control PID =
(WP724FI03FD011) x (-12.5) + 6000: SCFM
c) Primary Effluent Flow, WP724FI03FD011, is greater than or equal to 240 MGD
(1) SP for 724-B31CA011 flow control PID = 3,000 SCFM
4) Three flow conditions, both 724-B31CA011 and either 724-B31CA031 or 724-B31CA041 are ON
a) Primary Effluent Flow, WP724FI03FD011, is less than or equal to 80 MGD
(1) SP for 724-B31CA011 flow control PID = 5,000 SCFM
b) Primary Effluent Flow, WP724FI03FD011, is between 80 MGD and 240 MGD
(1) SP for 724-B31CA011 flow control PID =
(WP724FI03FD011) x (-18.44) + 6475: SCFM
c) Primary Effluent Flow, WP724FI03FD011, is greater than or equal to 240 MGD
(1) SP for 724-B31CA011 flow control PID = 2,050 SCFM
5) 724-B31CA011 in OFF
a) SP for 724-B31CA011 flow control PID = 0.0 SCFM
3. Mixed Liquor Channel Aeration Blower #2 – 724-B31CA021
a. Motor Start/Stop Control
1) No DCS AUTO Functions
b. Flow Setpoint Calculation
1) DCS Auto Permissives:
a) Flow Control Algorithm PID mode is in Cascade
2) Flow Control Algorithm PID Setpoint
a) Below calculation results write to set point in DCS Auto with PID in Cascade
3) Three flow conditions, both 724-B31CA021 and 724-B31CA011 are ON
a) Primary Effluent Flow, WP724FI03FD011, is less than or equal to 80 MGD
(1) SP for 724-B31CA021 flow control PID = 5,000 SCFM
b) Primary Effluent Flow, WP724FI03FD011, is between 80 MGD and 240 MGD
(1) SP for 724-B31CA021 flow control PID =
(WP724FI03FD011) x (-12.5) + 6000: SCFM

c) Primary Effluent Flow, WP724FI03FD011, is greater than or equal to 240 MGD
(1) SP for 724-B31CA021 flow control PID = 3,000 SCFM

4) Three flow conditions, both 724-B31CA021 and either 724-B31CA031 or 724-B31CA041 are ON
a) Primary Effluent Flow, WP724FI03FD011, is less than or equal to 80 MGD
(1) SP for 724-B31CA021 flow control PID = 5,000 SCFM
b) Primary Effluent Flow, WP724FI03FD011, is between 80 MGD and 240 MGD
(1) SP for 724-B31CA021 flow control PID = (WP724FI03FD011) x (-18.44) + 6475: SCFM
c) Primary Effluent Flow, WP724FI03FD011, is greater than or equal to 240 MGD
(1) SP for 724-B31CA021 flow control PID = 2,050 SCFM

5) 724-B31CA021 in OFF
a) SP for 724-B31CA021 flow control PID = 0.0 SCFM

1.08 DCS GRAPHICS

A. Graphic Changes:
1. Create a new graphic page showing all four mixed liquor blowers
2. On existing two graphics that show the four blower run statuses, add a control that opens the new graphic page.
3. Create Pop-Up control windows for Blower #1, Blower #2, Blower 1 Flow Control and Blower 2 Flow Control
4. Blower #1 and Blower #2 to include touch that opens control pop up
5. Blower #1 & #2 Flow PID blocks that includes a touch that opens control pop up
6. Add flow control indications of Blower #1 and Blower #2
7. Add indication of flow for Blower #3 and Blower #4
8. Add indication of Total Flow to ML Channel
9. Add indication of electrical power of all blowers
10. Add Plant Flow Data that the blower setpoint tracks

B. Suggested sample graphics Figure 1.

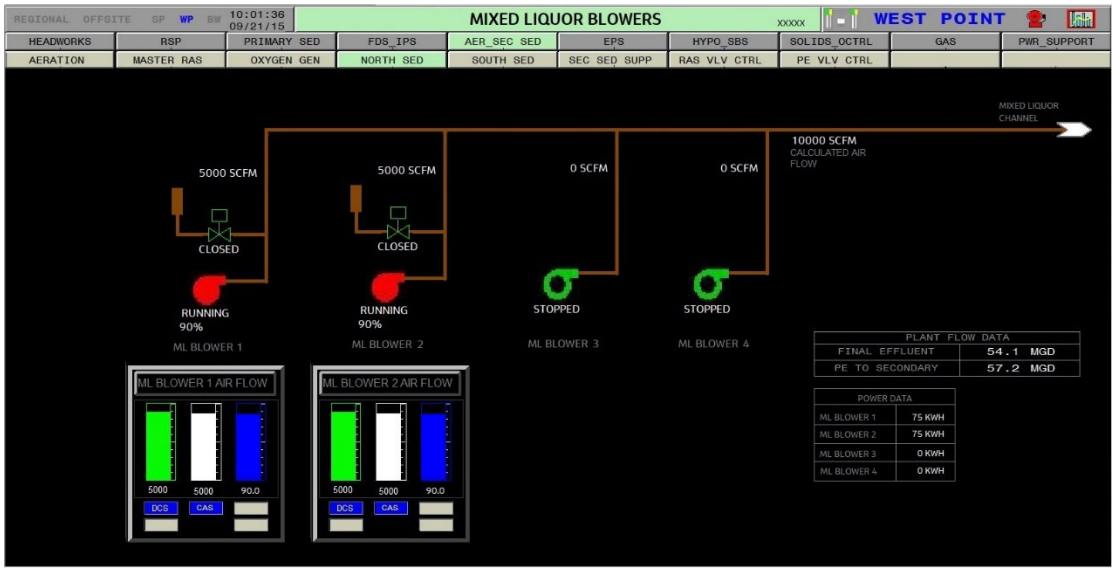


Figure 1 Sample Mixed Liquor Blower Graphic

END OF SECTION

SECTION 40 67 00

CONTROL SYSTEM EQUIPMENT PANELS AND RACKS

PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies requirements for panels, cabinets, consoles, and racks for instrumentation and communication equipment. Additional requirements are specified in sections specifying the various instrumentation and communication systems.

1.02 REFERENCED STANDARDS

A. This Section incorporates by reference the latest revisions of the embedded standard referenced herein. In case of conflict between the requirements of this Section and those of a listed document, the requirements of this Section shall prevail.

Reference	Title
FED STD 595A	Federal Standard Colors
IEC 60947-7-1	Low Voltage Switchgear and Controlgear - Terminal blocks for copper conductors
NEMA 250	Enclosures for Electrical Equipment (1000 Volts Maximum)
NFPA 79	Electrical Standards for Industrial Machinery
UL 94	Tests for Flammability of Plastic Materials for Parts in Devices and Appliances
UL 508A	Industrial Control Panels – Standard
UL 698A	Industrial Control Panels – Classified Areas

1.03 SUBMITTALS

A. Procedures: Section 01 33 00.

B. Dimensioned front view drawings.

C. Dimensioned internal equipment layout drawings.

D. Panel assembly drawings shall include sections showing clearances between face and rear mounted equipment and keyed Bills of Materials.

E. Nameplate engraving schedule showing engraving by line, character size, and nameplate size.

F. Enclosure manufactures' drawings.

G. Panel seismic calculations.

H. Panel wiring diagram for each panel. The diagram shall meet the requirements as set forth in the NFPA 79 Electrical standards for industrial machinery.

I. Operating and maintenance information: Section 01 78 23.

J. Completed testing reports.

1.04 DESIGN REQUIREMENTS

A. Enclosures shall be limited to the following NEMA 250 types:

Type	Location
NEMA 12	Switchboard and MCC rooms, and control rooms
NEMA 4X SS	All other locations and applications
NEMA 7D	Classified Locations

B. Panel Design:
1. General:
   a. Section 40 06 71 specifies major panels and equipment on those panels.
   b. Panel size and equipment layout requirements are specified on the Drawings.
2. No panel mounted operator interface devices, such as selector switches, will be mounted greater than 72" or less than 36" above the finished plant floor, with the exception of annunciators.
3. No panel mounted instruments, such as recorders, will be mounted greater than 66” or less than 40” above the finished plant floor, with the exception of the annunciator panel as described below.
4. Power supplies:
   a. The main control panel shall contain a dual redundant DC power supply system as shown on the Drawings.
   b. Other panels containing direct current powered instruments or serving as the termination point for transmission loop powered field instruments shall obtain the DC power from the main control panel's DC power supply system.

C. Labeling:
1. Panels shall be manufactured and labeled in accordance with UL 508A and/or UL 698A and shall bear the UL label.
2. Design shown on Drawings is for reference and shall be altered as required to make the panels UL 508A compliant.

D. Panel Schedule. Refer to Divisions 11 through 16 for additional panels which may cross-reference Div. 17 for panel requirements.

Panel Number	Description	Status
724-LCP3101	Local Control Panel for IPS	EXISTING
724-FP3153	Local Control Panel for Blower #3	EXISTING
724-FP3154	Local Control Panel for Blower #4	EXISTING
724-ICP3101	Ovation Control Panel for IPS 1	EXISTING
724-ICP3102	Ovation Control Panel for IPS 2	EXISTING
724-ICP3103	Ovation Control Panel for IPS 3	EXISTING
724-FP3151	Blower 1 System Control Panel	NEW
724-FP3152	Blower 2 System Control Panel	NEW

PART 2 PRODUCTS

2.01 MATERIALS AND QUALITY

A. General:
1. Panel work shall be designed for seismic requirements per Section 01 73 00.
2. Cutouts for future equipment shall be blanked off with suitable metal covers.
3. Instrument tag numbers shall be identified on the panel rear per paragraph 40 67 00-2.03.E.
4. Nameplates shall identify face-mounted instruments per paragraph 40 67 00-2.03A.
5. Instruments shall be mounted in a manner that allows ease of access to components and ease of removal.

6. Face-mounted instruments that are more than six inches deep, weigh more than 10 pounds, or exert more than a 4 ft-lb moment force on the face of the panel shall be supported underneath at the rear by a 1-inch x 1/8-inch thick steel angle.
7. Face-mounted equipment shall be flush or semi-flush with escutcheons.
8. Floor mounted cabinets less than 60 inches high shall be provided with floor stands to raise the top of the panel to at least 60 inches above the floor or work platform. Or, if panel weighs less than 100 pounds and wall space is available, wall mounting may be used in lieu of a floor stand.
9. Except for stainless steel and fiberglass panels, all panels and cabinets shall be painted inside and out. Exterior finish shall be per manufacturer's standard gray enamel. Interior panel finish shall be per manufacturer's standard white enamel.

A. Fabrication of NEMA Type 12 Industrial Use, Indoor Cabinets with Front Doors:
   1. Fabricate enclosure from 16-gauge minimum thickness sheet steel for enclosures smaller than 24"X24", and 14-gauge minimum for larger enclosures.
   2. Provide an interior frame or otherwise form the enclosure so as to provide a rigid structure.
   3. Mount face-mounted instruments in the door.
   4. Doors:
      a. Hang door on full-length continuous (piano-type) hinges.
      b. Provide a vault type latch capable of accepting a 3/8-inch shackle padlock.
      c. If greater than 48 inches high, provide three-point latch hardware.
      d. Unless shown on panel Drawings, door width shall not exceed 34 inches.

B. Fabrication of NEMA Type 4X Cabinets:
   1. Comply with NEMA 250, Type 4X requirements.
   2. Fabricate from 14 gauge (minimum thickness) Type 316L stainless steel or fiberglass when specified) and provide with an interior frame or otherwise formed to provide a rigid structure.
   3. Where face-mounted instruments are specified, mount on an interior sub-panel. Provide a gasketed Plexiglass window to allow visibility for displays and indicators.
   4. Doors:
      a. Hang door on full-length continuous (piano-type) hinges.
      b. Provide a vault type latch capable of accepting a 3/8-inch shackle padlock.
      c. If greater than 48 inches high, provide three-point latch hardware.
      d. Unless shown on panel drawings, door width shall not exceed 36 inches.
   5. For cabinets located outdoors, equip with rain and sun shields.

2.02 HEATING AND VENTILATING

A. Provide cooling to maintain the internal panel temperature below 104 degrees F (40 °C) when all equipment is operating at its maximum heat load and the ambient temperature is 86 degrees F (30 °C).
   1. Calculate heat flow through unmodified enclosure to determine if active cooling is required.
   2. Provide filtered forced air ventilation for NEMA 12 cabinets, as required.
   3. Provide glycol closed loop heat exchange system on a mechanical refrigeration system for NEMA 4X and NEMA 7 enclosures, as required.

B. Equip fans with UL-approved washable filters and provide at least 240 CFM. Do not exceed 60 db noise level at 3 feet from exterior wall of enclosures and 30° off axis.

C. Do not insulate outdoor or below grade enclosures and provide with thermostatically controlled space heaters.

D. Provide heater wattage sufficient to maintain the air temperature inside the cabinet above the dew point or 50° F (10° C), whichever is higher, at all times.

E. If space heater surface temperature exceeds 122° F (50° C), provide an expanded metal guard.

F. When a strip type heater is used, provide a 240 VAC heater and connected to 120 VAC. Size the heater to produce the required heat at 120 VAC.

G. Thermostat Acceptable Manufacturer:
   1. Hoffman Engineering TWR60.
   2. Eaton B-Line EST Series.
   3. Approved equal.

2.03 NAMEPLATES AND LABELS

A. Provide machine engraved laminated black phenolic nameplates 1/16-inch thick with white lettering for the panel and its face mounted equipment. Nameplate minimum size: 3/4-inch high by 2.0-inch long.

B. Engrave nameplates with 3/32-inch (2.4 mm) minimum size lettering as shown on the Drawings.

C. Attach nameplates to the panel with a high tack acrylic transfer tape.

D. Wording may be changed if changes are made prior to commencement of engraving.

E. Identify tag number of instruments and equipment inside the panels with machine-printed laminated adhesive labels.

F. Attach nameplates and labels to panel surfaces, not to instruments.

2.04 WIRING AND ELECTRICAL DEVICES

A. Wiring:
   1. Power, control and signal wiring inside panels:
      a. Power and control conductors:
         1) Type MTW, minimum size: 16 AWG.
         2) Conductor insulation rated for 600 volts and 90° C in dry locations.
         3) Conductors: Stranded copper
      b. Wiring for instrumentation analog signals:
         1) Aluminum foil shielded twisted pairs, minimum 18 AWG, stranded copper conductors with drain.
         2) Conductor insulation: PE in black and white or clear with overall jacket of grey PVC.
         3) Type CM rated 300V and 60° C in dry locations.
         4) Belden type 8760, Alpha 2422C or approved equal.
         5) Run continuously from measuring instrument to control cabinet terminal strips without splices.
      c. Conductor size vs. fuse rating for conductors inside panels:

Wire	Fuse
18 AWG	≤1 AMP
16 AWG	≤5 AMPS
14 AWG	≤15 AMPS
12 AWG	≤20 AMPS

   2. Support wiring independent of terminations by slotted flame retardant plastic wiring channels. Comply with UL94, Type V.

B. Wire Naming and Marking
   1. Wiring shall be marked at terminations with machine printed plastic sleeves per Section 26 05 00-2.02.
   2. Wire numbers shall consist of three parts, or as shown on the Drawings.
   3. Unless shown otherwise, the prefix of the wire number shall be the instrument loop number.
   4. If an instrument loop number is not available, the lowest mechanical equipment number of all final drives in the circuit shall be used.
   5. Following the prefix shall be a code letter. The third part of the wire number shall be a number that identifies wires in a circuit that are electrically identical.

6. Label each control and instrumentation wire as follows:
   a. FFF, LLL-CC-NNN, Where:
      FFF =facility number or process number
      LLL = equipment, panel or loop number
      CC = wire code from table
      NNN = wire number
      Note FFF, facility number, is only required if multiple facilities are involved or within a treatment plant with multiple processes.

C. Color Coding
   1. Color coding of wires within control panels shall be as follows (subject to restriction by UL 508A and/or UL 698A):

WIRE COLOR CODES

Code	Type	Color	Use	Volts
S1	TSP	BLACK	SIGNAL (+)	5-24 VDC
S2	TSP	WHITE or CLEAR	SIGNAL (-)	5-24 VDC
SG	TSP	BARE	SHIELD DRAIN	5-24 VDC
S1	TRIAD	BLACK	SIGNAL	0-24 VDC
S2	TRIAD	WHITE	SIGNAL	0-24 VDC
S3	TRIAD	RED	SIGNAL	0-24 VDC
SG	TRIAD	BARE	SHIELD DRAIN	0-24 VDC
24P	SINGLE	BLUE	POWER (+)	24 VDC
24C	SINGLE	WHITE/BLUE	COMMON (-)	24 VDC
D	SINGLE	BLUE	CONTROL	24 VDC
125P	SINGLE	BLUE	POWER	125 VDC
125C	SINGLE	WHITE/BLUE	COMMON	125 VDC
B	SINGLE	BLUE	CONTROL	125 VDC
L	SINGLE	BLACK	POWER	120 VAC
L	SINGLE	RED	CLASS 2 POWER	24 VAC
N	SINGLE	WHITE	NEUTRAL	120 VAC
C	SINGLE	RED	CONTROL	120 VAC
C	SINGLE	RED	CLASS 2 POWER	24 VAC
PG	SINGLE	GREEN	POWER GND	EARTH GND
SG	SINGLE	GREEN/YELLOW	SIGNAL GND	EARTH GND
UL	SINGLE	BLACK/WHITE	UPS POWER	120 VAC
UN	SINGLE	WHITE/GREY	UPS NEUTRAL	120 VAC
M	SINGLE	YELLOW	FOREIGN PWR	120 VAC
MN	SINGLE	WHITE/YELLOW	FOREIGN NEUT.	120 VAC GND'D
A	SINGLE	BLACK OR BLUE	ANNUNCIATOR	120 VAC/24VDC
IO	SINGLE	BLACK OR BLUE	ISOL I/O	120 VAC/24VDC
R	SINGLE	BLUE	RTU	12 VDC
IS	SINGLE	BLUE	INTRINSIC SAFE	<12 VDC

   2. Power and control wiring shall be carried in covered wiring channels separate from low voltage analog signal circuits.

D. Terminal Blocks and Accessories:
   1. UL listed.
   2. DIN rail mounted. Compliant with IEC 60947-7-1.
   3. 22 AWG to 12 AWG copper wire size range.

4. Mark using marker carrier and preprinted marker bars for the terminal numbers.
   a. Each terminal strip shall be labeled per this specification with sequential numbers, i.e. 'TB-01'.
   b. Each terminal shall be numbered sequentially starting at 01.
5. Connect field wiring to individual terminal blocks. Terminal blocks for field terminations shall be in a separate part of the panel close to where the field cables enter the panel.
6. Any circuits entering the panel shall be fused.
7. Feed through terminal blocks:
   a. Compression clamp type terminals rated for 600 Volts and 30 Amperes.
   b. Acceptable manufacturers:
      1) Phoenix Contact series UK IEC.
      2) Allen-Bradley series 1492 IEC.
      3) Approved equal.
8. Fused terminal blocks:
   a. Compression clamp type terminals rated for 600 Volts and 10 Amperes
   b. Blown fuse indicator lamp.
   c. Acceptable manufacturers:
      1) Phoenix Contact series UK IEC.
      2) Allen-Bradley series 1492 IEC.
      3) Approved equal.

E. Circuit Breakers:
   1. Thermal magnetic, miniature case type with the ampere rating as specified.
   2. Circuit breaker interrupting rating shall be 10,000 amperes symmetrical minimum for service at 240 volts and below.

2.05 CONTROL DEVICES

A. Provide in accordance with Section 26 09 16.

2.06 INDICATING LIGHTS (LIGHT EMITTING DIODES)

A. Indicating lights per Section 26 09 16.

B. Indicating lights shall be Push to Test type.

C. Color and associated function:

Color	Function	Example
Red	Run, open valve	Equipment operating, motor running
Green	Ready, closed valve	Equipment ready, end of cycle
White or clear	Normal condition	Control power on, status
Amber (yellow)	Automatic	Equipment control in automatic position

D. Additional colors for other operation indications shall be as noted on the Drawings.

2.07 PANEL GROUNDING

A. Each panel shall be provided with two copper ground bars. One bar shall be bonded to the panel frame or sheet metal and to the station ground system. The second (signal) ground bar shall be mounted on insulated stand-offs and shall be bonded to the frame ground bar at one point only.

B. Signal circuits, signal cable shields, and low-voltage DC power supply commons shall be bonded to the signal ground bar.

C. Surge protectors and separately derived AC power supplies shall be bonded to the frame ground bar.

PART 3 EXECUTION

3.01 GENERAL

A. Wired as shown on the wiring diagrams.

B. Control room cabinets:
   1. Mount on channel iron sills as specified.
   2. Sills shall be leveled so panel structures will not be distorted.
   3. Panels shall be shimmed to precise alignment so doors operate without binding.
   4. Sealant shall be provided under panels not located in dry control or electrical equipment rooms.
   5. Mount field panels and cabinets in compliance with Section 01 73 00.
   6. Floor-mounted cabinets except in dry control rooms or electrical equipment rooms shall be mounted on 3-1/2-inch minimum height concrete pads or grouted bases as specified
   7. Store record drawings for wiring, connection, and interconnection diagrams inside the panel door document pocket.

3.02 ASSEMBLY

A. Conform to the requirements of UL 508.

B. Test the functional operation of the local control panel prior to shipment.

3.03 INSTALLATION

A. Install all wiring and tubing crossing hinges in a manner that will prevent chafing.

B. Securely clamp bundles of similar conductors to the door and to the panel, and run the bundles parallel to the hinge for at least 12 inches.

C. Use spiral nylon cable wrap in the hinge section of the bundle to fully protect the conductors or tubing against chafing.

3.04 COATING

A. Paint cutouts to prevent corrosion using manufacturer’s recommended paint.

END OF SECTION

SECTION 40 68 70

PROGRAMMING

PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies the requirements for programming the PLC and Operator Interface Terminal (OIT) as supplied by equipment vendors.

B. This section does not address programming of the Emerson Ovation DCS. See Section 40 65 01 Control Strategy CS724-01.

C. Provide fully operational PLC Systems at each piece of equipment. The operation of the equipment under PLC control and operation via the SCADA System shall be as per the Contract Drawings and the Control Strategies as defined in Section 43 11 40 Variable-Speed Turbo Air Blowers.

D. Be fully cognizant of Allen-Bradley Ladder Logic programs and include all those functions that are required to operate and monitor the equipment using the PLC.

E. The Contractor responsible for performing the detailed design and programming of the PLC equipment shall have a minimum of five (5) years' experience in similar projects. The Contractor shall assume full responsibility for system design.

1.02 REFERENCED STANDARDS

A. This Section incorporates by reference the latest revisions of the embedded standard referenced herein. In case of conflict between the requirements of this Section and those of a listed document, the requirements of this Section shall prevail.

Reference	Title
King County	PLC and OIT Programming and Installation Requirements

1.03 SUBMITTALS

A. Procedures: Section 01 33 00.

B. Software Submittal with O&M manuals

C. Software programming shall include:
   1. I/O, program, and SCADA databases; block diagrams of logic sequence; PLC program with fully commented ladder logic; and all support information necessary for review.
   2. Submit on CD-ROM or USB memory media. All programs shall be submitted to Project Representative for review. Submitting just the program on electronic media is unacceptable.
   3. Provide documented Studio 5000 program (.acd) and program listing in PDF format with all submittals.

1.04 PROGRAMMING SOFTWARE

A. Utilize Rockwell Automation Studio 5000 Standard Edition Programming Software, King County approved version - No exception.

1.05 DOCUMENTATION

A. Provide complete documentation of all programs. Utilize all of the available documentation services available through the Studio 5000 Programming Software. All application programs shall be fully commented. Program databases shall be fully expanded and shall include a comments field.

B. All PLC programs shall be fully documented. Include references to drawings, original rung comments and requirements defined in the King County's latest “PLC and OIT Installation and Programming Requirements” document.

1.06 PROGRAMMING LANGUAGE

A. Rockwell Software’s application Studio 5000 programming software is to be utilized.

B. King County prefers routines programmed with Ladder Diagram language. In addition, Function Block Diagram Language may be used sparingly for analog signal processing with written permission from King County.

C. Specifically forbidden are the use of Structured Text language and Sequential Function Charts without written permission from King County. Time spent by the Contractor to correct programming that is not compliant with the programming software and programming language defined in this Section will be at the Contractor's expense and shall not affect the project schedule or milestone dates.

1.07 SOFTWARE REVISIONS

A. Provide a formal revision tracking procedure for all software being submitted and delivered to the Project Representative after the Factory Acceptance Test. The revision tracking procedure shall contain information necessary to track all changes, ensure revisions are properly tested, documented, and incorporated into the final program. The revision tracking procedure shall track submitted programs, reference Project Representative's comments, show date program was saved, date of all revisions and reference to material used for the program revisions.

B. The revision tracking procedure shall ensure that only fully tested, fully documented and properly revised software is loaded into the PLC for delivery.

1.08 SOFTWARE FUNCTIONS

A. Provide common functions and software structures among programs for County facilities. If necessary, obtain a sample PLC program from the County Operation and Maintenance via Project Representative.

B. Provide PLC programs capable of performing the following functions at a minimum:
   1. Analog input processing and conversion to engineering units
   2. Discrete input processing for alarms and interlocks
   3. Discrete output processing for Alarm generation to local annunciators and other equipment
   4. Equipment protection interlocks
   5. Equipment start and stop sequencing
   6. Equipment process controls
   7. Analog Output processing for control loop outputs
   8. Real-time clock for scheduling of control functions and tasks
   9. Display of process data on OIT

C. Provide OIT programming that allows adjustment of loop setpoints, timer and counter presets, and loop tuning parameters.

PART 2 PRODUCTS

2.01 PROGRAMS

A. Provide each piece of equipment defined by the Contract Documents with a fully functioning program that is without error, does not perform abnormal stops or actions, and is fully documented.

B. OIT graphic displays shall include both text and simple graphical representations of the equipment. Refer to Appendix D of King County's latest "PLC and OIT Installation and Programming Requirements" document for structure of screen displays and color standards.

2.02 PLC PROGRAM DOCUMENTATION

A. Program documentation shall be in accordance with King County's latest "PLC and OIT Installation and Programming Requirements" document.

B. Provide complete descriptors for all elements used in the programs. This includes:
   1. Inputs
   2. Outputs
   3. Coils
   4. Contacts
   5. Tasks, Programs and Routines
   6. Rung functions
   7. Data Structures
   8. Tables and Arrays

C. Fully utilize all descriptor fields provided by the programming software, including:
   1. Tags and Aliases
   2. Descriptions
   3. Comments
   4. Titles

D. Provide clear and concise tags for all active components within a rung of logic. Tags shall be descriptive in nature. Provide narrative in Rung, Task, and Routine comments fields for complex rungs of logic or where the function is not readily understood without clarification. Provide cross-reference to chapter and paragraph of the Control Strategy Specification document.

E. Use cross-references. Label all coils with descriptive tag names. Label rungs according to function and equipment tag name. Label all input contacts with the equipment tag name.

F. Rockwell Software Studio5000 programming version
   1. Studio5000 Logix version shall match the PLC controller version.
   2. Studio5000 View version shall match PanelView version

G. Programs shall be fully documented and an electronic copy shall be provided to Project Representative as a submittal demonstrating compliance to the full documentation requirements. Electronic copy shall include:
   1. Tags
   2. Descriptors
   3. Program, Task and Routine Comments
   4. Titles
   5. I/O Rack configuration
   6. Communications Interface Configurations
   7. Listing of Data structures and ASCII message tables

PART 3 EXECUTION

3.01 PROGRAM INSTALLATION

A. Install the application program as defined in Section 40 63 43 and 40 63 63.

B. When a facility is operating under PLC control, edits to the PLC software shall comply to the following:
   1. Coordinate the changes, edits or reloading of the programs with the Project Representative. Make changes to the program to correct deficiencies or incorrect operation.
   2. The Project Representative shall approve all changes before loading the program into the PLC. The Project Representative shall be present at the facility when changes are downloaded to the PLC.
   3. All programming changes shall be downloaded locally, not transmitted over the phone line.
   4. Install electrical equipment or devices together with all required interconnections.
   5. All documentation, drawings, copies of the program and narratives shall be revised by the Contractor to reflect the edits to the program.

3.02 PROGRAM TESTING

A. Test programs in accordance with Section 01 80 00, 40 61 13 and 43 11 40.

3.03 TRAINING

A. Provide twenty-four (24) hours of training for the County's personnel on all aspects of design, operation and maintenance of the PLC and OIT applications programs and Control Strategies.

B. Provide training at a County facility specified by the Project Representative at a time mutually agreed between the Contractor and the Project Representative.

C. Notify the Project Representative at least two weeks prior of the proposed training date.

D. Complete forms 01 80 00 - B and 01 80 00 – C included in Section 01 33 10 at the end of Startup and Training. Submit the forms to the Project Representative for approval.

END OF SECTION

SECTION 40 70 10

PROCESS TAPS AND PRIMARY ELEMENTS

PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies requirements for instrumentation elements that quantitatively convert the measured variable energy into a form suitable for measurement and process measurement accessories.

1.02 REFERENCED STANDARDS

A. This Section incorporates by reference the latest revisions of the embedded standard referenced herein. In case of conflict between the requirements of this Section and those of a listed document, the requirements of this Section shall prevail.

Reference	Title
API RP 551	Process Measurement Instrumentation
ASTM A269	Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service
ASTM A276	Specification for Stainless Steel Bars and Shapes
ASTM A479	Specification for Stainless Steel Bars and Shapes for use in Boilers and Other Pressure Vessels
ASTM D1248	Specification for Polyethylene Plastics Extrusion Materials For Wire and Cable
ASME PTC 19.3 TW	Thermowells

1.03 SUBMITTALS

A. Procedures: Section 01 33 00.

B. All submittals shall be per Section 40 61 13.

C. Flow calculation for each differential-type flow element.

PART 2 PRODUCTS

2.01 VALVES

A. Gage Valves:
   1. Machined from ASTM A276 bar stock.
   2. Use with 1/2-inch NPT connections and integral bleed valve.
   3. Acceptable manufacturer:
      a. Anderson Greenwood M9530.
      b. Hoke 6801L8Y.
      c. Approved Equal.

B. Root Valves:
   1. ASTM A276, Type 316 stainless steel bar stock.
   2. 1/2-inch NPT male process connection and three 1/2-inch NPT female instrument connections.
   3. One instrument connection shall be provided with an ASTM A276, Type 316 stainless steel bleed valve.
   4. ASTM A276, Type 316 stainless steel plugs for unused ports.
   5. Lagging type units shall be provided for insulated vessels and pipes.

6. Acceptable manufacturer:
   a. Anderson Greenwood M5 AVS-44.
   b. Hoke 6802L8Y.
   c. Approved Equal.

2.02 TUBING AND TUBING FITTINGS – NOT USED

2.03 CHEMICAL SEALS – NOT USED

2.04 BUSHINGS AND THERMOWELLS – NOT USED

2.05 PURGE ASSEMBLIES – NOT USED

2.06 FLOW STRAIGHTENING VANES – NOT USED

2.07 FLEXIBLE AIR HOSE AND CLAMPS – NOT USED

2.08 INSTRUMENTATION SPECIFICATION SHEETS (INSTRUSPEC)

A. General requirements for primary elements specified in this Section are listed on INSTRUSPEC sheets in this Section.

2.09 INSTRUSPEC SHEETS

A. The following INSTRUSPEC sheets are included in this Article:

INSTRUSPEC Symbol	Instrument Description	Instrument Function
PG	Pressure gage	Pressure measurement

Instrument Identification:	PG
Instrument Description:	Pressure gage
Instrument Function:	Pressure measurement
Power Supply:	N/A
Signal Input:	Process Pressure
Signal Output:	Mechanical Indication
Process Connection:	1/2-inch male NPT
Product Requirements:	
Pressure gages:	1. 4-1/2-inch premium grade, glycerin filled units with bourdon tube element, 270-degree milled stainless steel movement, phenolic case, and shatterproof glass window. 2. Accuracy: ANSI grade 2A (+0.5% of span). 3. The range of the measuring element shall be as shown in the Instrument Schedule, Section 40 06 71. The dial scale shall be equivalent to the measuring element range, but displayed in the engineering units shown as Scale in the instrument index. 4. Acceptable manufacturer: a. WIKA model 233.34, no substitutions.
Installation:	1. Install in accordance with Standard Detail 170402 and the manufacturer's instructions and the recommendations of API RP551 to the specified requirements. 2. Root valves shall be provided at all process pressure taps except taps made for safety instruments. 3. Gage valves shall be provided at the instrument where the instrument is not within sight of the root valve or where two or more instruments are connected to a single tap. 4. Unless otherwise specified, pressure instruments shall be located as close as practical to the process tap but shall be positioned to permit observation and maintenance.
Application/Calibration:	1. Pressure gages may be supported from the process tap if this location permits observation from the floor or a permanent work platform. 2. Pressure instruments shall be installed in such a manner that blowout discs are not obstructed. 3. Application, calibration, and set points shall be as specified in Section 40 06 71.

PART 3 EXECUTION

3.01 INSTALLATION

A. Process Connections:
   1. Unless otherwise specified, process taps shall comply with API RP550.
   2. Root valves shall be provided at taps, except temperature taps and pump discharge pressure taps.
   3. Arrange, where possible, such that instruments may be readily removed for maintenance without disruption of process units or draining of large tanks or vessels.
   4. Unions or flange connections shall be provided as necessary to permit removal without rotating equipment.
   5. Where process taps are not readily accessible from instrument locations, a block valve shall be provided at the instrument. Block valves shall also be provided for each instrument where multiple instruments are connected to one process tap.

3.02 TESTING

A. Testing requirements per Sections 40 61 13 and 01 80 00.

END OF SECTION

SECTION 40 78 73

MINIATURE CASE ELECTRONIC PANEL INSTRUMENTS

PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies requirements for panel mounted electronic instruments used to provide process control and interface between the operator and the process.

1.02 REFERENCED STANDARDS

A. This Section incorporates by reference the latest revisions of the embedded standard referenced herein. In case of conflict between the requirements of this Section and those of a listed document, the requirements of this Section shall prevail.

Reference	Title
NEMA 250	Enclosures for Electrical Equipment (1000 Volts Maximum)

1.03 SUBMITTALS

A. Procedures: Section 01 33 00.

B. Product Data: per Section 40 61 13.

C. Calibration and Test Results: per Section 40 61 13.

D. Operation and Maintenance Information: per Section 01 78 23.

PART 2 PRODUCTS

2.01 GENERAL

A. Unless otherwise specified, panel instruments shall comply with the following requirements:
   1. Analog instruments shall be miniature-case draw-out type, standard DIN dimensions, and not more than 20 inches deep.
   2. Operator, tuning, and configuration adjustments shall be accessible without disconnecting the instrument from the process.
   3. Analog signal indicators shall be solid-state, LED, or gas-discharge type, 4-digit numerical display or bar-graph displays with not less than 100 segments, as specified
   4. Analog signal inputs shall be 1 to 5 VDC into not less than 250K ohms.
   5. Analog signal outputs shall be 1 to 5 VDC into >10K ohms except where instrument provides final output signal to field in which case output shall be 4 to 20 mA current regulated into 0 to 600 ohms.
   6. Unless otherwise specified, power supply shall be 120 VAC plus or minus 10 percent.
   7. Signal and power supply connections shall be isolated from the instrument case.

B. Unless otherwise specified, panel instruments specified in this Section shall be the product of a single manufacturer, and shall match and line up to form an integrated appearance and operator interface strategy.

2.02 INSTRUMENT SPECIFICATION (INSTRUSPEC) SHEETS

A. General requirements for instruments specified in this Section are listed on INSTRUSPEC.

B. Application requirements are specified in the instrument schedule in Section 40 06 71, and/or on the Contract Drawings.

2.03 INSTRUSPEC SHEETS

A. The following INSTRUSPEC sheets are included in this Section.

INSTRUSPEC Symbol	Instrument Description	Instrument Function
XIS	Blower Process Monitor Meter	Miniature-case blower flow and power

INSTRUMENT SPECIFICATION SHEET—INSTRUSPEC

Instrument Identification:	XIS
Instrument Description:	Blower Process Monitor Meter
Instrument Function:	Blower Flow and Power Meter
Power Supply:	120 VAC 60 Hz, or as specified
Signal Input:	1. 0 – 5 A from AC Current transformer.
Signal Output:	1. SPST relays rated at 5A, 240 VAC. 2. Analog output card: a. Two 4-20 mA analog outputs.
Process Connection:	N/A
Product Requirements:	1. Microprocessor based digital monitor/controller, designed to provide protection for a single blower in constant speed applications. 2. Full configuration capability via front faceplate push buttons. 3. Provides motor amperage and airflow indication. 4. Analog outputs to transmit out motor amperage and airflow process signals for remote monitoring. 5. Acceptable manufacturer: a. Hoffman/Lamson: Smart Meter II b. No substitutions allowed as this is an OEM Blower Panel.

Execution:

Installation: Install in panels per Contract Drawings and in accordance with manufacturer's instructions.

Configuration/Programming:

1. Station shall be configured and programmed for the specified functional requirements.
2. Application, calibration, and setpoints shall be per Section 40 06 71.

PART 3 EXECUTION

3.01 INSTALLATION

A. Operator interface instruments shall be installed on panels per Contract Drawings.

3.02 TESTING

A. Testing requirements per Section 40 61 13.

END OF SECTION

SECTION 43 05 01

GENERAL REQUIREMENTS FOR EQUIPMENT

PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies general requirements which are applicable to all mechanical equipment and the electrical equipment driving the mechanical equipment.

B. Additional specific requirements are listed in other Sections of the Contract Specifications and Drawings.

C. Equipment under this Division includes providing and testing the equipment described in the sections listed in Divisions 26, 40, and 43.

1.02 REFERENCED STANDARDS

A. This Section incorporates by reference the latest revisions of the embedded standard referenced herein. In case of conflict between the requirements of this Section and those of a listed document, the requirements of this Section shall prevail.

Reference	Title
ASME B1.1	Unified Inch Screw Threads
ASME B1.20.1	Pipe Threads, General Purpose
ASME B16.1	Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250 and 800
ASME B18.2.1	Square and Hex Bolts and Screws
ASME B18.2.2	Square and Hex Nuts
IMC	International Mechanical Code
ISO 1940	Mechanical Vibration- Balance Quality Requirements of Rigid Rotors
NFPA 70	National Electrical Code
UL 508	Industrial Control Equipment

1.03 SUBMITTALS

A. Procedures: Section 01 33 00.

B. Submittals: Made as specified for each equipment item or group of related equipment items. Identify the equipment by the number listed in the Specification section, by manufacturer and by type designation.

1.04 QUALITY ASSURANCE

A. Arrangement: The arrangement of equipment shown on the Drawings is based upon information available at the time of design and is not intended to show exact dimensions for a specific manufacturer. The Drawings are, in part, diagrammatic and some features of the illustrated equipment installation may require revision to meet actual equipment installation requirements. Structural supports, foundations, connected piping and valves, electrical and instrument equipment connections shown may have to be altered to accommodate the equipment provided. No additional payment will be made for such revisions and alterations. Substantiating calculations and drawings: submitted prior to beginning the work.

B. Unit Responsibility:
   1. Equipment systems (operating units) made up of two or more components *that require the contractor to assume Unit Responsibility* are identified in their respective Specification Sections. Coordinate, assemble, install and test the system as an operating unit.
   2. Coordinate equipment selection with the manufacturer(s) or supplier(s) of each component to ensure its compatibility with other system components. Ensure listed system components fit together and will function properly as an operating unit to achieve the performance requirements specified.
   3. Where the system specification requires a certificate of System Responsibility, such certificates shall conform to the content, form and style of Form 43 05 01-C included in Section 01 33 10, signed and certified by the Contractor that the components are compatible as specified.
   4. Submittals for components of a listed system will not be processed until a Certificate of Unit Responsibility for that system has been received and has been found to be satisfactory. Owner approval of individual component submittals will not relieve the Contractor of its System Responsibility.

C. Balance:
   1. Unless specified otherwise, all rotating elements in motors, pumps, blowers and centrifugal compressors: fully assembled, including coupling hubs, before being statically and dynamically balanced. All rotating elements: balanced to G 2.5 as specified in ISO 1940, Parts 1 and 2.
   2. Where specified, balancing reports, demonstrating compliance with this requirement, submitted as product data.

1.05 SHIPMENT, PROTECTION, AND STORAGE

A. Shipment, protection, and storage: Section 01 67 00.

1.06 SEISMIC REQUIREMENTS

A. Anchor and brace equipment: Section 01 73 00.

1.07 ELECTRICAL REQUIREMENTS

A. Starters: Except for starters specifically included in Division 26, furnish all starters for motors in this Division.

B. Disconnects: Except for factory-supplied disconnects mounted on mechanical equipment or in combination with starters, motor disconnects: in accordance with Division 26.

C. Power and control wiring: Except for factory wiring on mechanical equipment, power and control wiring under this Section: in accordance with Division 26.

D. Provide controls, controllers, transformers, and switches required by the work of this Section.

E. Factory-wired assemblies and panels: prewired to numbered terminal strips for connection to field wiring.

F. Provide disconnect switch for each control circuit connection to prewired assemblies and control panels.

G. Provide approved wiring diagrams for work furnished under this Section.

H. Provide weatherproof devices and installations for outdoor applications or as specified in Division 26.

I. Install wiring as specified in Division 26.

J. Equipment devices and wiring shall comply with NEC.

K. See Section 26 05 00 for listing and labeling requirements

PART 2 PRODUCTS

2.01 FLANGES AND PIPE THREADS

A. Unless otherwise noted, all flanges on equipment and appurtenances: flat faced and shall conform in dimensions and drilling to ASME B16.1, Class 125.

B. Flange assembly bolts: heavy pattern, hexagonal head, carbon steel machine bolts with heavy pattern, hot pressed, hexagonal nuts conforming to ASME B18.2.1 and B18.2.2. Threads: Unified Screw Threads, Standard Coarse Thread Series, Class 2A and 2B, ASME B1.1.

C. All pipe threads shall conform in dimension and limits of size to ASME B1.20.1, Class 2 NPT, Taper Pipe Thread.

2.02 CAUTION SIGNS

A. Equipment with guarded moving parts which operate automatically or by remote control: identified by signs reading "CAUTION - AUTOMATIC EQUIPMENT MAY START AT ANY TIME". Signs: constructed of fiberglass material, minimum 1/8-inch thick, rigid, suitable for post or wall mounting. Letters: white on a red background. The sign size and pattern: comparable to existing signs. Signs: installed near guarded moving parts.

2.03 GAGE TAPS, TEST PLUGS, DRAINS, AND GAGES

A. Unless otherwise specified, 1/2-inch threaded pressure taps with full port ball valve isolation cocks: provided on the suction and discharge sides of all pumps, blowers and compressors.

B. Permanent pressure devices (gages, sensors, switches, etc.): provided only where shown or specified, and installed in accordance with the standard details shown on the Drawings.

C. Gage taps, test plugs, and gages: as specified in Division 40.

2.04 NAMEPLATES

A. Nameplates: provided on each item of equipment and shall contain the specified equipment name and equipment number. Equipment nameplates: laser etched on 1/16-inch thick Type 316 stainless steel with 3/16-inch letters. The normal size of nameplates: 3/4-inch high by 2-inch long.

B. Equipment titles: spelled out on the nameplates. If abbreviations are required because of space limitations, abbreviations: submitted to the Project Representative and approved prior to manufacture.

C. Nameplates: fastened to the equipment in an accessible and easily visible location with No. 4 or larger oval head self-tapping stainless steel screws or drive pins. The use of adhesives shall not be permitted.

2.05 LUBRICANTS

A. Provide for each item of mechanical equipment a supply of the lubricant required for the commissioning period. Lubricants: of the type recommended by the equipment manufacturer. Limit the various types of lubricants by consolidating them, with the equipment manufacturer's approval, into the least number of different types, consistent with the County's current supplier. Not less than 90 days before the date shown in construction schedule for starting, testing and adjusting equipment, provide the Project

Representative with three copies of a list showing the required lubricants, after consolidation, for each item of mechanical equipment. The list shall show estimated quantity of lubricant needed for a full year's operation, assuming the equipment will be operating continuously.

2.06 ANCHOR BOLTS

A. Anchor bolts: designed for lateral forces for both pullout and shear in accordance with the provisions of Section 05 05 19. Drilled-in epoxy or expansion anchor bolts will not be permitted for permanent application where subject to pull-out forces. Unless otherwise stated in the specifications, anchor bolt materials shall be Type 316 stainless steel and conform to the provisions of Section 05 05 19.

2.07 ELECTRICAL DEVICES

A. All motors, starters, controls, instruments, and other electrical components and devices furnished with mechanical systems: listed and labeled for the purpose for which it is used by Underwriters Laboratories (UL) or equivalent nationally recognized testing laboratory acceptable to the Washington State Department of Labor and Industry and to the local administrative authority. Where one of these listings is required but not available, Contractor shall obtain written permission for a variance from the authorities having Jurisdiction. In addition, electrical components and devices shall comply with Division 26 of these Specifications.

2.08 CONTROL PANELS

A. All control panels, factory, shop or field assembled, labeled as a unit in accordance with UL 508. The UL 508 label: affixed to the inside of the door or cover, adjacent to the data pocket.

2.09 MOTORS AND CONTROLLERS

A. Provide under Divisions 26 and 43 all motors for all equipment specified herein and all controllers other than those specifically indicated as being furnished under other sections; all equipment and wiring shall conform to applicable sections of Division 26.

B. Power wiring for all motors and associated controllers other than wiring for automatic controls will be furnished under Division 26. Unless otherwise noted, power supply will be 480 volts, 3-phase, 60 hertz for motors. Control voltages: 120 volts or lower, single phase, 60 hertz, or direct current, 30 volts or lower. Disconnect switches for roof exhaust fans or other equipment installed remote from its controller: furnished as an integral part of the equipment.

C. The horsepower ratings of electrical motors shown on the Drawings and Specifications are based on engineering design calculations and the selection of specific manufacturer's catalog items of mechanical equipment. If the actual equipment to be furnished requires a different motor horsepower, any resulting changes in motor branch circuits and associated circuiting must be included in the original contract bid.

D. All equipment: designed and built for industrial service and be capable of delivering rated horsepower under the following applicable conditions:
   1. 100 degrees F maximum ambient temperature.
   2. Voltage variations to +/-10 percent of nameplate rating.
   3. Frequency variations to+/-5 percent of nameplate rating.
   4. Combined voltage and frequency variations to +/-l0 percent total, as long as frequency does not exceed+/-5 percent.

E. Unless otherwise specified, motors: TEFC.

2.10 SPARE PARTS

A. See Section 01 78 43.

B. Spare parts, wherever required by detailed specification sections, stored in accordance with the provisions of this paragraph. Spare parts: tagged by project equipment number and identified as to part number, equipment manufacturer, and subassembly component (if appropriate). Spare parts subject to deterioration such as ferrous metal items and electrical components: properly protected by lubricants or desiccants and encapsulated in hermetically sealed plastic wrapping. Spare parts with individual weights less than 50 pounds and dimensions less than 2 feet wide, or 18 inches high, or 3 feet in length: stored in a wooden box with a hinged wooden cover and locking hasp. Hinges: strap type. The box: painted and identified with stenciled lettering stating the name of the equipment, equipment numbers, and the words "spare parts." A neatly typed inventory of spare parts: taped to the underside of the cover.

PART 3 EXECUTION

3.01 EQUIPMENT INSTALLATION

A. Locate and install sleeves, inserts, and supports as required at proper stage of construction.

B. Basis for equipment and material installation is the published recommendations of manufacturer. Submit recommendations for review.

3.02 TESTING

A. Equipment: provided and tested within the tolerances recommended by the equipment manufacturer where indicated in the individual mechanical specification sections. Certain sections may also require that equipment additionally be installed and tested under the direction of installers who have been factory trained by the equipment manufacturer. This requirement, however, shall not be construed as relieving the Contractor of the overall responsibility for this portion of the work. Forms 43 05 01-A and 43 05 01-B specified in Section 01 33 10, completed and submitted.

B. System-wide, station-wide, and plant-wide process testing: in accordance with Section 01 80 00.

END OF SECTION

SECTION 43 05 60

EQUIPMENT SUPPORT, GROUTING AND INSTALLATION

PART 1 GENERAL

1.01 DESCRIPTION

A. This section specifies minimum requirements for equipment supports, including concrete housekeeping pads, equipment bases, supports, anchorage, and accessories for equipment meeting any of the following criteria:
   1. Weights greater than 200 pounds.
   2. Less than 25 horsepower.
   3. Equipped with a vibration isolation system
   4. As applicable when this Section is referenced.

B. Refer to requirements of Section 01 73 00 for Seismic Anchorage.

C. If conflict exists between specification sections and recommendations of individual equipment manufacturers, the more restrictive shall prevail.

1.02 DEFINITIONS

A. Base or Baseplate: Rigid Fabricated welded steel elements cast iron, or plate steel baseplate providing a common mounting element on which the soleplate or l feet, or mounting surfaces of equipment are mounted by means of bolted connections.

B. Soleplate: A machined plate providing a common mounting element on which the feet or mounting surfaces of equipment are mounted by means of bolted connections.

C. Mounting Blocks: Multiple smaller baseplates on which individual feet or equipment supports are mounted when the mounting surfaces of equipment or a driver are not fastened to a common baseplate or soleplate.

D. Housekeeping Pads: Structural Concrete pad to raise the equipment or equipment foundation above grade level of the supporting floor.

E. Mounting Pads: Thickened or raised areas of baseplates and soleplates where the feet or mounting surfaces of mounted equipment and drivers are bolted and/or doweled to the baseplate or soleplate.

F. Leveling Blocks: Temporary steel blocks placed under baseplates, soleplates, or a mounting block at leveling positions (at equipment anchors) for the purpose of leveling baseplates, soleplates, or mounting blocks prior to grouting.

G. Shims: Thin stainless steel plates of a uniform thickness installed on top of Leveling Blocks for fine adjustment of level. Shims may also be used between equipment or drivers and baseplates, soleplates, or mounting blocks for equipment alignment purposes.

H. Wedges: Pairs of uniformly tapered metal blocks that are stacked with the tapered surfaces reversed (relative to the other wedge) so that the top and bottom surfaces of the wedges are parallel. Wedges are used between equipment pads and baseplates, soleplates, or mounting blocks for the purpose of leveling baseplates, soleplates, or mounting blocks.

I. Mounting Stud: Threaded rod or bolts anchored to baseplates, soleplates, or mounting blocks for the purpose of mounting equipment or ancillary devices onto baseplates, soleplates, or mounting blocks.

J. Reinforcement Dowels: Steel reinforcement rods embedded in concrete, across a cold joint, for the purpose of transferring loads or force across the joint.

K. Machine Alignment Dowels: Tapered diameter rods inserted in tapered diameter holes for the purpose of aligning machinery. The practice of drilling tapered diameter holes through machinery and baseplates so that Machine Alignment Dowels may be inserted to facilitate alignment of machinery is known as Doweling.

L. Leveling Position: A location on the top of a concrete equipment pad or pedestal where leveling tools and equipment will be temporarily installed or used for the purpose of leveling baseplates, soleplates, and mounting blocks prior to grouting.

1.03 REFERENCED STANDARDS

A. This Section incorporates by reference the latest revisions of the embedded standard referenced herein. In case of conflict between the requirements of this Section and those of a listed document, the requirements of this Section shall prevail.

Reference	Title
ANSI/HI	Baseplate Design
API RECOMMENDED PRACTICE 686	Recommended Practices for Machinery Installation and Installation Design
SSPC	Society for Protective Coatings Specifications, Vol. 2.

1.04 SUBMITTALS

A. Procedures: Section 01 33 00.

B. Provide the following submittals:
1. Shop drawings for all equipment bases showing anchorage and reinforcement details.
   a. No less than 4 weeks in advance of equipment installation.
2. Stamped drawings and calculations bearing the stamp of a Professional Engineer registered in the State of Washington are required for:
   a. Equipment with a vibration isolation system
   b. Equipment equal to or greater than 25 horsepower require stamped drawings and calculations.
3. Drawings and calculations shall include and clearly show the criteria used to determine seismic coefficients and forces applied to the equipment, including seismic zone, soil profile type, and importance factors.
4. Manufacturer’s information on epoxy grout or cementitious grout as applicable.
5. Machine and equipment base installation schedule with manufacturers' anchor bolt torque requirements.
6. Results of grout strength tests.

PART 2 PRODUCTS

2.01 GENERAL

A. Provide all supports, anchorage, and mounting of all equipment, unless otherwise specified, in accordance with the manufacturer's recommendations, the IBC, and industry standards requirements.

B. Each piece of equipment shall be anchored to resist the greater of the maximum lateral and vertical forces required by the local governing code or by the manufacturer of the equipment, whichever is greater. This force shall be considered acting at the center of gravity of the piece under consideration. No equipment shall be anchored to vertical structural elements without written approval of the Project Representative.

C. All equipment shall be mounted on concrete housekeeping pads. Unless otherwise specified, equipment and drivers shall be rigidly mounted on a common cast iron or fabricated steel baseplate or soleplate grouted into place on the housekeeping pads. Under no circumstances shall equipment supports be connected directly to concrete slabs or floors.

D. Installation practices shall follow the guidance presented in Chapters 4 and 5 of API Recommended Practice 686, unless superseded by more restrictive requirements of these specifications or manufacturer requirements.

2.02 CONCRETE HOUSEKEEPING PADS

A. Concrete housekeeping pads for equipment and floor penetrations shall be at least 4 inches larger in plan on all sides than the steel or cast base and not less than 4 inches above the finished floor elevation, and shall be shaped to drain liquids away from the base.

B. Housekeeping pad details shall follow the requirements set forth in Figure A-4 of API 686 unless superseded by more restrictive requirements of these specifications or the requirements of the equipment manufacturer.

C. All conduits, piping connections, drains, etc. serving the equipment, shall be enclosed by the concrete housekeeping pad. Unless otherwise specified, no conduits, piping connections, drains, etc., will be accepted which rise directly from the floor.

2.03 EQUIPMENT BASES

A. General:
1. Unless otherwise specified, rigidly mount equipment and driver on a common cast iron or fabricated steel baseplate.
2. Unless otherwise indicated, hot-dip galvanize steel equipment bases after fabrication.
3. All bases shall have edges bearing on the grout surface rounded to a radius of not less than 2-inches to avoid producing stress risers on the grouted foundation.
4. Grout pouring holes (minimum 4 inches in diameter) shall be provided in all bases and all bases shall have grout release holes.
5. Except where vibration isolation systems are specified, all bases shall be grouted as specified in this section.
6. Internal stiffeners shall be provided and shall be designed to allow free flow of grout from one section of the base to another.
7. The minimum acceptable opening in cross-bracing and stiffeners shall be 2-inches high by 6-inches in length. All welds shall be continuous and free from skips, blow holes, laps and pockets.
8. Mounting holes for anchor bolts in the bases, mounting blocks, or sole plates shall be drilled and not burned out and they shall not be open slots.
9. Mounting pads for equipment shall be machined after all welding and stress relieving and shall be coplanar to 0.002 in. in all directions.
10. Mounting pads shall extend not less than 1-inch on all sides beyond the position for the equipment.
11. Direct mounting on the housekeeping pads will not be permitted.

B. Type I Bases:
1. Type I bases shall be structural steel bases with thickened steel pads for doweling.
2. The bases shall be rectangular in shape .
3. Perimeter members shall be beams with a minimum depth equal to 1/10th of the longest dimension of the base. Beam depth need not exceed 14 inches provided that the deflection and misalignment is kept within acceptable limits as determined by the manufacturer.
4. Terminations requiring connections to the base shall be nuts welded to the bottom side of the base and plugged with cork, plastic plugs or grease, or acorn nuts.
5. Grout holes shall be provided for the bases of all equipment where vibration isolation is not specified.

6. Sole plates, mounting blocks and baseplates weighing more than 1000 pounds shall be leveled with jackscrews incorporated into the fabrication. Jackscrews shall be located in thickened pads or otherwise in sufficient metal to provide ease in adjusting level.

C. Type II Bases:
   1. Type II bases shall be steel members used to cradle machines having legs or bases that do not require a complete supplementary base.
   2. All members shall be sufficiently rigid to prevent strains in the equipment. Height saving brackets shall be employed in all mounting locations to provide a clearance of 1-inch below the base.

D. Type III Bases:
   1. Type III bases shall be rectangular foundations consisting of concrete filled structural steel beam or channel forms.
   2. In general, base depth shall be a minimum of 1/12 of the longest dimension of the base but not less than 6 inches.
   3. Forms shall include, as a minimum, concrete reinforcement consisting of ½-inch bars or angles welded in place on 6-inch centers each way in a layer 1½ inches above the bottom or additional steel as required by structural conditions.
   4. Forms shall be provided with drilled steel members with sleeves welded below the holes to receive equipment anchor bolts where the anchor bolts fall in concrete locations.
   5. Height saving brackets shall be employed in all mounting locations to maintain a 1-inch clearance below the base.

E. Type IV Bases:
   1. Type IV bases shall be cast iron.
   2. Terminations requiring connections to the base shall be nuts welded to the bottom side of the base and plugged with cork, plastic plugs or grease, or acorn nuts. In no case shall the fastener terminate only into the metal base.

F. Mounting Blocks: Not Used

2.04 GROUT FOR EQUIPMENT BASES

A. Unless otherwise indicated, grout for equipment bases shall be non-shrink grout as specified in Section 03 60 00.

B. Procedures for leveling and clamping equipment shall be as specified in this Section.

2.05 EPOXY PRIMER

A. The epoxy primer shall be a lead free, chrome free, rust inhibitive, two-component epoxy primer specifically designed for use on metal substrates and in conjunction with epoxy grout. The epoxy primer shall be a product of the epoxy grout manufacturer.

2.06 ANCHOR BOLTS

A. Anchor bolts shall be Concrete Anchors as specified in Section 05 05 19. Projection above the nut on the baseplate or soleplate shall be no more than 3/4-inch.

B. A non-seize or non-galling compound shall be used on all threads.

C. The equipment manufacturer shall recommend the size of the anchor bolts for the equipment.

D. Manufacturer shall provide the recommended tightening torque for the nuts.

2.07 ANTI-SEIZE/ANTI-GALLING COMPOUND

A. Anti-seize or anti-galling compound shall be a molybdenum disulfide and graphite combination in an aluminum complex baseplate grease conforming to MIL-PRF-907E.

B. Acceptable products include Jet Lube 550 by Jet Lube, Inc., E-Z Break by LA-CO, or approved equal.

PART 3 EXECUTION

3.01 GENERAL

A. Grouting of equipment bases shall take place prior to connecting any field piping or electrical and instrumentation systems. Unless the Project Representative accepts an alternate installation procedure in writing, baseplates shall be grouted with the equipment removed.

B. Equipment that is not mounted on vibration isolators shall be anchored directly to the supporting floor system. In addition to the anchorage, all such equipment shall be internally designed so that all static and moving parts are anchored to the supporting framework to resist all imposed forces. All forces shall be transmitted to the base in order to be anchored as required.

C. Connecting piping with flexible connections and/or expansion joints shall be anchored such that the intended uses of these joints are maintained in the piping system without imposing strain on the equipment connections.

D. Where an equipment manufacturer's installation requirements include a rigid connection between the machine and connecting piping systems, the Contractor shall delete any flexible coupling (including equipment connection fittings) shown on the drawings and install the equipment in the following manner, in lieu of installing the flexible coupling:
   1. The equipment pad shall be prepared as shown on the details for rigid equipment mounts
   2. The baseplate, soleplate, or mounting blocks supporting the equipment shall be installed, leveled, and grouted in place as specified in this section.
   3. The equipment shall be installed, aligned and doweled in place as specified.
   4. The piping shall be installed and aligned to the equipment connections and the field piping connections without welding one of the joints for one section of pipe between the equipment connection and the field piping and all valving. All flanged joints shall be bolted up and pressure tested.
   5. All piping shall be fully supported by supports designed to accept their full weight and thrust forces.
   6. The final sections of piping shall be aligned with the equipment and field connections without the use of jacks, chain falls or other devices to force it into alignment.
   7. The final piping joints shall be welded only after the previous steps have been completed and accepted by the Project Representative.

E. Conduit and piping for future equipment shall be capped flush with the floor or concrete pad in such a manner to allow future connection.

F. Coordinate location of electrical conduit and piping penetrations within the concrete pad and equipment base. All penetrations shall stub-up on the same side of the equipment as required for connection to the equipment. Equipment drains shall be located as required for drainage from equipment.

3.02 INSTALLATION

A. Anchor Bolts:
   1. Prior to concrete placement, anchor bolts shall be accurately set according to the manufacturer's shop drawings and firmly secured to prevent shifting during concrete placement. The bolts shall be

embedded in the structural concrete to develop the full strength of the bolt. Concrete in housekeeping pads cannot be used for this purpose.

2. All anchor bolts shall be dimensionally checked against the shop drawings for proper length, diameter, thread length, thread projection, etc., by a representative of the equipment manufacturer prior to placing concrete.
3. Prior to placing concrete for the housekeeping pad, plastic sleeves shall be placed around each bolt to provide for minor adjustment of bolt position prior to grouting.
   a. Bolt threads and projections in the sleeves shall be per Paragraph 43 05 60-2.06.
   b. Bolt projections above the structural slab shall be protected in the sleeve by heavily greasing or waxing the threads and shank with paste wax and wrapping with plastic sheeting.
   c. The protective wrapping shall be firmly secured with tie wires.
   d. The protective wrapping shall be removed prior to placing the grout.

B. Concrete Housekeeping Pad Preparation:
1. After the concrete is fully cured, the top of the equipment pad shall be roughened by chipping the surface.
   a. Chipping shall remove all laitance and defective or weak concrete and result in a rough surface profile with a 0.25 inch minimum amplitude.
   b. Chipping shall expose broken aggregate without dislodging unbroken aggregate from the cement matrix and shall not cause fractures below the concrete surface.
   c. A light duty, hand held pneumatic chipper with a chisel type tool shall be used for chipping the equipment pad concrete surface. Abrasive blast, bush-hammer, jack hammers with sharp chisels, heavy chipping tools, or needle gun preparation of concrete surfaces to be grouted is not acceptable.
   d. The chipped surface of the concrete shall be such that the final baseplate, soleplate, or mounting block elevation results in the grout manufacturer's recommended grout thickness between the surface of the equipment pad and the lower baseplate flange, underside of the soleplate or underside of mounting block.
   e. All edges shall be chamfered 3/4 inch at a 45-degree angle
   f. All dust, dirt, chips, oil, water, and any other contaminants shall be removed and the surface protected with plastic sheeting until grout is installed.
2. The grout contact surface on the housekeeping pad shall be coated with one coat of epoxy bonding agent as recommended by the manufacturer.

C. Equipment Bases, Soleplates, and Mounting Blocks:
1. All surfaces of equipment bases and soleplates to be in contact with epoxy grout shall be cleaned to SSPC SP-6 and shall be primed with cementitious non-shrink primer within 8 hours of cleaning.
2. Primer coatings shall conform to the supplier's recommendations for thickness and solvents.

D. Leveling and Shimming:
1. All machinery shall be mounted and leveled by millwrights.
2. All equipment bases and equipment shall be leveled against steel surfaces. Use of other materials for leveling purposes is prohibited.
3. Unless otherwise specified, baseplates, mounting blocks and soleplates weighing less than 1000 pounds shall be leveled on stainless steel blocks 4 inches square and 1½ inches thick with a hole drilled in the center for the anchor bolt, placed under the base at every anchor bolt. Jackscrews acting on flat steel plates shall be used for heavier components.
4. Leveling shall be by use of leveling blocks machined flat on all horizontal surfaces and measuring not less than 4 inches wide horizontally and shims that shall extend not less than three inches beyond the base of the equipment. Leveling blocks shall be coated with a light oil just prior to beginning the leveling and grouting work.
5. Using precut stainless steel shims coated with a light oil between the base and the steel blocks at the anchor bolts, level the equipment baseplates, soleplates or mounting blocks against the anchor bolt nuts to a maximum tolerance of 0.005 in/ft or as otherwise required by the equipment manufacturer, if more stringent. Mounting surfaces for equipment shall be coplanar within 0.002 in. in any direction. The shims shall be placed so the tabs on the shims are easily accessible. A

minimum of four shims per anchor bolt shall be used. The total shim thickness at each anchor bolt shall be at least 0.015 inch.

6. Leveling shall be against anchor bolts prior to final grouting. Leveling equipment shall be precision surveying equipment. Machinists' spirit levels will not be permitted for leveling purposes for any base plate or equipment foundation with a plan dimension greater than 4 feet.
7. Leveling nuts may be used for mounting equipment less than 500 pounds. Level the equipment against the anchor bolt nuts to a maximum tolerance of 0.005 in/ft or as otherwise required by the equipment manufacturer, if more stringent. Wedges will not be allowed.

E. Grouting:
   1. Forms:
      a. Built of minimum of ¾-inch thick waterproof plywood
      b. Securely braced (minimum brace size shall be 2-inch by 4-inch).
      c. Coat all areas that will come in contact with the grout with three coats of paste wax to prevent the grout from bonding to the forms.
      d. Forms shall be waxed before assembly to prevent accidental application of wax to surfaces where the grout is to bond.
      e. Before any forms are installed, all concrete surfaces that will contact epoxy grout shall be free from any foreign material, such as oil, sand, water, grease, etc.
      f. Forms shall be liquid-tight. Any open spaces or cracks in forms, or at the joint between forms and the foundation, shall be sealed off, using sealant.
      g. All outside vertical and horizontal edges of the grout shall have 45-degree chamfers.
      h. Blockouts shall be provided at all shimming and leveling nut positions to allow removal of shimming equipment after the grout has cured.
      i. Jackscrews shall be coated with a light oil or other acceptable bond-breaking compound.
   2. Top of Grout:
      a. The 45-degree chamfer strip shall be located at the top of the grout.
      b. The top of the grout on baseplates with exposed I-beam or C-channel supports shall be at the top of the lower support flange.
      c. The top of the grout on baseplate plates with solid sides and soleplates, shall be 1.0-inch above the bottom of the baseplate plate or the underside of the soleplate. The grout's final elevation shall not be so high as to bond the anchor bolt nut and washer.
   3. Epoxy grout:
      a. The epoxy resin and hardener shall be mixed in accordance with the grout manufacturer's recommendations.
      b. Aggregate shall be slowly added to the mixer one bag at a time.
      c. The grout should be mixed only long enough to wet out all the aggregate.
      d. Grout shall be placed at the center of one end of the baseplate or soleplate and worked toward the ends in such a manner as to force the air out from beneath the baseplate or soleplate and out the vent holes, to eliminate voids.
      e. The grout shall be placed in a manner that avoids air entrapment using a head box to pour grout into the grout holes.
      f. When the head box is moved to the next grout hole, a 6-inch high standpipe shall be placed over the grout hole and filled with grout.
      g. The Contractor shall exercise care to never allow the grout to fall below the baseplate level once the grout has made contact with the baseplate.
      h. Grout placement shall be continuous until the all portions of the space beneath the baseplate or soleplate have been filled. Subsequent batches of grout shall be prepared so as to be ready when the preceding batch has been placed. Under no circumstances shall the grouting operation be halted because of lack of grout mix.
      i. After the entire baseplate is full, 6-inch high standpipes shall be maintained over each grout hole, to continue purging of air.
      j. When the grout has started to take an initial set (determined by a noticeable increase in temperature and no flow of grout at the vent holes) the standpipes shall be removed and excess grout cleaned from all surfaces.

4. Grout Sampling:
    a. A grout sample shall be taken for each piece of equipment to be grouted.
    b. The sample shall be placed in a cylinder of sufficient size to yield three 2" x 2" x 2" test samples.
    c. The samples shall be tagged with the equipment number and ambient temperature at the time of placement.
    d. The samples shall be tested in accordance with the manufacturer's recommendations.
        1) Once the epoxy grout cylinder has been completely filled, it shall be placed next to the foundation of the equipment being grouted and allowed to cure for 48 hours.
        2) After 48 hours, the test cylinder shall be tested in accordance with the grout manufacturer's recommendations by an independent testing laboratory.
        3) The results shall be reported directly to the Project Representative.
5. Forms shall be removed only after the grout has cured sufficiently and upon specific permission from the Project Representative.

F. Completion:
1. Form Removal:
    a. Upon acceptance by the Project Representative and the equipment manufacturer's representative, and after the grout has reached sufficient strength, the shims shall be removed, or leveling nuts or jack screws backed off to allow the grout to fully support the equipment base, leveling block or soleplate.
    b. Removal procedures shall protect the grout from damage.
2. Torque Requirements:
    a. The anchor bolts shall be torqued, using calibrated indicating torque wrenches, to develop the full clamping force required by the equipment manufacturer.
    b. Anchor bolts shall be torqued in increments of not more than 25 percent of final value in an alternating pattern to avoid stress concentration on the grout surface.
3. Pockets for access to shims, mounting blocks, or leveling nuts shall be filled with grout mix and pointed after the anchor bolts have been torqued to final values.

3.03 FINAL INSPECTION

A. The Project Representative will conduct a final inspection with the Contractor for conformance to requirements of the contract documents.

END OF SECTION

SECTION 43 11 40

VARIABLE-SPEED TURBO AIR BLOWERS

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes furnishing, installing, testing and startup of variable speed turbo air blowers, related equipment, and required appurtenances for a complete installation in accordance with Drawings and Specifications.

B. The general requirements applicable to all mechanical equipment, as specified in Section 43 05 01, are applicable to the equipment specified in this Section.

C. In order to reduce energy consumption and comply with King County's energy reduction policy (Ordinance 16927), the new blowers shall meet guaranteed blower power draw requirements defined in Article 1.03.B.1. of this section.

D. Equipment List:

EQUIPMENT	EQUIPMENT NO.
Channel Aeration Air Blower 1	724-B31CA011
Channel Aeration Air Blower 2	724-B31CA021
Channel Aeration Blower Motor 1	724-MTR31CA011
Channel Aeration Blower Motor 2	724-MTR31CA021
Blower 1 Blowoff Valve	724-PCV31CA011
Blower 2 Blowoff Valve	724-PCV31CA021
Blower 1 Blowoff Silencer	724-S31CA011
Blower 2 Blowoff Silencer	724-S31CA021
Blower 1 Discharge Check Valve	724-310402
Blower 2 Discharge Check Valve	724-310502
Blower 1 Discharge Butterfly Valve	724-310403
Blower 2 Discharge Butterfly Valve	724-310503
Blower 1 Pre-Filter	724-FLT31CA011A
Blower 1 Main Filter	724-FLT31CA011B
Blower 1 Electronics Filter	724-FLT31CA011C
Blower 2 Pre-Filter	724-FLT31CA021A
Blower 2 Main Filter	724-FLT31CA021B
Blower 2 Electronics Filter	724-FLT31CA021C
Blower 1 System Control Panel	724-FP3151
Blower 2 System Control Panel	724-FP3152
Blower 1 Variable Frequency Drive	724-VFD31CA011
Blower 2 Variable Frequency Drive	724-VFD31CA021
Blower 1 Programmable Controller	724-PLC31CA011
Blower 2 Programmable Controller	724-PLC31CA021
Blower 1 Human Machine Interface	724-HMI31CA011
Blower 2 Human Machine Interface	724-HMI31CA021

EQUIPMENT	EQUIPMENT NO.
Blower 1 Expansion Joint	724-ME31CA011A
Blower 2 Expansion Joint	724-ME31CA021A

1.02 REFERENCED STANDARDS

A. This Section incorporates by reference the latest revisions of the embedded standard referenced herein. In case of conflict between the requirements of this Section and those of a listed document, the requirements of this Section shall prevail.

Reference	Title
ASHRAE 52-76	Method of Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter
ASME PTC-13	Wire-To-Air Performance Test Code for Blower Systems
ASME PTC-36	Measurement of Industrial Sound
ASTM 278	Grey Iron Castings for Pressure Containing Parts for Temperatures Up to 343 degrees C
ANSI	American National Standards Institute
IEEE 85	Test Procedure for Airborne Sound Measurements on Rotating Electric Machinery
IEEE 112	Standard Test Procedures for Polyphase Induction Motors and Generators
IEEE 519	Recommended Practices and Requirements for Harmonic Control in Electric Power Systems
NEMA	National Electrical Manufacturers Association
NEMA MG 1	Motors and Generators
OSHA	Occupational Safety and Health Act
UL 508	ANSI/NETA Industrial Control Equipment
UL 508A	Standard for Safety Industrial Control Panels

1.03 SYSTEM DESCRIPTION

A. Design Requirements:
1. When measured in accordance with ASME PTC-36 “Measurement of Industrial Sound,” and operating at the maximum design capacities, the tested sound power values from blowers shall not exceed 85 dBa at 3ft. Submit sound power levels for both inlet and radiated conditions, for review.
2. Blowers shall be designed to operate at maximum capacity with a minimum rise to surge margin of 2 psig away from surge, and at minimum capacity with a minimum rise to surge margin of 0.5 psig away from surge.
3. Each blower package, including enclosure and internal components, shall be listed by National Recognized Testing Laboratory (NRTL), such as UL/CSA/TUV, in accordance with UL 508.
4. Blower units shall be exposed to indoor temperatures between 45 degrees F to 90 degrees F and 0-95% non-condensing humidities. All components must be rated for continuous operation across a range of ambient air temperatures and humidities. Blowers must be able to cool themselves adequately using ambient air and discharging the cooling air to atmosphere at grade as described.
5. Blowers shall be complete prepackaged units. High efficiency, high speed motors shall be furnished as an integral part of the blower core assembly. Units shall have integrated air filters, blowoff valve, silencer, cooling air fans, variable frequency drive, and control panel. Each blower shall have a discharge expansion joint, check valve, and isolation valve shipped loose.

6. Blowers shall be able to operate continuously across the entire discharge flow rate range for each of the scenarios shown in the following Blower Performance Table assuming an inlet atmospheric pressure of 14.7 psia and a minus 0.2 psig suction pressure due to head loss through internal dirty filter.

Scenario	MAXIMUM		MINIMUM		STANDARD CONDITIONS	
Inlet Temp. (°F)	90		25		68	
Inlet Relative Humidity (%)	95		95		36	
Differential Pressure (psid)	4.5	4.0	4.5	4.0	4.5	4.0
Discharge Flow Rate Range (SCFM)	3000	5000	3000	5000	3000	5000
Maximum Power Draw (kW)	63	100	55	83	59	91

B. Performance Requirements:
   1. Blower Power Consumptions in Maximum Power Draw (kW) shall be Guaranteed:
      a. The blower power draw (kW) shall be established by factory performance testing in accordance with ASME PTC-13. In the event that the required kW per blower is in excess of the specified Maximum Power Draw, the blower units shall be re-worked and re-tested within 2 weeks from non-compliant factory test at no additional cost to the County, until they comply with the Specifications.
      b. The Maximum Power Draw (kW) is defined as the wire-to-air power of the blower package. As defined in ASME PTC-13, this shall include all power-consuming electrical components of the blower package as required for normal operation.
      c. Alternatively, the County may accept non-conforming blowers by imposing a power penalty of $12,000 per KW, per blower, in excess of the specified maximum Power Draw. The penalties shall be calculated to the nearest KW, for each blower, and deducted from payments to the Contractor for the work performed. A credit shall not be allowed for any blower (tested) Power Draw under that the maximum kW specified.

C. System Operation: Section 40 65 01.

1.04 SUBMITTALS

A. Procedure: 01 33 00

B. Provide the submittals from this Section with the submittals for Section 40 05 64 for evaluation as a unit.

C. Provide the following submittals:
   1. Shop drawings:
      a. Anchorage and bracing drawings and catalog information.
      b. Mechanical:
         1) Complete Specifications, descriptive Drawings, catalog cuts, and descriptive literature which shall include make, model, dimensions and weight of the blowers, motors, and accessories. Include weight of largest components requiring removal for maintenance.
         2) Detailed Design layout Drawings and dimensional data, including minimum clearance distances around equipment required to access equipment for normal service, repair, and removal.
      c. Electrical:
         1) System wiring diagrams, with recommended power feeder conductor sizes and feeder breaker sizes.
         2) Panel/control station layouts giving the physical location of each item wired into the electrical system. These shall show the physical location within panels or junction boxes of relays, meters, etc., and the location of any electrical component anywhere else in the system, so that the system may be maintained.
      d. Controls:
         1) Complete specifications, descriptive drawings, catalog cuts, and descriptive literature which shall include make and model of instrumentation and components of control system.
         2) Complete process and instrumentation diagrams (P&IDs), network interface drawing, electrical elementary and wiring diagrams, interconnection diagram showing power and control interfaces among all system components, and instrument settings.
         3) Outline and Arrangement Drawings for blower-motor assembly, System Control Panel. Include wiring and schematic diagrams, program documentation (PLC-based), network equipment, mounting, location, and communications network diagram, and I/O listing. Include panel interior and door layout Drawings, and sample operator interface screens.
      e. Detailed installation manuals.
   2. Diagrams:
      a. Electrical:
         1) Connection diagrams showing the actual wiring within a complete electrical system or enclosure with all cables and terminals numbered and identified.
         2) Interconnection diagrams showing the actual wiring connecting all terminal points in complete systems with other complete systems and other isolated units including power sources and interconnections of all instruments.
         3) Logic Diagram: Provide logic diagrams showing operation of panel controls including but not limited to panel or MCC switches and indicating lights. Include diagrams of PLC control logic including interfaces with field devices.
      b. Controls:
         1) Completed wiring diagrams, interconnection diagrams, elementary diagrams, control schematics, and network interface drawing.
         2) Elementary diagrams showing in detail all components of an entire system. A legend shall be provided to identify the meaning of each symbol used. The numbers on the schematic diagram shall correspond to the numbers on the wiring diagram and the interconnection diagram.
   3. Design Data:
      a. Mechanical:
         1) Data on the characteristics and performance of the units to indicate ability to meet the system performance specified herein. Plot the blower performance curves of recommended blower at the indicated capacities. Inlet conditions shall be as specified under design conditions. Clearly show the surge pressure associated with each of the performance curves. Include curves showing blower brake horsepower associated with each performance curve.
         2) Estimated blower sound level data, for both inlet and radiated conditions, and description of sound control measures required to meet the specified sound levels.
         3) Provide a statement of the lateral critical speeds of each blower system.

b. Electrical:
    1) Motor Data: Complete motor data shall be submitted with the driven machinery shop drawings. Motor data shall include items applicable to this motor, such as:
        a) Descriptive information.
        b) Nominal horsepower.
        c) Voltage, phase, and frequency ratings.
        d) Full load current at rated horsepower for application voltage.
        e) Full load speed.
        f) Guaranteed minimum full load efficiency. Also provide nominal efficiencies at ½ and ¾ load.
        g) Description and rating of thermal protection or over-temperature protection for stator windings including product data sheet.
        h) Power factor at ½, ¾, and full load.
        i) Insulation class.
    2) Variable Frequency Drive (VFD) Data:
        a) Information on harmonics generated by the drive, along with descriptive information on all reactors, filters, or other harmonics mitigation equipment.
            (1) Complete system rating, including all nameplate data, continuous operation load capability throughout speed range of 0 percent to 120 percent of rated speed.
        b) Current and voltage distortion calculations:
            (1) Point of Common Coupling (PCC) is the main distribution panel 480 volt bus.
            (2) Include first 36 odd current and voltage harmonics: Voltage calculated on line to line basis
            (3) Provide distortion figures for each harmonic and the total demand distortion.
            (4) Provide plots of voltage and current waves.
            (5) Perform calculations for the following criteria:
                (a) Two 200 hp VFDs operating at full load on utility power
            (6) Efficiency and power factor calculations:
                (a) Calculate efficiencies of the VFD controller including the auto-transformer (where applicable), ventilation fans, control power and all VFD losses.
                (b) Calculate displacement and total power factor including filter.
                (c) Perform calculations at 100, 75, and 50 percent speed.
                (d) Include first 36 harmonics.
            (7) Calculations of cooling and ventilation requirements.
            (8) Provide letters of certification from the VFD manufacturer and the motor manufacturer that the specific application has been reviewed and that the motor and drive combination will satisfy the torque and drive requirements under all conditions of operation and that VFD high voltage ringing on motor cables will not be detrimental to the motors.
            (9) Recommended spare parts list.
    3) A written Sequence of Operation describing in detail the various steps of operation in their proper order, including interlocks and permissives. and/or information describing electric power supply requirements and control interfaces.
    4) Controls:
        a) Operating description for the system control panels. Provide detailed description covering all specified logic and sequences of operation.
        b) Summary of local control software applications program and proposed approach for integration with plant DCS.
        c) Complete motor and drive, controls and instrumentation data, PLC or micro-controller details, and program descriptions.
        d) Preliminary and final electronic copies of PLC and OIT programs listings per Section 40 68 70.
4. Test Information:
    a. Factory Test Procedures: Submit factory test plan outlining all required testing activities within this section for the Owner's approval a minimum of 12 weeks prior to testing. Submit a detailed test procedure with complete piping and instrumentation configuration diagram per ASME

PTC-13 showing inlet and discharge air test pipe size. The location, type, and quantity of all major instruments necessary for performance data, including those on air and water with corresponding distances from reference points, shall be identified per ASME PTC-13 requirements. As a minimum, the detailed test plan shall include:
    1) Quality control procedures.
    2) Functional testing of entire package, including instrumentation, ancillary components, and system control panels and interface to DCS (Ovation).
    3) Field Test: Submit a detailed test procedure for complete blower system.
  b. Factory Test Results:
    1) Submit factory test results including manufacturer's quality assurance.
    2) Include copies of original test data collection forms.
  c. Manufacturer's Field Report: Submit manufacturer's field report of inspections, tests, and observations for all items furnished under this Section.
  d. Test procedures.
  e. Test results, reports, and certifications.
5. Support calculations made and signed by a professional engineer currently registered in the State of Washington, as required by Section 01 73 00, Bracing and Anchoring.
6. Manufacturer's printed installation instructions.
7. Special shipping, storage and protection, and handling instructions.
8. Qualifications:
  a. Submit proof of listing by a National Recognized Testing Laboratory (NRTL) such as UL/CSA/TUV in accordance with UL 508 on the same blower models and sizes proposed.
9. Manufacturer's certifications as described herein.
  a. Certified copies of all material test reports.
  b. Certify that materials and equipment supplied conform to the respective standards referenced herein.
  c. Certify that shop test equipment has been calibrated and checked against an approved standard within the last 12 months.
  d. Certify that field test equipment has been calibrated and checked against an approved standard within the last three (3) months.
  e. Certify that the motor starting torque is compatible with blower requirements.
  f. Manufacturer's Certificate of Proper Installation.
  g. Manufacturer's certification that the controller can withstand fault conditions on the load side based on the assumption that an infinite bus and 5 percent impedance on a 1000kVA delta-to-wye service transformer exists on the supply side of the controller.
10. Certificate of Unit Responsibility attesting that the Contractor has assumed Unit Responsibility in accordance with the requirements of this Section and Section 43 05 01.
11. O&M manual: 01 78 23.
12. Installation certification: Form 43 05 01-A.
13. Training certification: Form 43 05 01-B.
14. Spare parts, including Form 01 78 43-A.

1.05 QUALITY ASSURANCE

A. Unit Responsibility:
  1. The turbo blower system specified in this Section shall be the product of a single vendor. Unit Responsibility for the system shall be as specified in this Section in accordance with the requirements of Section 43 05 01. This manufacturer is the unit responsibility manufacturer and has unit responsibility. Provide a completed and signed certificate of unit responsibility.
  2. The system shall consist of the following components: high speed turbo blower, discharge check valve, discharge butterfly valve, discharge expansion joint, harmonic filter, blowoff valve, blowoff silencer, system control panel, motor, variable frequency drive, temperature sensors, and pressure sensors.

B. Qualifications:
   1. The blower manufacturer shall have an established blower-dedicated base of operation in North America that furnishes experienced technical resources to continually improve the product and service personnel to carry out startup and troubleshooting.
   2. The blower manufacturer shall have a developed service network in North America to support the operation of the blower providing responses to technical inquiries within 12 hours and shipment of replacement parts within 48 hours.

1.06 SHIPMENT, PROTECTION, AND STORAGE

A. Shipment, protection, and storage: Section 01 67 00.

1.07 ENVIRONMENTAL CONDITIONS

A. Site Conditions:
   1. The blower units shall operate within a municipal wastewater treatment plant and shall be installed in a blower room with outdoor air supply ducted inside as shown on Drawings. Site elevation is approximately 0 feet above mean sea level (MSL).

B. Electrical Classification: See Section 26 05 00.

1.08 SPECIAL WARRANTY

A. Provide manufacturer's extended guarantee or warranty, with Owner named as beneficiary, in writing, as special guarantee. Special guarantee shall provide for correction, or at option of Owner, removal and replacement of Work specified in this Section found defective within 2 years after date of Substantial Completion. Duties and obligations for correction or removal and replacement of defective work as specified in the General Conditions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable manufacturers:
   1. APG-Neuros Inc., Quebec, Canada, per Special Facilities Waiver.

B. The blower supplier shall have a service and support facility operation in the U.S.A. for supply, support, and the provision of replacement components.

2.02 MATERIALS

A. Materials specified are acceptable for the application. Contractor may propose alternative materials, subject to review and approval or rejection by the County.

B. Materials of construction:

Component	Material
Fasteners (bolts, nuts, washers, etc)	Type 316 Stainless Steel
Blower Blowoff Valve Silencer	Carbon Steel
Blower Check Valve	Cast Iron Body
Piping and Tubing	Type 316L Stainless Steel

2.03 EQUIPMENT FEATURES AND COMPONENTS

A. General:
   1. Blowers shall be air bearing type turbo blowers and shall not require oils or lubricants for specified performance. Blowers shall be capable of variable speed and output operation.
   2. Blower cooling system shall use room air for cooling all blower components and exhaust cooling air through a ducted discharge to atmosphere at grade.
   3. Blower material internals and externals shall be appropriate for the service conditions specified herein.
   4. Blower casing shall have a maximum continuous duty design temperature of 400 degrees F, and a design pressure of 50 psig.
   5. Fasteners: All bolts, nuts, washers, and other fasteners shall be Type 316 stainless steel.

B. Blower Accessories:
   1. Inlet Filter Silencer:
      a. Each blower shall receive main process air directly from the room they are located in.
      b. Each blower shall be provided with an inlet filter/silencer integral with all inlets of the blower.
      c. Inlet filter/silencer shall reduce sound power levels as indicated in design requirements.
      d. The filter elements shall be rectangular, replaceable or reusable elements mounted on a flat, vertical mounting frame of stainless-steel construction, and removable through doors located on each blower housing. The filter shall have a removal efficiency 90 percent by weight per ASHRAE 52-76 with synthetic dust equivalent of 95 percent at 10 micron.
      e. Maximum clean filter pressure drop of the inlet filter/silencer with the elements installed shall be 2.4 inches water column (0.087 psig). Maximum pressure drop with dirty inlet filters shall be 5.5 inches water column (0.2 psig).
   2. Discharge Expansion Joint: Provide each blower with a discharge expansion joint capable of withstanding the vacuum, pressure, and high discharge air temperature up to 350 degrees F under all operating conditions. The expansion joint shall include control rods and carbon steel flanges drilled for standard ANSI 150-pound pattern.
   3. Blower Blowoff Valve: Provide manufacturer's standard actuated valve. Controls for the valve shall be mounted in each system control panel.
   4. Blower Blowoff Valve Silencer: A carbon steel bypass valve silencer shall be provided for each blower. The silencer shall be an integral unit, fitted with one flange for direct bolting to the bypass valve. Silencer shall be high performance type including internal baffles packed with sound absorbent material, with maximum 95 dBA outlet.
   5. Blower Check Valve: Provide each blower with a wafer type discharge check valve of the dual, flat-plate type with center hinge, spring closure, cast iron body, silicon seal and aluminum plates, 316 stainless steel springs, and rated for temperatures up to 400 degrees F. The check valve shall be especially designed and suitable for use with variable speed turbo blowers, and shall retain positive sealing capability at 300 degrees F.
   6. Discharge Valve: Provide each blower with a manually-actuated butterfly valve suitable for high temperature air service and in accordance with Section 40 05 64. Operator shall be gear type complete with chainwheel.
   7. Piping and Tubing: All piping, tubing, and fittings provided with the blower shall be Type 316L stainless steel.

C. Blower:
   1. Impeller: The impeller shall be of the backswept three-dimensional high efficiency configuration designed using Computational Fluid Dynamics (CFD) with first lateral critical speed at least 120 percent of the maximum allowable operating speed.
   2. Bearings: Bearings shall be of the air bearing type.
   3. Equipment Housing and Mountings:
      a. Each blower shall be supplied with a sound enclosure covering the entire blower package. The sound enclosure must be designed for easy inspection and maintenance of all blower package components. Quick release panels, each less than 50 pounds (as mandated by OSHA) must provide easy and quick access for routine maintenance of the blower and the package

components. Should the panels be heavier than 50 pounds, hinged doors must be supplied, with the appropriate frame, reinforcements and supporting elements. Electrical components, instrumentation and instrument connections shall not be mounted or interface with removable panels of the sound enclosure.

b. Blower cooling system shall consist of liquid or air cooling. Any liquid cooling system shall be closed loop and require no external connections or water supply from the plant. Cooling air shall be brought in through blower inlets; cooling air shall be pulled from the Blower Room. The cooling air fans shall exhaust cooling air into an air duct and sized to discharge to atmosphere at grade. Cooling system shall be capable of accommodating range of ambient conditions described herein.

4. Anchorage: Blowers shall be mounted on fixed anchor bolt system.

2.04 MOTOR

A. Include the following features:

Motor	**724-MTR31CA011**
Horsepower	200
Type	PMSM (Permanent Magnet Synchronous Motor), Direct Drive
Duty	General
Hazard rating	None
Inverter duty	Yes
Operating speed, rpm (max)	2,400
Voltage / Frequency / Phase	480 / 60 / 3
Motor starting type	VFD (skid-mounted)
Installation type	Horizontal
Temperature sensing and protection	Yes
Space heater	No

Motor	**724-MTR31CA021**
Horsepower	200
Type	PMSM (Permanent Magnet Synchronous Motor), Direct Drive
Duty	General
Hazard rating	None
Inverter duty	Yes
Operating speed, rpm (max)	2,400
Voltage / Frequency / Phase	480 / 60 / 3
Motor starting type	VFD (skid-mounted)
Installation type	Horizontal
Temperature sensing and protection	Yes
Space heater	No

B. Electrical Components and Accessories:

1. Provide all necessary electrical components and wiring for a complete, functional system. Electrical components shall be provided in accordance with the requirements of Division 26, Electrical. All equipment on the blower skid shall be prewired.
2. Wiring: Drawings and Specifications indicate the anticipated wiring for the equipment provided under this Section. If additional wiring is required, or if required wiring does not match what is indicated, the Subcontractor shall make the necessary modifications to the electrical wiring and

documentation as part of the lump sum price. All wiring shall meet the requirements of Division 26, Electrical, and NFPA 70. All insulation shall be rated 600 volts, minimum. All low-voltage (24V) analog signals shall be run in twisted, shielded pair cable with 600-volt rated insulation.

3. Power Disconnect: Blowers shall be provided with an externally operable power disconnect.
4. Blower Drive Motor: Each blower shall be supplied with a Permanent Magnet Synchronous (PMSM) high-speed motor that shall operate as specified herein.
   a. The motor shall be able to start under the starting conditions required. Blower manufacturer shall be responsible for coordinating the starting torque requirement of the blower and the motor.
   b. Motor shall have a guaranteed minimum efficiency of 95 percent.
   c. Each blower shall be supplied with a motor that shall operate on 460/480 volts, 3-phase, 60-Hz current, totally enclosed, fan cooled. The maximum allowable motor horsepower shall be 200 hp. The motor shall have a 1.15 service factor.

2.05 INSTRUMENTATION AND CONTROLS

A. General:
   1. There are two existing control panels to which the Blower control wiring is connected for interconnection to the Plant DCS. These are 724-LCP3101 and 724-ICP3101. The Blowers are operated Locally from the System Control Panels (724-FP3151 and 724-FP3152) located on the Blower skids and the Blowers are operated Remotely through the Instrument Control Panel (ICP) that contains the Ovation control hardware.
   2. Control Voltage:
      a. Blower control voltage shall be either 24V dc or 120V ac.
      b. All discrete input and output between the blower PLC and the Plant DCS shall require isolation relays. The following descriptions are all referenced to the Blower System Control Panel.
         1) Discrete Inputs: Isolation relays are provided by the Plant DCS. Relay dry contacts shall switch power derived from the blower PLC. Voltage and current limits are 1A and 120 VAC or 24 VDC.
         2) Discrete Outputs: Blower System Control Panel shall contain isolation relays and provide relay dry contacts that shall switch 120V ac power derived from the DCS. Current shall be limited to less than 1A.
      c. All analog input and output between the blower PLC and the Plant DCS shall be 4 mA to 20 mA current loops and require current isolators. Maximum loop resistance shall be ≤500 Ohms.
         1) The Blower System Control Panel shall provide the loop current isolation.
         2) Analog Inputs: Loop power for loops from the Plant DCS shall be provided by the Plant DCS.
         3) Analog Outputs: Loop power for loops to the Plant DCS may be provided by either the Blower PLC or the Plant DCS. Coordinate with the Project Representative.
   3. For each blower, the Plant Distributed Control System (DCS) shall be used to sequence blowers ON and OFF, and control blower capacity as described herein.
      a. The Mixed Liquor Aeration Blowers shall be controlled to maintain a blower speed setpoint (0 percent to 100 percent) given by the Plant DCS in order to deliver varying amounts of air to the Mixed Liquor Channel. The blower PLC shall control the blower speed within the surge limits of the blower.
      b. LOCAL/REMOTE control mode selection shall be provided at the Blower System Control Panel.
      c. In the REMOTE control mode, the Plant DCS shall provide a remote RUN command to a specific blower and a remote speed setpoint signal. The remote speed setpoint shall vary as required to maintain the needed amounts of air to the Mixed Liquor Channel. The System Control Panel controls shall respond to the speed setpoint signal within the surge limits of the blower. The response shall be limited to prevent shutdown of the blower due to a surge condition.
      d. In LOCAL mode, the operator controls the blower through the Blower System Control Panel which provides start and stop control and the blower output setpoint.

B. Controllers:
   1. Allen-Bradley ControlLogix or CompactLogix Programmable Logic Controllers (PLC) shall be provided as specified in Section 40 63 43.
   2. Control for all components of an individual blower shall be provided in the System Control Panel at the blower. The System Control Panel shall provide all control and monitoring functions required for the operation, monitoring, and protection of the blower including, but not limited to, timing, interlocks, and permissive functions required for safe operation of its specific blower.
   3. All control communications/interfaces between the System Control Panel and the Plant DCS shall be hardwired discrete and analog circuits.
   4. Provide an Ethernet connection to the blower PLC to provide program maintenance and optional informational monitoring.
   5. Ethernet addresses are per the drawings, Coordinate configuration with the Project Representative.
   6. Coordinate the list of data, format and memory location of data available for communication the Ethernet connection with the Project Representative.
   7. The blower manufacturer shall provide all programming of their unit to make the blower unit PLCs fully functional with the Plant DCS sequences.

C. System Control Panel – Blower Control and Protection:
   1. General: Refer to Section 40 67 00 for panel requirements. Provide a comprehensive blower machine control and protection system that meets the system requirements specified, safely start and stop the machine, and protect the machine from adverse operating conditions and equipment failures. The blower machine control and protection system shall be monitored and controlled from a System Control Panel.
   2. Each blower shall include integral vibration, temperature, and pressure sensors.
   3. Provide each blower with the following function and features:
      a. Controls shall be located interior to the blower package. All control power shall be prewired, and derived from the main 480- volt, 3-phase power supply to the blower. No additional external wiring connections shall be necessary for control power. Provide control power transformers as required for lower voltage device and control requirements.
      b. The System Control Panel shall be factory assembled and wired such that field wiring shall consist only of connection to panel terminals.
      c. All controls and instruments shall fail into a safe condition. The controls shall be designed such that the blower cannot operate unless the controls are energized, nor can they operate with any defective controls.
      d. Power supply for startup blow off valve shall be from the System Control Panel.
      e. Surge suppressors shall be provided for “noise” protection and to remove transient peaks across all inductive loads.
      f. Provide panel mounted Graphical Operator Interface (OIT), as specified in Section 40 63 63, incorporating manufacturer’s standard functions, controls, alarms, and meters in easy-to-interpret operator interface displays.
   4. Functional Requirements:
      a. The blower shall start under an automatic sequence initiated by the local start signal at the System Control Panel when in LOCAL control, or the remote run signal from the Plant DCS when in REMOTE control.
      b. Blowers shall be speed controlled based on input from the plant control system.
      c. The surge detection system shall regulate the blower away from the surge condition, but after a designated time it shall shut down the blower.
      d. There shall be three means of shutting down the blower:
         1) Normal Stop: Initiated by pushing the local stop button or removing the Remote RUN signal from the Plant DCS. Machine normally stops such that no surging occurs.
         2) Soft Stop Initiated by blower PLC when a surge condition is detected.
         3) Emergency Stop Initiated by:
            a) Pushing EMERGENCY STOP button.
            b) PLC failure.

5. System Control Panel Control Interfaces with Plant DCS via hardwired communication, at a minimum:
    a. Discrete Inputs: (0-State/1-State)
        1) Remote RUN command. (OFF/RUN)
    b. Discrete Outputs: (0-State/1-State)
        1) Blower status (OFF/ON).
        2) Blower fault (Normal/Fault).
        3) Startup Blow Off Valve Closed Indication (Not-Closed/Closed)
    c. Analog Inputs: (4 mA – 20 mA)
        1) Remote SPEED command (0 percent to 100 percent).
    d. Analog Outputs: (4 mA – 20 mA)
        1) Calculated air flow rate. [SCFM]
        2) Electrical Power Consumption. [Watts]

D. Instrumentation: Instrumentation for each blower shall include the manufacturer's standard items including, as a minimum:
    1. Inlet air temperature gauge, transmitter element (RTD) and transmitter.
    2. Inlet air filter differential pressure indicating transmitter.
    3. Discharge air pressure gauge, transmitter.
    4. Discharge air temperature gauge, transmitter element (RTD), and transmitter.
    5. Vibration Monitoring System: Manufacturer's standard vibration monitoring system shall be furnished for each blower and motor.

2.06 VARIABLE FREQUENCY DRIVE

A. Variable frequency drive shall be manufacturer's standard design, generally of the pulse-width modulation design, with all necessary components to provide a complete and functioning blower system capable of meeting the design requirements.

B. Variable frequency drive provided for each blower shall have a service and support facility operation in the U.S.A. for supply, support, and the provision of replacement components.

C. Variable frequency drive inverter shall be listed by a National Recognized Testing Laboratory in accordance with UL 508.

D. Variable frequency drive shall be integrally mounted within blower enclosure.

E. Drive shall be provided with an internally mounted, 3 percent minimum input line reactor.

F. Variable frequency drive provided for each blower shall have a sinusoidal filter consisting of an inductor and capacitor filter to increase motor life.

G. Harmonics:
    1. All line side harmonic suppression devices used to eliminate or deal with harmonics in any way shall be contained within the VFD enclosure and shall be integral with the VFD controller.
    2. Use of input line filters external to the VFD shall not be permitted to meet the specified harmonic levels contained in this specification.
    3. VFD controller's performance shall be in compliance with the latest version of IEEE 519.

H. Maintainability: VFD controller's parts shall be interchangeable and modular for all controllers.

2.07 ACCESSORIES

A. Special tools if required for equipment maintenance and repair.

B. Equipment Identification Plate: 16-gauge stainless steel with 3/8-inch die-stamped equipment tag number securely mounted in a readily visible location.

C. Concrete Anchors: Blowers shall be mounted on fixed anchor bolt system designed by blower manufacturer.

D. Blower shall be skid mounted that is suitable for moving complete unit with a forklift.

2.08 SPARE PARTS

A. Section 01 78 43 and Section 43 05 01.

B. For each blower, provide the following spare parts:
   1. One spare memory module for each blower PLC model supplied, with the blower programming preloaded.
   2. Two sets of special tools required for complete assembly or disassembly of blower system components.
      a. Tool kits shall be sufficiently complete to permit normal repair and maintenance of all equipment furnished under this Section.
   3. One VFD.
   4. One set of Temperature sensors.
   5. One set of Vibration sensors.
   6. Spare filters
      a. Pre-filter: 12 spares.
      b. Main Filter: 2 spares.
      c. Electrical Filter: 2 spares.

C. The manufacturer shall furnish all special tools and appliances necessary to disassemble, service, repair, and adjust the equipment and appurtenances.

2.09 FINISHES

A. Section 09 90 00 for all other items.

B. Section 40 05 24 for pipe coating.

C. All exterior surfaces, except stainless steel, shall be shop coated and finished with the manufacturer's standard corrosion-resistant paint system. Paint schedule and colors shall be submitted to the County and Project Representative for approval prior to painting.

2.10 SOURCE QUALITY CONTROL

A. General:
   1. Owner representatives shall witness factory testing of blowers, the Contractor shall be responsible for all Owner travel expenses to witness the factory tests. Travel expenses are to include airfare, car rentals, taxis, hotel accommodations, and per diem costs. Contractor shall assume up to two Owner representatives shall attend factory testing. If a factory test fails and an extension of time at the factory is required for retesting or a retest is scheduled at a later date, the Contractor shall bear all additional expenses at no additional cost to the Owner.
   2. All furnished blowers and components supplied within this section shall be tested. Testing of similar size units and components which are not actually furnished shall not be allowed.

3. In addition to any testing herein, perform all testing for this product or system consistent with the requirements of Section 01 80 00, Equipment Testing Training and Commissioning, Section 40 61 13, Process Control System General Provisions, and the Manufacturers' current Quality Assurance program.

B. Pre-Installation (Factory) Tests:
1. The blower package manufacturer must submit a pre-installation (factory) test procedure for approval. Pre-requisite for scheduling the pre-installation test is an approved test procedure at least 6 weeks prior to scheduling the pre-installation test.
2. The test procedure shall include the completed Form 43 11 40-A, Process and Fluid Components and Electrical Power Related Components – Factory Testing Summary Checklists, Section 01 33 10.
3. The blower test report shall present computation in exact accordance with Sections 5, and 6 of the ASME PTC-13 Code with the performance curves showing capacity, pressure, and horsepower inputs for each of the flow and pressure conditions and determination of surge point and verification of the guaranteed points.
4. Upon completion of assembly, the blower system shall be tested at the place of assembly. Provide 4 weeks' notice, in writing, for the witnessing of the testing.
5. The blower pre-installation tests shall be witnessed by the Owner and/or Engineer. Owner and/or Engineer shall be allowed proper time for inspections and witnessing of shop testing of material and equipment. Proper time shall be defined as the time required to successfully complete the specified factory test.
6. The blower package shall be factory tested for duration not less than 4 hours in accordance with PTC-13.
7. The blower package including blowoff valve and System Control Panel shall be tested before shipment. The System Control Panel shall be connected to all enclosure instruments, and appurtenances. All start/stop, running sequences and flow control and all safety alarm systems shall be tested. Local and Remote modes shall be demonstrated. The witnessing engineer shall sign the test procedures and results, certifying that the assembled blowers, auxiliaries, blowoff valves, and system control panel were tested together, as a system, in the blower manufacturer's shop.
8. Each blower shall be performance tested in accordance with ASME PTC-13 Wire-To-Air Performance Test Code for Blower Systems to verify flow and wire power consumption at design conditions as well as blower minimum and maximum operating conditions. Tests shall be conducted using all components to be installed in the field.
9. A calibrated wattmeter shall measure the electrical shaft power, including but not limited to the motor, inverter, drive, cooling system, etc.
10. The test shall include determination of the surge point and verification of the guarantee points. Net delivered flow rate (capacity) and discharge pressure shall be guaranteed with no negative tolerance. There shall be no tolerances or measuring uncertainties used in the reporting of the test results (i.e., the test results report plus or minus 0 percent tolerance using measured values).
11. Inlet pressure, inlet temperature, inlet humidity, discharge temperature, discharge pressure, and net delivered flow rate shall be recorded for all operating design points outlined within this section.
12. The capacity and all measurements of the blower shall be defined as per Section 4 of the ASME PTC-13. Air flow rate shall be measured on the discharge side of the blower. Discharge pressure (delivered pressure) shall be measured at the package outlet flange. Input power is the sum of the input electrical power to the blower system (package).
13. All test equipment shall be calibrated and certified by an independent test agency no more than 3 months prior to the test date. Certificates shall show the stability of calibration over a period of at least 1 year per ISO 9001, Paragraph 4.11.
14. Velocity (in/sec) vibration versus frequency levels shall be recorded within 10-1,000 and 10-10,000 Hz frequency.
15. Provide total power consumption calculations for each blower for each specified operating condition.
16. The blower test report shall also present documentation of certification of the System Control Panel component testing.

17. The noise level shall be measured during the preliminary equipment tests at the factory.
18. Test results of the motors and blowers shall be included in the Operation and Maintenance Manual.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify all field conditions prior to installation.

3.02 INSTALLATION

A. Install blowers in accordance with the manufacturer's written instructions and as directed on Site by the Manufacturer's representative. The Contractor shall be responsible for coordinating related items, not covered in this Section of the specifications, such as piping, fittings, additional valves, supports, motor controls, and wiring.

B. The blower supplier shall supply blower packages shipped completely pre-assembled. Only the electrical connections and installation of the blowoff valve assembly, piping, and piping appurtenances shall be performed on Site by the Contractor.

C. Contractor shall install anchor bolts per the Manufacturer's instructions and calculations.

3.03 FIELD QUALITY CONTROL

A. Inspection: Factory trained engineers of the manufacturer, who have complete knowledge and experience in the proper installation, startup and operation of the equipment, shall inspect the final installation and assist the Contractor with all field tests of the equipment.

B. Field Testing: Section 01 80 00.

C. The contractor shall be responsible for providing all labor, and incidentals required to complete the field tests. The blower manufacturer shall provide testing equipment including, but not limited to portable power monitoring equipment, recording devices, and pressure sensors to verify field testing results. Manufacturer shall coordinate all requirements with the Contractor.

D. Component Test Phase: Following the pre-installation test phase specified in Article 2.10.B of this Section, perform the following:
   1. After the installation of the blowers and all appurtenances, functional testing shall be conducted on each blower and associated components. The equipment shall be operated for a sufficient period to make any corrections or adjustments.
   2. The Contractor shall provide, calibrate, and install all temporary gauges and meters, shall make necessary tapped holes in the pipes and install all temporary piping and wiring required for the functional tests. Written test procedures shall be submitted to Project Representative for approval as per Section 01 80 00.
   3. Component testing shall demonstrate that under all conditions of operation, each unit:
      a. Has not been damaged by transportation or installation.
      b. Has been properly installed.
      c. Has no mechanical defects.
      d. Is in proper alignment.
      e. Has current to all motor electrical leads balanced.
      f. Has been properly connected.
      g. Has fully function instrumentation that are properly calibrated and set.
      h. Shall start, run, and stop in the prescribed manner.
      i. Shall run through entire range of specified pressure and flow.
      j. Has the proper shutdown sequence of standard stop, soft stop, and emergency stop.

k. Is free of overheating of any parts.
l. Is free of overloading of any parts.
m. Shall operate as specified with the control system.

E. System Test Phase:
1. Each equipment item shall be subject to system testing under actual operating conditions to determine that operation is satisfactory and in compliance with the Specifications.
2. System testing shall confirm proper control system interfaces and function.
3. Performance Testing:
a. Conduct a minimum of 4 hour field run test on each blower including instrumentation, controls, and valves. The test shall demonstrate that the blowers shall operate across the entire range of specified pressure and flow while in remote with control from the Plant Control System. Document each blower's maximum and minimum air flow rate under field conditions to demonstrate blower's full turndown capability. The test shall be conducted at plant flows lower than 240 mgd.
b. A Field Startup Log shall be submitted to the County on completion of each performance test which records the blower model number, blower serial number, test date, beginning test time, ending test time, motor horsepower, motor speed, amperage draw, and all of the key operating parameters specified in the Design Criteria. In addition to this information, complete Form 43 11 40-B, Blower Field Performance Test Results, Section 01 33 10, during field startup and testing to demonstrate proper operation. Function test results shall be certified by the manufacturer/manufacturer's representative and witnessed by the County.
4. Harmonic Distortion Tests:
a. Calculate total harmonic distortion at the common node switchgear bus for the controller units based on the specified impedances and system configuration. Unless otherwise indicated, determine distortion in accordance with IEEE 519-2014.
b. The Contractor shall retain an independent harmonic testing company to conduct harmonic distortion tests on the new operational blower system as follows:
1) With the new blower, as well as combinations of each blower up to the full operating load, measure current harmonic distortion at the point of common coupling (PCC), 724-SWGR01, for all harmonics up to 35th harmonic.
2) Show that the percent current harmonic distortion is below specified IEEE 519 limits.
3) Measure total voltage distortion at the MCC with two new blowers operating at full load.
4) Measured results should approximate to the approved calculations submitted by the blower manufacturer.
5) Provide distortion analyzer, current, and potential transformers required for the harmonic distortion tests.
6) Submit a test plan for engineer's review and approval 30 days prior to implementing the actual test. An approved test plan is mandatory before conducting a test.
7) Provide at least 2 weeks' notice before conducting test.
8) Submit all test documentation for approval.

F. Operational Test Phase:
1. Upon approval of system testing, conduct operational testing in accordance with Section 01 80 00.

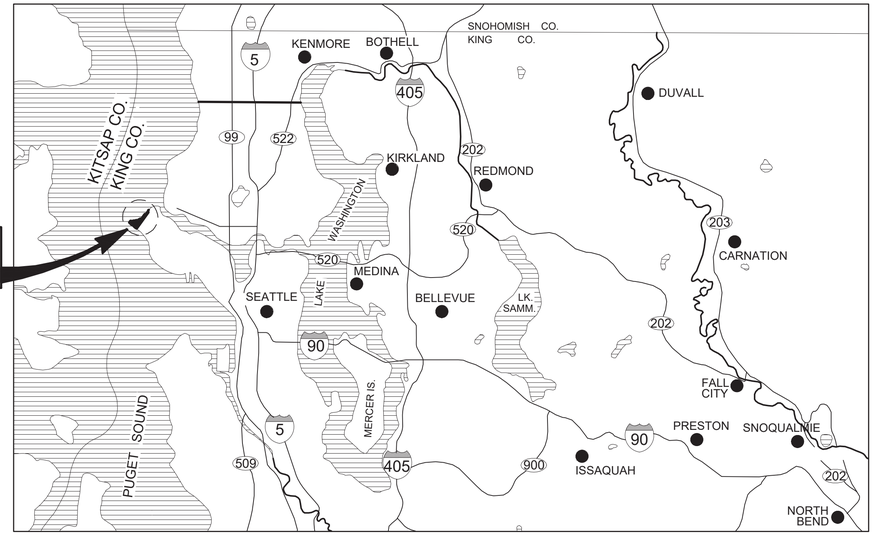
G. Component and Systems Testing: Blowers failing to meet the specifications to the satisfaction of the County shall be corrected and re-tested by the Contractor. If the packaged blower fails the second test within two weeks for the first test, the unit shall be rejected and the Contractor shall furnish a unit that shall perform as specified. Contractor shall be responsible for all transportation costs as well as costs to remove the defective unit and install the new unit.

H. Commissioning Phase: As per Section 01 80 00.

3.04 MANUFACTURER SERVICES

A. Provide a factory-trained representative at the site for the specified quantity and duration of the following activities. Durations do not include travel time to or from the project site. Provide written documentation for check out including who performed the work, when performed, what was the final setting or tolerance and who witnessed the final settings.
   1. One Installation Inspection:
      a. Assist, supervise, and inspect the Contractor's activities during installation.
      b. Provide a minimum of 3 person-days for installation assistance and inspection of the Subcontractor's activities during installation.
      c. Complete Form 43 05 01-A, Section 01 33 10.
   2. Test Phase Assistance:
      a. Assist, supervise, and inspect the Contractor's activities during testing.
      b. Provide a minimum of 2 person-days for functional and performance testing and completion of Manufacturer's Installation Certification Form.
      c. Complete Form 01 80 00-A and 43 05 01-B, Section 01 33 10.
   3. Three Training Sessions:
      a. Procedures: Section 01 80 00.
      b. Provide a minimum 2-week notice prior to scheduling training sessions.
         1) Training shall occur Tuesday-Thursday.
      c. Provide a minimum of 1 person-day for training. Provide a minimum of 4 hours of training per session on the variable-speed turbo air blowers. Conduct one training session per week on consecutive weeks, or as scheduled by Owner, to accommodate the shift schedules of operation and maintenance staff.
      d. Provide 1 person-day for post-startup review of operations. After the equipment has been placed into operation for a minimum of 30 calendar days, the equipment manufacturer shall provide one 8-hour day of follow-up services (inspection of equipment, review of operation, additional training if required) for equipment inspection. Post-startup services to be schedule by Owner.
      e. Certify completion of training on Form 43 05 01-B, Section 01 33 10.
      f. Complete Forms 01 80 00-B and 01 80 00-C, Section 01 33 10.
   4. Component Test to be verified by the PLC System Integrator. Comply with Section 01 80 00, Equipment Testing Training and Commissioning.

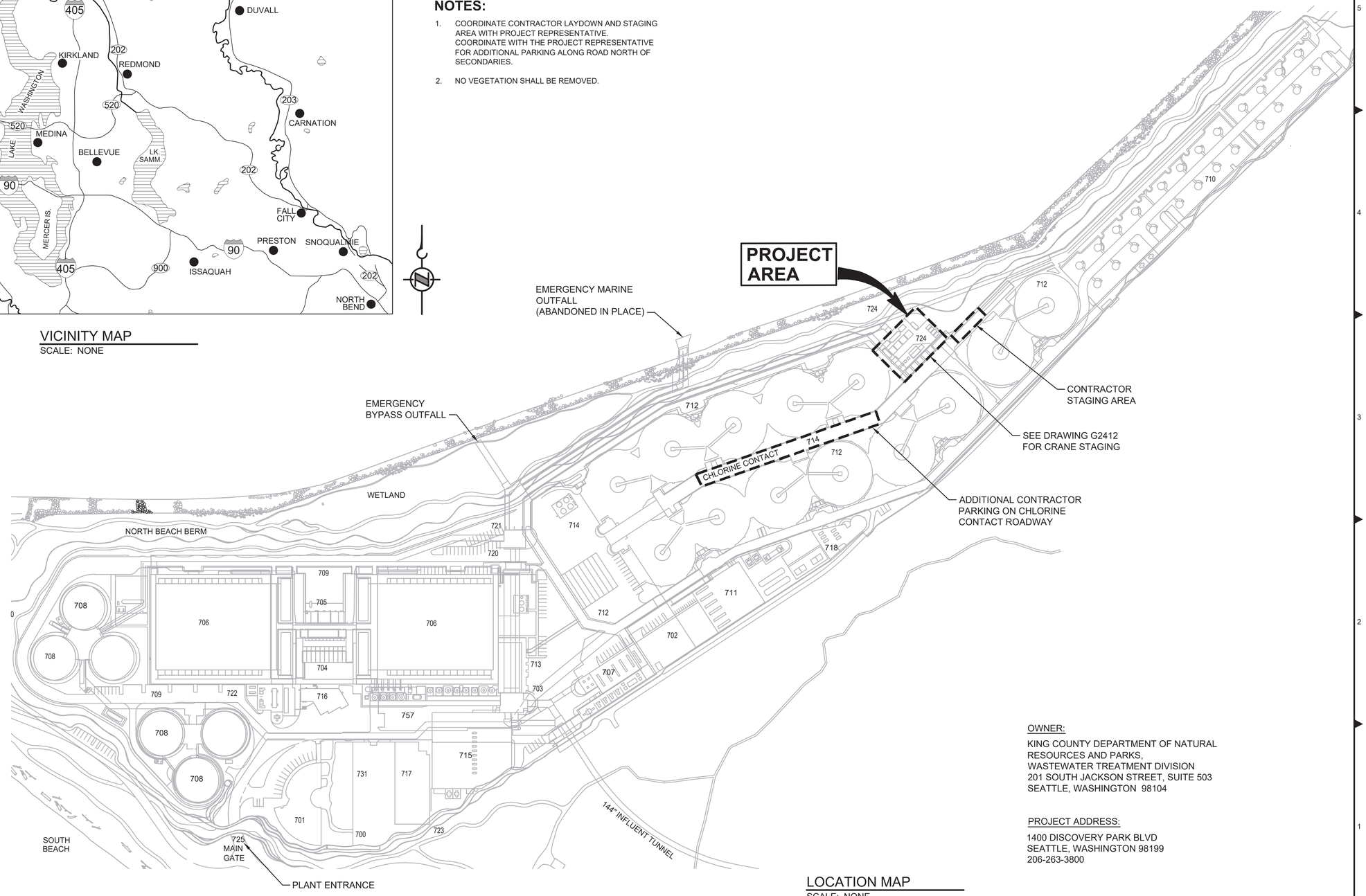
END OF SECTION



VICINITY MAP
SCALE: NONE

NOTES:

1. COORDINATE CONTRACTOR LAYDOWN AND STAGING AREA WITH PROJECT REPRESENTATIVE. COORDINATE WITH THE PROJECT REPRESENTATIVE FOR ADDITIONAL PARKING ALONG ROAD NORTH OF SECONDARIES.
2. NO VEGETATION SHALL BE REMOVED.



LOCATION MAP
SCALE: NONE

WEST POINT TREATMENT PLANT FACILITIES REFERENCE KEY

700 YARD PIPING, CIVIL, SITE-WIDE SYSTEMS
701 ADMINISTRATION/OPERATIONS CENTER
702 MAINTENANCE BUILDING
703 INFLUENT CONTROL STRUCTURE (ICS)
704 RAW SEWAGE PUMP BUILDING (RSPB)
705 GRIT/SCREENINGS HANDLING, BOILERS
706 WEST/EAST PRIMARY SEDIMENTATION
707 EFFLUENT PUMPING STATION (EPS)
708 DIGESTERS, PROPANE, WASTE GAS
709 PRIMARIES/DIGESTER GALLERIES
710 AERATION TANKS & GALLERY
711 OXYGEN GENERATION FACILITY (OGADS)
712 SECONDARY SED, CONTACT CHANNEL, GALLERIES
713 STORAGE, "FACILITY 713" FUTURE USE TBD
714 HYPOCHLORITE DISINFECTION & MIX STRUCTURE
715 SOLIDS HANDLING, GALLERY, ODOR CONTROL
716 INFLUENT SCREENINGS BUILDING
717 MULTI-USE FAC (MUF), WASTE TO ENERGY (W2E)
718 FACILITY SERVICES AND FS ANNEX
720 BYPASS & INFLUENT CHANNELS, WASTE GAS INCINERATORS
721 FLOW DIVERSION STRUCTURE (FDS)
722 WEST POINT MAIN ELECTRICAL SUBSTATION
723 HILLSIDE RETAINING WALL
724 INTERMEDIATE PUMP STATION (IPS)
725 WEST POINT MAIN GATE
731 ADMINISTRATION ANNEX BUILDING
757 WATER REUSE SYSTEM

OWNER:

KING COUNTY DEPARTMENT OF NATURAL RESOURCES AND PARKS,
WASTEWATER TREATMENT DIVISION
201 SOUTH JACKSON STREET, SUITE 503
SEATTLE, WASHINGTON 98104

PROJECT ADDRESS:

1400 DISCOVERY PARK BLVD
SEATTLE, WASHINGTON 98199
206-263-3800

NO	REVISION DESCRIPTION	BY	APVD	DATE
0	BID ISSUE			4/17/2020

ch2m:

WILLIAM S. FARMER — STATE OF WASHINGTON — 28552 — REGISTERED PROFESSIONAL ENGINEER — 4-17-20

DESIGNED/DRAWN: JY	CHECKED: BF
PROJECT ENGINEER: EC	SCALE: NONE
DESIGN APPROVAL: ES	FACILITY NUMBER: WP-724
PROJECT ACCEPTANCE: JRM	CONTRACT NO: C01397C20

King County

DEPARTMENT OF NATURAL RESOURCES & PARKS
WASTEWATER TREATMENT DIVISION
KING COUNTY WEST POINT TREATMENT PLANT
SECONDARY MIXED LIQUOR BLOWER REPLACEMENT

VICINITY AND LOCATION MAPS AND STAGING AREA

DATE: APRIL 2020
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ch2m:

WILLIAM S. FARMER — STATE OF WASHINGTON — 28570 — REGISTERED PROFESSIONAL ENGINEER
4-17-20

DESIGNED/DRAWN: JY	CHECKED: BF
PROJECT ENGINEER: EC	SCALE: NONE
DESIGN APPROVAL: ES	FACILITY NUMBER: WP-724
PROJECT ACCEPTANCE: JRM	CONTRACT NO: C01397C20

King County

DEPARTMENT OF NATURAL RESOURCES & PARKS
WASTEWATER TREATMENT DIVISION
KING COUNTY WEST POINT TREATMENT PLANT
SECONDARY MIXED LIQUOR BLOWER REPLACEMENT

DRAWING INDEX

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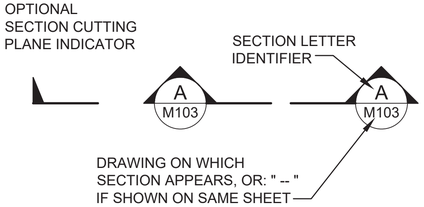
ABBREVIATIONS

A	AMMETER, AMPERE, AMBER
AA	AGITATION AIR
AB	ANCHOR BOLT
ABAN	ABANDONED
ABV	ABOVE
AC	ALTERNATING CURRENT
ACT	ACTUATOR
AE	ANALYSIS ELEMENT
AET	ANALYSIS ELEMENT TRANSMITTER
AI	ANALYSIS INDICATOR
AIT	ANALYSIS INDICATOR TRANSMITTER
AM	AUTO-MANUAL
BF	BUTTERFLY VALVE
BF	BLIND FLANGE, BOTTOM FACE, BOTH FACES
BLW	BELOW
BV	BALL VALVE
C	CONDUIT, CONTACTOR, CONDUCTOR, CLEAR
CAL	CALIBRATION , CALIBRATE
CKT	CIRCUIT
CND	CONDUIT
CRS	COATED RIGID STEEL CONDUIT
CS	CONTROL STATION
DEMO	DEMOLISH
DIA	DIAMETER
DN	DOWN
DWG	DRAWING
EA	EACH
ELEC	ELECTRICAL
EXST	EXISTING
FAIL	FAIL
FC	FLEXIBLE COUPLING, FLEXIBLE CONNECTION, FAIL CLOSED
FCA	FLANGED COUPLING ADAPTER
FCV	FLOW CONTROL VALVE
FE	FLOW ELEMENT
FLG	FLANGE
FNSH	FINISH
FT	FEET
FT	FLOW TRANSMITTER
FV	FLOW VALVE
GOX	GASEOUS OXYGEN
GOX1	GASEOUS OXYGEN
GOX2	GASEOUS OXYGEN
GOX3	GASEOUS OXYGEN VENT
GOX4	GASEOUS OXYGEN PRESSURE BUILD
GOX5	GASEOUS OXYGEN ADDITION
GVL	GRAVEL
HS	HAND SWITCH
HOA	HAND-OFF-AUTO
I&C	INSTRUMENT & CONTROL
IA	INSTRUMENT AIR
ID	INSIDE DIAMETER
IE	INVERT ELEVATION
IN	INCH
LCL	LOCAL
L/R	LOCAL/REMOTE
LF	LINEAR FEET
LOX	LIQUID OXYGEN
LOX1	LIQUID OXYGEN MAKE
LOX2	LIQUID OXYGEN PRODUCT
LOX3	LIQUID OXYGEN ADDITION
LOX4	LIQUID OXYGEN TRANSFER
LOX5	LIQUID OXYGEN WITHDRAWL
LOX6	LIQUID OXYGEN PRESSURE BUILD
M	MOTOR
ME	MECHANICAL HEATER ELEMENT
MIN	MINIMUM
MISC	MISCELLANEOUS
MJ	MECHANICAL JOINT
N	NORTH
NA	NOT APPLICABLE
NO.A.A.	NUMBER
NOM	NOMINAL
NTS	NOT TO SCALE
O2	OXYGEN
OCA	OPEN-CLOSE-AUTO
OCR	OPEN-CLOSE-REMOTE
OD	OUTSIDE DIAMETER
OFF	OFF
ON	ON
OOA	ON-OFF-AUTO
OOR	ON-OFF-REMOTE
PAI	PRESSURE ALARM INDICATION
PCV	PRESSURE CONTROL VALVE
PIC	PRESSURE CONTROLLER/W INDICATION
PE	PLAIN END
PE	PRESSURE ELEMENT
PET	O2 PLANT EMERGENCY TRIP
PGRS	PVC COATED GALVANIZED RIGID STEEL
PI	PRESSURE INDICATOR
PIT	PRESSURE INDICATOR TRANSMITTER
PLC	PROGRAMMABLE LOGIC CONTROLLER
PNL	PANEL
PSIG	LBS PER SQ. INCH, GUAGE
PSV	PRESSURE SAFETY VALVE
PSL	PRESSURE LOW SWITCH
PT	PRESSURE TRANSMITTER
PWR	POWER
PY	CURRENT/VOLTAGE ISOLATOR
QA	EVENT ALARM
QL	EVENT LIGHT
QS	EVENT SWITCH
REM	REMOTE
REPL	REPLACE
REQD	REQUIRED
RJ	RESTRAINED JOINT
RMV	REMOVE
SCFM	STANDARD CUBIC FEET PER MINUTE
SCHED	SCHEDULE
SIM	SIMILAR
SP	SET POINT
SPEC	SPECIFICATION
SPG	SPACING
SST	STAINLESS STEEL
STD	STANDARD
STL	STEEL
SUPT	SUPPORT
SV	SOLENOID VALVE
TAI	TEMPERATURE ALARM INDICATION
TAH	TEMPERATURE ALARM HIGH
TAHH	TEMPERATURE ALARM HIGH HIGH
TAL	TEMPERATURE ALARM LOW
TALL	TEMPERATURE ALARM LOW LOW
TBG	TUBING
TC	TEMPERATURE CONTROL
TCA	TEMPERATURE CONTROL ALARM
TCS	TEMPERATURE CONTROL SWITCH
TCU	THERMAL AIR CONTROL UNIT
TCV	TEMPERATURE CONTROL VALVE
TD	TIME DELAY
TDC	TERMINAL DEVICE CONTROL
TE	TEMPERATURE ELEMENT
TEMP	TEMPORARY
TET	TEMPERATURE ELEMENT TRANSMITTER
TI	TEMPERATURE INDICATOR
TIC	TERMINAL JUNCTION BOX
TIT	TEMPERATURE INDICATING TRANSMITTER
TJB	TERMINAL JUNCTION BOX
TP	TERMINAL POINT
TPA	TERMINAL POINT ARRANGEMENT
TSH	TEMPERATURE SWITCH HIGH
TSHH	TEMPERATURE SWITCH HIGH HIGH
TSL	TEMPERATURE SWITCH LOW
TSLL	TEMPERATURE SWITCH LOW LOW
TSP	TWISTED SHIELDED PAIR
TT	TEMPERATURE TRANSMITTER
TW	TOP OF WALL
TYP	TYPICAL
UG	UNDERGROUND
V	VOLTMETER, VOLT
VB	VALVE BOX
W/	WITH
W/O	WITHOUT
YD	YARD
ZI	POSITION INDICATOR
ZL	POSITION LIGHT
ZS	POSITION SWITCH
ZV	POSITION VALVE

NOTE: NOT ALL OF THE ABBREVIATIONS SHOWN ARE USED ON THIS PROJECT.

GENERAL SYMBOLS

SECTION REFERENCING



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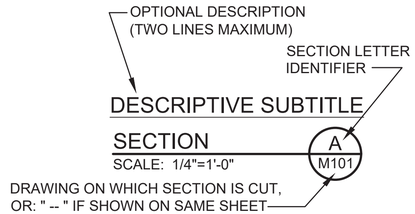

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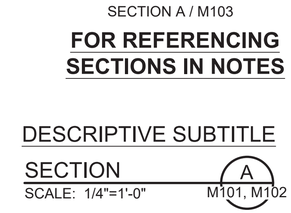
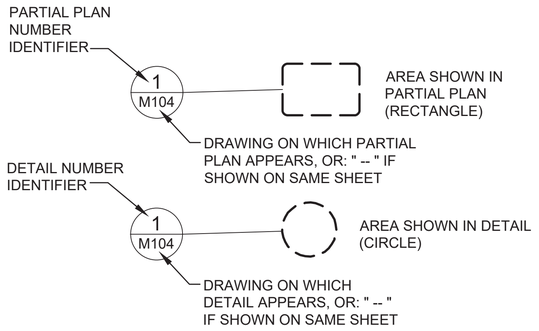
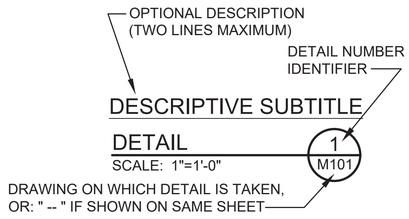


FOR REFERENCING MULTIPLE DRAWINGS

DETAIL REFERENCING



DETAIL IDENTIFICATION ON DRAWING WHERE DETAIL IS TAKEN



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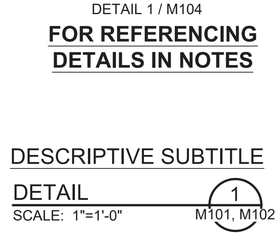

FOR REFERENCING MULTIPLE DRAWINGS

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ch2m:

WILLIAM S. FARMER, STATE OF WASHINGTON, 28592, REGISTERED PROFESSIONAL ENGINEER, 4-17-20

DESIGNED/DRAWN: JY	CHECKED: BF
PROJECT ENGINEER: EC	SCALE: NONE
DESIGN APPROVAL: ES	FACILITY NUMBER: WP-724
PROJECT ACCEPTANCE: JRM	CONTRACT NO: C01397C20

King County

DEPARTMENT OF NATURAL RESOURCES & PARKS
WASTEWATER TREATMENT DIVISION
KING COUNTY WEST POINT TREATMENT PLANT
SECONDARY MIXED LIQUOR BLOWER REPLACEMENT

GENERAL SYMBOLS AND ABBREVIATIONS

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GENERAL STRUCTURAL NOTES

1. BUILDING CODE: ALL CONSTRUCTION AND DESIGN SHALL BE IN CONFORMANCE WITH THE REQUIREMENTS OF THE 2015 SEATTLE BUILDING CODE (SBC 2015).
2. VERIFICATION OF DIMENSIONS: THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS, ELEVATIONS AND EXISTING CONDITIONS PRIOR TO BEGINNING CONSTRUCTION. THE CONTRACTOR SHALL NOTIFY THE PROJECT REPRESENTATIVE OF ANY DISCREPANCIES PRIOR TO STARTING WORK.
3. BRACING AND STABILITY: THE CONTRACTOR SHALL PROVIDE ALL BRACING NEEDED TO ENSURE THE STRENGTH AND STABILITY OF THE STRUCTURE DURING CONSTRUCTION.
4. DIMENSIONS CONTROLLED BY OR RELATED TO MECHANICAL OR ELECTRICAL EQUIPMENT SHALL BE DETERMINED AND/OR VERIFIED BY THE CONTRACTOR PRIOR TO CONSTRUCTION.
5. MECHANICAL AND/OR ELECTRICAL EQUIPMENT SUPPORTS, ANCHORAGES, OPENINGS, PENETRATIONS, PADS AND/OR RECESSES NOT SHOWN ON THE STRUCTURAL DRAWINGS BUT REQUIRED BY OTHER DISCIPLINE DRAWINGS SHALL BE PROVIDED FOR.

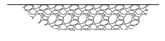
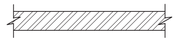
DESIGN CRITERIA

1. DESIGN LOAD DATA:
   - A. LIVE LOAD AS NOTED ON CRANE STAGING AREA PLAN SEE G2412.
   - B. LIVE LOAD SURCHARGE
     - i. AREA SUBJECT TO TRUCK LOADS: 250 PSF VERTICAL SURCHARGE

CONSTRUCTION MATERIALS

1. CONCRETE:
   - A. CONCRETE MATERIALS AND CONSTRUCTION SHALL BE IN ACCORDANCE WITH THE REQUIREMENTS OF ACI 301 EXCEPT AS MODIFIED BY THE CONTRACT DOCUMENTS.
   - B. CONCRETE DESIGN STRENGTH (MIN. 28 DAY COMPRESSIVE STRENGTH, UNO):
     - i. ALL STRUCTURAL CONCRETE: 4,000 PSI
   - C. ROUGHEN AND CLEAN CONSTRUCTION JOINTS AS SPECIFIED PRIOR TO PLACING ADJACENT CONCRETE.
   - D. COORDINATE PLACEMENT OF OPENINGS, PIPE PENETRATIONS, CURBS, DOWELS, SLEEVES, CONDUITS, BOLTS AND INSERTS PRIOR TO PLACEMENT OF CONCRETE.
   - E. NO ALUMINUM CONDUIT OR PRODUCTS CONTAINING ALUMINUM OR ANY OTHER MATERIAL INJURIOUS TO THE CONCRETE SHALL BE EMBEDDED IN THE CONCRETE.
2. REINFORCING STEEL:
   - A. REINFORCING STEEL SHALL CONFORM TO ASTM A615 GRADE 60 UNLESS OTHERWISE INDICATED.
   - B. ALL DETAILING, FABRICATION AND ERECTION OF REINFORCING BARS, UNLESS OTHERWISE NOTED, SHALL BE IN ACCORDANCE WITH ACI DETAILING MANUAL (ACI SP-66), LATEST EDITION.
   - C. ALL LAPPED REINF LAP SPLICES SHALL BE ACI CLASS B TENSION LAP SPLICES.
   - D. ALL HOOKED REINF SHALL BE ACI STANDARD HOOKS, UNLESS NOTED OTHERWISE.
   - E. CONCRETE COVER FOR REINFORCING, UNLESS OTHERWISE SHOWN, SHALL BE:
     - i. ALL CONCRETE CONSTRUCTION: 2"
3. POST INSTALLED ANCHORS:
   - A. POST INSTALLED CONCRETE ANCHORS:
     - i. ALL POST INSTALLED ANCHORS USED IN CONCRETE SHALL HAVE AN ICC-ES ENGINEERING SERVICE REPORT INDICATING COMPLIANCE WITH THE IBC 2015 REQUIREMENTS FOR POST INSTALLED ANCHORS.
     - ii. POST INSTALLED ANCHORS SHALL BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS.
     - iii. POST INSTALLED ANCHORS SHALL BE STAINLESS STEEL TYPE 316 UNLESS OTHERWISE CALLED OUT ON THE PLANS.

STRUCTURAL LEGEND

SYMBOL	LEGEND
	GROUT
	GRANULAR FILL
	EARTH OR FINISH GRADE
	CONCRETE
	STEEL
	ALUMINUM

REQUIRED SPECIAL INSPECTIONS

TYPE	FREQUENCY		REFERENCED STANDARDS	IBC REFERENCE
	CONTINUOUS	PERIODIC		
CONCRETE CONSTRUCTION				1705.3
1. INSPECT REINFORCEMENT, INCLUDING PRESTRESSING TENDONS, AND VERIFY PLACEMENT		X	ACI 318 CH. 20, 25.2, 25.3, 26.5.1-26.5.3	1908.4
2. INSPECT ANCHORS CAST IN CONCRETE		X	ACI 318: 17.8.2	
3. INSPECT ANCHORS POST-INSTALLED IN HARDENED CONCRETE MEMBERS				
A. ADHESIVE ANCHORS INSTALLED IN HORIZONTALLY OR UPWARDLY INCLINED ORIENTATIONS TO RESIST SUSTAINED TENSION LOADS.	X		ACI 318: 17.8.2.	
B. MECHANICAL ANCHORS AND ADHESIVE ANCHORS NOT DEFINED IN 3.A.		X		
4. VERIFY USE OF REQUIRED DESIGN MIX.		X	ACI 318: CH. 19, 26.4.3, 26.4.4	1904.1, 1904.2, 1908.2, 1908.3
5. PRIOR TO CONCRETE PLACEMENT, FABRICATE SPECIMENS FOR STRENGTH TESTS, PERFORM SLUMP AND AIR CONTENT TESTS, AND DETERMINE THE TEMPERATURE OF THE CONCRETE.	X		ASTM C172 ASTM C31 ACI 318: 26.4.5, 26.12	1908.10
6. VERIFY MAINTENANCE OF SPECIFIED CURING		X	ACI 318: 26.4.7-26.4.9	1908.9
7. INSPECT FORMWORK FOR SHAPE, LOCATION AND DIMENSIONS OF THE CONCRETE MEMBER BEING FORMED.		X	ACI 318: 26.10.1(B)	

STRUCTURAL ABBREVIATIONS

@	AT
ACI	AMERICAN CONCRETE INSTITUTE
ASTM	AMERICAN SOCIETY FOR TESTING AND MATERIALS
AWS	AMERICAN WELDING SOCIETY
BOT	BOTTOM
CH	CHAPTER
CJ	CONSTRUCTION JOINT
C/L	CENTER LINE
CLR	CLEARANCE, CLEAR
CONC	CONCRETE
DEG or °	DEGREES
DIA OR Ø	DIAMETER
DIAG	DIAGONAL
DWG(S)	DRAWING(S)
EF	EACH FACE
EL OR ELEV	ELEVATION
EMBED	EMBEDMENT
ES	EACH SIDE
EW	EACH WAY
FT or '	FOOT or FEET
fy	YIELD STRESS
IN or "	INCH
JT	JOINT
KIP	THOUSAND POUNDS
KSF	KIPS PER SQUARE FEET
KSI	KIPS PER SQUARE INCH
LB	POUNDS
LD	REBAR TENSION DEVELOPMENT LENGTH
LDC	REBAR COMPRESSION DEVELOPMENT LENGTH
LDH	HOOKED BAR DEVELOPMENT LENGTH
LSB	REBAR CLASS B LAP SPLICE
MAX	MAXIMUM
MECH	MECHANICAL
MIN	MINIMUM
MISC	MISCELLANEOUS
NTS	NOT TO SCALE
OC	ON CENTER
OD	OUTSIDE DIAMETER
OPNG	OPENING
REINF	REINFORCEMENT
REQ'D	REQUIRED
SIM	SIMILAR
SPEC	SPECIFICATIONS
SST	STAINLESS STEEL
STD	STANDARD
STL	STEEL
T&B	TOP AND BOTTOM
T/	TOP OF
TOC	TOP OF CONCRETE
TOS	TOP OF STEEL, TOP OF SLAB
TOT	TOTAL
TOW	TOP OF WALL
TYP	TYPICAL
UNO	UNLESS NOTED OTHERWISE
W/	WITH
W/O	WITHOUT
WP	WORK POINT
WSTP	WATERSTOP

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ch2m: Roberts Engineering PLLC

DONALD M. ROBERTS, STATE OF WASHINGTON, 20403, STRUCTURAL ENGINEER, PROFESSIONAL ENGINEER

DESIGNED/DRAWN: CR	CHECKED: RR
PROJECT ENGINEER: RR	SCALE: NONE
DESIGN APPROVAL: ES	FACILITY NUMBER: WP-724
PROJECT ACCEPTANCE: JRM	CONTRACT NO: C01397C20

King County

DEPARTMENT OF NATURAL RESOURCES & PARKS
WASTEWATER TREATMENT DIVISION
KING COUNTY WEST POINT TREATMENT PLANT
SECONDARY MIXED LIQUOR BLOWER REPLACEMENT

STRUCTURAL GENERAL NOTES AND SPECIAL INSPECTIONS

DATE:	APRIL 2020
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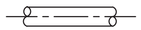
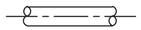
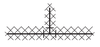
REFERENCE 1" 0

PIPE AND FITTING SYMBOLS

DOUBLE LINE	SINGLE LINE	
		EXISTING PIPE
		NEW PIPE
		EXISTING PIPE TO BE REMOVED
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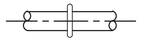
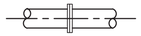
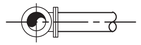
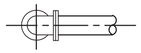
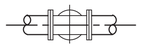
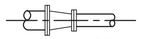
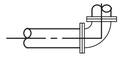
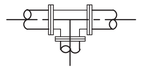
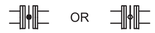
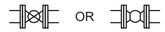
		GROOVED END JOINT
		FLANGED JOINT
		ELBOW UP
		ELBOW DOWN
		TEE UP
		TEE DOWN
		CONCENTRIC REDUCER
		ELBOW, 90 DEGREE
		TEE

VALVE SYMBOLS

SINGLE LINE		DOUBLE LINE	
	GATE		
	BUTTERFLY		OR
	BALL		OR

GENERAL PIPING NOTES

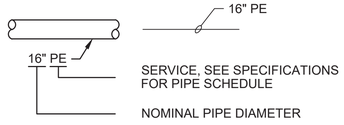
1. LAY PIPE TO UNIFORM GRADE BETWEEN INDICATED ELEVATION POINTS.
2. SIZE OF FITTINGS SHOWN ON DRAWINGS SHALL CORRESPOND TO ADJACENT STRAIGHT RUN OF PIPE, UNLESS OTHERWISE INDICATED. TYPE OF JOINT AND FITTING MATERIAL SHALL BE THE SAME AS SHOWN FOR ADJACENT STRAIGHT RUN OF PIPE.
3. PIPE HANGERS AND SUPPORTERS ARE NOT SHOWN UNLESS A SPECIAL TYPE OR CONFIGURATION IS REQUIRED. FINAL SUPPORT, LOCATIONS, AND TYPES SHALL BE DETERMINED BY THE CONTRACTOR AND APPROVED BY THE CONSTRUCTION MANAGER PRIOR TO INSTALLATION. MAXIMUM SPACING SHALL BE SPECIFIED.
4. ALL FLEXIBLE CONNECTORS AND COUPLING ADAPTERS SHALL BE PROVIDED WITH THRUST PROTECTION AS SPECIFIED, UNLESS OTHERWISE NOTED. THRUST PROTECTION SHALL BE ADEQUATE FOR TEST PRESSURES SHOWN ON THE PIPING AND VALVE SCHEDULE.
5. EXISTING PIPING AND EQUIPMENT IS SHOWN LIGHT-LINED AND/OR SCREENED AND IS ALWAYS NOTED AS EXISTING. NEW PIPING AND EQUIPMENT IS SHOWN HEAVY-LINED.

GENERAL PIPE HANGER NOTES

1. WHERE NO REFERENCE TO PIPE SUPPORT SYSTEMS IS GIVEN, USE AN APPROPRIATE SYSTEM.
2. UNLESS OTHERWISE NOTED OR SPECIFIED, ALL PIPE HANGERS AND SUPPORTS SHALL BE HOT DIP GALVANIZED AFTER FABRICATION.
3. UNLESS OTHERWISE NOTED, THE CONTRACTOR SHALL NOT USE CONCRETE ANCHORS WITHOUT THE PRIOR WRITTEN APPROVAL OF THE CONSTRUCTION MANAGER.
4. PIPE SYSTEM DESIGN WEIGHT SHALL BE AS DEFINED IN SECTION 40 50 01.

PIPING DESIGNATION

EXAMPLE:



ACTUATOR

CHAINWHEEL ACTUATOR

NO	REVISION DESCRIPTION	BY	APVD	DATE
0	BID ISSUE			4/17/2020

ch2m:

WILLIAM S. FARMER, STATE OF WASHINGTON, 28570, REGISTERED PROFESSIONAL ENGINEER, 4-17-20

DESIGNED/DRAWN: JY	CHECKED: BF
PROJECT ENGINEER: EC	SCALE: NONE
DESIGN APPROVAL: ES	FACILITY NUMBER: WP-724
PROJECT ACCEPTANCE: JRM	CONTRACT NO: C01397C20

King County

DEPARTMENT OF NATURAL RESOURCES & PARKS
WASTEWATER TREATMENT DIVISION
KING COUNTY WEST POINT TREATMENT PLANT
SECONDARY MIXED LIQUOR BLOWER REPLACEMENT

MECHANICAL LEGEND

DATE:	
APRIL 2020	
PROJECT FILE NO:	
17-1123627	
DRAWING NO:	
G2407	
SHT NO / TOTAL	REV NO:
5 / 53	

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PLOTTED: Apr 17, 2020-07:41:44am By dyang1
XREFS: KC_ML_TitleBlock.dwg
IMAGES:

ELECTRICAL LEGEND

ONE-LINE DIAGRAM

400 — CIRCUIT BREAKER, THERMAL MAGNETIC TRIP SHOWN, 3 POLE, UNO

3 — AC MOTOR, SQUIRREL CAGE INDUCTION - HORSEPOWER INDICATED

DPM — DIGITAL POWER METER (MULTIFUNCTION)

GROUND

POWER SYSTEM PLAN

100/40 — BREAKER, SEPARATELY MOUNTED, CURRENT RATING INDICATED (100/40, 100 = FRAME SIZE; 40 = TRIP RATING) 3 POLE

XX / 2 — CONVENIENCE RECEPTACLE - DUPLEX UNLESS NOTED OTHERWISE
WP - WEATHERPROOF
GFCI - GROUND FAULT CIRCUIT INTERRUPTER
SUBSCRIPT NUMBER AT RECEPTACLE INDICATES CIRCUIT

T — THERMOSTAT

LIGHTING SYSTEM PLAN

1 — LUMINAIRE, SEE SCHEDULE

5 OR 5 — WALL MOUNTED LUMINAIRE, SEE SCHEDULE

$ — WALL SWITCH:
WP-WEATHERPROOF

GROUND SYSTEM PLAN

GROUND ROD

GROUND ROD IN TEST WELL

G — GROUNDING CONDUCTOR, SIZE AS INDICATED

PIGTAIL FOR CONNECTION TO EQUIPMENT CABINET OR FRAME

G — EQUIPMENT GROUND BUS

N — EQUIPMENT NEUTRAL BUS

NOTES:

1. THESE ARE STANDARD LEGEND SHEETS. SOME SYMBOLS AND ABBREVIATIONS MAY APPEAR ON THE LEGEND AND NOT ON THE DRAWINGS.
2. FOR ADDITIONAL ABBREVIATIONS OF OTHER DIVISIONS (HVAC, MECHANICAL, AND STRUCTURAL/ARCHITECTURAL) SEE OTHER LEGENDS.

POWER SYSTEM PLAN

LP—XXX — PANELBOARD - SURFACE MOUNTED
PANELBOARD NUMBER
LP - LOW VOLTAGE PANEL
DP - DISTRIBUTION PANEL

PANELBOARD - FLUSH MOUNTED

TERMINAL JUNCTION BOX

[AAXXX] — RACEWAY AND CONDUCTOR TAG SEE RACEWAY AND CONDUCTOR (R&C) SCHEDULES
A = C - CONTROL
P - POWER
S - SIGNAL (24VDC)
FO - FIBER OPTIC
D - DATA
T - TELEPHONE/COMMUNICATION
F - FIRE
R- RACEWAY

[TAG] — RACEWAY AND CONDUCTOR CALLOUT, SEE SCHEDULE.

OR G — EXPOSED CONDUIT AND CONDUCTORS

OR G — CONCEALED CONDUIT AND CONDUCTORS

G — CROSSHATCHES WITH BAR INDICATE NO.10 CONDUCTOR. SIZE CONDUIT ACCORDING TO SPECIFICATIONS AND APPLICABLE CODE.

NOTE
SIZE ALL UNIDENTIFIED POWER CIRCUITS PER NEC (MINIMUM SIZE 2#12, 1#12 IN 3/4" CONDUIT).

CONDUIT DOWN

CONDUIT UP

CONDUIT, STUBBED AND CAPPED

CONDUIT TERMINATION AT CABLE TRAY

DIRECT BURIED CONDUIT

NEW CONDUIT IN BOLD/DARK

EXISTING CONDUIT LIGHT/SHADED

J or HH — GENERAL CONTROL OR WIRING DEVICE. LETTER SYMBOLS OR ABBREVIATIONS INDICATE TYPE OF DEVICE

CONTROL STATION, SEE CONTROL DIAGRAMS FOR CONTROL DEVICE(S) REQUIRED.

EQUIPMENT CONNECTION

T — TRANSFORMER

MOTOR CONTROL CENTER

[CXXXX] — CONTROL CONDUIT

[SXXXX] — SIGNAL CONDUIT

[DXXXX] — DATA CONDUIT

JX — J-BOX

ABBREVIATIONS

A	AMPERE, AUTOMATIC
AC	ALTERNATING CURRENT
AFD	ADJUSTABLE FREQUENCY DRIVE = VFD
AFF	ABOVE FINISHED FLOOR
AHF	ACTIVE HARMONIC FILTER
BA CU	BARE COPPER
BKR	BREAKER
C	CONDUIT, CONTRACTOR, CONDUCTOR, CLOSE
CDB	COMMUNICATIONS DEMARK BOARD
CP	CONTROL PANEL
DC	DIRECT CURRENT
DP	DISTRIBUTION PANEL
DPL	LIGHTING DISTRIBUTION PANEL
DPL-UX	DPL POWERED FROM UPS
DPM	DIGITAL POWER METER
DPP	DISTRIBUTION PANEL (480V)
DS	DISCONNECT SWITCH
DSF	DISCONNECT SWITCH FUSED
E	EMPTY
ECP	ENVIRONMENTAL CONTROL PANEL
EF	EXHAUST FAN
ENPS	ETHERNET POWER SUPPLY UNIT
ENSW	ETHERNET SWITCH
F, FU	FUSE
FACP	FIRE AND GAS ALARM AND SUPPRESSION PANEL
FREQ	FREQUENCY
G	GROUND, GREEN
GEN	GENERATOR
GFCI	GROUND FAULT CIRCUIT INTERRUPTER
GND	GROUND
HH	HANDHOLE
HOA	HAND-OFF-AUTOMATIC
HP	HORSEPOWER
HS	HAND SWITCH
HZ	HERTZ
IC	INTERRUPTING CAPACITY
ICP	INTERGRATED CONTROL PANEL
J, JB	JUNCTION BOX
KA	KILOAMPERES
KV	KILOVOLTS
KVA	KILOVOLTAMPERES
KW	KILOWATTS
LC	LIGHTING CONTROL
LP	LOCAL PANEL
M	MOTOR, MANUAL, MAGNETIC CONTACTOR COIL
MB	METER BASE
MCB	MAIN CONTROL BREAKER
MCC	MOTOR CONTROL CENTER
MDP	MAIN DISTRIBUTION PANEL
MH	MANHOLE, METAL HALIDE, MOUNTING HEIGHT
MLO	MAIN LUGS ONLY
MMS	MANUAL MOTOR STARTER
MS	MOTOR STARTER
MSB	MAIN SWITCHBOARD
MSC	MANUFACTURER SUPPLIED CABLE
NC	NORMALLY CLOSED
N.O.	NORMALLY OPEN
NTS	NOT TO SCALE
OL	OVERLOAD RELAY
PACU	PACKAGED AIR CONDITIONING UNIT
PB	PULL BOX
PDP	POWER DISTRIBUTION PANEL
PFR	PHASE FAILURE RELAY
PNL	PANEL
R&C	RACEWAY AND CONDUCTOR
RCPT	RECEPTACLE
RGS	RIGID GALVANIZED STEEL CONDUIT
SPD	SURGE PROTECTIVE DEVICE (TVSS)
SS	START STOP
SST	STAINLESS STEEL
SV	SOLENOID VALVE
SWBD	SWITCHBOARD
T	TRANSFORMER
TL	TWISTLOCK
TVSS	TRANSIENT VOLTAGE SURGE SUPPRESSOR
TX	TRANSFORMER
TYP	TYPICAL
UNO	UNLESS NOTED OTHERWISE
V	VOLTAGE, VOLTS
VFD	VARIABLE FREQUENCY DRIVE = AFD=VFD
W	WATTS
WP	WEATHERPROOF
XFMR	TRANSFORMER

GENERAL CONSTRUCTION NOTES

1. PROVIDE CONDUIT SUPPORTS AND PULL BOXES AS NEEDED PER SPECIFICATIONS.
2. CORE DRILL AND SEAL ALL CONDUIT PENETRATIONS WITH THE APPROVAL OF PROJECT REPRESENTATIVE.
3. CONDUIT ROUTING IS DIAGRAMMATIC, CONTRACTOR TO FIELD VERIFY ALL EXISTING ROUTING AND CROSSING WITH ALL OTHER EQUIPMENT. PENETRATIONS SHALL BE VERIFIED PRIOR TO INSTALLING. COORDINATE RACEWAY ROUTING AND CROSSINGS PRIOR TO INSTALLING.
4. USE EXISTING CONDUIT SUPPORTS WHERE FEASIBLE.
5. DO NOT USE CONDUIT CONDULET FITTINGS FOR FIBER CABLES. USE RECOMMENDED BENDING RADIUS BY MANUFACTURE. USE PULL BOXES FOR PULL POINTS.
6. PROVIDE NEW CONDUIT AND CONDUCTORS. RE-USE OF EXISTING CONDUITS, OTHER THAN ALREADY SHOWN ON THE DRAWINGS MUST BE APPROVED BY THE PROJECT REPRESENTATIVE ON A CASE-BY-CASE BASIS.
7. PROVIDE NEW WIRE IN RACEWAYS PER THE LOOP DIAGRAMS, ONE-LINES, AND SCHEDULES.
8. GROUND ALL EQUIPMENT PER SPECIFICATIONS AND DRAWING DETAILS.

NO	REVISION DESCRIPTION	BY	APVD	DATE
0	BID ISSUE			4/17/2020

ch2m: ER Electrical Engineering

ELMO W. RAJAH — STATE OF WASHINGTON — 30315 — REGISTERED PROFESSIONAL ENGINEER

DESIGNED/DRAWN: JY	CHECKED: DW
PROJECT ENGINEER: ER	SCALE: NONE
DESIGN APPROVAL: ES	FACILITY NUMBER: WP-724
PROJECT ACCEPTANCE: JRM	CONTRACT NO: C01397C20

King County

DEPARTMENT OF NATURAL RESOURCES & PARKS
WASTEWATER TREATMENT DIVISION
KING COUNTY WEST POINT TREATMENT PLANT
SECONDARY MIXED LIQUOR BLOWER REPLACEMENT

ELECTRICAL LEGEND, SYMBOLS AND ABBREVIATIONS

DATE:	APRIL 2020
PROJECT FILE NO:	17-1123627
DRAWING NO:	G2408
SHT NO / TOTAL	6 / 53
REV NO:	

BORDER FILE EDITION: KCWTD-2015R0-Dsize-TB-Border
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LINE LEGEND

- MATCH LINE
- LINE
- PREFABRICATED INSTRUMENT CABLE
- PANEL
- ANALOG SIGNAL LINE
- DISCRETE SIGNAL LINE
- NETWORK CABLE
- ELECTROMAGNETIC OR SONIC SIGNAL (GUIDED)
- ELECTROMAGNETIC OR SONIC SIGNAL (UNGUIDED)
- PNEUMATIC LINE OR PNEUMATIC TUBING
- POWER CONNECTION
- CAPILLARY TUBING
- HYDRAULIC LINE
- VENDOR SUPPLIED EQUIPMENT BOUNDARY
- MAIN PROCESS FLOW (WITH TYPICAL DIRECTION OF FLOW SHOWN)
- SECONDARY PROCESS FLOW (WITH TYPICAL DIRECTION OF FLOW SHOWN)
- CONNECTING LINES
- NON-CONNECTING LINES
- I OR I — INTERLOCK
- C — SEAL WATER OR WATER PURGE CONTROL UNIT
- P — AIR OR WATER PURGE FOR LEVEL MEASUREMENT
- T — PIPE TAP APPURTENANCE (SEE SCHEDULE IN SECTION 15130)

NOTES:

THIS IS A STANDARD SHEET. NOT ALL SYMBOLS OR NOTATIONS MAY HAVE BEEN USED ON THIS PROJECT.

INTERFACE SYMBOLS

P101 AA
REMARK LINE 1
REMARK LINE 2

PROCESS/
SIGNAL FLOW INTERFACE
AA = CONNECTOR NUMBER
P101 = DESTINATION DRAWING NO.

BB P102
REMARK LINE 1
REMARK LINE 2

PROCESS/
SIGNAL FLOW INTERFACE
BB = CONNECTOR NUMBER
P102 = SOURCE DRAWING NO.

NOTE:
USE DOUBLE LETTERS "AA", "AB" THRU "AZ", THEN "BA", "BB" THRU "BZ" AND CONTINUING THRU "ZA", "ZB" THRU "ZZ" AS REQUIRED.

REMARK LINE 1
REMARK LINE 2

FROM PROCESS EXTERNAL TO PROJECT

REMARK LINE 1
REMARK LINE 2

TO PROCESS EXTERNAL FROM PROJECT

ES

ELECTRIC SUPPLY
ES: DEFINES TYPE OF SUPPLY
EXAMPLE:
120=120VAC, SINGLE PHASE

IA

INSTRUMENT AIR SUPPLY

PIPE IDENTIFICATION SYSTEM (P&ID)

XX" YYYY

- PIPE SERVICE (FLOW STREAM IDENTIFICATION)
- PIPE SIZE

PIPE SERVICE (P&ID)

FLOW STREAM IDENTIFICATIONS

AA - AIR, AGITATION
V - VENT

ACTUATOR SYMBOLS

- S — SOLENOID
- DIAPHRAGM
- M — MOTOR
- E/H — ELECTROHYDRAULIC
- G — GRAVITY
- H — HYDRAULIC

PRIMARY ELEMENT SYMBOLS

FE
M — MAGNETIC FLOW TUBE

LSH
FLOAT SWITCH (HIGH WATER LEVEL)

LE
ULTRASONIC LEVEL ELEMENT

- BUBBLER
- FI — VARIABLE AREA FLOW INDICATOR (ROTAMETER)
- UTILITY METER
- DIAPHRAGM SEAL

VALVE SYMBOLS

- GATE VALVE (NORMALLY OPEN)
- THREE WAY VALVE
- GLOBE VALVE (NORMALLY OPEN)
- DIAPHRAGM VALVE (NORMALLY OPEN)
- DIAPHRAGM VALVE (NORMALLY CLOSED)
- BALL VALVE (NORMALLY OPEN)
- BALL VALVE (NORMALLY CLOSED)
- PLUG VALVE (NORMALLY OPEN)
- PLUG VALVE (NORMALLY CLOSED)
- BUTTERFLY VALVE
- CHECK VALVE
- DOUBLE LEAF CHECK VALVE
- BALL CHECK VALVE
- AIR VACUUM RELIEF VALVE
- PRESSURE RELIEF VALVE
- RELIEF VALVE
- MUD VALVE
- FUSIBLE VALVE
- PIV — POSITION INDICATING VALVE
- AIR REGULATION VALVE
- PRESSURE REGULATOR
- DRY PIPE VALVE
- FLOAT VALVE

PIPE LINE SYMBOLS

- T — TRAP
- SEPARATOR
- PIPELINE FILTER
- AIR VENT
- STEAM VENT
- AUTOMATIC AIR VENT
- MANUAL AIR VENT
- STRAINER
- FUEL PIPING LEAK DETECTOR ELEMENT
- AIR SEPARATOR
- D, CD — DRAIN OR CHEMICAL DRAIN
- CALIBRATION CHAMBER
- PULSATION DAMPENER
- SIGHT GLASS
- SAMPLING AND FLUSHING CONNECTIONS
- QUICK CONNECTOR
- CAP OR PLUG
- BLIND FLANGE
- REDUCER
- HOSE CONNECTION
- WATER HAMMER ARRESTOR
- IN-LINE EXPANSION TANK
- FLEX COUPLING
- ELECTRICAL GROUND
- INJECTOR
- SLIDE GATE
- REDUCED PRESSURE BACKFLOW PREVENTER
- FLAP GATE
- EW — EYE WASH
- EWSS — EYE WASH SAFETY SHOWER
- HEAT TRACE
- INSULATION
- EXPANSION JOINT
- EXPANSION BOOT

NO	REVISION DESCRIPTION	BY	APVD	DATE
0	BID ISSUE			4/17/2020

ch2m:

RICHARD A. PEARSON — STATE OF WASHINGTON — 35596 — REGISTERED PROFESSIONAL ENGINEER
2020.04.17 09:10:20-07'00'

DESIGNED/DRAWN: JY	CHECKED: SB
PROJECT ENGINEER: RP	SCALE: NONE
DESIGN APPROVAL: ES	FACILITY NUMBER: WP-724
PROJECT ACCEPTANCE: JRM	CONTRACT NO: C01397C20

King County

DEPARTMENT OF NATURAL RESOURCES & PARKS
WASTEWATER TREATMENT DIVISION
KING COUNTY WEST POINT TREATMENT PLANT
SECONDARY MIXED LIQUOR BLOWER REPLACEMENT

PROCESS INSTRUMENTATION LEGEND AND SYMBOLS 1

DATE:	APRIL 2020
PROJECT FILE NO:	17-1123627
DRAWING NO:	G2409
SHT NO / TOTAL	7 / 53
REV NO:	

BORDER FILE EDITION: KCWTD-2015R0-Dsize-TB-Border
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IMAGES:

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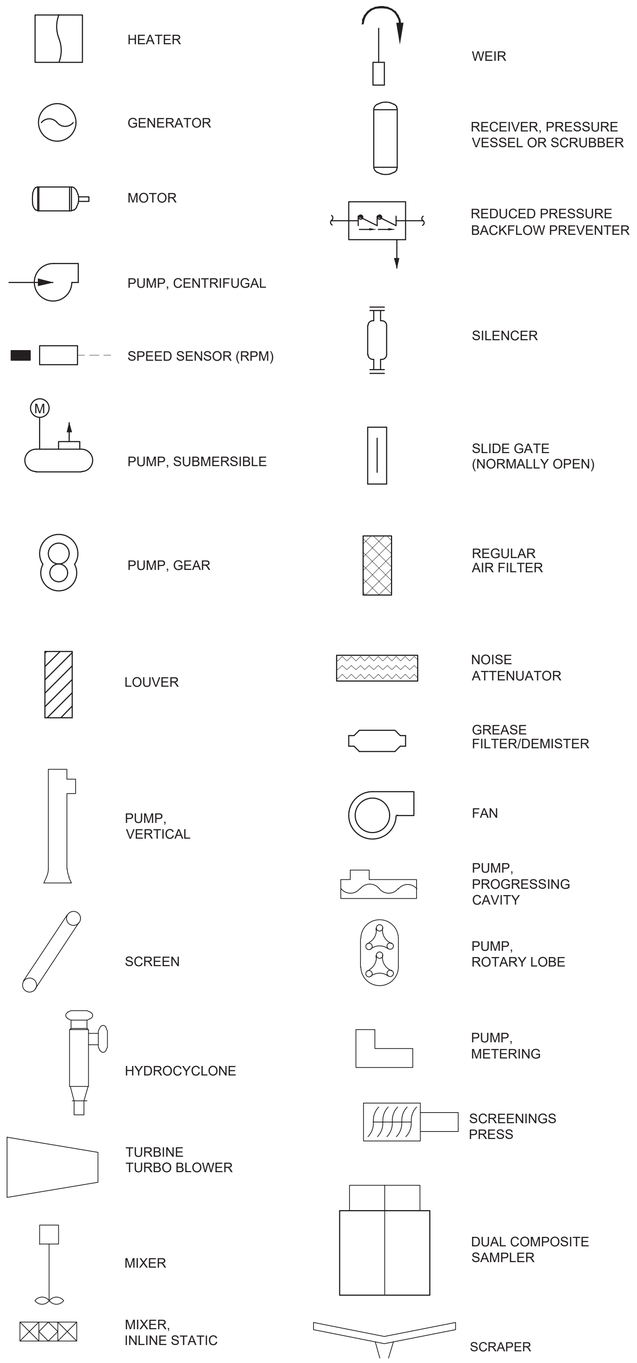


INSTRUMENTATION

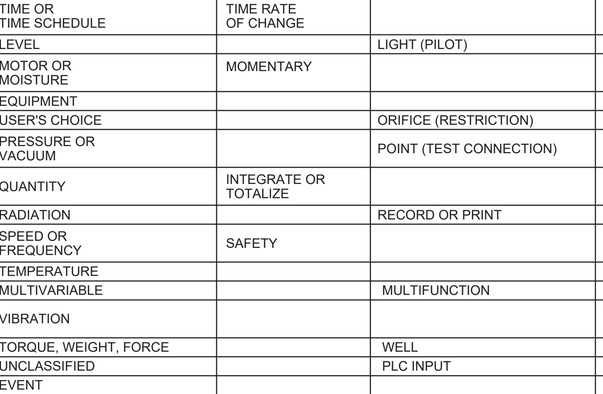
PLC INTERFACES

- ▲ ANALOG INPUT
- ▼ ANALOG OUTPUT
- △ DISCRETE INPUT
- ▽ DISCRETE OUTPUT
- □ CABLE CONNECTION

PACKAGE LEGEND

- * PACKAGE SYSTEM
- ** ELECTRICAL SPECIFICATION

INSTRUMENT SYMBOLS



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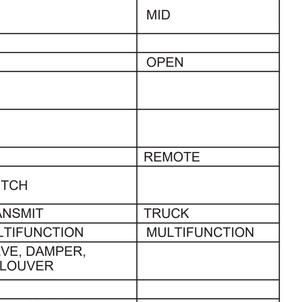


INSTRUMENT IDENTIFICATION LETTER TABLE - NOTE 2

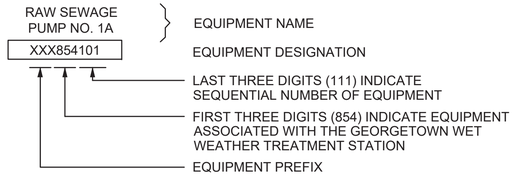
FIRST LETTER			SUCCEEDING LETTERS		
MEASURED OR INITIATING VARIABLE		MODIFIER	READOUT OR PASSIVE FUNCTION	OUTPUT FUNCTION	MODIFIER
A	ANALYSIS		ALARM	ALARM	AUTO
B	BURNER FLAME		USER'S CHOICE	USER'S CHOICE	USER'S CHOICE
C	CONDUCTIVITY (ELECTRICAL)			CONTROL	CLOSED
D	DENSITY (MASS) OR SPECIFIC GRAVITY	DIFFERENTIAL			FAIL, ERROR ABNORMAL
E	VOLTAGE (EMF)		PRIMARY ELEMENT		
F	FLOW RATE	RATIO (FRACTION)			
G	GAUGING (DIMENSIONAL)		GLASS		READY
H	HAND (MANUALLY INITIATED)				HIGH
I	CURRENT (ELECTRICAL)		INDICATE		
J	POWER	SCAN			RUNNING, RUN
K	TIME OR TIME SCHEDULE	TIME RATE OF CHANGE		CONTROL STATION	STOP
L	LEVEL		LIGHT (PILOT)		LOW, LOCAL, LIGHT
M	MOTOR OR MOISTURE	MOMENTARY			MID
N	EQUIPMENT				
O	USER'S CHOICE		ORIFICE (RESTRICTION)		OPEN
P	PRESSURE OR VACUUM		POINT (TEST CONNECTION)		
Q	QUANTITY	INTEGRATE OR TOTALIZE			
R	RADIATION		RECORD OR PRINT		REMOTE
S	SPEED OR FREQUENCY	SAFETY		SWITCH	
T	TEMPERATURE			TRANSMIT	TRUCK
U	MULTIVARIABLE		MULTIFUNCTION	MULTIFUNCTION	MULTIFUNCTION
V	VIBRATION			VALVE, DAMPER, OR LOUVER	
W	TORQUE, WEIGHT, FORCE		WELL		
X	UNCLASSIFIED		PLC INPUT	UNCLASSIFIED	
Y	EVENT			RELAY OR COMPUTER OR PLC OUTPUT	
Z	POSITION			DRIVE, ACTUATE OR UNCLASSIFIED FINAL CONTROL ELEMENT	

ABBREVIATIONS

AAB	LIT-A/AUTO/LIT-B
ACK	ACKNOWLEDGE
AM	AUTO/MANUAL
AO	AUTO/OFF
AOM	AUTO/OFF/MANUAL
AU	AUTO
AV	AUTO LEVEL
BA	BACKUP/AUTO
CL	CLOSED
CMD	COMMAND
CONC	CONCENTRATION
CP	CONTROL POWER
CS	CONTROL STATION
D/A	DIGITAL TO ANALOG CONVERTER
DP	DIFFERENTIAL PRESSURE
ED	ENABLE/DISABLE
E/I	VOLTAGE-TO-CURRENT CONVERTER
ETM	ELAPSED TIME METER
ESTOP	EMERGENCY STOP
FAU	FAULT
FLT	FLOAT(S)
FOR	FORWARD/OFF/REVERSE
FOS	FAST/OFF/SLOW
FR	FORWARD/REVERSE
FREQ	FREQUENCY
FS	FAST/SLOW
H	HAND
HIM	HUMAN INTERFACE MODULE
HMI	HUMAN MACHINE INTERFACE
HO	HAND/OFF
HOA	HAND/OFF/AUTO
HOAL	HAND/OFF/AUTO/LOCAL
HOR	HAND/OFF/REMOTE
HORL	HAND/OFF/REMOTE/LOCAL
H_2S	HYDROGEN SULFIDE
I/I	CURRENT ISOLATOR
INV	INVERTER
INT	INTERMEDIATE
JAM	JAM
JOG	JOG
JN	JOG/NORMAL
LAF	LEVEL/AUTO/FLOATS
LCS	LOCAL CONTROL STATION
LEL	LOWER EXPLOSIVE LIMIT
LL	LEAD/LAG
LLCO	LOW LEVEL CUT OFF LOCAL/REMOTE
LMR	LOCAL/MANUAL/REMOTE LOCAL/OFF
LOC	LOCAL
LOH	LOCAL/OFF/HAND
LOR	LOCAL/OFF/REMOTE
LOS	LOCKOUT STOP LOCAL/PLC/REMOTE
LSS	LOW SIGNAL SELECTOR
LSR	LOCAL/STOP/REMOTE
LVL	LEVEL
NP	NORMAL/PUMP-DOWN
O_2	OXYGEN
OA	OFF/AUTO
OC	OPEN/CLOSE
OCA	OPEN/CLOSE/AUTO
OCP	ODOR CONTROL PANEL OFF/ENABLE
OL	OVERLOAD
OO	ON/OFF
OOA	ON/OFF/AUTO
OOR	ON/OFF/REMOTE
OOS	OUT OF SERVICE
OP	OPENED
OR	OFF/REMOTE
OSC	OPEN/STOP/CLOSE
OSCA	OPEN/STOP/CLOSE/AUTO
OSCR	OPEN/STOP/CLOSE/REMOTE
RDY	READY
REM	REMOTE
RNG	RUNNING
RST	RESET
RUN	RUN
SIL	SILENCE
SL	STROBE LIGHT
SP	STOP
SS	START/STOP
ST	START
SW	SWITCH
POS	POSITION
TMR	TIMER
TRBL	TROUBLE
TST	TEST
UVT	ULTRAVIOLET TRANSMITTANCE

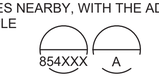
EQUIPMENT IDENTIFICATION SYSTEM

EQUIPMENT IS CALLED OUT BY ITS PREFIX FOLLOWED BY A NUMBER, ENCLOSED AS SHOWN:



NOTES:

1. THIS IS A STANDARD SHEET. NOT ALL SYMBOLS OR NOTATIONS MAY HAVE BEEN USED ON THIS PROJECT.
2. INSTRUMENT IDENTIFICATION LETTER TABLE IS EXCERPTED FROM ISA S50.1, AS MODIFIED BY KING COUNTY.
3. A DEVICE WITH A SINGLE LETTER IN PLACE OF THE TAG NUMBER INDICATES THAT THE DEVICE HAS THE SAME TAG NUMBER AS OTHER DEVICES NEARBY, WITH THE ADDITION OF INDICATED LETTER FOR EXAMPLE



MEANS THE DEVICE ON THE RIGHT HAS TAG 854XXXA.

NO	REVISION DESCRIPTION	BY	APVD	DATE
0	BID ISSUE			4/17/2020

ch2m:

RICHARD A. PETERSON STATE OF WASHINGTON 35596 REGISTERED PROFESSIONAL ENGINEER
09:11:31-07'00'

DESIGNED/DRAWN: JY	CHECKED: SB
PROJECT ENGINEER: RP	SCALE: NONE
DESIGN APPROVAL: ES	FACILITY NUMBER: WP-724
PROJECT ACCEPTANCE: JRM	CONTRACT NO: C01397C20

King County

DEPARTMENT OF NATURAL RESOURCES & PARKS
WASTEWATER TREATMENT DIVISION
KING COUNTY WEST POINT TREATMENT PLANT
SECONDARY MIXED LIQUOR BLOWER REPLACEMENT

PROCESS INSTRUMENTATION LEGEND AND SYMBOLS 2

DATE:	APRIL 2020
PROJECT FILE NO:	17-1123627
DRAWING NO:	G2410
SHT NO / TOTAL	8 / 53
REV NO:	

BORDER FILE EDITION: KCWTD-2015R0-Dsize-TB-Border
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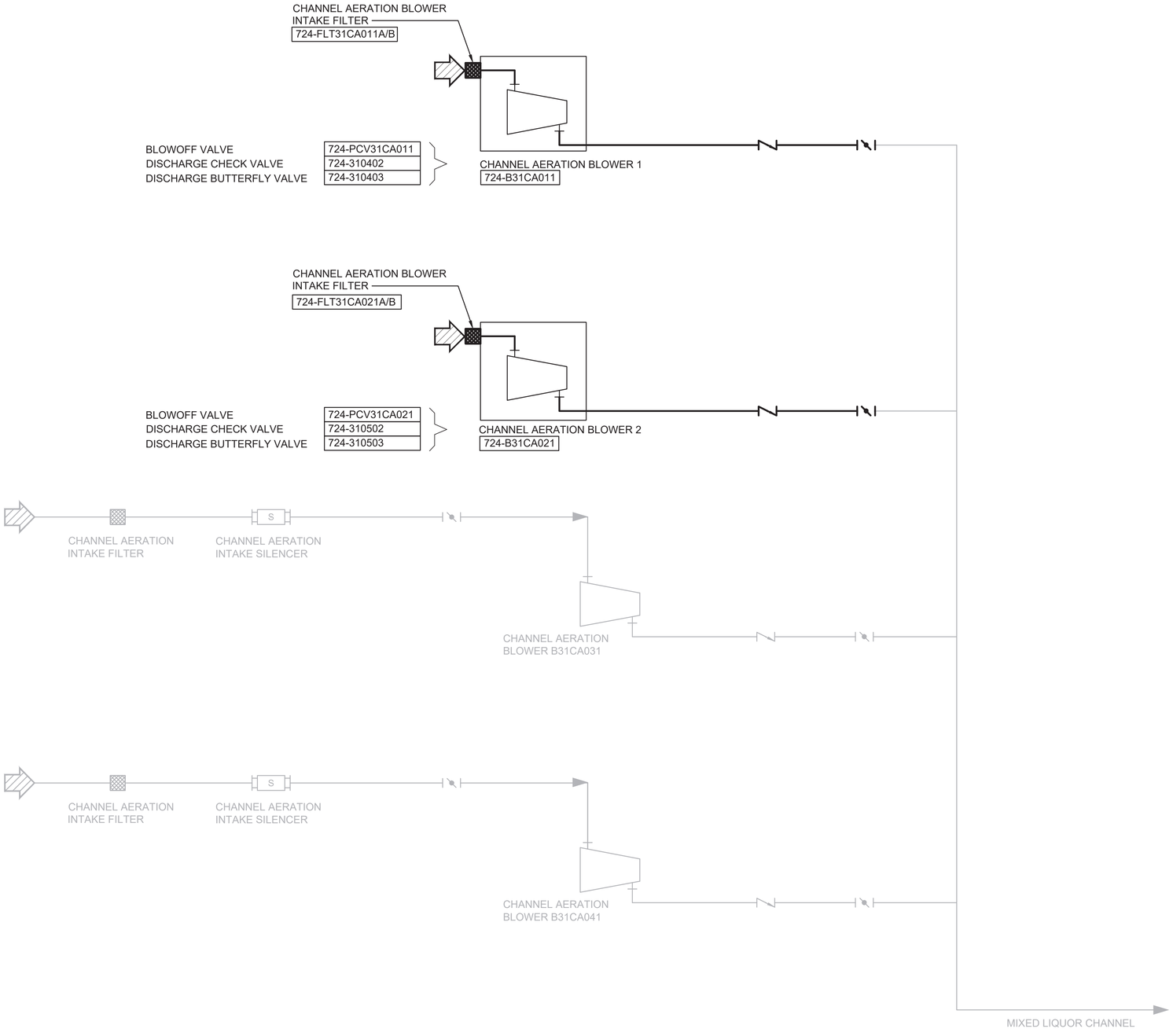

NO	REVISION DESCRIPTION	BY	APVD	DATE
0	BID ISSUE			4/17/2020

ch2m:

WILLIAM S. FARMER — STATE OF WASHINGTON — 28547 — REGISTERED PROFESSIONAL ENGINEER — 4-21-20

DESIGNED/DRAWN: JY	CHECKED: BF
PROJECT ENGINEER: EC	SCALE: NONE
DESIGN APPROVAL: ES	FACILITY NUMBER: WP-724
PROJECT ACCEPTANCE: JRM	CONTRACT NO: C01397C20

King County

DEPARTMENT OF NATURAL RESOURCES & PARKS
WASTEWATER TREATMENT DIVISION
KING COUNTY WEST POINT TREATMENT PLANT
SECONDARY MIXED LIQUOR BLOWER REPLACEMENT

PROCESS FLOW DIAGRAM

DATE: APRIL 2020
PROJECT FILE NO: 17-1123627
DRAWING NO: G2411
SHT NO 9 / TOTAL 53 | REV NO:

BORDER FILE EDITION: KCWTD-2015R0-Dsize-TB-Border
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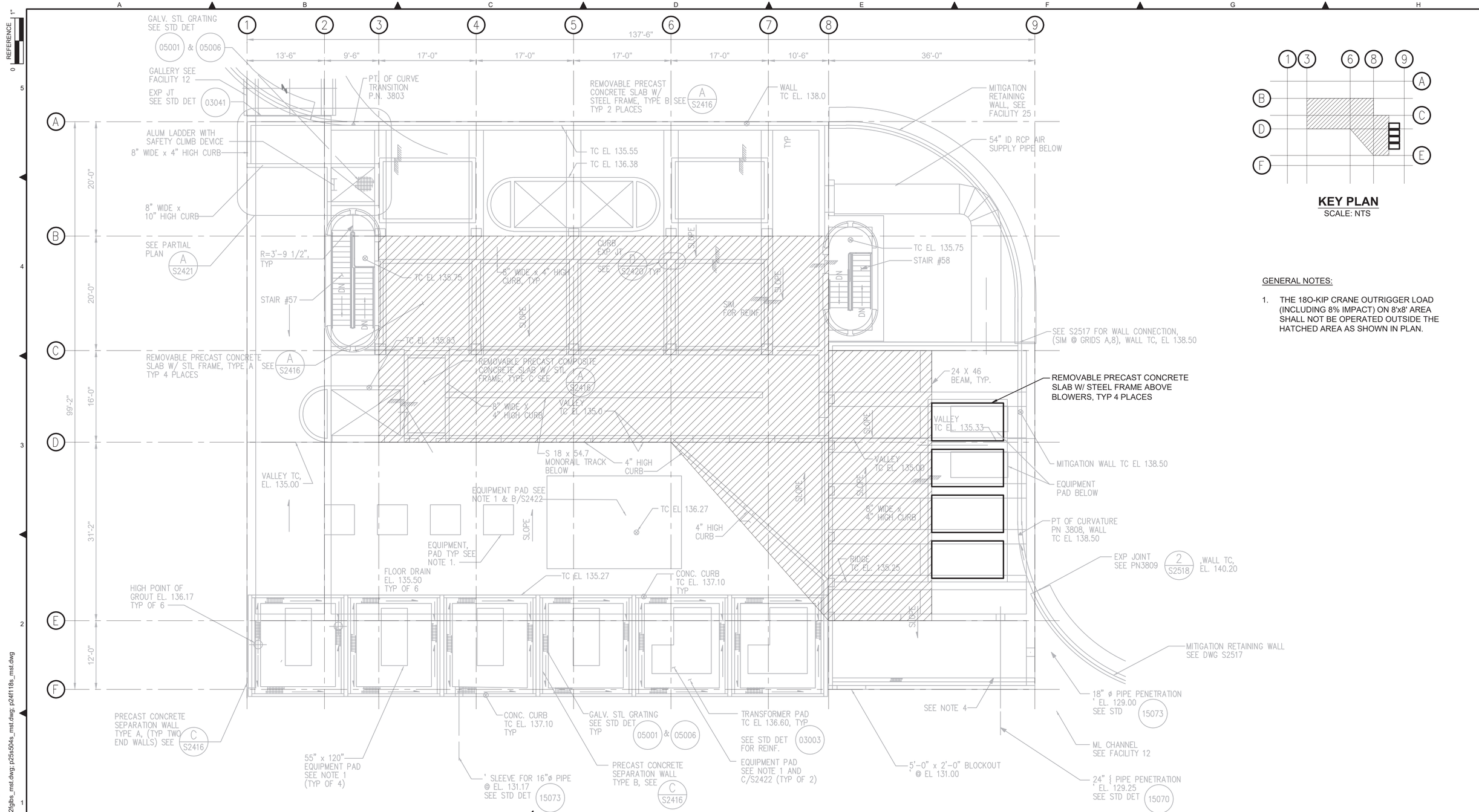

GRADE LEVEL PLAN
SCALE: 1/8"=1'-0"

KEY PLAN
SCALE: NTS

GENERAL NOTES:

1. THE 180-KIP CRANE OUTRIGGER LOAD (INCLUDING 8% IMPACT) ON 8'x8' AREA SHALL NOT BE OPERATED OUTSIDE THE HATCHED AREA AS SHOWN IN PLAN.

NO	REVISION DESCRIPTION	BY	APVD	DATE
0	BID ISSUE			4/17/2020

ch2m: Roberts Engineering PLLC

DESIGNED/DRAWN: CR | CHECKED: RR
PROJECT ENGINEER: RR | SCALE: AS NOTED
DESIGN APPROVAL: ES | FACILITY NUMBER: WP-724
PROJECT ACCEPTANCE: JRM | CONTRACT NO: C01397C20

King County

DEPARTMENT OF NATURAL RESOURCES & PARKS
WASTEWATER TREATMENT DIVISION
KING COUNTY WEST POINT TREATMENT PLANT
SECONDARY MIXED LIQUOR BLOWER REPLACEMENT

CRANE STAGING AREA

DATE: APRIL 2020
PROJECT FILE NO: 17-1123627
DRAWING NO: G2412
SHT NO 10 / TOTAL 53 | REV NO:

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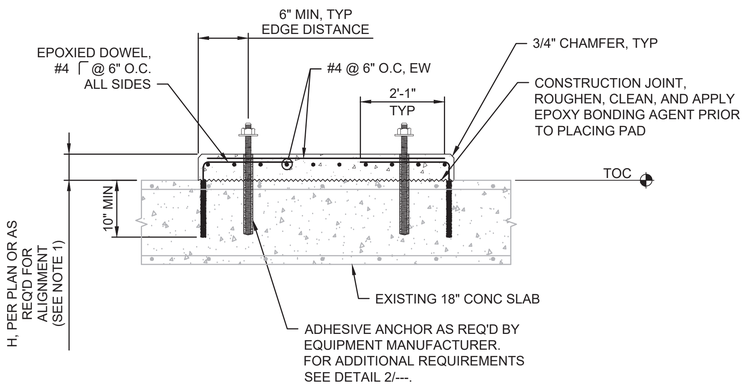
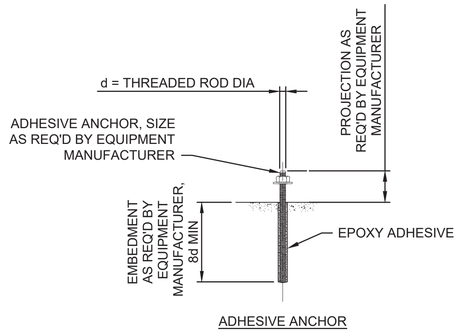


NOTES:

1. CONCRETE PAD SIZE SHALL BE MINIMUM INDICATED OR AS SHOWN ON THE PLANS OR AS REQUIRED BY THE EQUIPMENT MANUFACTURER AND APPROVED BY THE PROJECT REPRESENTATIVE. CONCRETE PAD HEIGHT "H" SHALL BE 4" MIN TO 8" MAX.
2. COORDINATE LOCATION OF ELECTRICAL CONDUIT AND PIPING PENETRATIONS WITHIN THE CONCRETE PAD. STUB-UP PENETRATIONS ON THE SAME SIDE OF THE EQUIPMENT AS REQUIRED.
3. THE SIZE, NUMBER, TYPE, LOCATION, AND THREAD PROJECTION OF THE EPOXIED ANCHORS SHALL BE DETERMINED BY THE EQUIPMENT MANUFACTURER AND AS APPROVED BY THE PROJECT REPRESENTATIVE.
4. EQUIPMENT BASES SHALL BE INSTALLED LEVEL. WEDGES, SHIMS, OR LEVELING NUTS SHALL BE USED TO SUPPORT THE BASE WHILE GROUT IS PLACED. WEDGES AND SHIMS SHALL BE REMOVED AFTER GROUT HAS SET. PACK RESULTING VOIDS WITH CEMENTITIOUS NONSHRINK GROUT.

CONCRETE PAD

DETAIL 1 / VAR
SCALE: NTS



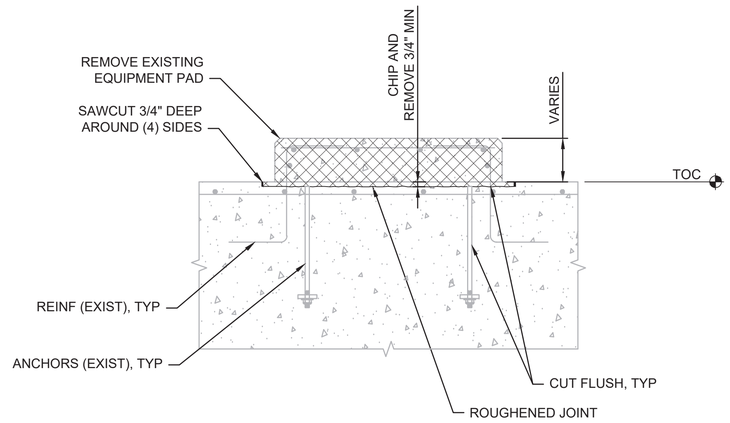
ADHESIVE ANCHOR

NOTES:

1. FOR CONCRETE EQUIPMENT PAD DETAILS AND NOTES NOT SHOWN SEE DETAIL 1/---.
2. NUT AND WASHER MATERIAL TO MATCH BOLT MATERIAL.
3. ALL ADHESIVE ANCHORS SHALL BE TYPE 316 SST UNLESS OTHERWISE NOTED.

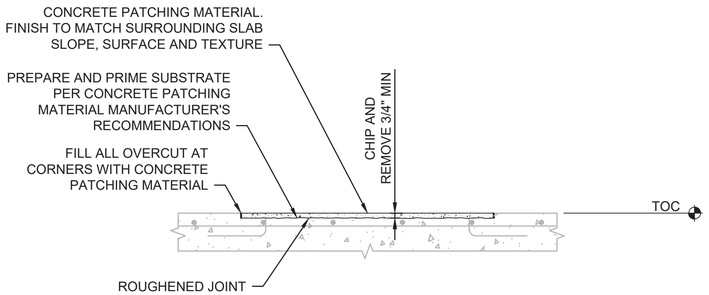
ADHESIVE ANCHOR DETAIL

DETAIL 2 / VAR
SCALE: NTS



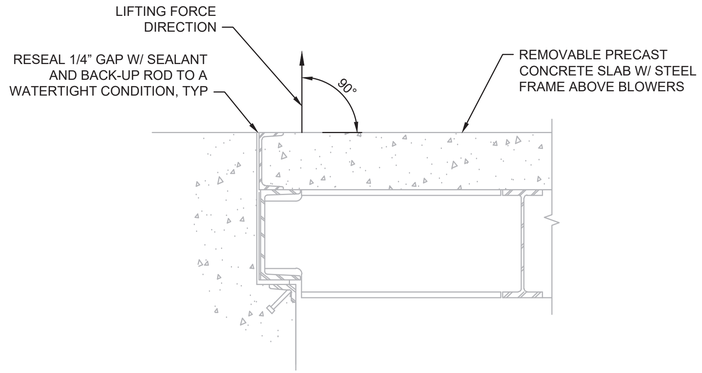
TYPICAL EQUIPMENT PAD REMOVAL

DETAIL 3 / VAR
SCALE: NTS



TYPICAL EQUIPMENT PAD REMOVAL REPAIR

DETAIL 4 / VAR
SCALE: NTS



TYPICAL REMOVABLE CONCRETE SLAB SEALANT RESTORATION

DETAIL 5 / VAR
SCALE: NTS

NO	REVISION DESCRIPTION	BY	APVD	DATE
0	BID ISSUE			4/17/2020

ch2m: SM
Roberts Engineering PLLC

RONALD M. ROBERTS
STATE OF WASHINGTON
29403
STRUCTURAL ENGINEER
PROFESSIONAL ENGINEER
4/17/20

DESIGNED/DRAWN: CR	CHECKED: RR
PROJECT ENGINEER: RR	SCALE: AS NOTED
DESIGN APPROVAL: ES	FACILITY NUMBER: WP-724
PROJECT ACCEPTANCE: JRM	CONTRACT NO: C01397C20

King County

DEPARTMENT OF NATURAL RESOURCES & PARKS
WASTEWATER TREATMENT DIVISION
KING COUNTY WEST POINT TREATMENT PLANT
SECONDARY MIXED LIQUOR BLOWER REPLACEMENT

DETAILS

DATE:	APRIL 2020
PROJECT FILE NO:	17-1123627
DRAWING NO:	S2424
SHT NO / TOTAL	11 / 53
REV NO:	

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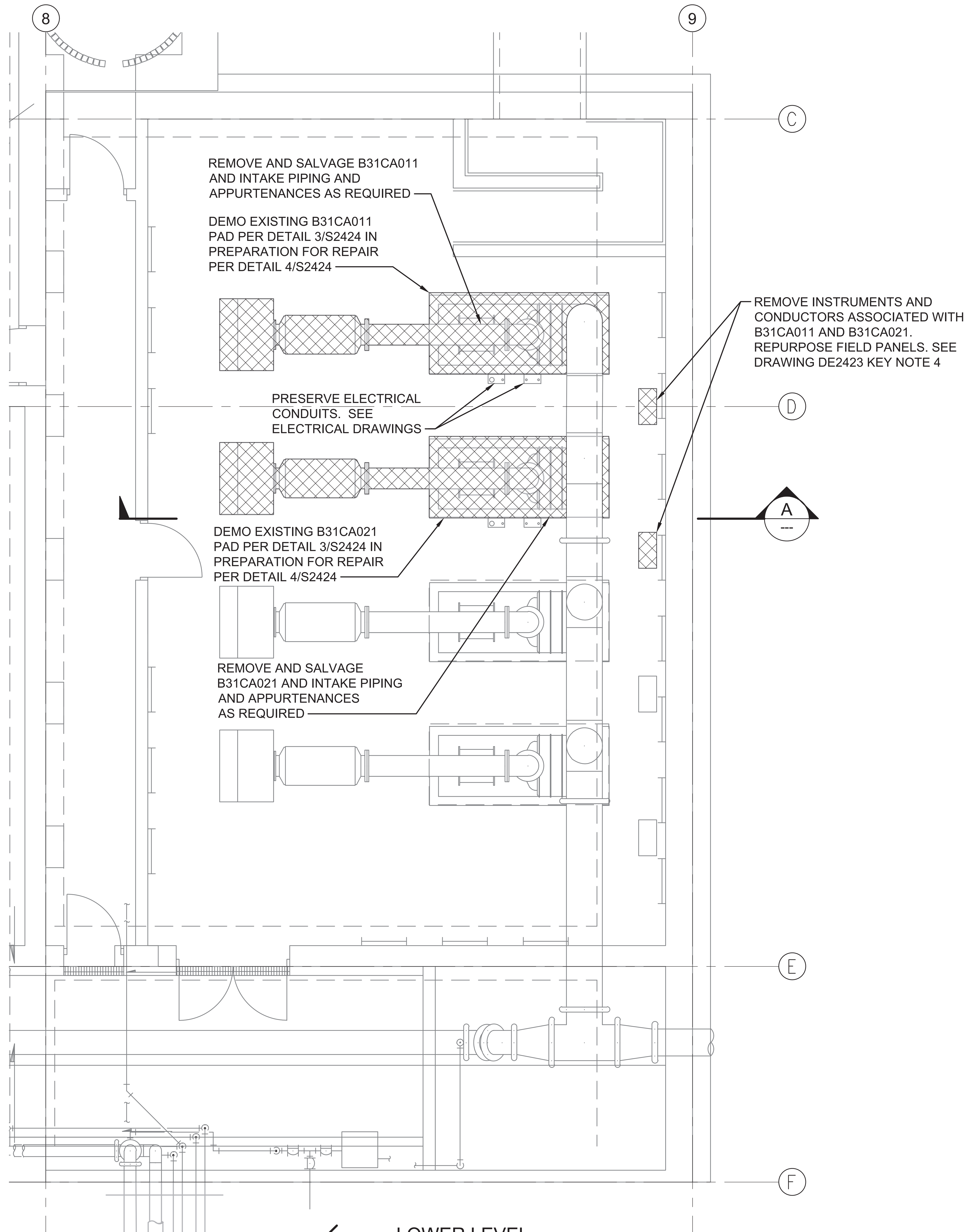
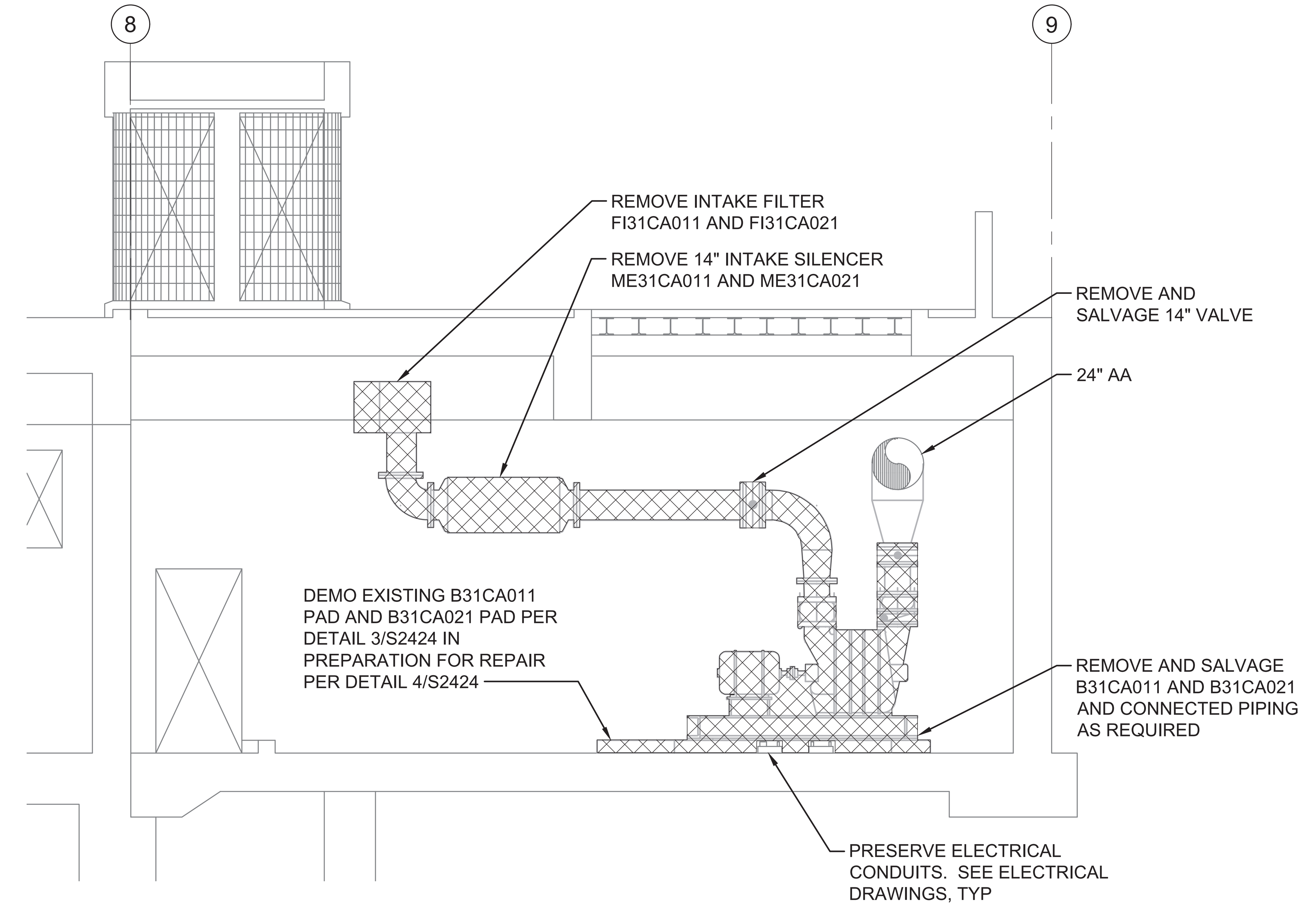


LOWER LEVEL

DEMOLITION PLAN

SCALE: 1/4"=1'-0"



DEMOLITION

SECTION (A / ---)

SCALE: 1/4"=1'-0"

NOTES

1. SALVAGE BLOWERS, MOTORS, AND INSTRUMENTS AS PER PROJECT REPRESENTATIVE'S DIRECTION.

NO	REVISION DESCRIPTION	BY	APVD	DATE
0	BID ISSUE			4/17/2020

ch2m

WILLIAM S. FARMER, STATE OF WASHINGTON, 28510, REGISTERED PROFESSIONAL ENGINEER, 4-21-20

DESIGNED/DRAWN: DS	CHECKED: BF
PROJECT ENGINEER: EC	SCALE: AS NOTED
DESIGN APPROVAL: ES	FACILITY NUMBER: WP-724
PROJECT ACCEPTANCE: JRM	CONTRACT NO: C01397C20

King County

DEPARTMENT OF NATURAL RESOURCES & PARKS
WASTEWATER TREATMENT DIVISION
KING COUNTY WEST POINT TREATMENT PLANT
SECONDARY MIXED LIQUOR BLOWER REPLACEMENT

DEMOLITION BLOWER REPLACEMENT PLAN

DATE: APRIL 2020
PROJECT FILE NO: 17-1123627
DRAWING NO: DM2414
SHT NO 12 / TOTAL 53 REV NO:

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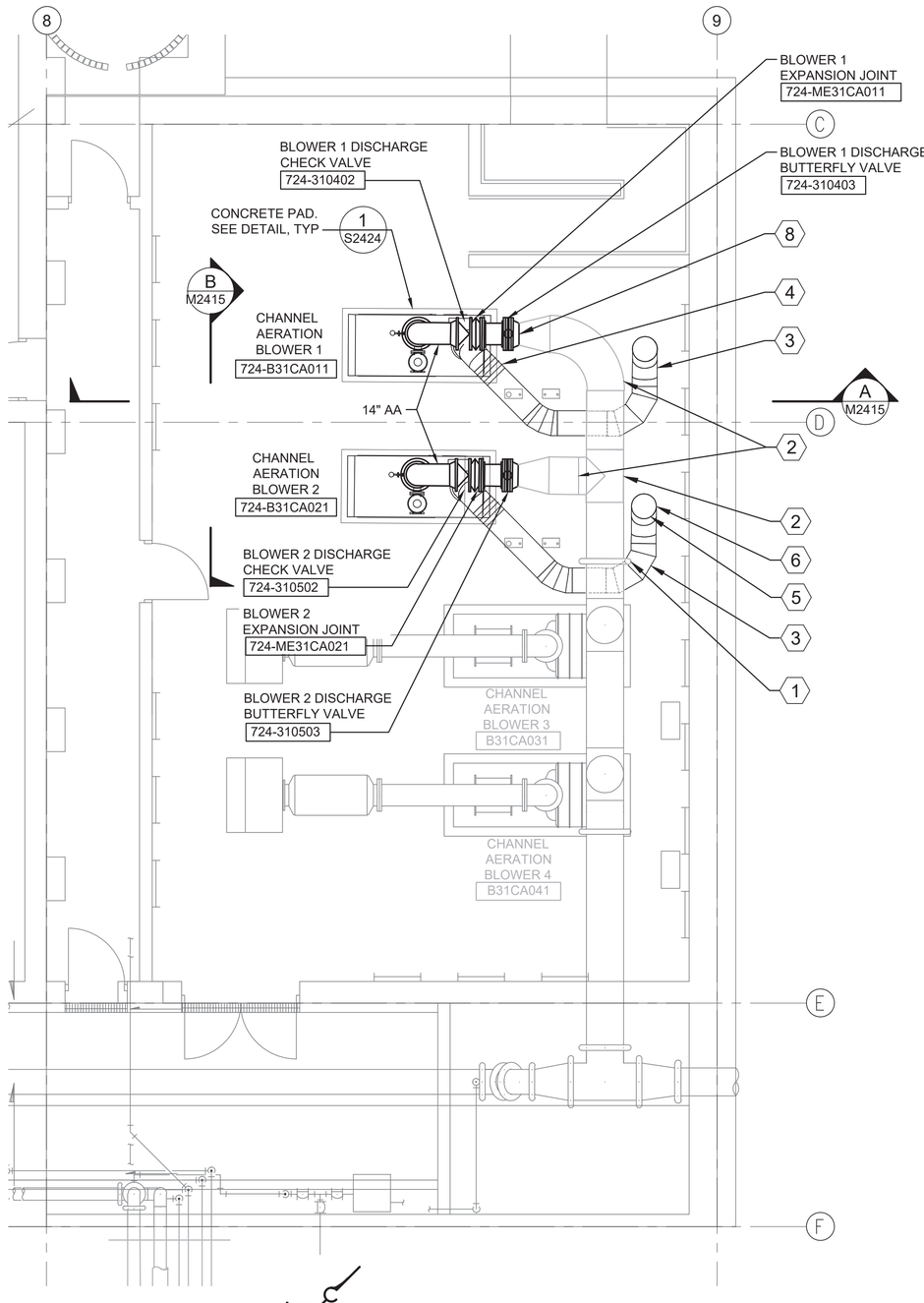
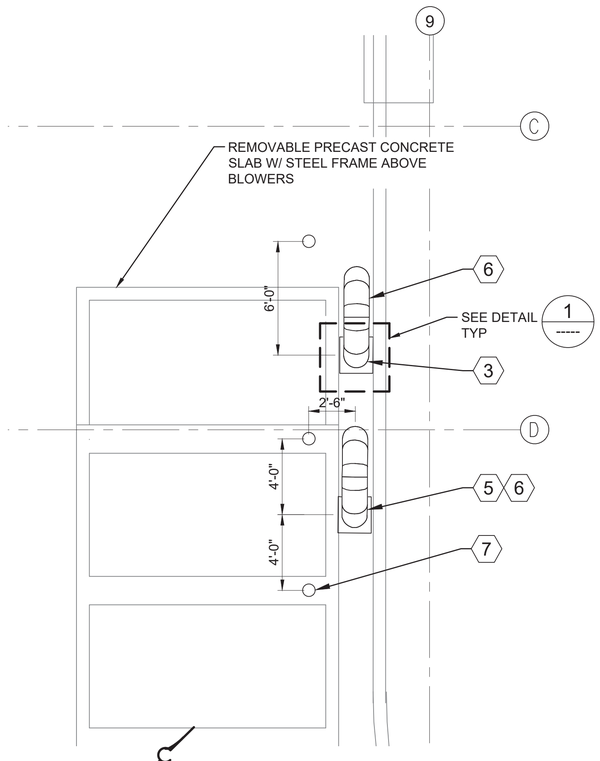
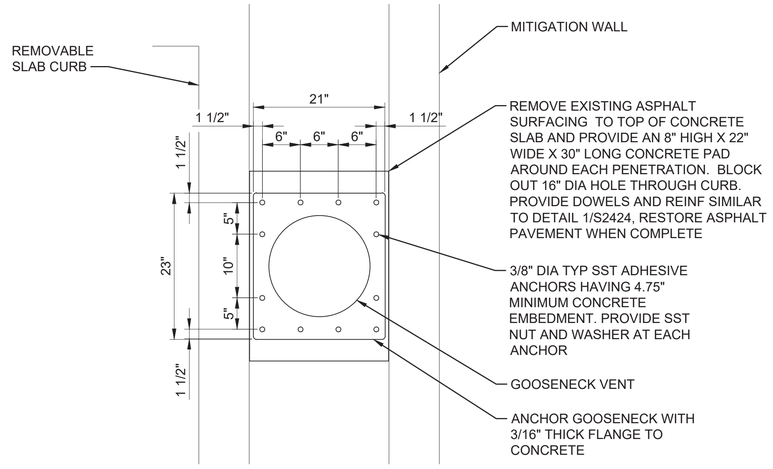


LOWER LEVEL PLAN
SCALE: 1/4"=1'-0"



UPPER LEVEL PLAN DETAIL
SCALE: 1/4"=1'-0"



DETAIL 1 / ----
SCALE: 1"=1'-0"

NOTES:

1. CONTRACTOR SHALL BE RESPONSIBLE FOR CLEARING OBSTACLES PRIOR TO LOWERING NEW BLOWERS INTO BLOWER ROOM.
2. CONSTRUCT AND SUPPORT ALL DUCTWORK TO SMACNA STANDARDS.

KEY NOTES:

1. FIELD VERIFY INTEGRITY OF COUPLING AND REPLACE GASKET. ISOLATE BLOWERS 1 AND 2 WITH A PLUG AT EXISTING COUPLING TO ALLOW BLOWERS 3 AND 4 TO STAY IN OPERATION.
2. ROTATE THE SECTION OF DISCHARGE HEADER PIPE FOR BLOWERS 1 AND 2 INTO THE HORIZONTAL POSITION.
3. ALL ROUND DUCT TO BE SPIRAL STAINLESS STEEL DUCT CONSTRUCTED TO 4" PRESSURE CLASS. USE VAN-STONE OR DUCTMATE TYPE FITTINGS.
4. PROVIDE A FLEX CONNECTION IN THE HORIZONTAL OF THE CONNECTION POINT OF THE BLOWER. COORDINATE THE FINAL LOCATION AND CONNECTION SIZE WITH BLOWER MANUFACTURER. TYP OF 2
5. CORE DRILL ROOF WITH 16" OPENING. DO NOT PASS DUCT THROUGH OPENING. ANCHOR 16" ROUND DUCT 3/16" FLANGE TO UNDERSIDE OF CONCRETE ROOF SIMILAR TO DETAIL 1; MAINTAIN MINIMUM 2" EDGE DISTANCE FOR ANCHOR BOLTS; SEAL AIR TIGHT, TYP OF 2
6. TERMINATE WITH A 16" GOOSENECK AT GRADE WITH ALL WELDED JOINTS. SEAL GOOSENECK TO ROOF WATER TIGHT AS PER DETAIL 1. PROVIDE WITH A BIRD SCREEN AT OUTLET. GOOSENECK SHALL BE CONSTRUCTED OF 16 GA STAINLESS STEEL, TYP OF 2
7. BOLLARD, SEE DETAIL 3471-850 ON M2415, TYP OF 3
8. MODIFY EXISTING 24X12 REDUCER TO 24X14 WITH NEW 14" FLANGE, TYP OF 2

NO	REVISION DESCRIPTION	BY	APVD	DATE
0	BID ISSUE			4/17/2020

ch2m:

WILLIAM S. ACKERMAN — STATE OF WASHINGTON — 20510 — REGISTERED PROFESSIONAL ENGINEER — 4-21-20

DESIGNED/DRAWN: DS	CHECKED: BF
PROJECT ENGINEER: EC	SCALE: AS NOTED
DESIGN APPROVAL: ES	FACILITY NUMBER: WP-724
PROJECT ACCEPTANCE: JRM	CONTRACT NO: C01397C20

King County

DEPARTMENT OF NATURAL RESOURCES & PARKS
WASTEWATER TREATMENT DIVISION
KING COUNTY WEST POINT TREATMENT PLANT
SECONDARY MIXED LIQUOR BLOWER REPLACEMENT

BLOWER REPLACEMENT PLAN

DATE:	APRIL 2020
PROJECT FILE NO:	17-1123627
DRAWING NO:	M2414
SHT NO / TOTAL	13 / 53
REV NO:	

BORDER FILE EDITION: KCWTD-2015R0-Dsize-TB-Border
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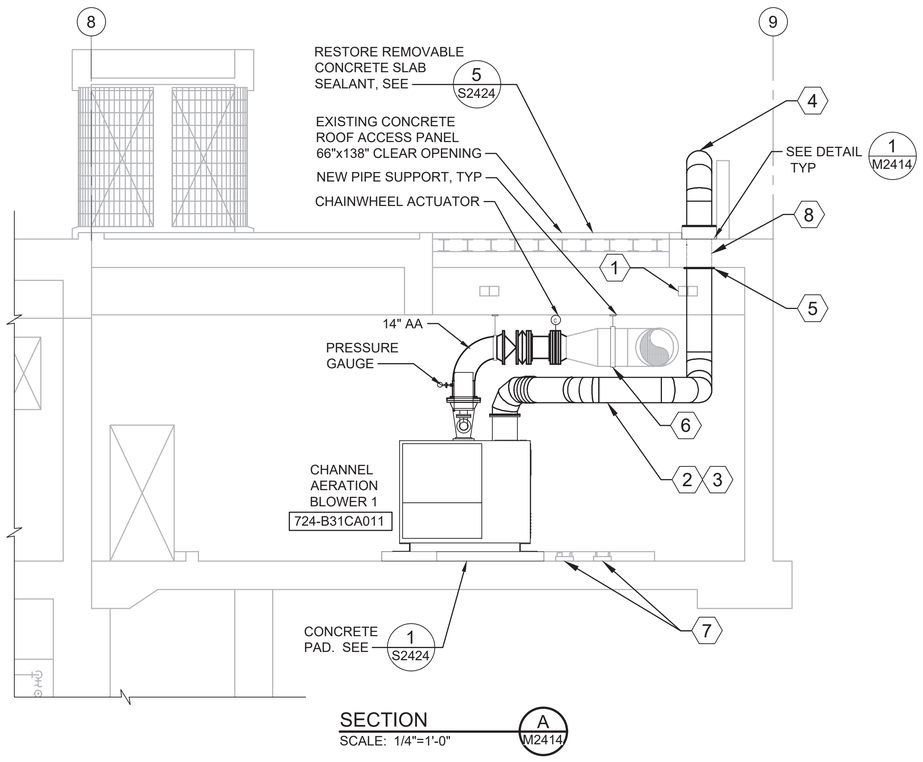
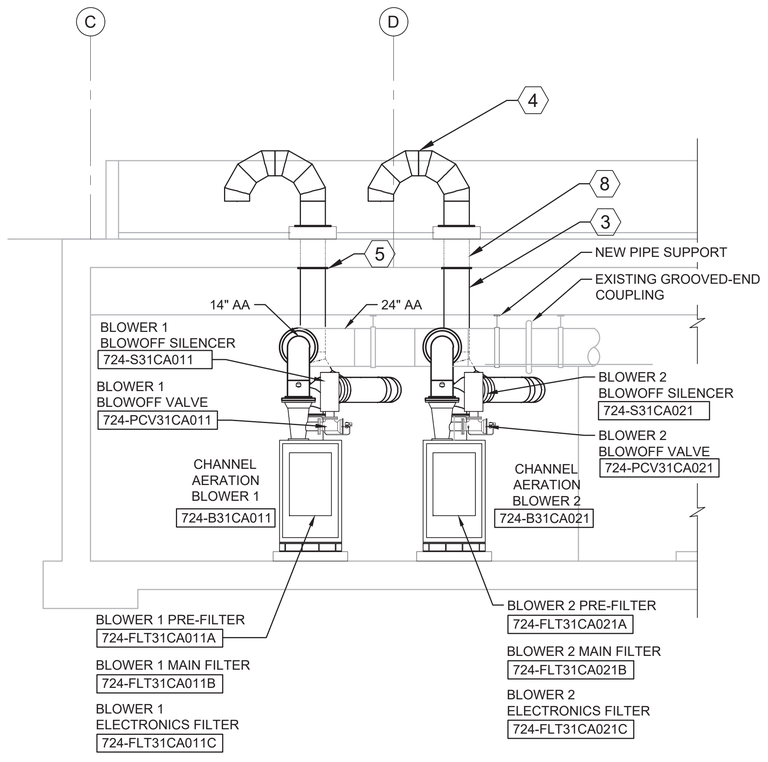


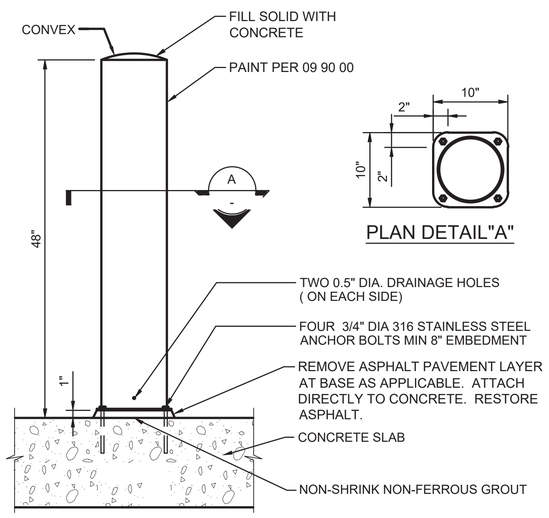
SECTION A M2414
SCALE: 1/4"=1'-0"



SECTION B M2414
SCALE: 1/4"=1'-0"

KEY NOTES:

1. EXISTING LIFTING EYES (4 PER BAY) PROTRUDE INTO CLEAR OPENING.
2. CONSTRUCT AND SUPPORT ALL DUCTWORK TO SMACNA STANDARDS .
3. ALL ROUND DUCT TO BE SPIRAL STAINLESS STEEL DUCT CONSTRUCTED TO 4" PRESSURE CLASS. USE VAN-STONE OR DUCTMATE TYPE FITTINGS.
4. 16" ROUND GOOSENECK CONSTRUCTED OF 16 GA STAINLESS STEEL WITH ALL WELDED JOINTS; FLANGE AS PER DETAIL 1/M2414. SEAL GOOSENECK TO ROOF WATER TIGHT. PROVIDE WITH A BIRD SCREEN AT OUTLET, TYP OF 2
5. 3" FLANGE (3/16" THICK) WITH BOLT HOLES AT 2" EDGE DISTANCE FROM CORE-DRILLED HOLE. 3/8" DIA ADHESIVE ANCHORS FROM BELOW WITH 4" EMBEDMENT, TYP
6. 24" AA. ROTATE AIR HEADER UP TO HORIZONTAL TO CONNECT TO B31CA011 AND B31CA021
7. EXISTING ELECTRICAL STUB-UPS SEE E2420 FOR CONDUIT ROUTING TO NEW BLOWER CONNECTIONS
8. 16" CORE-DRILLED HOLE THROUGH DECK WITH NO DUCTWORK



PLAN DETAIL"A"

STEEL BOLLARD ON CONCRETE SLAB 3471-850
NTS

NO	REVISION DESCRIPTION	BY	APVD	DATE
0	BID ISSUE			4/17/2020

ch2m:

WILLIAM S. FOREMAN — STATE OF WASHINGTON — 29512 — REGISTERED PROFESSIONAL ENGINEER — 4-21-20

DESIGNED/DRAWN: DS	CHECKED: BF
PROJECT ENGINEER: EC	SCALE: AS NOTED
DESIGN APPROVAL: ES	FACILITY NUMBER: WP-724
PROJECT ACCEPTANCE: JRM	CONTRACT NO: C01397C20

King County

DEPARTMENT OF NATURAL RESOURCES & PARKS
WASTEWATER TREATMENT DIVISION
KING COUNTY WEST POINT TREATMENT PLANT
SECONDARY MIXED LIQUOR BLOWER REPLACEMENT

SECTIONS

DATE:	APRIL 2020
PROJECT FILE NO:	17-1123627
DRAWING NO:	M2415
SHT NO / TOTAL	14 / 53
REV NO:	

BORDER FILE EDITION: KCWTD-2015R0-Dsize-TB-Border
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REFERENCE 1"

724-MCC02

800A, 480V, 3 PH, 3W, GND, 65,000A RMS SYMM. SHORT CIRCUIT RATING

FROM 724-SWGR01 DWG E2402

1 | 2 | 3 | 4 | 5 | 8 | 10 | 9 | 6 | 7 | 11 | 12 | 13 | 14 | 15 | 16

2 | PREPARED SPACE FOR SIZE 1 STARTER | PREPARED SPACE FOR SIZE 1 STARTER | 400/M | 150 | 125 | PREPARED SPACE FOR 100A CIRCUIT BREAKER | PREPARED SPACE FOR CIRCUIT BREAKER | PREPARED SPACE FOR CIRCUIT BREAKER | 3/M | 3/M | 3/M | 3/M

75 KVA 480–208Y/120V 3 ph, 4W, 724–XFMR02

CT/1

200 | 1/2 | 1/2 | 1/2

ANALOG METER

CHANNEL AERATION BLOWER MOTOR.1 724-MTR31CA011

CHANNEL AERATION BLOWER MOTOR.3 724–MTR31CA031

724–DPL02

724–VFD31AC021 AUXILIARY POWER

724–XFMR021 COOLING FAN (FUTURE)

724–XFMR021 COOLING FAN (FUTURE)

724–DCLR021 COOLING FAN (FUTURE)

SPARE

SPACE

KEY NOTES

1. REMOVE MOTOR STARTER, BREAKER AND DELIVER TO KING COUNTY PROJECT REPRESENTATIVE ON SITE FOR USE AS "SPARE".
2. REMOVE EXISTING ANALOG METER AND REPLACE WITH NEW. SEE SHEET E2404.

724-MCC03

800A, 480V, 3PH, 3W, GND, 65,000A RMS SYMM. SHORT CIRCUIT RATING

FROM 724-SWGR01 DWG E2402

2 | 3 | 4 | 5 | 8 | 9 | 6 | 7 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20

2 | PREPARED SPACE FOR CIRCUIT BREAKER | PREPARED SPACE FOR CIRCUIT BREAKER | 400/M | 125 | 15/M | 7/M | 125 | 80 | 3/M | 3/M | 3/M | 3/M | PREPARED SPACE FOR SIZE 1 STARTER | PREPARED SPACE FOR SIZE 1 STARTER | PREPARED SPACE FOR SIZE 1 STARTER | PREPARED SPACE FOR SIZE 1 STARTER

45 KVA 480–208Y/120V 3 ph, 4W, 724–XFMR03

CT/1

200 | 5 | 1/2 | 1/2 | 1/2 | 1/2

ANALOG METER

CHANNEL AERATION BLOWER MOTOR.2 724-MTR31CA021

CHANNEL AERATION BLOWER MOTOR.4 724–MTR31CA041

724–VFD31AC031 AUXILIARY POWER

ELECTRICAL ROOM SUPPLY FAN MOTOR 724–MTR2504010

CIRCULATING WATER PUMP FOR SF2502010 724–MTR2502012

724–VFD31AC041 AUXILIARY POWER (FUTURE)

724–DPL03

724–XFMR031 COOLING FAN (FUTURE)

724–XFMR031 COOLING FAN (FUTURE)

724–DCLR031 COOLING FAN (FUTURE)

SPARE

NO	REVISION DESCRIPTION	BY	APVD	DATE
0	BID ISSUE			4/17/2020

ch2m: ER Electrical Engineering

ELMO W. RAJAH — STATE OF WASHINGTON — 30315 — REGISTERED PROFESSIONAL ENGINEER

DESIGNED/DRAWN: ER	CHECKED: DW
PROJECT ENGINEER: ER	SCALE: NONE
DESIGN APPROVAL: ES	FACILITY NUMBER: WP-724
PROJECT ACCEPTANCE: JRM	CONTRACT NO: C01397C20

King County

DEPARTMENT OF NATURAL RESOURCES & PARKS
WASTEWATER TREATMENT DIVISION
KING COUNTY WEST POINT TREATMENT PLANT
SECONDARY MIXED LIQUOR BLOWER REPLACEMENT

DEMOLITION ONE-LINE DIAGRAM 724-MCC02 AND MCC03

DATE: APRIL 2020
PROJECT FILE NO: 17-1123627
DRAWING NO: DE2404
SHT NO 15 / TOTAL 53
REV NO:

BORDER FILE EDITION: KCWTD-2015R0-Dsize-TB-Border
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XREFS: KC_ML_TitleBlock.dwg
IMAGES:

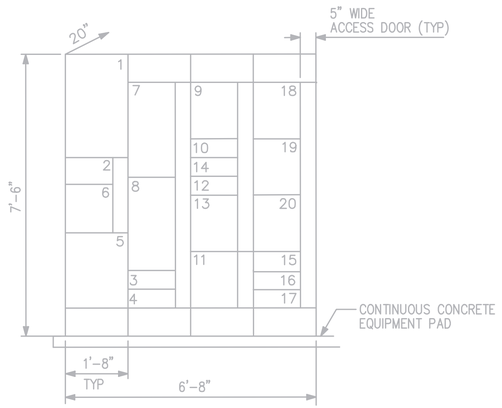
REFERENCE 0 1"

KEY NOTES

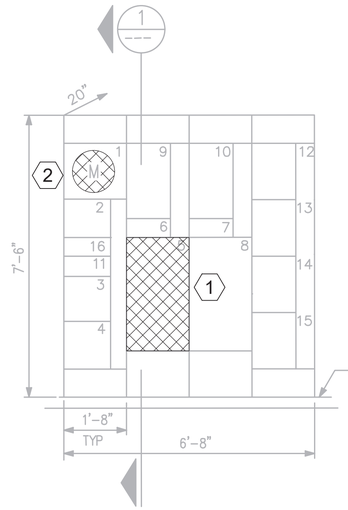
1. REMOVE MOTOR STARTER, BREAKER AND DELIVER TO PROJECT REPRESENTATIVE ON SITE FOR USE AS "SPARE".
2. REMOVE ANALOG METER AND REPLACE WITH NEW DOOR.

GENERAL NOTES

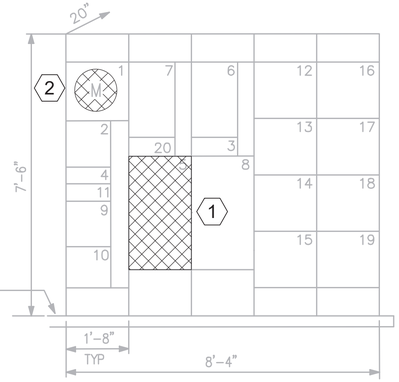
1. SEE SHEET E2420 FOR MCC LOCATION.



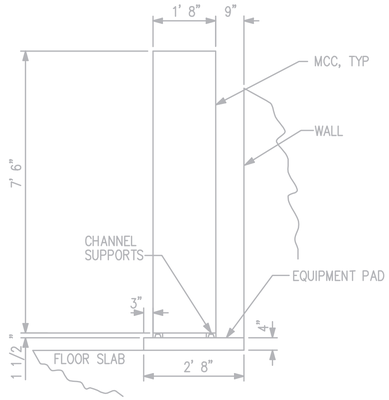
ELEVATION
MCC01



MCC 02 ELEVATION



MCC 03 ELEVATION



TYPICAL SECTION LOOKING NORTHWEST

SECTION – MCC'S 1
SCALE: 1/2"=1'-0"

NO	REVISION DESCRIPTION	BY	APVD	DATE
0	BID ISSUE			4/17/2020

ch2m: Electrical Engineering (ER)

ELMO W. RAJAH — STATE OF WASHINGTON — 30315 — REGISTERED PROFESSIONAL ENGINEER — 4-17-2020

DESIGNED/DRAWN: ER	CHECKED: DW
PROJECT ENGINEER: ER	SCALE: 1/2"=1'-0"
DESIGN APPROVAL: ES	FACILITY NUMBER: WP-724
PROJECT ACCEPTANCE: JRM	CONTRACT NO: C01397C20

King County

DEPARTMENT OF NATURAL RESOURCES & PARKS
WASTEWATER TREATMENT DIVISION
KING COUNTY WEST POINT TREATMENT PLANT
SECONDARY MIXED LIQUOR BLOWER REPLACEMENT

DEMOLITION PLAN AND ELEVATION 724-MCC02 AND MCC03

DATE:	APRIL 2020
PROJECT FILE NO:	17-1123627
DRAWING NO:	DE2407
SHT NO / TOTAL	16 / 53
REV NO:	

BORDER FILE EDITION: KCWTD-2015R0-Dsize-TB-Border
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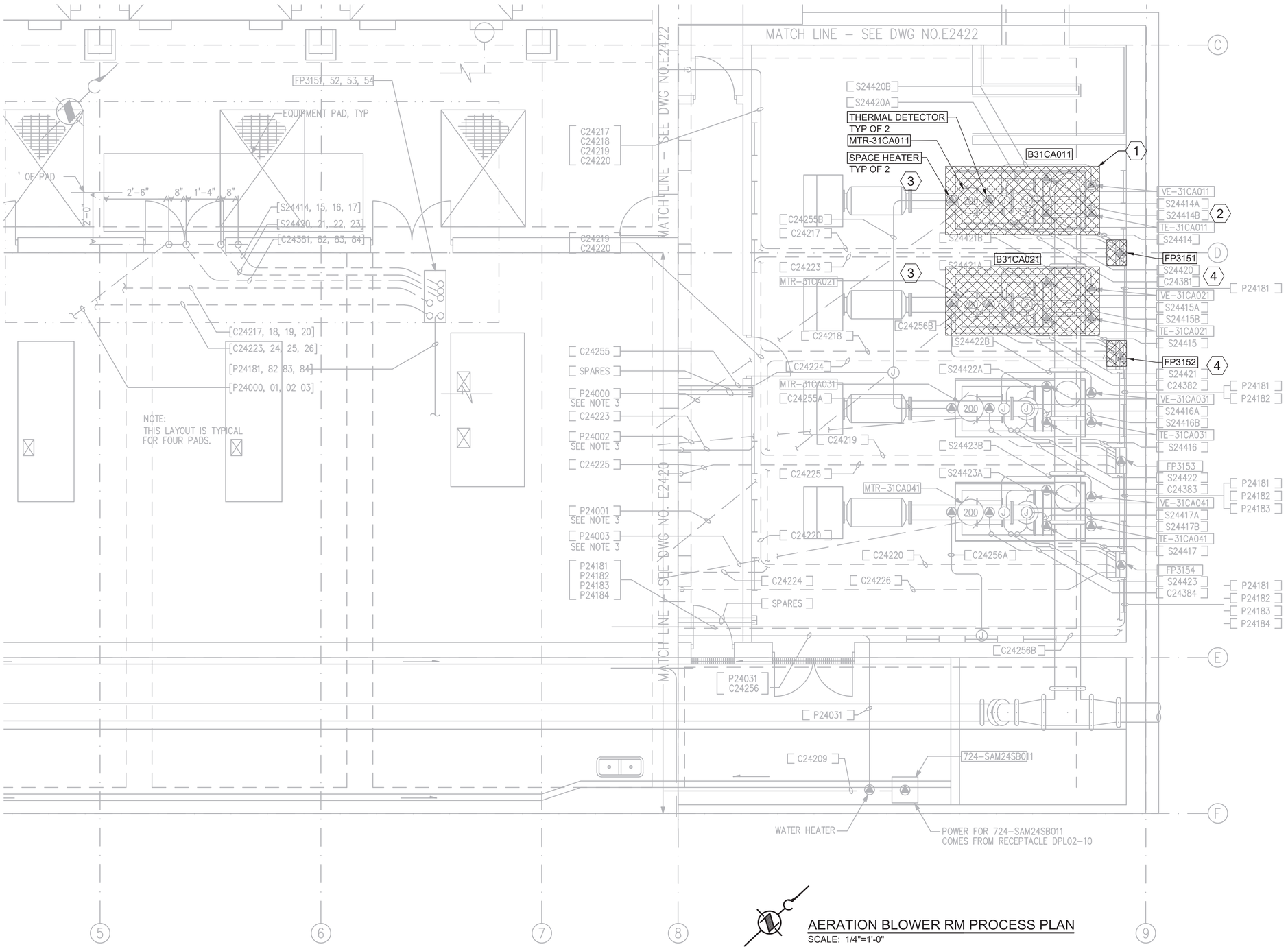

AERATION BLOWER RM PROCESS PLAN

SCALE: 1/4"=1'-0"

GENERAL NOTES

1. ALL EXISTING CONDUITS SHALL REMAIN. MANDREL AND CLEAN ALL CONDUITS. MEGGER TEST ALL REMOVED CABLES, IF MEGGER READINGS ARE ABOVE 100M OHMS DELIVER CABLES TO ON SITE REPRESENTATIVE. IF TEST FAILS, DISPOSE CABLES.
2. LABEL ALL UNUSED CONDUITS AS "SPARE".
3. CONTRACTOR TO PROVIDE A COMPLETE SET OF RED LINE AS-BUILTS. CONTRACTOR SHALL ALSO RECORD SPARE TERMINALS AND BREAKERS IN ICP AND ELECTRICAL PANELS RESPECTIVELY AND SPARE CONDUITS AND PROVIDE AS-BUILTS RED LINES.

KEY NOTES

1. REMOVE ALL UNUSED WIRES FROM MOTOR TO MCC.
2. REMOVE ALL UNUSED "C-CONTROL" AND "S-SIGNAL" WIRES FROM BLOWERS 1 AND 2 BACK TO ICP/LCP PANELS.
3. REMOVE SPACE HEATER AND THERMAL DETECTOR WIRES BACK TO ELECTRICAL PANEL AND ICP/LCP PANELS. INSTALL REVISED NEW PANEL SCHEDULE.
4. REMOVE UNUSED WIRES FROM PANELS FP3151 AND FP3152 BACK TO ICP/LCP PANELS. FP3151 AND FP3152 TO BE USED AS "PULL BOX" FOR NEW "C-CONTROL" AND "S-SIGNAL" WIRES FROM BLOWERS TO ICP/LCP PANELS. PROVIDE COVER FOR ANY HOLES ON FRONT OF PANEL.

NO	REVISION DESCRIPTION	BY	APVD	DATE
0	BID ISSUE			4/17/2020

ch2m: Electrical Engineering (ER)

ELMO W. RAJAH — STATE OF WASHINGTON — 30315 — REGISTERED PROFESSIONAL ENGINEER

DESIGNED/DRAWN: ER	CHECKED: DW
PROJECT ENGINEER: ER	SCALE: 1/4"=1'-0"
DESIGN APPROVAL: ES	FACILITY NUMBER: WP-724
PROJECT ACCEPTANCE: JRM	CONTRACT NO: C01397C20

King County

DEPARTMENT OF NATURAL RESOURCES & PARKS
WASTEWATER TREATMENT DIVISION
KING COUNTY WEST POINT TREATMENT PLANT
SECONDARY MIXED LIQUOR BLOWER REPLACEMENT

DEMOLITION LOWER LEVEL PROCESS PLAN

DATE: APRIL 2020
PROJECT FILE NO: 17-1123627
DRAWING NO: DE2423
SHT NO 17 / TOTAL 53 | REV NO:

BORDER FILE EDITION: KCWTD-2015R0-Dsize-TB-Border
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GENERAL NOTES

1. SEE MECHANICAL DRAWINGS FOR PLACEMENT OF BLOWER EQUIPMENT.
2. SEE SHEET G2408 FOR LEGEND AND SYMBOLS.

724-WCNW00001
IPS BUILDING - NETWORK CABINET
OVATION DCS NETWORK
OVATION PLC NETWORK
POWER MONITORING NETWORK

ETHERNET 1U 24 PORT CAT5e PATCH PANEL

OVATION CABINET
724-ICP3101

[C24523]
[S24282]

[D24168]
[D24169]

724-DPL01
120/208 V

FIELD WIRES & CABLE WILL LAND ON TERMINALS IN THE LCP FIRST THEN EXTEND TO I/O IN THE ICP

724-LCP3101

[S24281]
[C24237]
[C24238]

J-BOX (TYP)

JB2
JB3
JB4

[S24281B]
[S24281D]
[S24281F]
[S24281A]
[S24281E]
[S24281C]

[D24169B]
[D24169A]

J
JB1

724-LCPI31CA011
724-HMI31CA011
724-VFD31CA011
724-HF31CA011
724-B31CA011
724-PLC31CA011
724-MTR31CA011

BLOWER #1
VFD/HF/PLC/HMI/LCP
400 ACB [480V, 3PH]

BLOWER #2
VFD/HF/PLC/HMI/LCP
400 ACB [480V, 3PH]

724-LCPI31CA021
724-HMI31CA021
724-VFD31CA021
724-HF31CA021
724-B31CA021
724-PLC31CA021
724-MTR31CA021

BLOWER #3
724-MTR31CA031

BLOWER #4
724-MTR31CA041

[S24281H]
[S24281G]

724-FP3153
724-FP3154

[P24001]
[P24000]

724-FP3151
724-FP3152

JB5

[D24168A]
[D24168B]

724-MCC02
724-MCC03

724-SWGR01

NO	REVISION DESCRIPTION	BY	APVD	DATE
0	BID ISSUE			4/17/2020

ch2m: Electrical Engineering

ELMO W. RAJAH
STATE OF WASHINGTON
30315
REGISTERED PROFESSIONAL ENGINEER

DESIGNED/DRAWN: JY	CHECKED: DW
PROJECT ENGINEER: ER	SCALE: NONE
DESIGN APPROVAL: ES	FACILITY NUMBER: WP-724
PROJECT ACCEPTANCE: JRM	CONTRACT NO: C01397C20

King County

DEPARTMENT OF NATURAL RESOURCES & PARKS
WASTEWATER TREATMENT DIVISION
KING COUNTY WEST POINT TREATMENT PLANT
SECONDARY MIXED LIQUOR BLOWER REPLACEMENT

BLOCK DIAGRAM

DATE:	APRIL 2020
PROJECT FILE NO:	17-1123627
DRAWING NO:	E1049
SHT NO / TOTAL	18 / 53
REV NO:	

BORDER FILE EDITION: KCWTD-2015R0-Dsize-TB-Border
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REFERENCE 1"

724-MCC02

800A, 480V, 3ph, 3W. GND, 65,000 RMS SYMM. SHORT CIRCUIT RATING

FROM 724-SWGR01 DWG E2402

1 — 2 — DPM (2)

3 — PREPARED SPACE FOR SIZE 1 STARTER

4 — PREPARED SPACE FOR SIZE 1 STARTER

5 — 400/3P LS (1)

CHANNEL AERATION BLOWER MOTOR 1 724-MTR31CA011

8 — 400/M — 5 — CT/1 — 200

CHANNEL AIR BLOWER NO.3 724-MTR31CA031

10 — 150 — 724-XFMR02 75 KVA 480-208Y/120V 3ϕ, 4W,

724-DPL02

9 — 125

724-VFD31AC021 AUXILIARY POWER

6 — PREPARED SPACE FOR 100A CIRCUIT BREAKER

7 — PREPARED SPACE FOR CIRCUIT BREAKER

11 — PREPARED SPACE FOR CIRCUIT BREAKER

12 — 3/M — 1 — 1/2

724-XFMR021 COOLING FAN (FUTURE)

13 — 3/M — 1 — 1/2

724-XFMR021 COOLING FAN (FUTURE)

14 — 3/M — 1 — 1/2

724-DCLR021 COOLING FAN (FUTURE)

15 — 3/M — 1

SPARE

16

SPACE

KEY NOTES

(1) INSTALL NEW 400A/3P BREAKER IN EXISTING MCC GE8000 LINE. MODIFY MCC AS NEEDED TO ACCOMMODATE BREAKER. BREAKER SHALL BE SOLID STATE WITH TRIP ADJUSTMENTS. BREAKER SHALL MATCH EXISTING AIC RATING. INSTALL NEW DOOR OR MODIFY EXISTING DOOR,

(2) PROVIDE POWER METER PER SPECIFICATIONS.

REFERENCE DRAWINGS:

E2402	ONE-LINE DIAGRAM, 724-SWGR01
E2407	ELEVATIONS, 724-MCC01, 02 & 03
E2420	LOWER LEVEL PROCESS PLAN
E2421	LOWER LEVEL PROCESS PLAN

724-MCC03

800A, 480V, 3ph, 3W. GND, 65,000 RMS SYMM. SHORT CIRCUIT RATING

FROM 724-SWGR01 DWG E2402

1 — 2 — DPM (2)

3 — PREPARED SPACE FOR CIRCUIT BREAKER

4 — PREPARED SPACE FOR CIRCUIT BREAKER

5 — 400/3P LS (1)

CHANNEL AERATION BLOWER MOTOR 2 724-MTR31CA021

8 — 400/M — 5 — CT/1 — 200

CHANNEL AIR BLOWER NO.4 724-MTR31CA041

9 — 125

724-VFD31AC031 AUXILIARY POWER

6 — 15/M — 1 — 5

ELECTRICAL ROOM SUPPLY FAN MOTOR 724-MTR2504010

7 — 7/M — 1 — 1/2

CIRCULATING WATER PUMP FOR SF2502010 724-MTR2502012

10 — 125 — 724-XFMR03 45 KVA 480-208Y/120V 3ϕ, 4W,

11 — 80

724-VFD31AC041 AUXILIARY POWER (FUTURE)

724-DPL03

12 — 3/M — 1 — 1/2

724-XFMR031 COOLING FAN (FUTURE)

13 — 3/M — 1 — 1/2

724-XFMR031 COOLING FAN (FUTURE)

14 — 3/M — 1 — 1/2

724-DCLR031 COOLING FAN (FUTURE)

15 — 3/M — 1

SPARE

16 — PREPARED SPACE FOR SIZE 1 STARTER

17 — PREPARED SPACE FOR SIZE 1 STARTER

18 — PREPARED SPACE FOR SIZE 1 STARTER

19 — PREPARED SPACE FOR SIZE 1 STARTER

20

NOTE:

1. MOUNT VENDOR PROVIDED CT/1 (250:5), ONE AT EACH M.C.C. SECTION FOR EACH BLOWER.

NO	REVISION DESCRIPTION	BY	APVD	DATE
0	BID ISSUE			4/17/2020

ch2m: Electrical Engineering (ER)

ELMO W. RAJAH — STATE OF WASHINGTON — 30315 — REGISTERED PROFESSIONAL ENGINEER — 4-17-20

DESIGNED/DRAWN: ER	CHECKED: DW
PROJECT ENGINEER: ER	SCALE: NONE
DESIGN APPROVAL: ES	FACILITY NUMBER: WP-724
PROJECT ACCEPTANCE: JRM	CONTRACT NO: C01397C20

King County

DEPARTMENT OF NATURAL RESOURCES & PARKS
WASTEWATER TREATMENT DIVISION
KING COUNTY WEST POINT TREATMENT PLANT
SECONDARY MIXED LIQUOR BLOWER REPLACEMENT

INTERMEDIATE PUMP STATION ONE-LINE DIAGRAM 724-MCC02 AND MCC03

DATE: APRIL 2020
PROJECT FILE NO: 17-1123627
DRAWING NO: E2404
SHT NO 19 / TOTAL 53 | REV NO:

BORDER FILE EDITION: KCWTD-2015R0-Dsize-TB-Border
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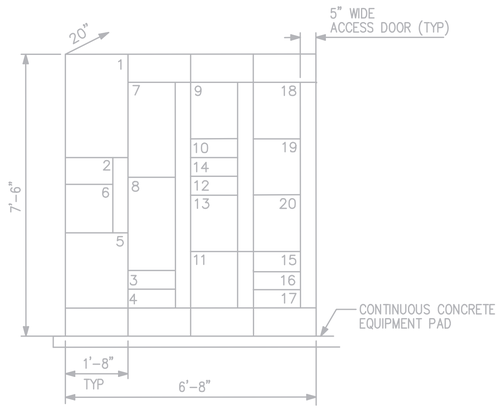
IMAGES:

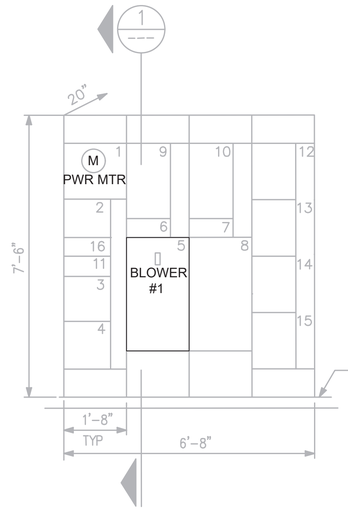
REFERENCE 0 1"

GENERAL NOTES

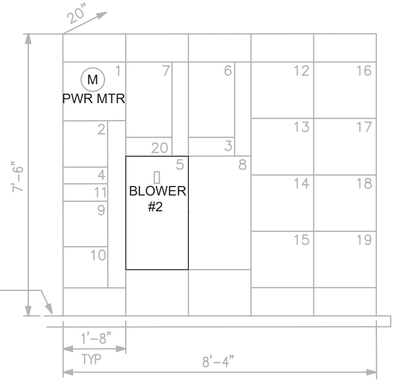
1. INSTALL 400A BREAKER AND POWER METER PER SPECIFICATIONS. INSTALL LABEL AS SHOWN. MODIFY DOOR AS NEEDED OR INSTALL NEW DOOR.



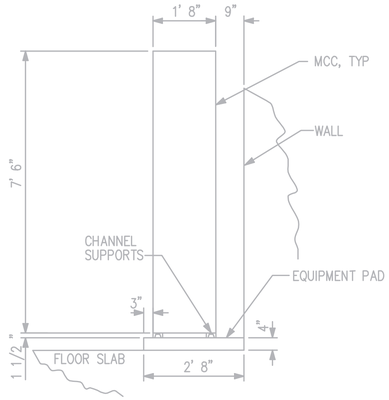
ELEVATION
MCC01



MCC 02 ELEVATION



MCC 03 ELEVATION



TYPICAL SECTION LOOKING NORTHWEST

SECTION – MCC'S (1)
SCALE: 1/2"=1'-0"

NO	REVISION DESCRIPTION	BY	APVD	DATE
0	BID ISSUE			4/17/2020

ch2m: Electrical Engineering (ER)

ELMO W. RAJAH — STATE OF WASHINGTON — 30315 — REGISTERED PROFESSIONAL ENGINEER

DESIGNED/DRAWN: ER	CHECKED: DW
PROJECT ENGINEER: ER	SCALE: 1/2"=1'-0"
DESIGN APPROVAL: ES	FACILITY NUMBER: WP-724
PROJECT ACCEPTANCE: JRM	CONTRACT NO: C01397C20

King County

DEPARTMENT OF NATURAL RESOURCES & PARKS
WASTEWATER TREATMENT DIVISION
KING COUNTY WEST POINT TREATMENT PLANT
SECONDARY MIXED LIQUOR BLOWER REPLACEMENT

INTERMEDIATE PUMP STATION PLAN AND ELEVATION 724-MCC02 AND MCC03

DATE:	APRIL 2020
PROJECT FILE NO:	17-1123627
DRAWING NO:	E2407
SHT NO / TOTAL	20 / 53
REV NO:	

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IMAGES:

GENERAL NOTES

1. SEE MECHANICAL DRAWINGS FOR PLACEMENT OF BLOWER EQUIPMENT.
2. SEE SHEET G2408 FOR LEGEND AND SYMBOLS.

KEY NOTES

1. ALL EXISTING CONDUITS TO REMAIN. VERIFY AND TAG/LABEL ALL CONTROLS AND SIGNAL WIRES PRIOR TO DISCONNECTING. EXTEND WIRES VIA 'FP3151 AND FP3152 TO ICP/LCP PANELS.
2. AHF-ACTIVE HARMONIC FILTER WILL BE PROVIDED AS INTERNAL TO THE BLOWER PACKAGE.
3. PANEL FP3151 AND FP3152 TO BE USED AS PULL BOX FOR "C-CONTROL" AND "S-SIGNAL" CABLES AS NEEDED.
4. PROVIDE CONDUIT SUPPORT FOR NEW CONDUITS PER SPECIFICATIONS.
5. INSTALL NEW WIRES FROM MCC TO BLOWER PACKAGE. EXTEND CONDUIT FROM COUPLING TO NEW BLOWER CONNECTION.
6. RECONNECT BUILDING GROUND TO BLOWER ASSEMBLY, EXTEND GROUND AS REQUIRED.
7. OBTAIN ENGINEERS APPROVAL PRIOR TO CORE DRILLING THROUGH WALLS.

LOWER LEVEL PROCESS PLAN
SCALE: 1/4"=1'-0"

NO	REVISION DESCRIPTION	BY	APVD	DATE
0	BID ISSUE			4/17/2020

ch2m: ER Electrical Engineering

ELMO W. RAJAH, STATE OF WASHINGTON, 30315, REGISTERED PROFESSIONAL ENGINEER

DESIGNED/DRAWN: ER	CHECKED: DW
PROJECT ENGINEER: ER	SCALE: 1/4" = 1'-0"
DESIGN APPROVAL: ES	FACILITY NUMBER: WP-724
PROJECT ACCEPTANCE: JRM	CONTRACT NO: C01397C20

King County

DEPARTMENT OF NATURAL RESOURCES & PARKS
WASTEWATER TREATMENT DIVISION
KING COUNTY WEST POINT TREATMENT PLANT
SECONDARY MIXED LIQUOR BLOWER REPLACEMENT

INTERMEDIATE PUMP STATION LOWER LEVEL PROCESS PLAN

DATE:	APRIL 2020
PROJECT FILE NO:	17-1123627
DRAWING NO:	E2420
SHT NO / TOTAL	21 / 53
REV NO:	

BORDER FILE EDITION: KCWTD-2015R0-Dsize-TB-Border
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PLOTTED: Apr 17, 2020-10:13:16am By Elmo Rajah HP4
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IMAGES:

CONDUIT SCHEDULE

Conduit #	EXISTING CONDUIT	NEW CONDUIT	From	To	C_Size	C_Type	New Conductors	Cable Type	Notes
C24237		X	724-LCP3101	724-MTR31CA011	1"	GRS	10#14 + #12 GND	XHHW-2	3 SPARES
C24238		X	724-LCP3101	724-MTR31CA021	1"	GRS	10#14 + #12 GND	XHHW-2	3 SPARES
C24523		X	724-ICP3101	724-LCP3101	1"	GRS	4 #14 + 1#12 GND	XHHW-2	4 SPARES
P24000	X		724-MTR31CA011	724-MCC02	3"	GRS+FLEX	3#350 MCM, 1#3G	XHHW-2	
P24001	X		724-MTR31CA021	724-MCC03	3"	GRS+FLEX	3#350 MCM, 1#3G	XHHW-2	
D24168		X	724-WCNW00001	JB5	3/4"	GRS	(2)CAT 6+	ENET	
D24168A		X	JB5	724-MCC02	3/4"	GRS	(1)CAT 6+	ENET	
D24168B		X	JB5	724-MCC03	3/4"	GRS	(1)CAT 6+	ENET	
D24169		X	724-WCNW00001	JB1	3/4"	GRS	(2)CAT 6+	ENET	
D24169A		X	JB1	724-MTR31CA011	3/4"	GRS	(1)CAT 6+	ENET	
D24169B		X	JB1	724-MTR31CA021	3/4"	GRS	(1)CAT 6+	ENET	
S24281		X	724-LCP3101	JB2	2"	GRS	(15) TSP	SIC	4 SPARE
S24281A		X	JB2	724-MTR31CA011	1 1/2"	GRS	(3) TSP	SIC	1 SPARE
S24281B		X	JB2	JB3	1 1/2"	GRS	(7) TSP	SIC	3 SPARE
S24281C		X	JB3	724-MTR31CA021	1 1/2"	GRS	(3)TSP	SIC	1 SPARE
S24281D		X	JB3	JB4	1 1/2"	GRS	(4) TSP	SIC	1 SPARE
S24281E		X	JB4	724-FP3153	1"	GRS	(2) TSP	SIC	1 SPARE
S24281F		X	JB4	724-FP3154	1"	GRS	(2) TSP	SIC	1 SPARE
S24281G		X	724-MTR31CA041	724-FP3154	1"	GRS	(2) TSP	SIC	1 SPARE
S24281H		X	724-MTR31CA031	724-FP3153	1"	GRS	(2) TSP	SIC	1 SPARE
S24282		X	724-ICP3101	724-LCP3101	1 1/2"	GRS	(5) TSP	SIC	1 SPARE

NO	REVISION DESCRIPTION	BY	APVD	DATE
0	BID ISSUE			4/17/2020

ch2m: Electrical Engineering (ER)

ELMO W. RAJAH — STATE OF WASHINGTON — 30315 — REGISTERED PROFESSIONAL ENGINEER

DESIGNED/DRAWN: ER	CHECKED: DW
PROJECT ENGINEER: ER	SCALE: NONE
DESIGN APPROVAL: ES	FACILITY NUMBER: WP-724
PROJECT ACCEPTANCE: JRM	CONTRACT NO: C01397C20

King County

DEPARTMENT OF NATURAL RESOURCES & PARKS
WASTEWATER TREATMENT DIVISION
KING COUNTY WEST POINT TREATMENT PLANT
SECONDARY MIXED LIQUOR BLOWER REPLACEMENT

CONDUIT SCHEDULE

DATE:	
	APRIL 2020
PROJECT FILE NO:	17-1123627
DRAWING NO:	**E24105**
SHT NO / TOTAL	22 / 53
REV NO:	

BORDER FILE EDITION: KCWTD-2015R0-Dsize-TB-Border
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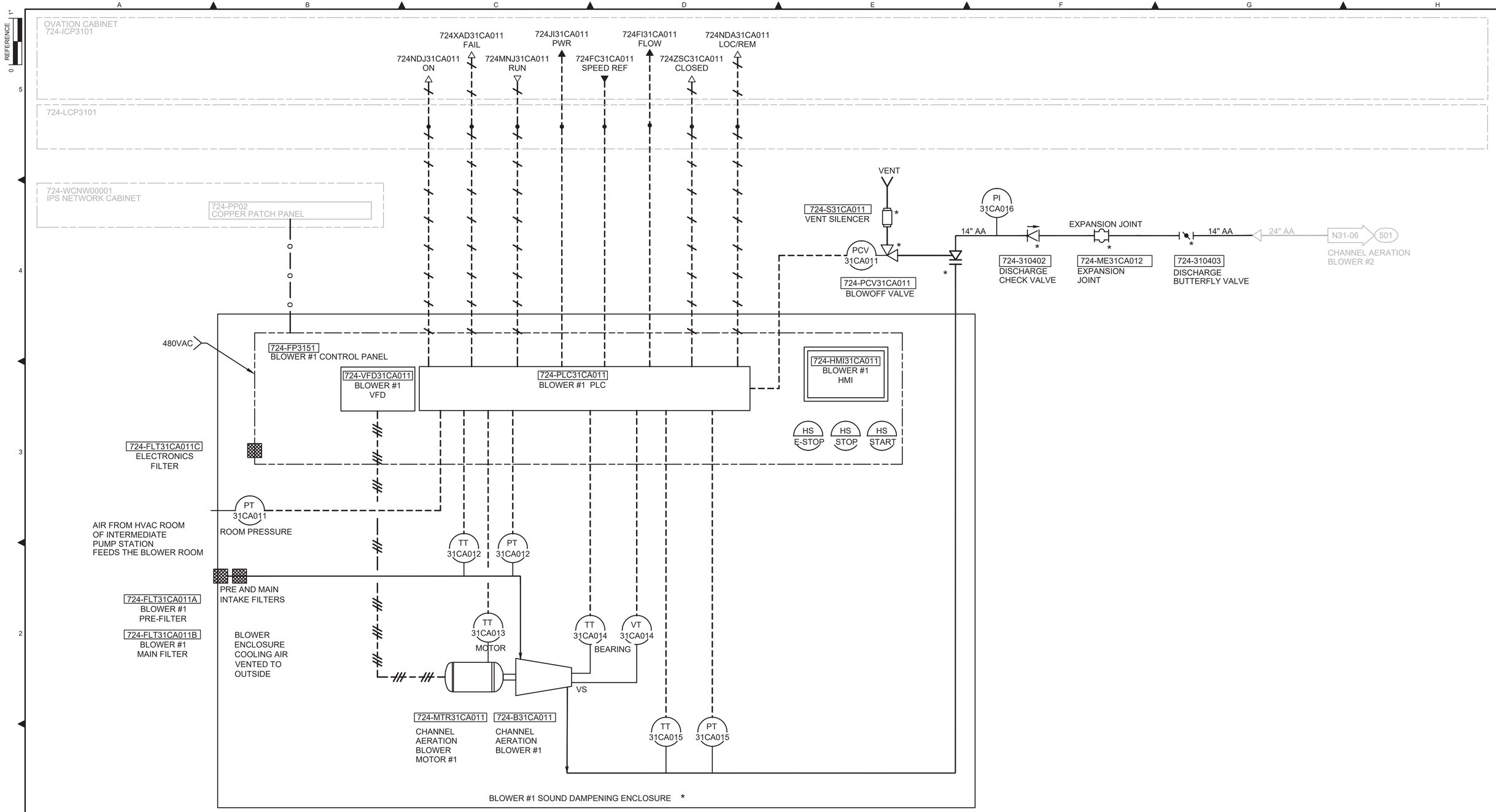

* VENDOR SUPPLIED ITEM

NO	REVISION DESCRIPTION	BY	APVD	DATE
0	BID ISSUE			4/17/2020

ch2m:

RICHARD A. PEARSON — STATE OF WASHINGTON — 35596 — REGISTERED PROFESSIONAL ENGINEER
2020.04.17 16:16:37-07'00'

DESIGNED/DRAWN: RP	CHECKED: SB
PROJECT ENGINEER: RP	SCALE: NONE
DESIGN APPROVAL: ES	FACILITY NUMBER: WP-724
PROJECT ACCEPTANCE: JRM	CONTRACT NO: C01397C20

King County

DEPARTMENT OF NATURAL RESOURCES & PARKS
WASTEWATER TREATMENT DIVISION
KING COUNTY WEST POINT TREATMENT PLANT
SECONDARY MIXED LIQUOR BLOWER REPLACEMENT

MIXED LIQUOR CHANNEL AERATION BLOWER #1 P&ID

DATE:	APRIL 2020
PROJECT FILE NO:	17-1123627
DRAWING NO:	N31-05
SHT NO / TOTAL	23 / 53
REV NO:	

BORDER FILE EDITION: KCWTD-2015R0-Dsize-TB-Border
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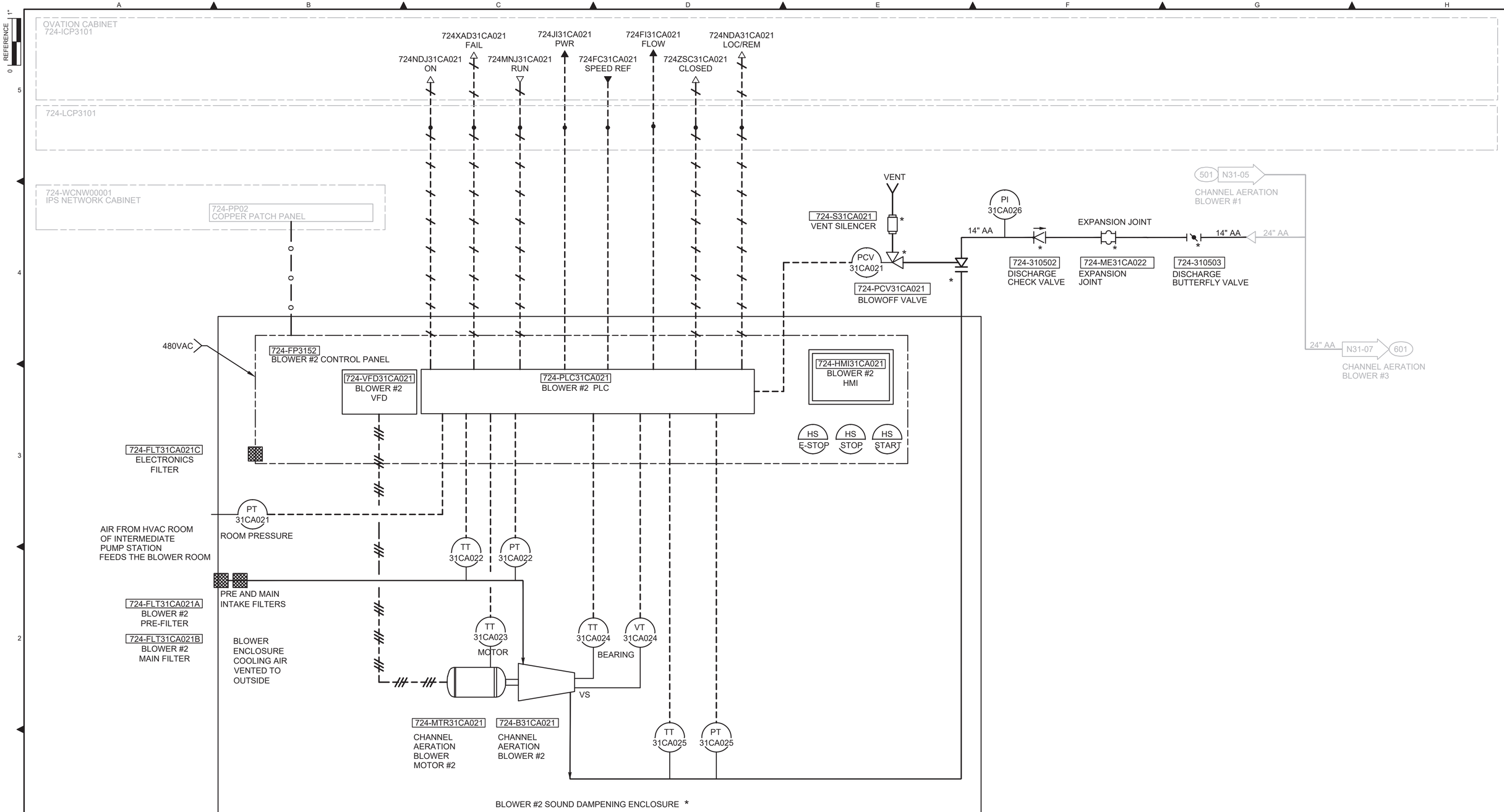

* VENDOR SUPPLIED ITEM

NO	REVISION DESCRIPTION	BY	APVD	DATE
0	BID ISSUE			4/17/2020

ch2m:

RICHARD A. PEARSON STATE OF WASHINGTON REGISTERED PROFESSIONAL ENGINEER 35596
2020.04.16 16:16:15-07'00'

DESIGNED/DRAWN: RP	CHECKED: SB
PROJECT ENGINEER: RP	SCALE: NONE
DESIGN APPROVAL: ES	FACILITY NUMBER: WP-724
PROJECT ACCEPTANCE: JRM	CONTRACT NO: C01397C20

King County

DEPARTMENT OF NATURAL RESOURCES & PARKS
WASTEWATER TREATMENT DIVISION
KING COUNTY WEST POINT TREATMENT PLANT
SECONDARY MIXED LIQUOR BLOWER REPLACEMENT

MIXED LIQUOR CHANNEL AERATION BLOWER #2 P&ID

DATE:	APRIL 2020
PROJECT FILE NO:	17-1123627
DRAWING NO:	N31-06
SHT NO / TOTAL	24 / 53
REV NO:	

BORDER FILE EDITION: KCWTD-2015R0-Dsize-TB-Border
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PLOTTED: Apr 17, 2020-04:14:06pm By rpearso6
XREFS: KC_ML_TitleBlock.dwg
IMAGES:

OVATION CABINET
724-ICP3103

724-LCP3101

724NDJ31CA031
ON

724XAD31CA031
FAIL

724JI31CA031
PWR

724FI31CA031
FLOW

480VAC

724-MCC02
UNIT 8
200 HP FVNR

RUN
ON
OFF
CURRENT

724-FP3153
BLOWER #3 CONTROL PANEL

QL ON | QL OFF | QL FAIL | QL HI BR T
SURG
HS S/S | LQ WARN | HS RST

OUTPUT
1
*** II
FI

BEARINGS
*** TLH INLT | *** VLH INLT
TLH OUTLT | VLH OUTLT

KEY NOTES:

1 EXISTING FLOW AND POWER MONITORING SMART METERS TO BE REPLACED WITH UNITS WITH DUAL ANALOG OUTPUTS

TE 31CA031
VE 31CA031
INLET BEARING

PI 31CA032

TE 31CA032
VE 31CA032
OUTLET BEARING

14" AA
724-FLT31CA031
CHANNEL AERATION
INTAKE FILTER

724-ME31CA031
CHANNEL AERATION
INTAKE SILENCER

14" AA
310601
14" AA
12" AA

CS

PI 31CA031

310602
310603
12" AA
24" AA

601 N31-06 24" AA
CHANNEL AERATION
BLOWER #2

24" AA
N31-08 701
CHANNEL AERATION
BLOWER #4

724-MTR31CA031
CHANNEL AERATION
BLOWER #3
MOTOR

724-B31CA031
CHANNEL AERATION
BLOWER #3

NO	REVISION DESCRIPTION	BY	APVD	DATE
0	BID ISSUE			4/17/2020

ch2m:

RICHARD A. PEARSON
STATE OF WASHINGTON
35596
REGISTERED PROFESSIONAL ENGINEER
2020.04.17 09:42:16-07'00'

DESIGNED/DRAWN: RP	CHECKED: SB
PROJECT ENGINEER: RP	SCALE: NONE
DESIGN APPROVAL: ES	FACILITY NUMBER: WP-724
PROJECT ACCEPTANCE: JRM	CONTRACT NO: C01397C20

King County

DEPARTMENT OF NATURAL RESOURCES & PARKS
WASTEWATER TREATMENT DIVISION
KING COUNTY WEST POINT TREATMENT PLANT
SECONDARY MIXED LIQUOR BLOWER REPLACEMENT

MIXED LIQUOR CHANNEL AERATION BLOWER #3 P&ID

DATE: APRIL 2020
PROJECT FILE NO: 17-1123627
DRAWING NO: N31-07
SHT NO 25 / TOTAL 53
REV NO:

BORDER FILE EDITION: KCWTD-2015R0-Dsize-TB-Border
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IMAGES:

OVATION CABINET
724-ICP3101

724NDJ31CA041
ON

724XAD31CA041
FAIL

724JI31CA041
PWR

724FI31CA041
FLOW

724-LCP3101

480VAC

724-MCC03
UNIT 8
200 HP FVNR

RUN
ON
OFF
CURRENT

724-FP3154
BLOWER #4 CONTROL PANEL

QL ON
QL OFF
QL FAIL
QL HI BR T
SURG
HS S/S
LQ WARN
HS RST

OUTPUT
BEARINGS

1
II
FI
*** TLH INLT
*** VLH INLT
TLH OUTLT
VLH OUTLT

KEY NOTES:

1 EXISTING FLOW AND POWER MONITORING SMART METERS TO BE REPLACED WITH UNITS WITH DUAL ANALOG OUTPUTS

TE 31CA041
VE 31CA041
INLET BEARING

PI 31CA042

14" AA
14" AA
310701
14" AA
12" AA

724-FLT31CA041
CHANNEL AERATION INTAKE FILTER

724-ME31CA041
CHANNEL AERATION INTAKE SILENCER

TE 31CA042
VE 31CA042
OUTLET BEARING

CS

PI 31CA041

310702
310703
12" AA
24" AA

724-MTR31CA041
CHANNEL AERATION BLOWER #4 MOTOR

724-B31CA041
CHANNEL AERATION BLOWER #4

701 N31-07 24" AA
CHANNEL AERATION BLOWER #3

N07-06 1905
MIXED LIQUOR CHANNEL

N07-07 1906
MIXED LIQUOR CHANNEL

NO	REVISION DESCRIPTION	BY	APVD	DATE
0	BID ISSUE			4/17/2020

ch2m:

RICHARD A. PEARSON
STATE OF WASHINGTON
35596
REGISTERED PROFESSIONAL ENGINEER
09:42:50-07'00'

DESIGNED/DRAWN: RP	CHECKED: SB
PROJECT ENGINEER: RP	SCALE: NONE
DESIGN APPROVAL: ES	FACILITY NUMBER: WP-724
PROJECT ACCEPTANCE: JRM	CONTRACT NO: C01397C20

King County

DEPARTMENT OF NATURAL RESOURCES & PARKS
WASTEWATER TREATMENT DIVISION
KING COUNTY WEST POINT TREATMENT PLANT
SECONDARY MIXED LIQUOR BLOWER REPLACEMENT

MIXED LIQUOR CHANNEL AERATION BLOWER #4 P&ID

DATE: APRIL 2020
PROJECT FILE NO: 17-1123627
DRAWING NO: N31-08
SHT NO 26 / TOTAL 53
REV NO:

BORDER FILE EDITION: KCWTD-2015R0-Dsize-TB-Border
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XREFS: KC_ML_TitleBlock.dwg
IMAGES:

724-WCNW00001
IPS BUILDING - NETWORK CABINET
OVATION DCS NETWORK
OVATION PLC NETWORK
POWER MONITORING NETWORK

724-WP-SW12-FO
24 PORT SWITCH
OVATION NETWORK SWITCH
FANOUT - 2

724-WP-SW12-PFO
24 PORT SWITCH
OVATION NETWORK SWITCH
PARTNER FANOUT - 2

724-SWPM01
24 PORT SWITCH
POWER MONITORING NETWORK SWITCH

724-WP-SW-PLC-FO4
24 PORT SWITCH
OVATION PLC NETWORK SWITCH

724-PP01
COPPER PATCH PANEL
ETHERNET 1U 24 PORT
CAT5e PATCH PANEL
OVATION SYSTEM

724-PP02
COPPER PATCH PANEL
ETHERNET 1U 24 PORT
CAT5e PATCH PANEL

10 11 19 20 21 22 23 24

(CAT5e PATCH)
(CAT5e PATCH)
1
2
5
LAND ON PORTS 19 - 24

(1-CAT5e CABLES)
(1-CAT5e CABLES)
(2-CAT5e CABLES)
(2-CAT5e CABLES)

724-MCC02
UNIT 2
CAT5e PATCH BOX
POWER METER
(CAT5e PATCH)
1
IP ADDRESS: 10.14.1.44
SUBNET: 255.255.255.0

724-MCC03
UNIT 2
CAT5e PATCH BOX
POWER METER
(CAT5e PATCH)
2
IP ADDRESS: 10.14.1.45
SUBNET: 255.255.255.0

724-B31CA011
CHANNEL AERATION
BLOWER #1 PANEL
IPS BUILDING
OPERATING FLOOR
CAT5e PATCH PANEL
(CAT5e PATCH)
3
BLOWER #1 VENDOR ETHERNET SWITCH
BLOWER #1 VENDOR FIREWALL
BLOWER #1 VENDOR PLC
BLOWER #1 VENDOR OIT
IP ADDRESS: 172.17.0.90
SUBNET: 255.255.254.0
IP ADDRESS: 172.17.0.91
SUBNET: 255.255.254.0

724-B31CA021
CHANNEL AERATION
BLOWER #2 PANEL
IPS BUILDING
OPERATING FLOOR
CAT5e PATCH PANEL
(CAT5e PATCH)
4
BLOWER #2 VENDOR ETHERNET SWITCH
BLOWER #2 VENDOR FIREWALL
BLOWER #2 VENDOR PLC
BLOWER #2 VENDOR OIT
IP ADDRESS: 172.17.0.92
SUBNET: 255.255.254.0
IP ADDRESS: 172.17.0.93
SUBNET: 255.255.254.0

BLOWER VENDER SUPPLIED

KEY NOTES

1. PATCH POWER MONITOR IN 724-MCC02 THROUGH TO SWITCH 724-SWPP01 PORT 10 WITH ORANGE COLOR PATCH CABLES.
2. PATCH POWER MONITOR IN 724-MCC03 THROUGH TO SWITCH 724-SWPP01 PORT 11 WITH ORANGE COLOR PATCH CABLES.
3. PATCH NETWORK SWITCH IN 724-B31CA011 THROUGH TO PATCH PANEL ONLY WITH RED COLOR PATCH CABLES.
4. PATCH NETWORK SWITCH IN 724-B31CA021 THROUGH TO PATCH PANEL ONLY WITH RED COLOR PATCH CABLES.
5. CONNECTION TO BLOWERS PROVIDED FOR FUTURE USE.

NO	REVISION DESCRIPTION	BY	APVD	DATE
0	BID ISSUE			4/17/2020

ch2m:

RICHARD A. PEARSON STATE OF WASHINGTON 35596 REGISTERED PROFESSIONAL ENGINEER
2020.04.09 09:40:06-07'00'

DESIGNED/DRAWN: RP	CHECKED: SB
PROJECT ENGINEER: RP	SCALE: NONE
DESIGN APPROVAL: ES	FACILITY NUMBER: WP-724
PROJECT ACCEPTANCE: JRM	CONTRACT NO: C01397C20

King County

DEPARTMENT OF NATURAL RESOURCES & PARKS
WASTEWATER TREATMENT DIVISION
KING COUNTY WEST POINT TREATMENT PLANT
SECONDARY MIXED LIQUOR BLOWER REPLACEMENT

CHANNEL AERATION OVATION PLC ETHERNET NETWORK

DATE:	APRIL 2020
PROJECT FILE NO:	17-1123627
DRAWING NO:	J24225
SHT NO / TOTAL	27 / 53
REV NO:	

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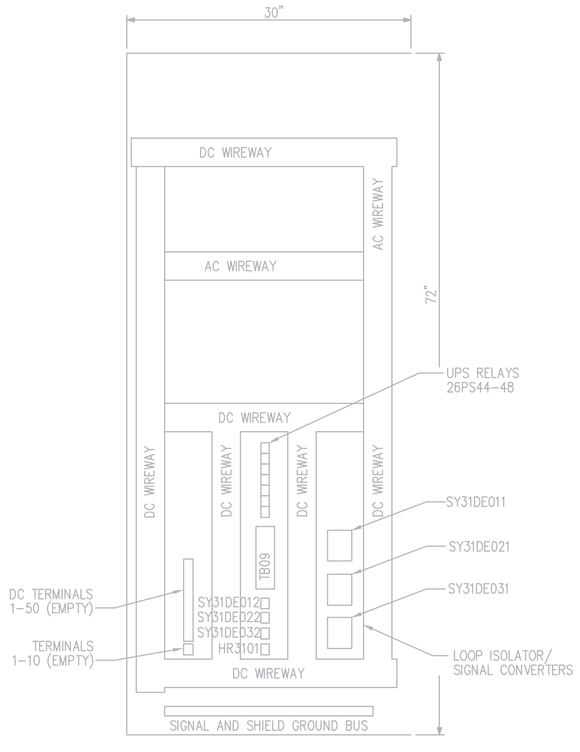
XREFS: KC_ML_TitleBlock.dwg
IMAGES:

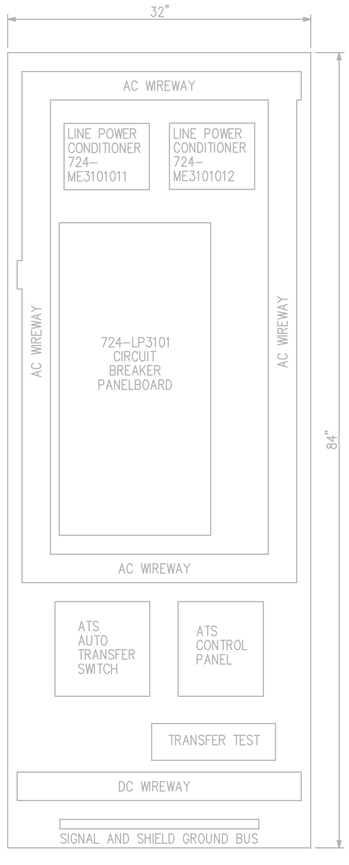
KEY NOTES

1. ALL SPARE WIRES ARE TO BE LANDED ON A TERMINAL AND PROPERLY LABELED AS SPARE AND ITS SOURCE LOCATION.
2. ADD ADDITIONAL TERMINALS AS REQUIRED TO ACCOMMODATE SPARE WIRES

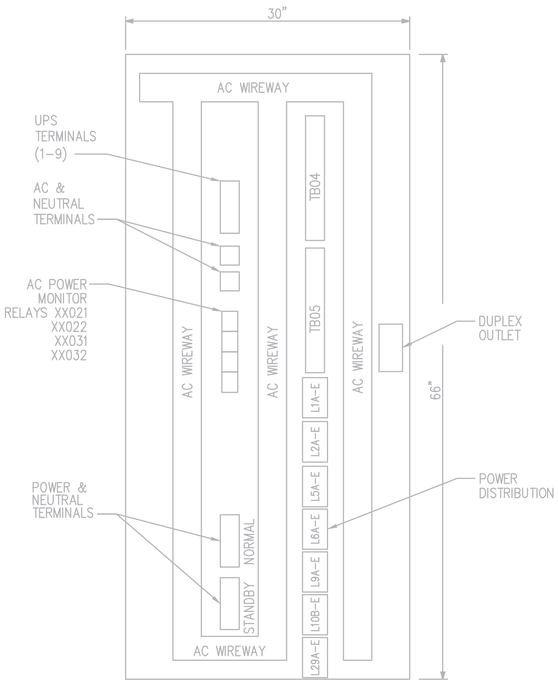
IPS CONTROL PANEL - 724-LCP3101A
SECTION A



724-LCP3101A (LEFT SUBPANEL)



724-LCP3101A (BACK SUBPANEL)



724-LCP3101A (RIGHT SUBPANEL)

FOR TERMINAL LOCATION
REFERENCE

NO	REVISION DESCRIPTION	BY	APVD	DATE
0	BID ISSUE			4/17/2020

ch2m:

RICHARD A. PETERSON
STATE OF WASHINGTON
35596
REGISTERED
PROFESSIONAL ENGINEER
2020.04.17 09:37:54-07'00'

DESIGNED/DRAWN: RP	CHECKED: SB
PROJECT ENGINEER: RP	SCALE: NONE
DESIGN APPROVAL: ES	FACILITY NUMBER: WP-724
PROJECT ACCEPTANCE: JRM	CONTRACT NO: C01397C20

King County

DEPARTMENT OF NATURAL RESOURCES & PARKS
WASTEWATER TREATMENT DIVISION
KING COUNTY WEST POINT TREATMENT PLANT
SECONDARY MIXED LIQUOR BLOWER REPLACEMENT

INTERMEDIATE PUMP STATION PANEL LCP3101 SUBPANEL A

DATE:	APRIL 2020
PROJECT FILE NO:	17-1123627
DRAWING NO:	J2404A
SHT NO / TOTAL	28 / 53
REV NO:	

BORDER FILE EDITION: KCWTD-2015R0-Dsize-TB-Border
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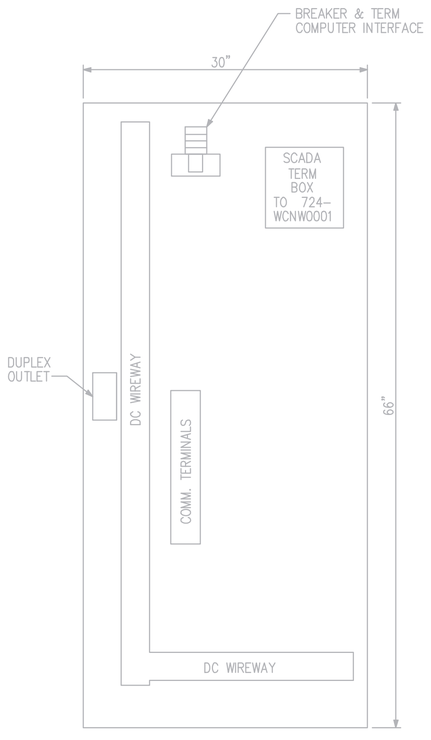
XREFS: KC_ML_TitleBlock.dwg
IMAGES:

REFERENCE 0 1"

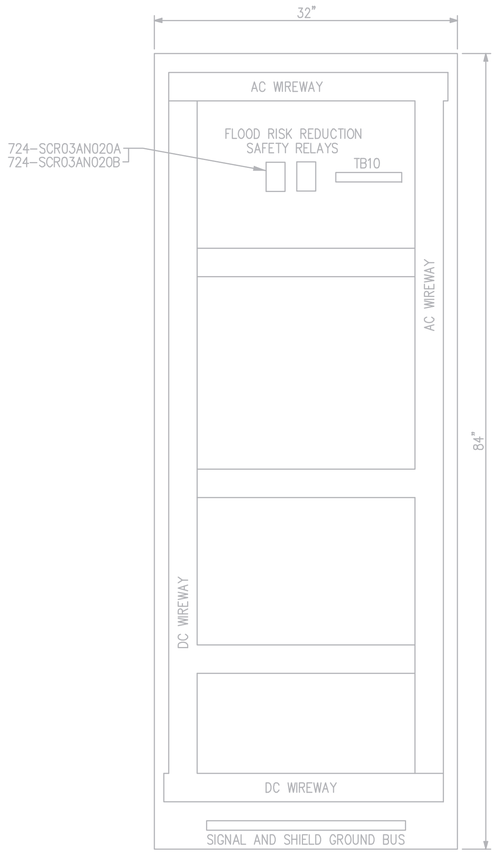
KEY NOTES

1. ALL SPARE WIRES ARE TO BE LANDED ON A TERMINAL AND PROPERLY LABELED AS SPARE AND ITS SOURCE LOCATION.
2. ADD ADDITIONAL TERMINALS AS REQUIRED TO ACCOMMODATE SPARE WIRES

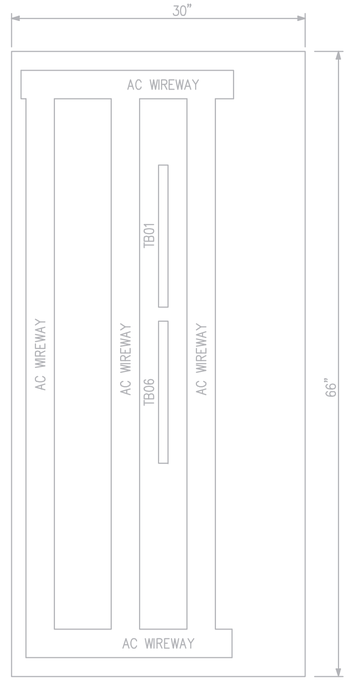
IPS CONTROL PANEL - 724-LCP3101B
SECTION B



724-LCP3101B (LEFT SUBPANEL)



724-LCP3101B (BACK SUBPANEL)



724-LCP3101B (RIGHT SUBPANEL)

FOR TERMINAL LOCATION
REFERENCE

NO	REVISION DESCRIPTION	BY	APVD	DATE
0	BID ISSUE			4/17/2020

ch2m:

RICHARD A. PEARSON STATE OF WASHINGTON 35596 REGISTERED PROFESSIONAL ENGINEER
09:30:26-07'00'

DESIGNED/DRAWN: RP	CHECKED: SB
PROJECT ENGINEER: RP	SCALE: NONE
DESIGN APPROVAL: ES	FACILITY NUMBER: WP-724
PROJECT ACCEPTANCE: JRM	CONTRACT NO: C01397C20

King County

DEPARTMENT OF NATURAL RESOURCES & PARKS
WASTEWATER TREATMENT DIVISION
KING COUNTY WEST POINT TREATMENT PLANT
SECONDARY MIXED LIQUOR BLOWER REPLACEMENT

INTERMEDIATE PUMP STATION PANEL LCP3101 SUBPANEL B

DATE: APRIL 2020
PROJECT FILE NO: 17-1123627
DRAWING NO: J2404B
SHT NO 29 / TOTAL 53 | REV NO:

BORDER FILE EDITION: KCWTD-2015R0-Dsize-TB-Border
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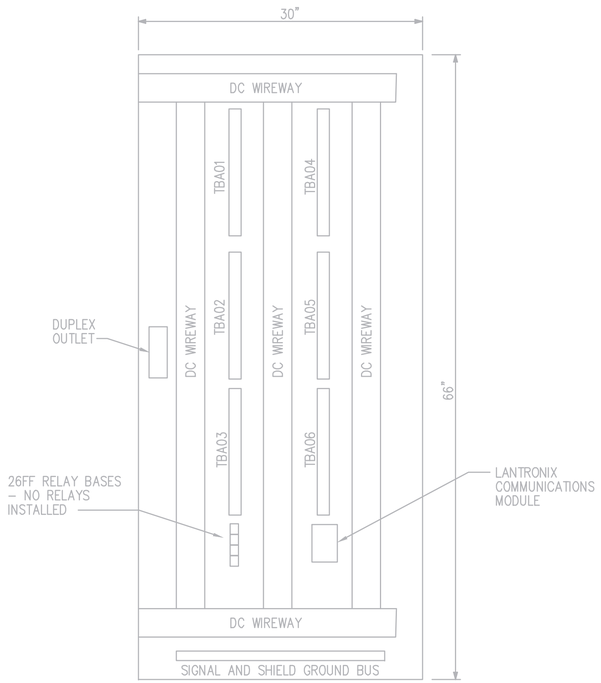
PLOTTED: Apr 17, 2020-08:31:20am By rpearso6
XREFS: KC_ML_TitleBlock.dwg
IMAGES:

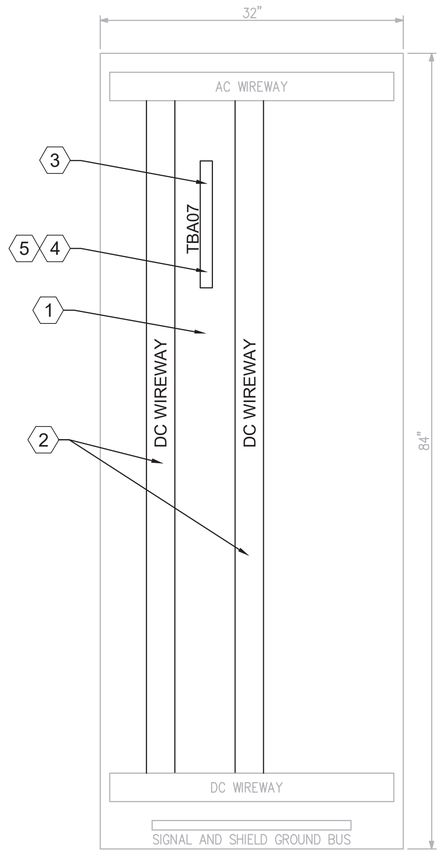
KEY NOTES

1. INSTALL FULL HEIGHT DIN RAIL TO ALLOW FOR FUTURE TERMINALS.
2. 3" X 5" WIDE SLOTTED WIREWAY WITH COVER INSTALLED FULL HEIGHT.
3. INSTALL NEW TERMINAL STRIP TBA07 WITH 51 PASS-THROUGH TERMINALS, TERMINAL STRIP LABEL, EACH TERMINAL LABELED 1-51, AND END ANCHORS.
4. TERMINATE ALL SPARE WIRES AND CABLES ON TERMINALS. LABEL AS SPARE.
5. ADD ADDITIONAL TERMINALS AS REQUIRED TO ACCOMMODATE SPARE WIRES

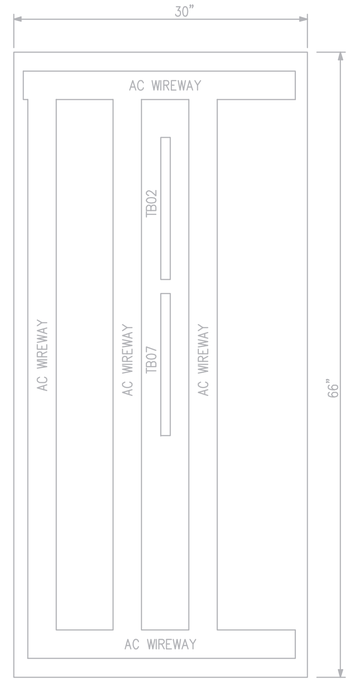
IPS CONTROL PANEL - 724-LCP3101C
SECTION C



724-LCP3101C (LEFT SUBPANEL)



724-LCP3101C (BACK SUBPANEL)



724-LCP3101C (RIGHT SUBPANEL)

NO	REVISION DESCRIPTION	BY	APVD	DATE
0	BID ISSUE			4/17/2020

RICHARD A. PEARSON STATE OF WASHINGTON 35596 REGISTERED PROFESSIONAL ENGINEER
2020.04.24 09:37:41-07'00'

DESIGNED/DRAWN: RP	CHECKED: SB
PROJECT ENGINEER: RP	SCALE: NONE
DESIGN APPROVAL: ES	FACILITY NUMBER: WP-724
PROJECT ACCEPTANCE: JRM	CONTRACT NO: C01397C20

King County

DEPARTMENT OF NATURAL RESOURCES & PARKS
WASTEWATER TREATMENT DIVISION
KING COUNTY WEST POINT TREATMENT PLANT
SECONDARY MIXED LIQUOR BLOWER REPLACEMENT

INTERMEDIATE PUMP STATION PANEL LCP3101 SUBPANEL C

DATE:	APRIL 2020
PROJECT FILE NO:	17-1123627
DRAWING NO:	J2405A
SHT NO / TOTAL	30 / 53
REV NO:	

BORDER FILE EDITION: KCWTD-2015R0-Dsize-TB-Border
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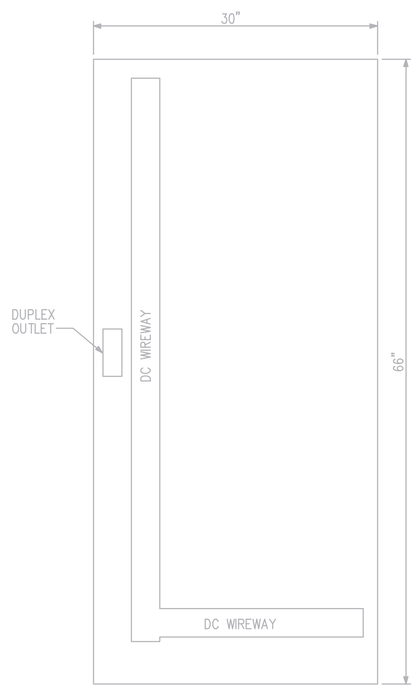
PLOTTED: Apr 17, 2020-08:31:22am By rpearso6
XREFS: KC_ML_TitleBlock.dwg
IMAGES:

REFERENCE 1" 0

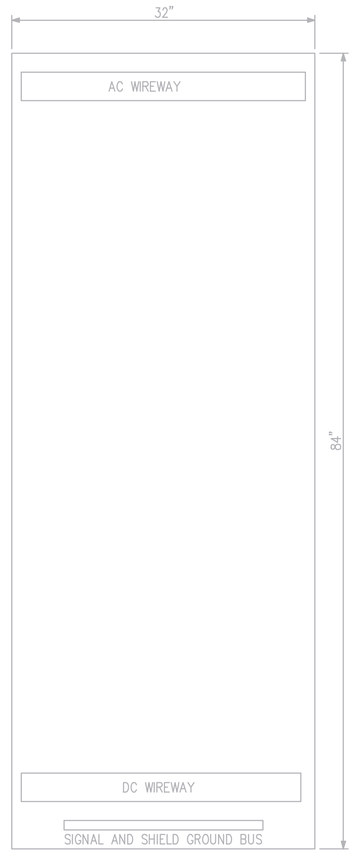
KEY NOTES

1. ALL SPARE WIRES ARE TO BE LANDED ON A TERMINAL AND PROPERLY LABELED AS SPARE AND ITS SOURCE LOCATION.
2. ADD ADDITIONAL TERMINALS AS REQUIRED TO ACCOMMODATE SPARE WIRES

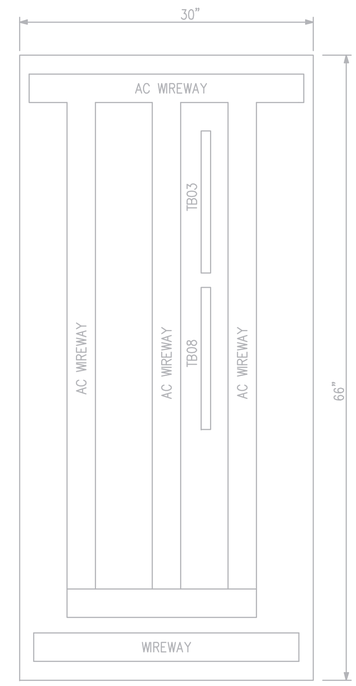
IPS CONTROL PANEL - 724-LCP3101D
SECTION D



724-LCP3101D (LEFT SUBPANEL)



724-LCP3101D (BACK SUBPANEL)



724-LCP3101D (RIGHT SUBPANEL)

FOR REFERENCE ONLY

NO	REVISION DESCRIPTION	BY	APVD	DATE
0	BID ISSUE			4/17/2020

ch2m:

RICHARD A. PEARSON STATE OF WASHINGTON 35596 REGISTERED PROFESSIONAL ENGINEER
2020.04.09 09:37:11-07'00'

DESIGNED/DRAWN: RP	CHECKED: SB
PROJECT ENGINEER: RP	SCALE: NONE
DESIGN APPROVAL: ES	FACILITY NUMBER: WP-724
PROJECT ACCEPTANCE: JRM	CONTRACT NO: C01397C20

King County

DEPARTMENT OF NATURAL RESOURCES & PARKS
WASTEWATER TREATMENT DIVISION
KING COUNTY WEST POINT TREATMENT PLANT
SECONDARY MIXED LIQUOR BLOWER REPLACEMENT

INTERMEDIATE PUMP STATION PANEL LCP3101 SUBPANEL D

DATE: APRIL 2020
PROJECT FILE NO: 17-1123627
DRAWING NO: **J2405B**
SHT NO 31 / TOTAL 53 | REV NO:

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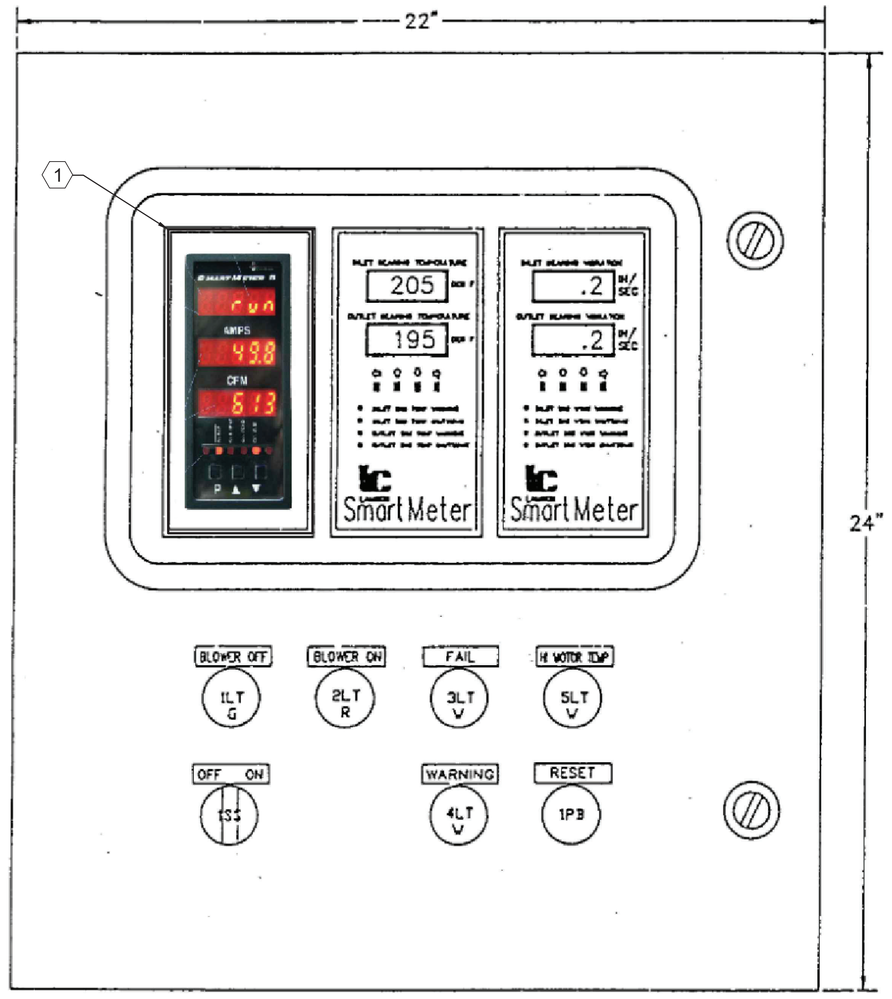
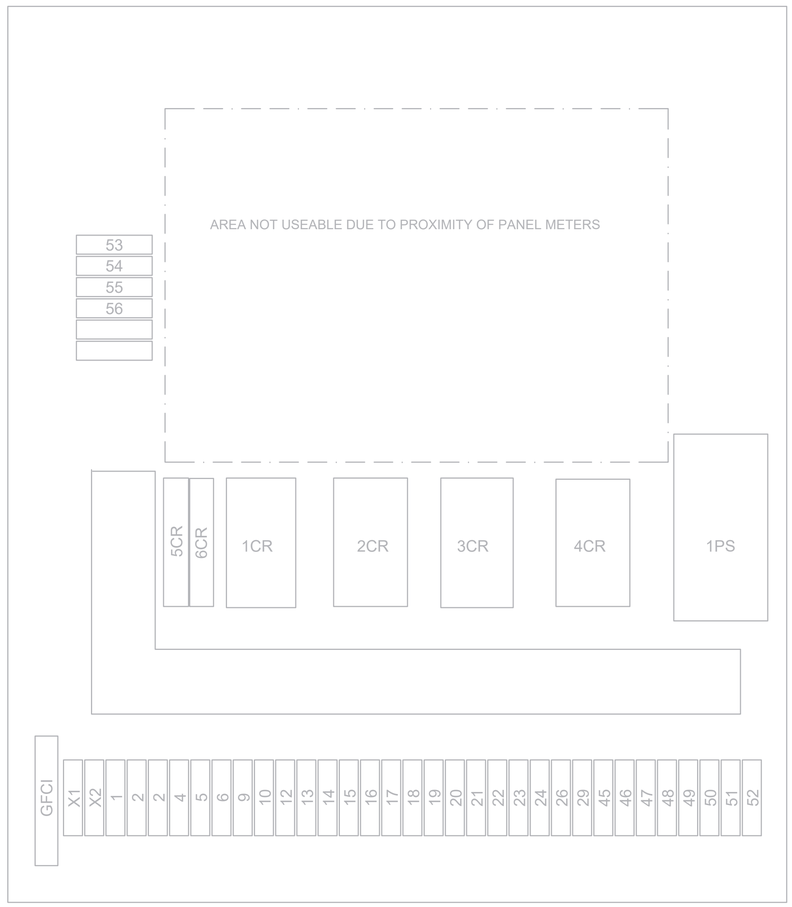


DOOR LAYOUT



PANEL LAYOUT

KEY NOTES

1. FIELD PANEL IS EXISTING. REPLACE EXISTING FLOW AND POWER METER WITH NEW SMARTMETER II USING KIT OPTION THAT CREATES A DIRECT REPLACEMENT, INCLUDE TWO ANALOG OUTPUT OPTION.

* – SHIPPED LOOSE

5,6CR		RH1BU-120	IDEC	1POLE CONTROL RELAY
GFCI	1	CHB1150F	C-H	GROUND FAULT INTERUPT
1PS	1	HB24 1.2	INTER/POWER	24VDC POWER SUPPLY
1TH	1	PER MOTOR MANF.		THERMISTOR MODULE
1TM	1	SM100097	LAWSON	SMART METER, BEARING TEMP
1VM	1	SM100098	LAWSON	SMART METER, BEARING VIBRAT
1VT	2	MODEL 191-1	BALMAC	VIBRATION TRANSDUCER
1CM	1	SM100090	LAWSON	SMART METER, SURGE/OVERLOAD
1CT *	1	T1805HT251	INST TRANS	CURRENT TRANSFORMER
2LT	1	ALD29911N-R-120	IDEC	RED PILOT LIGHT, PTT
1LT	1	ALD29911N-G-120	IDEC	GREEN PILOT LIGHT, PTT
1PB	1	ABD11GN	IDEC	FL HD PUSHBUTTON, + 1NC
1SS	1	ASD210N	IDEC	2 POSITION SELECTOR SWITCH
3-5LT	3	ALD29911N-W-120	IDEC	WHITE PILOT LIGHT, PTT
1-4CR	4	RR3BU-120	IDEC	CONTROL RELAY
1ENCL	1	SPECIAL	COXLINE	ENCLOSURE, NEMA12, 24X22X12

NO	REVISION DESCRIPTION	BY	APVD	DATE
0	BID ISSUE			4/17/2020

ch2m:

RICHARD A. PEARSON STATE OF WASHINGTON 35596 REGISTERED PROFESSIONAL ENGINEER
2020.04.17 09:37:25-07'00'

DESIGNED/DRAWN: RP	CHECKED: SB
PROJECT ENGINEER: RP	SCALE: NONE
DESIGN APPROVAL: ES	FACILITY NUMBER: WP-724
PROJECT ACCEPTANCE: JRM	CONTRACT NO: C01397C20

King County

DEPARTMENT OF NATURAL RESOURCES & PARKS
WASTEWATER TREATMENT DIVISION
KING COUNTY WEST POINT TREATMENT PLANT
SECONDARY MIXED LIQUOR BLOWER REPLACEMENT

MIXED LIQUOR MOTOR/BLOWER CONTROL PANELS 724-FP3153 PANEL LAYOUT

DATE:	APRIL 2020
PROJECT FILE NO:	17-1123627
DRAWING NO:	J2443
SHT NO / TOTAL	32 / 53
REV NO:	

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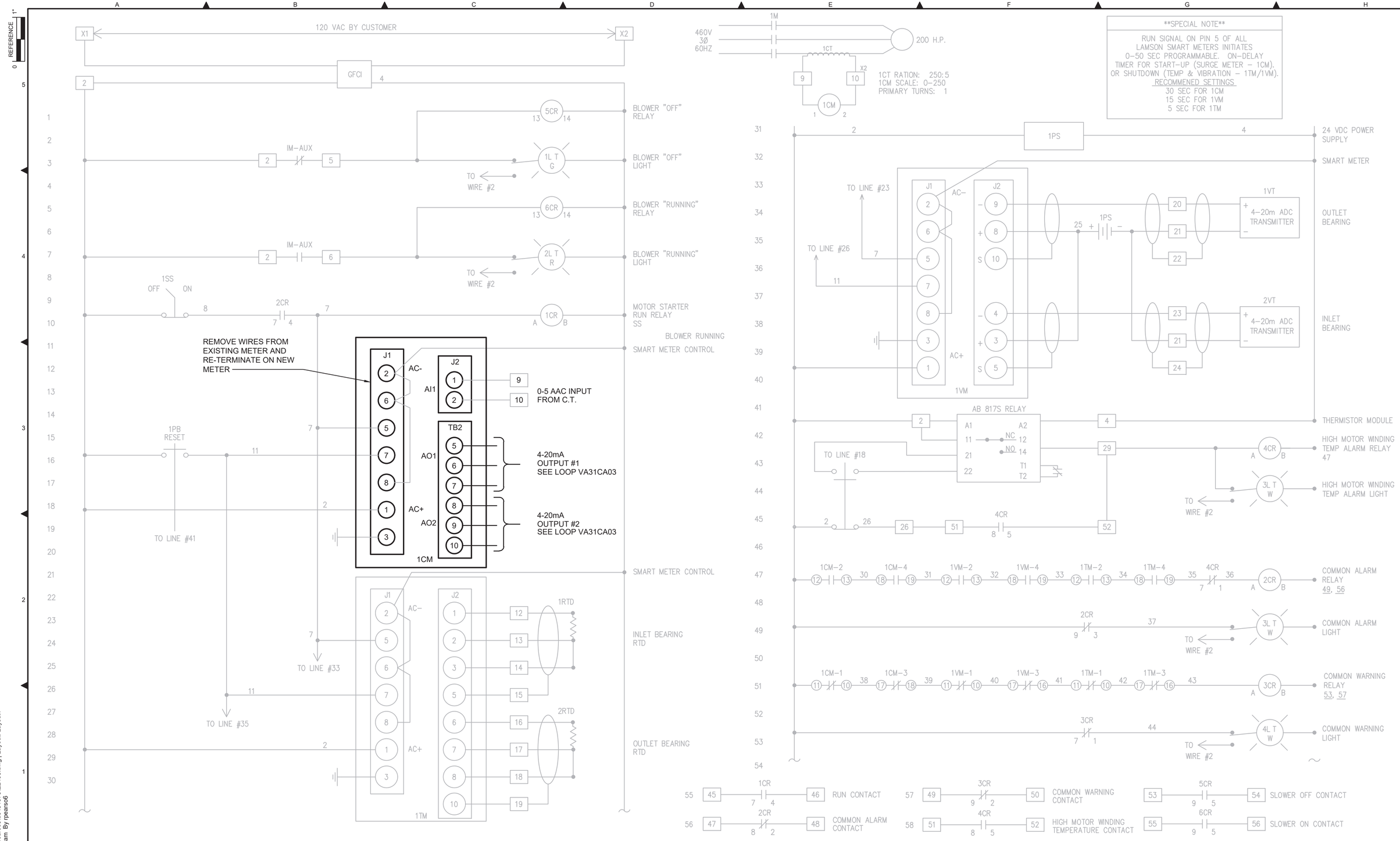

NO	REVISION DESCRIPTION	BY	APVD	DATE
0	BID ISSUE			4/17/2020

ch2m:

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2020.04.17 09:09:45-07'00'

DESIGNED/DRAWN: RP	CHECKED: SB
PROJECT ENGINEER: RP	SCALE: NONE
DESIGN APPROVAL: ES	FACILITY NUMBER: WP-724
PROJECT ACCEPTANCE: JRM	CONTRACT NO: C01397C20

King County

DEPARTMENT OF NATURAL RESOURCES & PARKS
WASTEWATER TREATMENT DIVISION
KING COUNTY WEST POINT TREATMENT PLANT
SECONDARY MIXED LIQUOR BLOWER REPLACEMENT

MIXED LIQUOR MOTOR/BLOWER PANEL 724-FP3153 CONTROL DIAGRAM

DATE: APRIL 2020
PROJECT FILE NO: 17-1123627
DRAWING NO: E2493
SHT NO / TOTAL: 33 / 53
REV NO:

BORDER FILE EDITION: KCWTD-2015R0-Dsize-TB-Border
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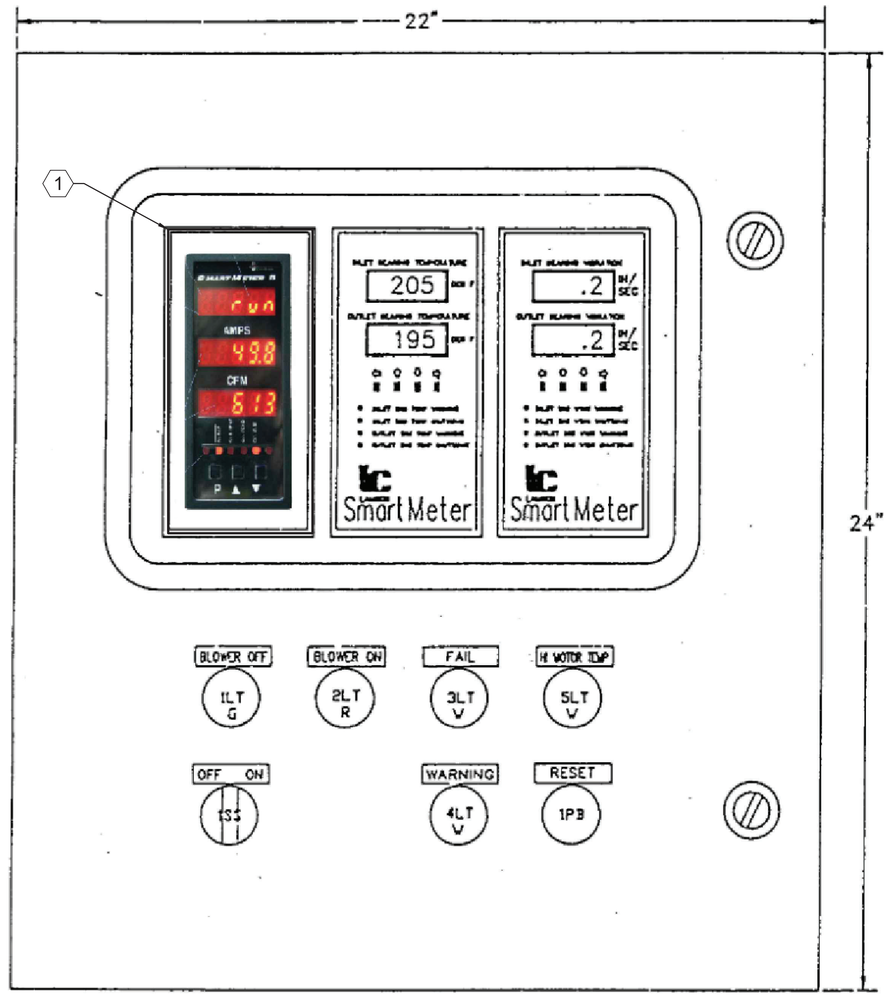
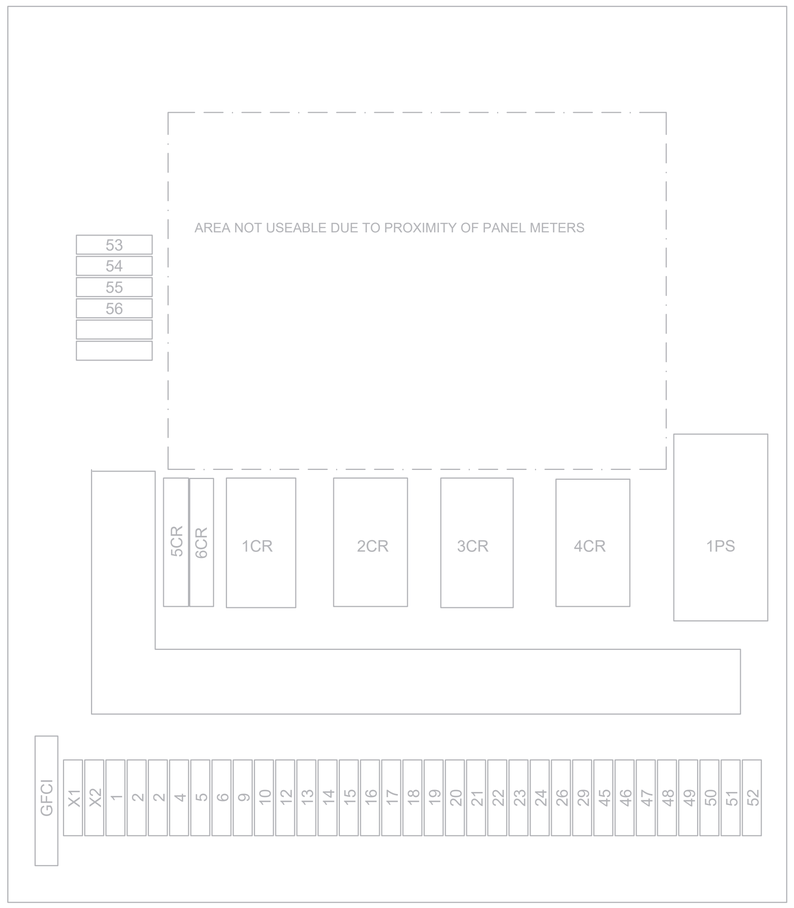


DOOR LAYOUT



PANEL LAYOUT

KEY NOTES

1. FIELD PANEL IS EXISTING. REPLACE EXISTING FLOW AND POWER METER WITH NEW SMARTMETER II USING KIT OPTION THAT CREATES A DIRECT REPLACEMENT, INCLUDE TWO ANALOG OUTPUT OPTION.

* – SHIPPED LOOSE

5,6CR		RH1BU-120	IDEC	1POLE CONTROL RELAY
GFCI	1	CHB1150F	C-H	GROUND FAULT INTERUPT
1PS	1	HB24 1.2	INTER/POWER	24VDC POWER SUPPLY
1TH	1	PER MOTOR MANF.		THERMISTOR MODULE
1TM	1	SM100097	LAMSON	SMART METER, BEARING TEMP
1VM	1	SM100098	LAMSON	SMART METER, BEARING VIBRAT
1VT	2	MODEL 191-1	BALMAC	VIBRATION TRANSDUCER
1CM	1	SM100090	LAMSON	SMART METER, SURGE/OVERLOAD
1CT *	1	T1805HT251	INST TRANS	CURRENT TRANSFORMER
2LT	1	ALD29911N-R-120	IDEC	RED PILOT LIGHT, PTT
1LT	1	ALD29911N-G-120	IDEC	GREEN PILOT LIGHT, PTT
1PB	1	ABD11GN	IDEC	FL HD PUSHBUTTON, + 1NC
1SS	1	ASD210N	IDEC	2 POSITION SELECTOR SWITCH
3-5LT	3	ALD29911N-W-120	IDEC	WHITE PILOT LIGHT, PTT
1-4CR	4	RR3BU-120	IDEC	CONTROL RELAY
1ENCL	1	SPECIAL	COXLINE	ENCLOSURE, NEMA12, 24X22X12

NO	REVISION DESCRIPTION	BY	APVD	DATE
0	BID ISSUE			4/17/2020

ch2m:

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2020.04.17 09:36:44-07'00'

DESIGNED/DRAWN: RP	CHECKED: SB
PROJECT ENGINEER: RP	SCALE: NONE
DESIGN APPROVAL: ES	FACILITY NUMBER: WP-724
PROJECT ACCEPTANCE: JRM	CONTRACT NO: C01397C20

King County

DEPARTMENT OF NATURAL RESOURCES & PARKS
WASTEWATER TREATMENT DIVISION
KING COUNTY WEST POINT TREATMENT PLANT
SECONDARY MIXED LIQUOR BLOWER REPLACEMENT

MIXED LIQUOR MOTOR/BLOWER CONTROL PANELS 724-FP3154 PANEL LAYOUT

DATE:	APRIL 2020
PROJECT FILE NO:	17-1123627
DRAWING NO:	J2444
SHT NO / TOTAL	34 / 53
REV NO:	

BORDER FILE EDITION: KCWTD-2015R0-Dsize-TB-Border
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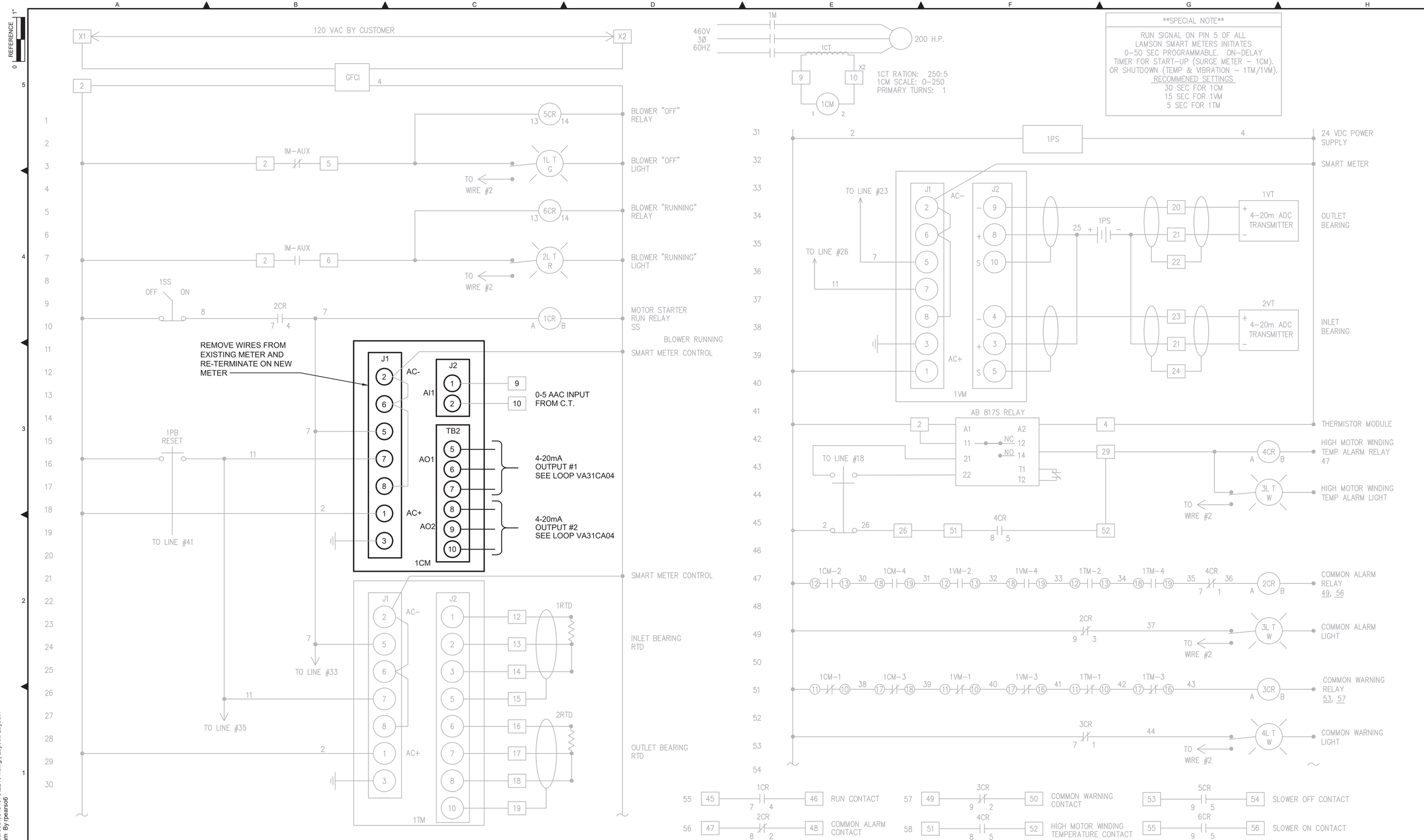

NO	REVISION DESCRIPTION	BY	APVD	DATE
0	BID ISSUE			4/17/2020

ch2m:

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2020.04.17 09:08:04-07'00'

DESIGNED/DRAWN: RP	CHECKED: SB
PROJECT ENGINEER: RP	SCALE: NONE
DESIGN APPROVAL: ES	FACILITY NUMBER: WP-724
PROJECT ACCEPTANCE: JRM	CONTRACT NO: C01397C20

King County

DEPARTMENT OF NATURAL RESOURCES & PARKS
WASTEWATER TREATMENT DIVISION
KING COUNTY WEST POINT TREATMENT PLANT
SECONDARY MIXED LIQUOR BLOWER REPLACEMENT

MIXED LIQUOR MOTOR/BLOWER PANEL 724-FP3154 CONTROL DIAGRAM

DATE: APRIL 2020
PROJECT FILE NO: 17-1123627
DRAWING NO: E2494
SHT NO 35 / TOTAL 53
REV NO:

BORDER FILE EDITION: KCWTD-2015R0-Dsize-TB-Border
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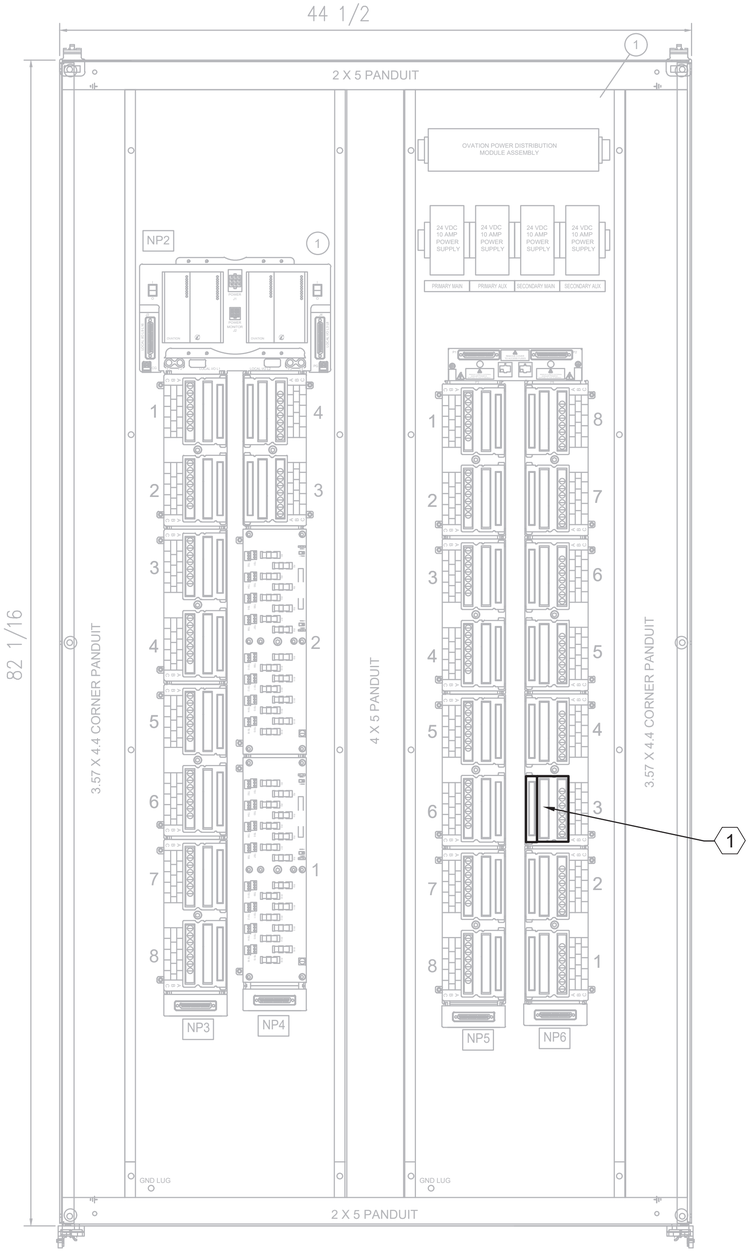

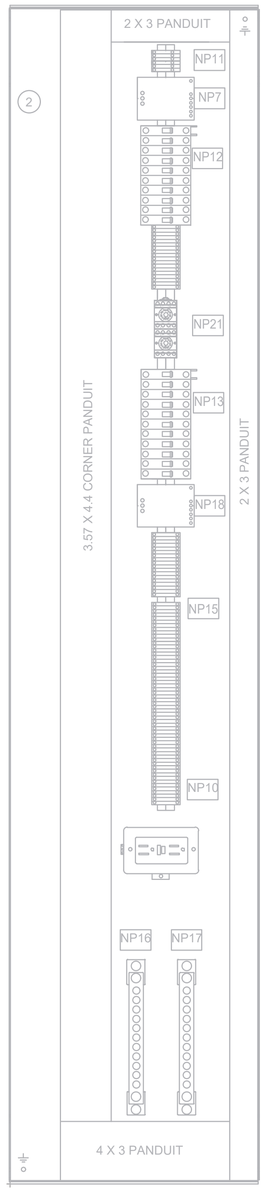

KEY NOTES

1. NEW ANALOG INPUT CARD SET IN BRANCH 04 SLOT 03 SEE I/O CARD DRAWING J24230.

NAME PLATE No.	NAMEPLATE INSCRIPTION	
	LINE 1	LINE 2
NP1	(NOT USED)	
NP2	PROCESSOR	DROP 017/077
NP3	BRANCH	1
NP4	BRANCH	2
NP5	BRANCH	3
NP6	BRANCH	4
NP7	FILTER/SURGE	724-EE31OV131
NP8	PANEL TEMP	724-TE31OV101
NP9	PANEL TEMP	724-TT31OV101
NP10	FOR PROGRAMMING	USE ONLY
NP11	TB01	120VAC FEED
NP12	TB02	120VAC
NP13	TB03	UPS 120VAC
NP14	TB04	24VDC
NP15	TB05	NEUTRAL TERMINALS
NP16	SIGNAL	GROUND BAR
NP17	EQUIPMENT	GROUND BAR
NP18	FILTER/SURGE	724-EE31OV132
NP19		
NP20	OVATION NETWORK	724-UPP3101A
NP21	724-CR31OV111	724-CR31OV121

POSITION	BRANCH 1	TYPE
1		120VAC DI
2		120VAC DI
3		120VAC DI
4		(SPARE)
5		(SPARE)
6		(SPARE)
7		(SPARE)
8		(SPARE)

POSITION	BRANCH 2	TYPE
4		(SPARE)
3		(SPARE)
2		DO RLY
1		DO RLY

POSITION	BRANCH 3	TYPE
1		(SPARE)
2		(SPARE)
3		(SPARE)
4		(SPARE)
5		(SPARE)
6		(SPARE)
7		(SPARE)
8		(SPARE)

POSITION	BRANCH 4	TYPE
8		(SPARE)
7		(SPARE)
6		AO
5		AO
4		(SPARE)
3		AI
2		AI
1		AI

1

BORDER FILE EDITION: KCWTD-2015R0-Dsize-TB-Border
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IMAGES:

NO	REVISION DESCRIPTION	BY	APVD	DATE
0	BID ISSUE			4/17/2020

ch2m:

RICHARD A. PEARSON STATE OF WASHINGTON 35596 REGISTERED PROFESSIONAL ENGINEER
2020.04.17 09:36:58-07'00'

DESIGNED/DRAWN:	CHECKED:
RP	SB
PROJECT ENGINEER:	SCALE:
RP	NONE
DESIGN APPROVAL:	FACILITY NUMBER:
ES	WP-724
PROJECT ACCEPTANCE:	CONTRACT NO:
JRM	C01397C20

King County

DEPARTMENT OF NATURAL RESOURCES & PARKS
WASTEWATER TREATMENT DIVISION
KING COUNTY WEST POINT TREATMENT PLANT
SECONDARY MIXED LIQUOR BLOWER REPLACEMENT

IPS PUMP 1
OVATION CONTROL PANEL
LAYOUT 724-ICP3101

DATE:	
APRIL 2020	
PROJECT FILE NO:	
17-1123627	
DRAWING NO:	
J24184	
SHT NO / TOTAL	REV NO:
36 / 53	

REFERENCE 1" 0

INTERMEDIATE PUMP STATION

724-LCP3101

724-LCP3101

724–C24501

TB04 1	VA31AF01A		VA31AF01A
TB04 2	VA31AF01B		VA31AF01B
TB04 3	VA31AF02A		VA31AF02A
TB04 4	VA31AF02B		VA31AF02B
SEE DWG: VA31CA01 — TB05 1	VA31CA01A		VA31CA01A
SEE DWG: VA31CA01 — TB05 2	VA31CA01B		VA31CA01B
TB05 3	VA31CA01C		VA31CA01C
TB05 16	VA31CA04A		VA31CA04A
TB05 17	VA31CA04B		VA31CA04B
TB05 18	VA31CA04C		VA31CA04C
TB06 22	VA31EA02A		VA31EA02A
TB06 23	VA31EA02B		VA31EA02B
TB04 14	VA26FF01A		VA26FF01A
TB04 15	VA26FF01B		VA26FF01B
TB04 16	VA26FF01C		VA26FF01C
TB04 17	VA26FF01D		VA26FF01D
TB05	1310A (SPARE)	1310B (SPARE)	
SEE DWG: VA31CA01 — TB05 26	VA31CA01D		VA31CA01D
TB05	1311A (SPARE)	1311B (SPARE)	
SEE DWG: VA31CA01 — TB05 27	VA31CA01E		VA31CA01E
	1312A (SPARE)		1312A (SPARE)
	1312B (SPARE)		1312B (SPARE)
	1313A (SPARE)		1313A (SPARE)
	1313B (SPARE)		1313B (SPARE)
	1314A (SPARE)		1314A (SPARE)
	1314B (SPARE)		1314B (SPARE)

C NO — 724–CR310V111A (SEE DWG J24185)

J24185A	
J24185B	

C NO — 724–CR310V121A (SEE DWG J24185)

J24185C	
J24185D	

OVATION PANEL

724-ICP3101

PS+		
PS–		
GND		
1+	LSLL31AF011 IPS WET WELL LEVEL LOW LOW	CH:01
1–		
RSV		
2+	LSHH31AF021 IPS WET WELL LEVEL HIHI	CH:02
2–		
RSV		
3+	NDJ31CA011 ML CHANNEL AERATION BLOWER 1 ON	CH:03
3–		
RSV		
4+	XAD31CA011 ML CHANNEL AERATION BLOWER 1 FAIL	CH:04
4–		
RSV		
5+	NDJ31CA041 ML CHANNEL AERATION BLOWER 4 ON	CH:05
5–		
RSV		
6+	XAD31CA041 ML CHANNEL AERATION BLOWER 4 FAIL	CH:06
6–		
RSV		
7+	TSH31EA021 IPS MOTOR ROOM HIGH TEMPERATURE	CH:07
7–		
RSV		
8+	ZDC26FF011 IPS 724-US01 SWITCHGEAR 1 CLOSED	CH:08
8–		
RSV		
9+	ZDO26FF011 IPS 724-US01 SWITCHGEAR 1 TRIPPED	CH:09
9–		
RSV		
10+	NDA31CA011 ML CHANNEL AERATION BLOWER 1 REMOTE	CH:10
10–		
RSV		
11+	ZSC31CA011 ML CHANNEL AERATION BLOWER 1 VENT CLOSED	CH:11
11–		
RSV		
12+	SPARE	CH:12
12–		
RSV		
13+	SPARE	CH:13
13–		
RSV		
14+	SPARE	CH:14
14–		
RSV		
15+	NDE31OV111 OVATION PANEL POWER UPS CKT POWER MONITORING	CH:15
15–		
RSV		
16+	NDE31OV121 OVATION PANEL POWER NON-UPS CKT POWER MON	CH:16
16–		
RSV		

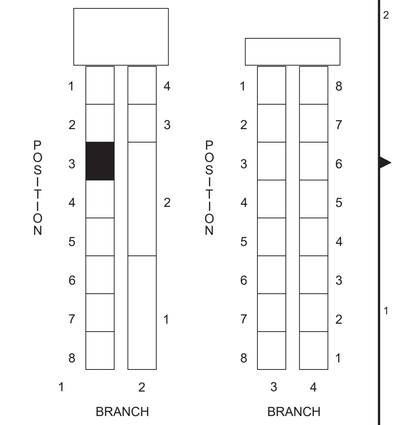
1 2 3

125VAC INDIVIDUALLY FUSED SINGLE ENDED COMPACT DISCRETE INPUT MODULE (NON-ISOLATED)
BASE: X
PMOD: 5X00034G01
EMOD: 1C31232G03
DROP: 17/77
BRANCH: 1
POSITION: 3

KEY NOTES:

1. FORCED SIGNALS OR VOLTAGES MAY BE PRESENT DUE TO BACKPLANE CONNECTIONS - DO NOT TERMINATE FIELD WIRING ON ANY UNMARKED OR "RSV" TERMINALS (TYPICAL WHERE SHOWN).
2. ISOLATED (DIFFERENTIAL) INPUTS DO NOT HAVE BLOWN FUSE INDICATOR AND MUST HAVE EXTERNAL PROTECTION.
3. DO NOT INSTALL ANY OTHER MODULES ON A BRANCH WITH 120VAC INPUTS.

OVATION PANEL CARD LOCATION REFERENCE



NO	REVISION DESCRIPTION	BY	APVD	DATE
0	BID ISSUE			4/17/2020

ch2m:

RICHARD A. PEARSON STATE OF WASHINGTON 35596 REGISTERED PROFESSIONAL ENGINEER
2020.04.17 09:36:14-07'00'

DESIGNED/DRAWN: RP	CHECKED: SB
PROJECT ENGINEER: RP	SCALE: NONE
DESIGN APPROVAL: ES	FACILITY NUMBER: WP-724
PROJECT ACCEPTANCE: JRM	CONTRACT NO: C01397C20

King County

DEPARTMENT OF NATURAL RESOURCES & PARKS
WASTEWATER TREATMENT DIVISION
KING COUNTY WEST POINT TREATMENT PLANT
SECONDARY MIXED LIQUOR BLOWER REPLACEMENT

DI CARD TERMINATION DRAWING 3 DROP:17/77 BRANCH:1 POSITION:3

DATE:	APRIL 2020
PROJECT FILE NO:	17-1123627
DRAWING NO:	J24200
SHT NO / TOTAL	37 / 53
REV NO:	

BORDER FILE EDITION: KCWTD-2015R0-Dsize-TB-Border
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INTERMEDIATE PUMP STATION

724-LCP3101

724-LCP3101

724-C24502

SL-1	TB06 1	VA31AC01M	
SL-2	TB06 2	VA31AC01N	
SL-9	TB06 9	VA31AC01P	
SL-10	TB06 10	VA31AC01H	
SL-13	TBA05 13	(SPARE)	
SL-14	TBA05 14	(SPARE)	
SL-15	TBA05 15		
SL-16	TBA05 16	(SPARE)	
SL-17	TBA05 17	(SPARE)	
SL-18	TBA05 18		
SL-1	TB01 31	VA31CG01A	
SL-2	TB01 32	VA31CG01B	
L5EH	TB05 24	VA24SB01C	
VA24SB01A	TB04 12	VA24SB01A	
SEE DWG: VA31CA01	TB05 28	VA31CA01F	2107A
	TB05 29	VA31CA01G	2107B
L2CH			
SL-5	TB01 19	VA31DC01D	
SL-7	TB01 21	VA31DC01K	
		2110A	
		2110B	

OVATION CABINET

724-ICP3101

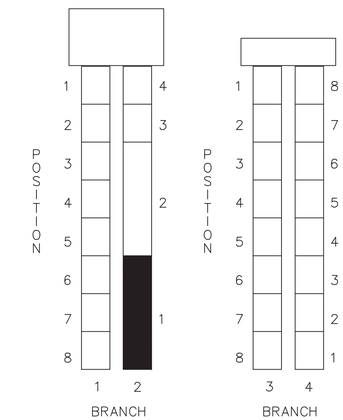
VA31AC01M	1C	MNJ31AC011	CH: 01
VA31AC01N	1NO	IPS PUMP 1	
	1NC	CALL TO RUN	
VA31AC01P	2C	MNP31AC011	CH: 02
VA31AC01H	2NO	IPS PUMP 1 SEAL WATER	
(SPARE)	2NC	LO PRES SHTDN	
(SPARE)	3C		CH: 03
	3NO	SPARE	
(SPARE)	3NC		
(SPARE)	4C		CH: 04
	4NO	SPARE	
	4NC		
VA31CG01A	5C	MNO31CG011	CH: 05
VA31CG01B	5NO	BACKPRESS VALVE 1	
	5NC	CALL TO OPEN	
VA24SB01C	6C	MNJ24SB011	CH: 06
VA24SB01A	6NO	IPS MIXED LIQUOR	
	6NC	SAMPLER START	
VA31CA01F	7C	MNO31CA011	CH: 07
VA31CA01G	7NO	ML CHANNEL AERATION	
	7NC	BLOWER 1 CALL TO RUN	
L2CH	8C	MNP31DC011	CH: 08
VA31DC01D	8NO	IPS PUMP 1 VIB ALM 1	
	8NC	DISABLE	
	9C	MNP31DC012	CH: 09
VA31DC01K	9NO	IPS PUMP 1 VIB ALM 2	
2110A	9NC	DISABLE	
2110B	10C		CH: 10
	10NO	SPARE	
	10NC		
	11C		CH: 11
	11NO	SPARE	
	11NC		
	12C		CH: 12
	12NO	SPARE	
	12NC		
	13C		CH: 13
	13NO	SPARE	
	13NC		
	14C		CH: 14
	14NO	SPARE	
	14NC		
	15C		CH: 15
	15NO	SPARE	
	15NC		
BRK04(L)	16C	MNJ31OV141	CH: 16
OVATION PANEL COOLING SYSTEM REF. DWG J24185 J24185E1	16NO	724-ICP3101 CAB	
J24185E2	16NC	FAN START	
		(4)	

G2R RELAY DISCRETE OUTPUT
BASE: 1C31223G01 (10A, 250VAC Rated)
PMOD: (NONE)
EMOD: 1C31219G01
DROP: 17/77
BRANCH: 02
POSITION: 01

KEY NOTES:

1. FORCED SIGNALS OR VOLTAGES MAY BE PRESENT DUE TO BACKPLANE CONNECTIONS - DO NOT TERMINATE FIELD WIRING ON ANY UNMARKED OR "RSV" TERMINALS (TYPICAL WHERE SHOWN).
2. THIS MODULE CANNNOT BE MIXED WITH DISCRETE INPUT MODULES THAT ARE 120VAC.
3. THIS MODULE IS MOUNTED ON PANEL BRANCH, REQUIRED VERTICAL SPACE IS 16.625".
4. THIS MODULE DOES NOT USE THE STANDARD BASE UNIT.

OVATION PANEL CARD LOCATION REFERENCE



NO	REVISION DESCRIPTION	BY	APVD	DATE
0	BID ISSUE			4/17/2020

ch2m:

RICHARD A. PEARSON, STATE OF WASHINGTON, 35596, REGISTERED PROFESSIONAL ENGINEER
2020.04.17 09:38:09-07'00'

DESIGNED/DRAWN: RP	CHECKED: SB
PROJECT ENGINEER: RP	SCALE: NONE
DESIGN APPROVAL: ES	FACILITY NUMBER: WP-724
PROJECT ACCEPTANCE: JRM	CONTRACT NO: C01397C20

King County

DEPARTMENT OF NATURAL RESOURCES & PARKS
WASTEWATER TREATMENT DIVISION
KING COUNTY WEST POINT TREATMENT PLANT
SECONDARY MIXED LIQUOR BLOWER REPLACEMENT

DO CARD TERMINATION DRAWING 1 DROP:17/77 BRANCH:2 POSITION:1

DATE:	APRIL 2020
PROJECT FILE NO:	17-1123627
DRAWING NO:	J24201
SHT NO / TOTAL	38 / 53
REV NO:	

BORDER FILE EDITION: KCWTD-2015R0-Dsize-TB-Border
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PLOTTED: Apr 17, 2020-08:31:31am By rpearso6
XREFS: KC_ML_TitleBlock.dwg
IMAGES:

REFERENCE 1" 0

INTERMEDIATE PUMP STATION
724-LCP3101

724-S24500

724-LCP3101 TBA04
- 6 — VA31AE01A
- 7 — VA31AE01B
- 8

724-LCP3101 TBA01
- 16 — VA31CB01E
- 17 — VA31CB01F
- 18

724-LCP3101 TBA01
- 11 — VA31CC01A
- 12 — VA31CC01B
- 13

724-LCP3101 TBA04
- 20 — VB31DC01A
- 21 — VB31DC01B
- 22

724-LCP3101 TBA04
- 23 — VB31DC01C
- 24 — VB31DC01D
- 25

724-LCP3101 TBA04
- 26 — VB31DC01E
- 27 — VB31DC01F
- 28

724-LCP3101C TBA07
SEE DWG: VA31CA01
- 1 — 724-VA31CA01A+ — 4107A (SPARE)
- 2 — 724-VA31CA01A- — 4107B (SPARE)
- 3

724-LCP3101C TBA07
SEE DWG: VA31CA01
- 4 — 724-VA31CA01B+ — 4108A (SPARE)
- 5 — 724-VA31CA01B- — 4108B (SPARE)
- 6

OVATION CABINET
724-ICP3101

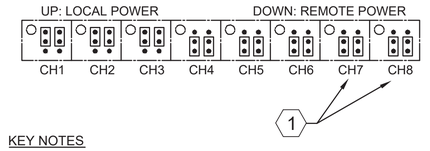
VA31AE01A	1+	CH: 01	LI31AE011 IPS WET WELL LEVEL 1
VA31AE01B	GND / A1+ / A1– / RSV / SH1		
VA31CB01E	2+	CH: 02	PDI31CB011 BACKPRESS VALVE 1 DIFFERENTIAL PRESSURE
VA31CB01F	GND / A2+ / A2– / RSV / SH2		
VA31CC01A	3+	CH: 03	PDI31CC011 IPS PUMP 1 DISCHARGE PRESSURE
VA31CC01B	GND / A3+ / A3– / RSV / SH3		
VB31DC01A	4+	CH: 04	VI31DC011F IPS PUMP 1 SHAFT VIBRATION VELOCITY
VB31DC01B	GND / A4+ / A4– / RSV / SH4		
VB31DC01C	5+	CH: 05	VI31DC011E IPS PUMP 1 SHAFT VIBRATION ACCELLERATION
VB31DC01D	GND / A5+ / A5– / RSV / SH5		
VB31DC01E	6+	CH: 06	VI31DC011D IPS PUMP 1 MOTOR TOP VIBRATION VELOCITY
VB31DC01F	GND / A6+ / A6– / RSV / SH6		
724-VA31CA01A+	7+	CH: 07	FI31CA011 ML CHANNEL AERATION BLOWER 1 FLOW CFM
724-VA31CA01A-	GND / A7+ / A7– / RSV / SH7		
724-VA31CA01B+	8+	CH: 08	JI31CA011 ML CHANNEL AERATION BLOWER 1 POWER KW
724-VA31CA01B-	GND / A8+ / A8– / RSV / SH8		

4–20mA ISOLATED ANALOG INPUT
PMOD: 5X00109G01
EMOD: 5X00106G01
DROP: 17/77
BRANCH: 04
POSITION: 01

KEY NOTES:

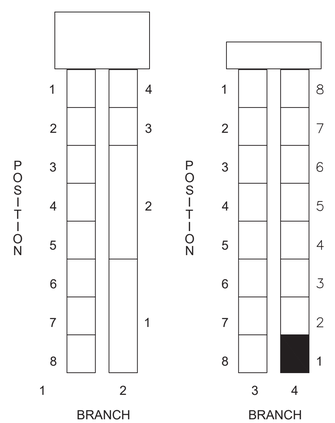
1. FORCED SIGNALS OR VOLTAGES MAY BE PRESENT DUE TO BACKPLANE CONNECTIONS - DO NOT TERMINATE FIELD WIRING ON ANY UNMARKED OR "RSV" TERMINALS (TYPICAL WHERE SHOWN).
2. LOCAL POWERED LOOP SHIELD TERMINATION ON GND TERMINAL. FIELD POWERED LOOP SHIELD TERMINATED ON SH# TERMINAL.
3. JUMPERS MUST BE SET DEPENDING ON LOCAL OR FIELD POWERED LOOP.
4. EXTERNAL POWER TO MODULE IS NOT REQUIRED FOR LOCAL POWERED LOOPS. PS+, PS- TERMINALS HAVE NO CONNECTION AND ARE NOT SHOWN.

JUMPER BLOCK (4)



KEY NOTES
1. REPOSITION LOOP POWER JUMPERS FOR REMOTE POWER

OVATION PANEL CARD LOCATION REFERENCE



NO	REVISION DESCRIPTION	BY	APVD	DATE
0	BID ISSUE			4/17/2020

ch2m:

RICHARD A. PEARSON — STATE OF WASHINGTON — 35596 — REGISTERED PROFESSIONAL ENGINEER
2020.04.09 09:40:45-07'00'

DESIGNED/DRAWN: RP	CHECKED: SB
PROJECT ENGINEER: RP	SCALE: NONE
DESIGN APPROVAL: ES	FACILITY NUMBER: WP-724
PROJECT ACCEPTANCE: JRM	CONTRACT NO: C01397C20

King County

DEPARTMENT OF NATURAL RESOURCES & PARKS
WASTEWATER TREATMENT DIVISION
KING COUNTY WEST POINT TREATMENT PLANT
SECONDARY MIXED LIQUOR BLOWER REPLACEMENT

AI CARD TERMINATION DRAWING 1 DROP: 17/77 BRANCH:4 POSITION:1

DATE: APRIL 2020
PROJECT FILE NO: 17-1123627
DRAWING NO: J24203
SHT NO 39 / TOTAL 53 — REV NO:

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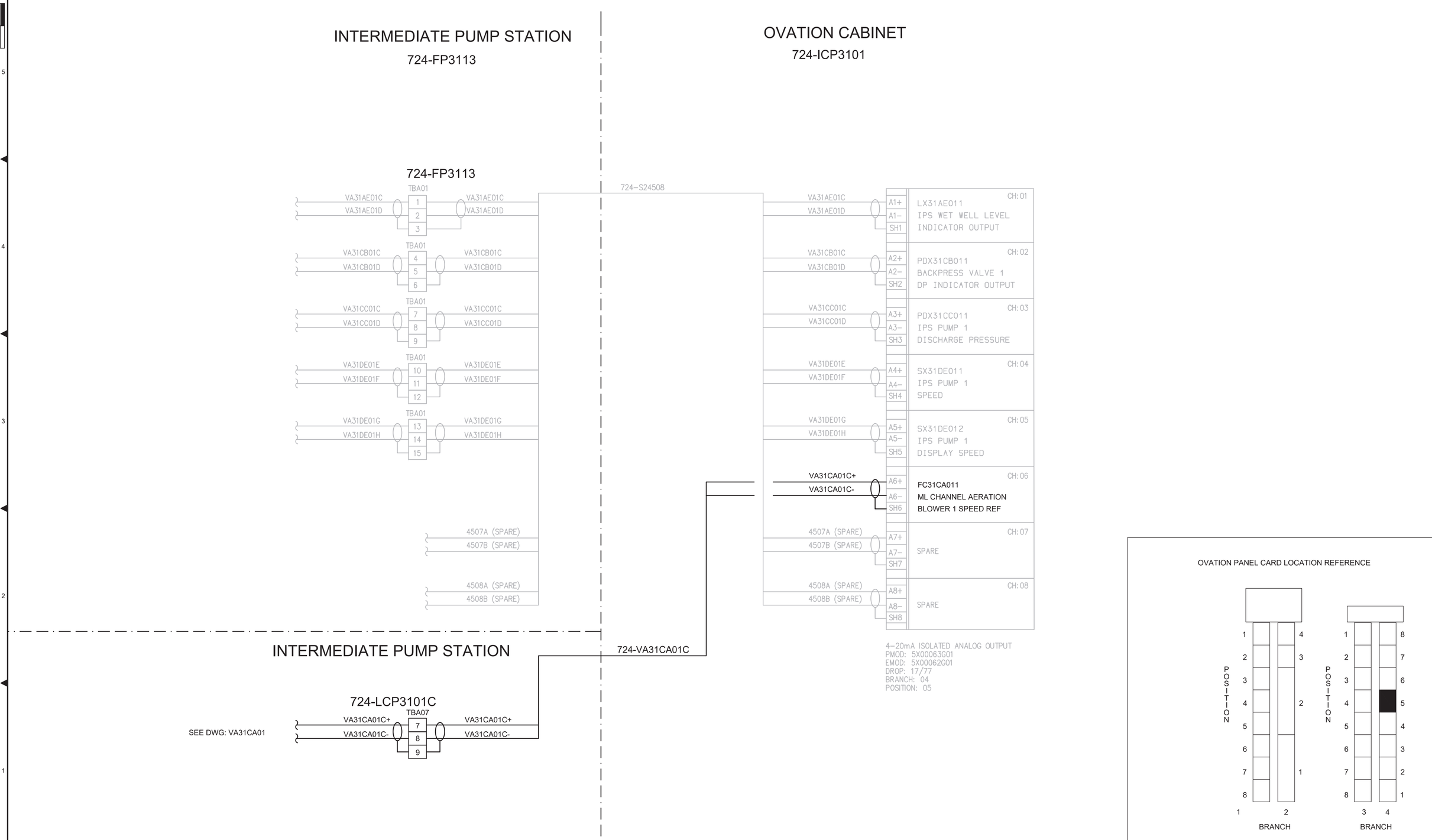
XREFS: KC_ML_TitleBlock.dwg
IMAGES:



NO	REVISION DESCRIPTION	BY	APVD	DATE
0	BID ISSUE			4/17/2020

ch2m

RICHARD A. PEARSON, STATE OF WASHINGTON, 35596, REGISTERED PROFESSIONAL ENGINEER
2020.04.17 09:39:41-07'00'

DESIGNED/DRAWN: RP	CHECKED: SB
PROJECT ENGINEER: RP	SCALE: NONE
DESIGN APPROVAL: ES	FACILITY NUMBER: WP-724
PROJECT ACCEPTANCE: JRM	CONTRACT NO: C01397C20

King County

DEPARTMENT OF NATURAL RESOURCES & PARKS
WASTEWATER TREATMENT DIVISION
KING COUNTY WEST POINT TREATMENT PLANT
SECONDARY MIXED LIQUOR BLOWER REPLACEMENT

AO CARD TERMINATION DRAWING 1 DROP: 17/77 BRANCH:4 POSITION:5

DATE: APRIL 2020
PROJECT FILE NO: 17-1123627
DRAWING NO: J24205
SHT NO 40 / TOTAL 53
REV NO:

BORDER FILE EDITION: KCWTD-2015R0-Dsize-TB-Border
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PLOTTED: Apr 17, 2020-08:31:36am By rpearso6
XREFS: KC_ML_TitleBlock.dwg
IMAGES:

INTERMEDIATE PUMP STATION
724-LCP3101

724-LCP3101

724-C24506

	TB01 3	VA31AN01A	VA31AN01A	PS+
	TB01 4	VA31AN01B	VA31AN01B	PS–
				GND
SEE DWG: VA31CA02	TB05 6	VA31CA02A	VA31CA02A	1+ LSHH31AN011 CH:01 IPS PUMP ROOM FLOOD ALARM
SEE DWG: VA31CA02	TB05 7	VA31CA02B	VA31CA02B	1– RSV
SEE DWG: VA31CA02	TB05 8	VA31CA02C	VA31CA02C	2+ NDJ31CA021 CH:02 IPS PUMP ROOM BLOWER 2 ON
	TB04 5	VA31EA01A	VA31EA01A	2– RSV
	TB04 6	VA31EA01B	VA31EA01B	3+ XAD31CA021 CH:03 IPS CHANNEL AERATION BLOWER 2 FAIL
	TB04 18	VA26FF02A	VA26FF02A	3– RSV
	TB04 19	VA26FF02B	VA26FF02B	4+ LSHH31EA011 CH:04 IPS SUMP HIGH LEVEL
	TB04 20	VA26FF02C	VA26FF02C	4– RSV
	TB04 21	VA26FF02D	VA26FF02D	5+ ZDC26FF021 CH:05 IPS 724-US01 SWITCHGEAR 2 CLOSED
	TB09 15	VA31XX02A	VA31XX02A	5– RSV
	TB09 16	VA31XX02B	VA31XX02B	6+ ZDO26FF021 CH:06 IPS 724-US01 SWITCHGEAR 2 TRIP
	TB09 17	VA31XX02C	VA31XX02C	6– RSV
	TB09 18	VA31XX02D	VA31XX02D	7+ NDE31XX021 CH:07 IPS 724-LCP3101 NORM 120VAC POWER SUPPLY 1 FAIL
		1309A (SPARE)	1309B (SPARE)	7– RSV
SEE DWG: VA31CA02	TB05 30	VA31CA02D	VA31CA02D	8+ NDE31XX022 CH:08 IPS 724-LCP3101 NORM 120VAC POWER SUPPLY 2 FAIL
		1310A (SPARE)	1310B (SPARE)	8– RSV
SEE DWG: VA31CA02	TB05 31	VA31CA02E	VA31CA02E	9+ NDA31CA021 CH:09 ML CHANNEL AERATION BLOWER 2 REMOTE
		1311A (SPARE)	1311A (SPARE)	9– RSV
		1311B (SPARE)	1311B (SPARE)	10+ ZSC31CA021 CH:10 ML CHANNEL AERATION BLOWER 2 VENT CLOSED
		1312A (SPARE)	1312A (SPARE)	10– RSV
		1312B (SPARE)	1312B (SPARE)	11+ CH:11 SPARE
		1313A (SPARE)	1313A (SPARE)	11– RSV
		1313B (SPARE)	1313B (SPARE)	12+ CH:12 SPARE
		1314A (SPARE)	1314A (SPARE)	12– RSV
		1314B (SPARE)	1314B (SPARE)	13+ CH:13 SPARE
				13– RSV
				14+ CH:14 SPARE
				14– RSV
C NO		J24188A	J24188A	15+ NDE31OV211 CH:15 OVATION PANEL POWER UPS CKT POWER MON
		J24188B	J24188B	15– RSV
724-CR31OV211A (SEE DWG J24188)				16+ NDE31OV221 CH:16 OVATION PANEL POWER NON-UPS CKT POWER MON
C NO		J24188C	J24188C	16– RSV
		J24188D	J24188D	
724-CR31OV221A (SEE DWG J24188)				

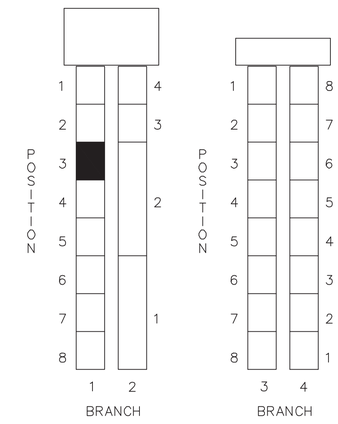
125VAC INDIVIDUALLY FUSED SINGLE ENDED COMPACT DISCRETE INPUT MODULE (NON-ISOLATED)
BASE: X
PMOD: 5X00034G01
EMOD: 1C31232G03
DROP: 18/78
BRANCH: 1
POSITION: 3

OVATION PANEL
724-ICP3102

KEY NOTES:

1. FORCED SIGNALS OR VOLTAGES MAY BE PRESENT DUE TO BACKPLANE CONNECTIONS - DO NOT TERMINATE FIELD WIRING ON ANY UNMARKED OR "RSV" TERMINALS (TYPICAL WHERE SHOWN).
2. ISOLATED (DIFFERENTIAL) INPUTS DO NOT HAVE BLOWN FUSE INDICATOR AND MUST HAVE EXTERNAL PROTECTION.
3. DO NOT INSTALL ANY OTHER MODULES ON A BRANCH WITH 120VAC INPUTS.

OVATION PANEL CARD LOCATION REFERENCE



NO	REVISION DESCRIPTION	BY	APVD	DATE
0	BID ISSUE			4/17/2020

ch2m:

RICHARD A. PEARSON STATE OF WASHINGTON 35596 REGISTERED PROFESSIONAL ENGINEER
09:39:17 -07'00'

DESIGNED/DRAWN: RP	CHECKED: SB
PROJECT ENGINEER: RP	SCALE: NONE
DESIGN APPROVAL: ES	FACILITY NUMBER: WP-724
PROJECT ACCEPTANCE: JRM	CONTRACT NO: C01397C20

King County

DEPARTMENT OF NATURAL RESOURCES & PARKS
WASTEWATER TREATMENT DIVISION
KING COUNTY WEST POINT TREATMENT PLANT
SECONDARY MIXED LIQUOR BLOWER REPLACEMENT

DI CARD TERMINATION DRAWING 6 DROP:18/78 BRANCH:1 POSITION:3

DATE:	APRIL 2020
PROJECT FILE NO:	17-1123627
DRAWING NO:	J24209
SHT NO / TOTAL	41 / 53
REV NO:	

BORDER FILE EDITION: KCWTD-2015R0-Dsize-TB-Border
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PLOTTED: Apr 17, 2020-08:31:38am By rpearso6
XREFS: KC_ML_TitleBlock.dwg
IMAGES:

INTERMEDIATE PUMP STATION
724-LCP3101

724-LCP3101

SL-1	TB07 1	VA31AC02M	724-C24507
SL-2	TB07 2	VA31AC02N	
SL-9	TB07 9	VA31AC02P	
SL-10	TB07 10	VA31AC02H	
SL-19	TBA05 19	(SPARE)	
SL-20	TBA05 20	(SPARE)	
SL-21	TBA05 21		
SL-22	TBA05 22	(SPARE)	
SL-23	TBA05 23	(SPARE)	
SL-24	TBA05 24		
SL-1	TB02 31	VA31CG02A	
SL-2	TB02 32	VA31CG02B	
L1AH	TB05 22	VA24SA01C	
VA24SA01A	TB01 24	VA24SA01A	
		L5CH	
SL-5	TB02 19	VA31DC02D	
SL-7	TB02 21	VA31DC02K	
SEE DWG: VA31CA02	TB05 32	VA31CA02F	2109A
	TB05 33	VA31CA02G	2109B
		2110A	
		2110B	

OVATION CABINET
724-LCP3102

VA31AC02M	1C	MNJ31AC021 IPS PUMP 2 CALL TO RUN	CH:01 (1)
VA31AC02N	1NO		
	1NC		
VA31AC02P	2C	MNP31AC021 IPS PUMP 2 SEAL WATER LO PRES SHTDN	CH:02 (2)
VA31AC02H	2NO		
(SPARE)	2NC		
(SPARE)	3C	SPARE	CH:03 (3)
	3NO		
(SPARE)	3NC		
(SPARE)	4C	SPARE	CH:04
	4NO		
	4NC		
VA31CG02A	5C	MNO31CG021 BACKPRESS VALVE 1 CALL TO OPEN	CH:05
VA31CG02B	5NO		
	5NC		
VA24SA01C	6C	MNJ24SA011 PRI EFFLUENT SAMPLER START	CH:06
VA24SA01A	6NO		
	6NC		
L5CH	7C	MNP31DC021 IPS PUMP 2 VIB ALM 1 DISABLE	CH:07
VA31DC02D	7NO		
	7NC		
	8C	MNP31DC022 IPS PUMP 2 VIB ALM 2 DISABLE	CH:08
VA31DC02K	8NO		
VA31CA02F	8NC		
VA31CA02G	9C	MNO31CA021 ML CHANNEL AERATION BLOWER 2 CALL TO RUN	CH:09
	9NO		
2110A	9NC		
2110B	10C	SPARE	CH:10
	10NO		
	10NC		
	11C	SPARE	CH:11
	11NO		
	11NC		
	12C	SPARE	CH:12
	12NO		
	12NC		
	13C	SPARE	CH:13
	13NO		
	13NC		
	14C	SPARE	CH:14
	14NO		
	14NC		
	15C	SPARE	CH:15
	15NO		
	15NC		
BRK04(L)	16C	MNJ310V241 724-ICP3102 CAB FAN START	CH:16 (4)
J24188E1	16NO		
J24188E2	16NC		

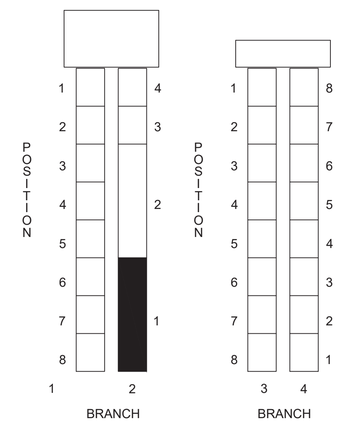
OVATION PANEL COOLING SYSTEM REF. DWG J24188

G2R RELAY DISCRETE OUTPUT
BASE: 1C31223G01 (10A, 250VAC Rated)
PMOD: (NONE)
EMOD: 1C31219G01
DROP: 18/78
BRANCH: 02
POSITION: 01

KEY NOTES:

1. FORCED SIGNALS OR VOLTAGES MAY BE PRESENT DUE TO BACKPLANE CONNECTIONS - DO NOT TERMINATE FIELD WIRING ON ANY UNMARKED OR "RSV" TERMINALS (TYPICAL WHERE SHOWN).
2. THIS MODULE CANNNOT BE MIXED WITH DISCRETE INPUT MODULES THAT ARE 120VAC.
3. THIS MODULE IS MOUNTED ON PANEL BRANCH, REQUIRED VERTICAL SPACE IS 16.625".
4. THIS MODULE DOES NOT USE THE STANDARD BASE UNIT.

OVATION PANEL CARD LOCATION REFERENCE



NO	REVISION DESCRIPTION	BY	APVD	DATE
0	BID ISSUE			4/17/2020

ch2m:

RICHARD A. PEARSON STATE OF WASHINGTON 35596 REGISTERED PROFESSIONAL ENGINEER
09:39:54 07'00'

DESIGNED/DRAWN: RP	CHECKED: SB
PROJECT ENGINEER: RP	SCALE: NONE
DESIGN APPROVAL: ES	FACILITY NUMBER: WP-724
PROJECT ACCEPTANCE: JRM	CONTRACT NO: C01397C20

King County

DEPARTMENT OF NATURAL RESOURCES & PARKS
WASTEWATER TREATMENT DIVISION
KING COUNTY WEST POINT TREATMENT PLANT
SECONDARY MIXED LIQUOR BLOWER REPLACEMENT

DO CARD TERMINATION
DRAWING 3 DROP:18/78
BRANCH:2 POSITION:1

DATE: APRIL 2020
PROJECT FILE NO: 17-1123627
DRAWING NO: **J24210**
SHT NO 42 / TOTAL 53
REV NO:

BORDER FILE EDITION: KCWTD-2015R0-Dsize-TB-Border
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PLOTTED: Apr 17, 2020-08:31:40am By rpearso6
XREFS: KC_ML_TitleBlock.dwg
IMAGES:

REFERENCE 0 1"

INTERMEDIATE PUMP STATION
724-LCP3101

724-S24509

724-LCP3101 TBA04
- 9 — VA31AE01E
- 10 — VA31AE01F
- 11

724-LCP3101 TBA01
- 21 — VA31CB02E
- 22 — VA31CB02F
- 23

724-LCP3101 TBA02
- 11 — VA31CC02A
- 12 — VA31CC02B
- 13

724-LCP3101 TBA06
- 1 — VB31DC02A
- 2 — VB31DC02B
- 3

724-LCP3101 TBA06
- 4 — VB31DC02C
- 5 — VB31DC02D
- 6

724-LCP3101 TBA06
- 7 — VB31DC02E
- 8 — VB31DC02F
- 9

724-LCP3101C TBA07
SEE DWG: VA31CA02
- 10 — 724-VA31CA02A+ — 4107A (SPARE)
- 11 — 724-VA31CA02A- — 4107B (SPARE)
- 12

724-LCP3101C TBA07
SEE DWG: VA31CA02
- 13 — 724-VA31CA02B+ — 4108A (SPARE)
- 14 — 724-VA31CA02B- — 4108B (SPARE)
- 15

OVATION CABINET
724-ICP3102

VA31AE01E	1+	CH: 01	LI31AE012 IPS WET WELL LEVEL 2
VA31AE01F	GND		
	A1+		
	A1–		
	RSV		
	SH1		
VA31CB02E	2+	CH: 02	PDI31CB021 BACKPRESS VALVE 2 DIFFERENTIAL PRESSURE
VA31CB02F	GND		
	A2+		
	A2–		
	RSV		
	SH2		
VA31CC02A	3+	CH: 03	PDI31CC021 IPS PUMP 2 DISCHARGE PRESSURE
VA31CC02B	GND		
	A3+		
	A3–		
	RSV		
	SH3		
VB31DC02A	4+	CH: 04	VI31DC021F IPS PUMP 2 SHAFT VIBRATION VELOCITY
VB31DC02B	GND		
	A4+		
	A4–		
	RSV		
	SH4		
VB31DC02C	5+	CH: 05	VI31DC021E IPS PUMP 2 SHAFT VIBRATION ACCELLERATION
VB31DC02D	GND		
	A5+		
	A5–		
	RSV		
	SH5		
VB31DC02E	6+	CH: 06	VI31DC021D IPS PUMP 2 MOTOR TOP VIBRATION VELOCITY
VB31DC02F	GND		
	A6+		
	A6–		
	RSV		
	SH6		
724-VA31CA02A+	7+	CH: 07	FI31CA021 ML CHANNEL AERATION BLOWER 2 FLOW CFM
724-VA31CA02A-	GND		
	A7+		
	A7–		
	RSV		
	SH7		
724-VA31CA02B+	8+	CH: 08	JI31CA021 ML CHANNEL AERATION BLOWER 2 POWER KW
724-VA31CA02B-	GND		
	A8+		
	A8–		
	RSV		
	SH8		

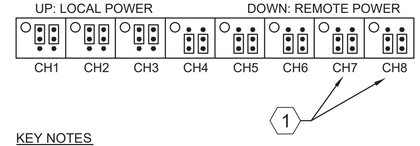
4–20mA ISOLATED ANALOG INPUT
PMOD: 5X00109G01
EMOD: 5X00106G01
DROP: 18/78
BRANCH: 04
POSITION: 01

KEY NOTES:

1. FORCED SIGNALS OR VOLTAGES MAY BE PRESENT DUE TO BACKPLANE CONNECTIONS - DO NOT TERMINATE FIELD WIRING ON ANY UNMARKED OR "RSV" TERMINALS (TYPICAL WHERE SHOWN).
2. LOCAL POWERED LOOP SHIELD TERMINATION ON GND TERMINAL. FIELD POWERED LOOP SHIELD TERMINATED ON SH# TERMINAL.
3. JUMPERS MUST BE SET DEPENDING ON LOCAL OR FIELD POWERED LOOP.
4. EXTERNAL POWER TO MODULE IS NOT REQUIRED FOR LOCAL POWERED LOOPS. PS+, PS- TERMINALS HAVE NO CONNECTION AND ARE NOT SHOWN.

JUMPER BLOCK (4)

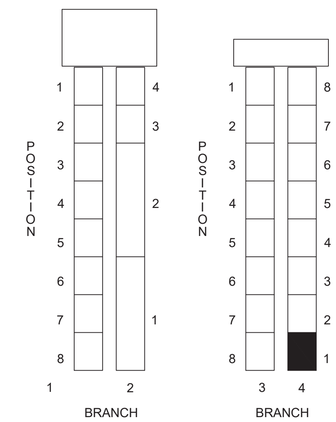
UP: LOCAL POWER — DOWN: REMOTE POWER



KEY NOTES

1. REPOSITION LOOP POWER JUMPERS FOR REMOTE POWER

OVATION PANEL CARD LOCATION REFERENCE



NO	REVISION DESCRIPTION	BY	APVD	DATE
0	BID ISSUE			4/17/2020

ch2m:

09:40:32-07'00'

DESIGNED/DRAWN: RP	CHECKED: SB
PROJECT ENGINEER: RP	SCALE: NONE
DESIGN APPROVAL: ES	FACILITY NUMBER: WP-724
PROJECT ACCEPTANCE: JRM	CONTRACT NO: C01397C20

King County

DEPARTMENT OF NATURAL RESOURCES & PARKS
WASTEWATER TREATMENT DIVISION
KING COUNTY WEST POINT TREATMENT PLANT
SECONDARY MIXED LIQUOR BLOWER REPLACEMENT

AI CARD TERMINATION DRAWING 3 DROP: 18/78 BRANCH:4 POSITION:1

DATE:	APRIL 2020
PROJECT FILE NO:	17-1123627
DRAWING NO:	J24212
SHT NO / TOTAL	43 / 53
REV NO:	

BORDER FILE EDITION: KCWTD-2015R0-Dsize-TB-Border
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PLOTTED: Apr 17, 2020-08:31:42am By rpearso6
XREFS: KC_ML_TitleBlock.dwg
IMAGES:

INTERMEDIATE PUMP STATION
724-FP3123

TBA01
1 — VA31AE02C
2 — 250Ω — VA31AE02D
3

TBA01
4 — VA31CB02C
5 — VA31CB02D
6

TBA01
7 — VA31CC02C
8 — VA31CC02D
9

TBA01
10 — VA31DE02E
11 — VA31DE02F
12

TBA01
13 — VA31DE02G
14 — VA31DE02H
15

4507A (SPARE)
4507B (SPARE)

4508A (SPARE)
4508B (SPARE)

724-S24515

OVATION CABINET
724-ICP3102

VA31AE02C	A1+	CH: 01 LX31AE021 IPS WET WELL LEVEL INDICATOR OUTPUT
VA31AE02D	A1−	
	SH1	
VA31CB02C	A2+	CH: 02 PDX31CB021 BACKPRESS VALVE 2 DP INDICATOR OUTPUT
VA31CB02D	A2−	
	SH2	
VA31CC02C	A3+	CH: 03 PDX31CC021 IPS PUMP 2 DISCHARGE PRESSURE
VA31CC02D	A3−	
	SH3	
VA31DE02E	A4+	CH: 04 SX31DE021 IPS PUMP 2 SPEED
VA31DE02F	A4−	
	SH4	
VA31DE02G	A5+	CH: 05 SX31DE022 IPS PUMP 2 DISPLAY SPEED
VA31DE02H	A5−	
	SH5	
VA31CA02C+	A6+	CH: 06 FC31CA021 ML CHANNEL AERATION BLOWER 2 SPEED REF
VA31CA02C-	A6−	
	SH6	
4507A (SPARE)	A7+	CH: 07 SPARE
4507B (SPARE)	A7−	
	SH7	
4508A (SPARE)	A8+	CH: 08 SPARE
4508B (SPARE)	A8−	
	SH8	

4−20mA ISOLATED ANALOG OUTPUT
PMOD: 5X00063G01
EMOD: 5X00062G01
DROP: 18/78
BRANCH: 04
POSITION: 05

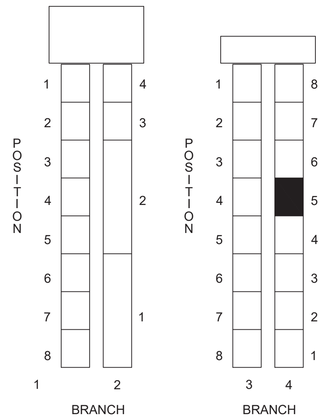
724-VA31CA02C

INTERMEDIATE PUMP STATION

724-LCP3101C
TBA07
VA31CA02C+ — 16 — VA31CA02C+
VA31CA02C- — 17 — VA31CA02C-
18

SEE DWG: VA31CA02

OVATION PANEL CARD LOCATION REFERENCE



NO	REVISION DESCRIPTION	BY	APVD	DATE
0	BID ISSUE			4/17/2020

ch2m:

RICHARD A. PEARSON — STATE OF WASHINGTON — 35596 — REGISTERED PROFESSIONAL ENGINEER
09:40:20-07'00'

DESIGNED/DRAWN: RP	CHECKED: SB
PROJECT ENGINEER: RP	SCALE: NONE
DESIGN APPROVAL: ES	FACILITY NUMBER: WP-724
PROJECT ACCEPTANCE: JRM	CONTRACT NO: C01397C20

King County

DEPARTMENT OF NATURAL RESOURCES & PARKS
WASTEWATER TREATMENT DIVISION
KING COUNTY WEST POINT TREATMENT PLANT
SECONDARY MIXED LIQUOR BLOWER REPLACEMENT

AO CARD TERMINATION DRAWING 3 DROP: 18/78 BRANCH:4 POSITION:5

DATE: APRIL 2020
PROJECT FILE NO: 17-1123627
DRAWING NO: J24214
SHT NO 44 / TOTAL 53 | REV NO:

BORDER FILE EDITION: KCWTD-2015R0-Dsize-TB-Border
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PLOTTED: Apr 17, 2020-08:31:45am By rpearso6
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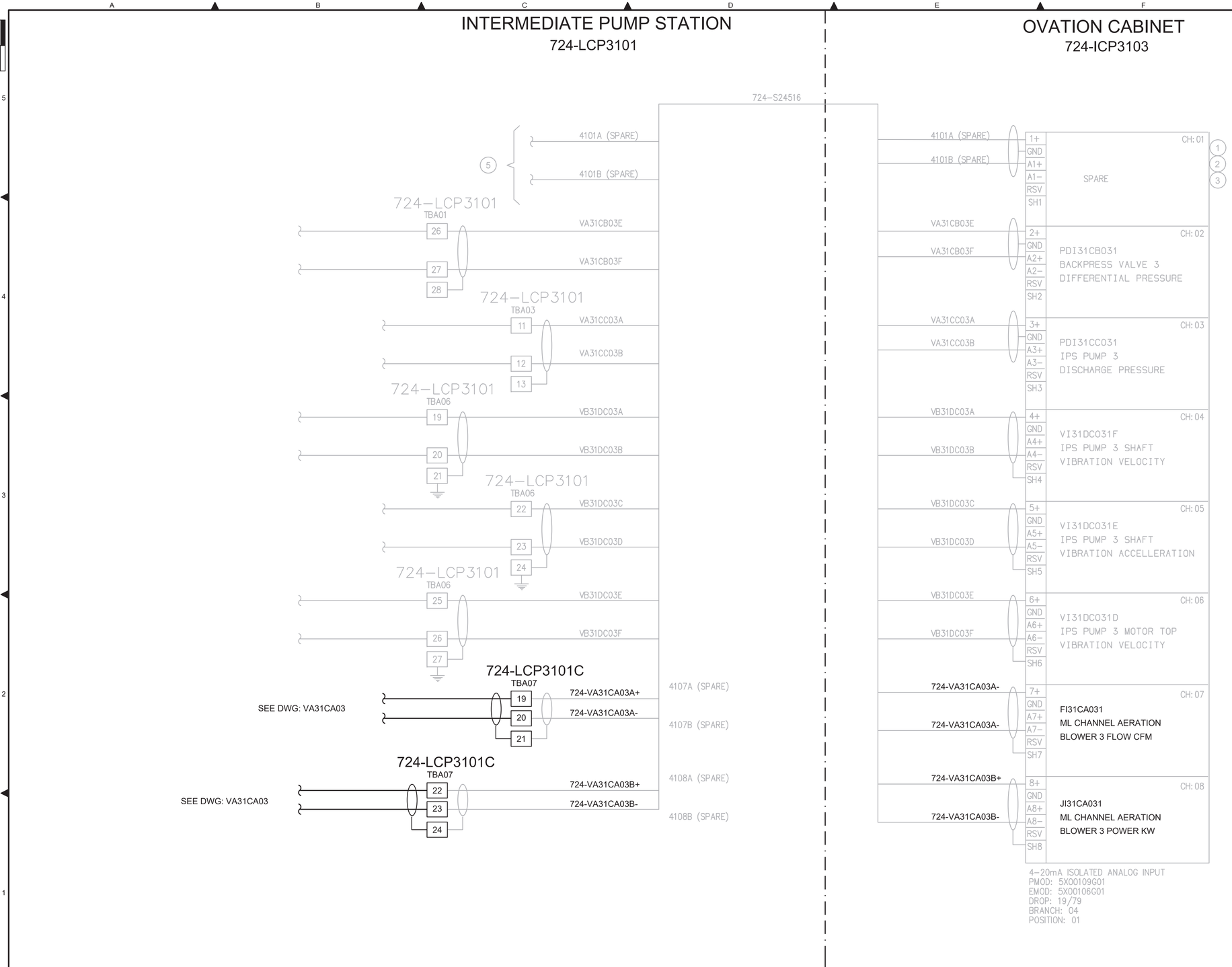
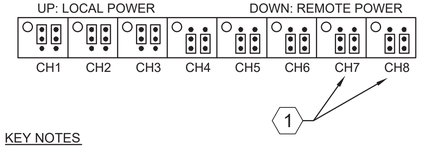


KEY NOTES:

1. FORCED SIGNALS OR VOLTAGES MAY BE PRESENT DUE TO BACKPLANE CONNECTIONS - DO NOT TERMINATE FIELD WIRING ON ANY UNMARKED OR "RSV" TERMINALS (TYPICAL WHERE SHOWN).
2. LOCAL POWERED LOOP SHIELD TERMINATION ON GND TERMINAL. FIELD POWERED LOOP SHIELD TERMINATED ON SH# TERMINAL.
3. JUMPERS MUST BE SET DEPENDING ON LOCAL OR FIELD POWERED LOOP.
4. EXTERNAL POWER TO MODULE IS NOT REQUIRED FOR LOCAL POWERED LOOPS. PS+, PS- TERMINALS HAVE NO CONNECTION AND ARE NOT SHOWN.

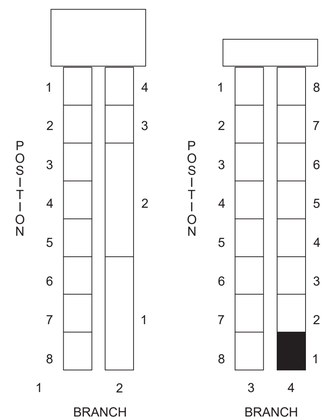
JUMPER BLOCK (4)



KEY NOTES

1. REPOSITION LOOP POWER JUMPERS FOR REMOTE POWER

OVATION PANEL CARD LOCATION REFERENCE



NO	REVISION DESCRIPTION	BY	APVD	DATE
0	BID ISSUE			4/17/2020

ch2m

RICHARD A. PEARSON, STATE OF WASHINGTON, 35596, REGISTERED PROFESSIONAL ENGINEER
2020.04
09:39:28-07'00'

DESIGNED/DRAWN: RP	CHECKED: SB
PROJECT ENGINEER: RP	SCALE: NONE
DESIGN APPROVAL: ES	FACILITY NUMBER: WP-724
PROJECT ACCEPTANCE: JRM	CONTRACT NO: C01397C20

King County

DEPARTMENT OF NATURAL RESOURCES & PARKS
WASTEWATER TREATMENT DIVISION
KING COUNTY WEST POINT TREATMENT PLANT
SECONDARY MIXED LIQUOR BLOWER REPLACEMENT

AI CARD TERMINATION
DRAWING 5 DROP: 19/79
BRANCH:4 POSITION:1

DATE: APRIL 2020
PROJECT FILE NO: 17-1123627
DRAWING NO: J24221
SHT NO 45 / TOTAL 53
REV NO:

BORDER FILE EDITION: KCWTD-2015R0-Dsize-TB-Border
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PLOTTED: Apr 17, 2020-08:31:47am By rpearso6
XREFS: KC_ML_TitleBlock.dwg
IMAGES:

INTERMEDIATE PUMP STATION
724-LCP3101

SEE DWG: VA31CA04

724-LCP3101C
TBA07

25 — VA31CA04A+
26 — VA31CA04A-
27

724-VA31CA04A

SEE DWG: VA31CA04

724-LCP310C
TBA07

28 — VA31CA04B+
29 — VA31CA04B-
30

724-VA31CA04B

OVATION CABINET
724-ICP3101

VA31CA04A+	1+	CH:01
VA31CA04A-	GND	FI31CA041
	A1+	ML CHANNEL AERATION
	A1-	BLOWER 4 FLOW CFM
	RSV	
	SH1	
VA31CA04B+	2+	CH:02
VA31CA04B-	GND	JI31CA041
	A2+	ML CHANNEL AERATION
	A2-	BLOWER 4 POWER KW
	RSV	
	SH2	
	3+	CH:03
	GND	SPARE
	A3+	
	A3-	
	RSV	
	SH3	
	4+	CH:04
	GND	SPARE
	A4+	
	A4-	
	RSV	
	SH4	
	5+	CH:05
	GND	SPARE
	A5+	
	A5-	
	RSV	
	SH5	
	6+	CH:06
	GND	SPARE
	A6+	
	A6-	
	RSV	
	SH6	
	7+	CH:07
	GND	SPARE
	A7+	
	A7-	
	RSV	
	SH7	
	8+	CH:08
	GND	SPARE
	A8+	
	A8-	
	RSV	
	SH8	

(1) 4-20mA ISOLATED ANALOG INPUT
PMOD: 5X00109G01
EMOD: 5X00106G01
DROP: 17/77
BRANCH: 04
POSITION: 03

KEY NOTES:

(1) FORCED SIGNALS OR VOLTAGES MAY BE PRESENT DUE TO BACKPLANE CONNECTIONS - DO NOT TERMINATE FIELD WIRING ON ANY UNMARKED OR "RSV" TERMINALS (TYPICAL WHERE SHOWN).

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(4) EXTERNAL POWER TO MODULE IS NOT REQUIRED FOR LOCAL POWERED LOOPS. PS+, PS- TERMINALS HAVE NO CONNECTION AND ARE NOT SHOWN.

CONSTRUCTION NOTES:

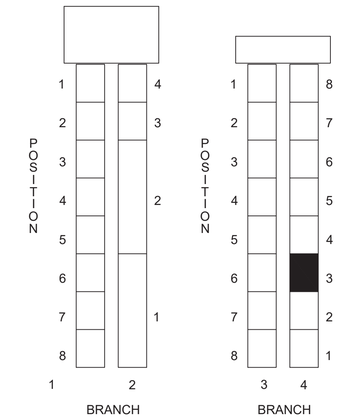
(1) SUPPLY AND INSTALL NEW EMERSON OVATION PMOD AND EMOD MODULES.

JUMPER BLOCK (4)

UP: LOCAL POWER — DOWN: REMOTE POWER

CH1 CH2 CH3 CH4 CH5 CH6 CH7 CH8

OVATION PANEL CARD LOCATION REFERENCE



NO	REVISION DESCRIPTION	BY	APVD	DATE
0	BID ISSUE			4/17/2020

ch2m:

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2020.08.17 09:40:56-07'00'

DESIGNED/DRAWN: RP	CHECKED: SB
PROJECT ENGINEER: RP	SCALE: NONE
DESIGN APPROVAL: ES	FACILITY NUMBER: WP-724
PROJECT ACCEPTANCE: JRM	CONTRACT NO: C01397C20

King County

DEPARTMENT OF NATURAL RESOURCES & PARKS
WASTEWATER TREATMENT DIVISION
KING COUNTY WEST POINT TREATMENT PLANT
SECONDARY MIXED LIQUOR BLOWER REPLACEMENT

AI CARD TERMINATION DRAWING 1 DROP: 17/77 BRANCH:4 POSITION:3

DATE: APRIL 2020
PROJECT FILE NO: 17-1123627
DRAWING NO: J24230
SHT NO / TOTAL: 46 / 53
REV NO:

BORDER FILE EDITION: KCWTD-2015R0-Dsize-TB-Border
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XREFS: KC_ML_TitleBlock.dwg
IMAGES:

REFERENCE 1"
0

INTERMEDIATE PUMP STATION

724-VA31CA01

724-FP3151
TB01

ON
FAIL

45
46
47
48
G

SL-1
SL-2
SL-3
SL-4
SL-5

* COIL AND TAPE

* 1

724-LCP3101
TB05

1
2
3
4
5

VA31CA01A
VA31CA01B
VA31CA01C

OVATION PANEL

724-ICP3101

DROP: 17/77

724-C24501

BRANCH: 1
POSITION: 3

VA31CA01A
VA31CA01B

DI
3+
3-

NDJ31CA011
ML CHANNEL AERATION
BLOWER 1 ON

BRANCH: 1
POSITION: 3

VA31CA01C

DI
4+
4-

XAD31CA011
ML CHANNEL AERATION
BLOWER 1 FAIL

NO	REVISION DESCRIPTION	BY	APVD	DATE
0	BID ISSUE			4/17/2020

ch2m:

RICHARD A. PEARSON
STATE OF WASHINGTON
35596
REGISTERED
PROFESSIONAL ENGINEER
2020.04.17
09:11:04-07'00'

DESIGNED/DRAWN: RP	CHECKED: SB
PROJECT ENGINEER: RP	SCALE: NONE
DESIGN APPROVAL: ES	FACILITY NUMBER: WP-724
PROJECT ACCEPTANCE: JRM	CONTRACT NO: C01397C20

King County

DEPARTMENT OF NATURAL RESOURCES & PARKS
WASTEWATER TREATMENT DIVISION
KING COUNTY WEST POINT TREATMENT PLANT
SECONDARY MIXED LIQUOR BLOWER REPLACEMENT

DEMOLITION
INTERMEDIATE PUMP STATION
CHANNEL AERATION BLOWER 1

DATE: APRIL 2020
PROJECT FILE NO: 17-1123627
DRAWING NO: D-VA31CA01
SHT NO 47 / TOTAL 53
REV NO:

BORDER FILE EDITION: KCWTD-2015R0-Dsize-TB-Border
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XREFS: KC_ML_TitleBlock.dwg
IMAGES:

REFERENCE 0 1"

INTERMEDIATE PUMP STATION

OVATION PANEL
724-ICP3102
DROP: 18/78

724-VA31CA02

724-FP3152
TB01

724-LCP3101
TB05

724-C24506

ON	45	SL-1	6	VA31CA02A
	46	SL-2	7	VA31CA02B
	47	SL-3	8	VA31CA02C
FAIL	48	SL-4	9	
	G	SL-5	10	

* COIL AND TAPE

* 1

BRANCH: 1
POSITION: 3

VA31CA02A
VA31CA02B

DI
2+
2-

NDJ31CA021
ML CHANNEL AERATION
BLOWER 2 ON

BRANCH: 1
POSITION: 3

VA31CA02C

DI
3+
3-

XAD31CA021
ML CHANNEL AERATION
BLOWER 2 FAIL

NO	REVISION DESCRIPTION	BY	APVD	DATE
0	BID ISSUE			4/17/2020

ch2m:

RICHARD A. PEARSON
STATE OF WASHINGTON
35596
REGISTERED PROFESSIONAL ENGINEER
2020.04.17 09:10:00-07'00'

DESIGNED/DRAWN: RP	CHECKED: SB
PROJECT ENGINEER: RP	SCALE: NONE
DESIGN APPROVAL: ES	FACILITY NUMBER: WP-724
PROJECT ACCEPTANCE: JRM	CONTRACT NO: C01397C20

King County

DEPARTMENT OF NATURAL RESOURCES & PARKS
WASTEWATER TREATMENT DIVISION
KING COUNTY WEST POINT TREATMENT PLANT
SECONDARY MIXED LIQUOR BLOWER REPLACEMENT

DEMOLITION
INTERMEDIATE PUMP STATION
CHANNEL AERATION BLOWER 2

DATE: APRIL 2020
PROJECT FILE NO: 17-1123627
DRAWING NO: D-VA31CA02
SHT NO 48 / TOTAL 53 | REV NO:

BORDER FILE EDITION: KCWTD-2015R0-Dsize-TB-Border
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XREFS: KC_ML_TitleBlock.dwg
IMAGES:

MIXED LIQUOR BLOWER ROOM

MIXED LIQUOR BLOWER #1
CONTROL PANEL 724-FP3151
ON BLOWER 724-B31CA01

ON — XX
FAIL — XX
REMOTE — XX
VENT CLOSED — XX
RUN COMMAND — XX

ANALOG OUT X
FLOW VALUE CFM — XX — VA31CA01A+ / VA31CA01A-

ANALOG OUT X
POWER VALUE KW — XX — VA31CA01B+ / VA31CA01B-

ANALOG IN X
REFERENCE SPEED — XX — VA31CA01C+ / VA31CA01C-

G

KEY NOTES

1. UTILIZE SPARE WIRES AND CABLES. EXISTING WIRE & CABLE LABELS SHOW SCREENED. RE-LABEL WIRES AND CABLES PER LOOP SHEET.
2. LOCATE AND UTILIZE EXISTING TERMINALS.

INTERMEDIATE PUMP STATION

724–LCP3101A

TB05

1	VA31CA01A	
2	VA31CA01B	
3	VA31CA01C	
4		
5		
26	VA31CA01D	1310B – SPARE
27	VA31CA01E	1311B – SPARE
28	VA31CA01F	2107A – SPARE
29	VA31CA01G	2107B – SPARE

2

724-LCP3101C
TBA07

1	VA31CA01A+	4107A – SPARE
2	VA31CA01A-	4107B – SPARE
3		
4	VA31CA01B+	4108A – SPARE
5	VA31CA01B-	4108B – SPARE
6		
7	VA31CA01C+	
8	VA31CA01C-	
9		

1

OVATION PANEL

724-ICP3101
DROP: 17/77

724–C24501

VA31CA01A / VA31CA01B → IDI CH:03 (3+ C3, 3- B3)
NDJ31CA011
ML CHANNEL AERATION BLOWER 1 ON
DR: 17/77 ND: LOCAL
BR: 01 PO: 03

VA31CA01C → IDI CH:04 (4+ C4, 4- B4)
XAD31CA011
ML CHANNEL AERATION BLOWER 1 FAIL
DR: 17/77 ND: LOCAL
BR: 01 PO: 03

724–C24502

VA31CA01D → IDI CH:10 (10+ C10, 10- B10)
NDA31CA011
ML CHANNEL AERATION BLOWER 1 REMOTE
DR: 17/77 ND: LOCAL
BR: 01 PO: 03

VA31CA01E → IDI CH:11 (11+ C11, 11- B11)
ZSC31CA011
ML CHANNEL AERATION BLOWER 1 VENT CLOSED
DR: 17/77 ND: LOCAL
BR: 01 PO: 03

VA31CA01F / VA31CA01G → RO CH:07 (C, NO, NC) TB07
MNJ31CA011
ML CHANNEL AERATION BLOWER 1 CALL TO RUN
DR: 17/77 ND: LOCAL
BR: 02 PO: 01

724–S24500

VA31CA01A+ / VA31CA01A- → HHPAI CH:07
P7+/A7+ A13
GND A14
A7+/RSV B13
RSV/A7- B14
RSV/SH7 C13
RSV C14
FI31CA011
ML CHANNEL AERATION BLOWER 1 FLOW CFM
DR: 17/77 ND: LOCAL
BR: 04 PO: 01
POWER JMPR DN:FLD

VA31CA01B+ / VA31CA01B- → HHPAI CH:08
P8+/A8+ A15
GND A16
A8+/RSV B15
RSV/A8- B16
RSV/SH8 C15
RSV C16
JI31CA011
ML CHANNEL AERATION BLOWER 1 POWER KW
DR: 17/77 ND: LOCAL
BR: 04 PO: 01
POWER JMPR DN:FLD

724-VA31CA01C

VA31CA01C+ / VA31CA01C- → HAO CH:06
A6+ A11
A6- B11
SH6 A12
FC31CA011
ML CHANNEL AERATION BLOWER 1 SPEED REF
DR: 17/77 ND: LOCAL
BR: 04 PO: 05

NO	REVISION DESCRIPTION	BY	APVD	DATE
0	BID ISSUE			4/17/2020

ch2m:

RICHARD A. PEARSON — STATE OF WASHINGTON — 35596 — REGISTERED PROFESSIONAL ENGINEER
2020.04.24 09:41:49-07'00'

DESIGNED/DRAWN: RP	CHECKED: SB
PROJECT ENGINEER: RP	SCALE: NONE
DESIGN APPROVAL: ES	FACILITY NUMBER: WP-724
PROJECT ACCEPTANCE: JRM	CONTRACT NO: C01397C20

King County

DEPARTMENT OF NATURAL RESOURCES & PARKS
WASTEWATER TREATMENT DIVISION
KING COUNTY WEST POINT TREATMENT PLANT
SECONDARY MIXED LIQUOR BLOWER REPLACEMENT

INTERMEDIATE PUMP STATION CHANNEL AERATION BLOWER 1

DATE: APRIL 2020
PROJECT FILE NO: 17-1123627
DRAWING NO: VA31CA01
SHT NO 49 / TOTAL 53 REV NO:

BORDER FILE EDITION: KCWTD-2015R0-Dsize-TB-Border
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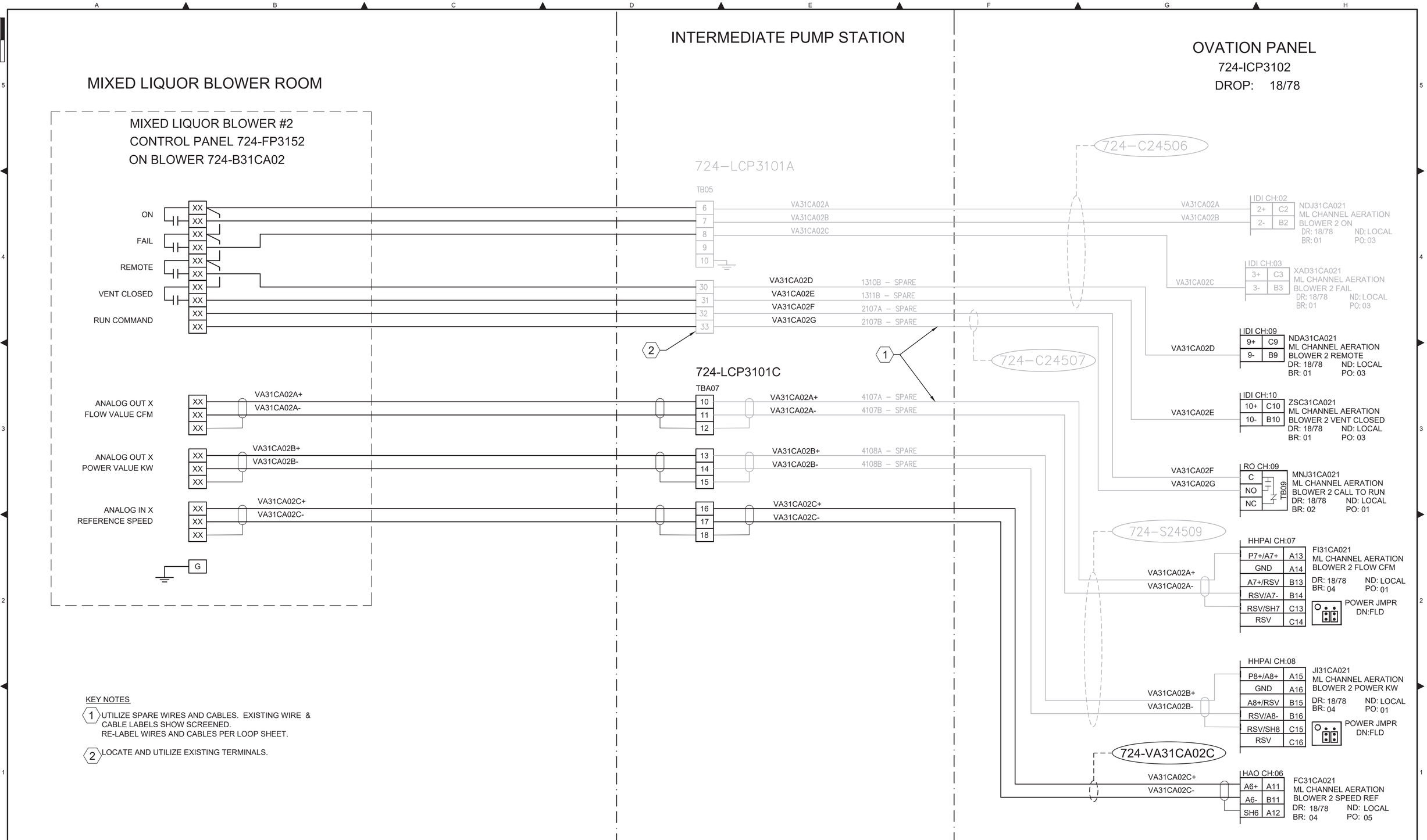

KEY NOTES

1. UTILIZE SPARE WIRES AND CABLES. EXISTING WIRE & CABLE LABELS SHOW SCREENED. RE-LABEL WIRES AND CABLES PER LOOP SHEET.
2. LOCATE AND UTILIZE EXISTING TERMINALS.

NO	REVISION DESCRIPTION	BY	APVD	DATE
0	BID ISSUE			4/17/2020

ch2m

RICHARD A. PEARSON, STATE OF WASHINGTON, 35596, REGISTERED PROFESSIONAL ENGINEER
2020.04
09:42:02-07'00'

DESIGNED/DRAWN: RP	CHECKED: SB
PROJECT ENGINEER: RP	SCALE: NONE
DESIGN APPROVAL: ES	FACILITY NUMBER: WP-724
PROJECT ACCEPTANCE: JRM	CONTRACT NO: C01397C20

King County

DEPARTMENT OF NATURAL RESOURCES & PARKS
WASTEWATER TREATMENT DIVISION
KING COUNTY WEST POINT TREATMENT PLANT
SECONDARY MIXED LIQUOR BLOWER REPLACEMENT

INTERMEDIATE PUMP STATION CHANNEL AERATION BLOWER 2

DATE: APRIL 2020
PROJECT FILE NO: 17-1123627
DRAWING NO: VA31CA02
SHT NO 50 / TOTAL 53
REV NO:

BORDER FILE EDITION: KCWTD-2015R0-Dsize-TB-Border
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PLOTTED: Apr 17, 2020-08:32:11am By rpearso6
XREFS: KC_ML_TitleBlock.dwg
IMAGES:

REFERENCE 0 1"

MIXED LIQUOR BLOWER ROOM

MIXED LIQUOR BLOWER #3
CONTROL PANEL 724-FP3153
SEE - E2493

724-FP3153
TB01

724-VA31CA03

ON — 55, 56
FAIL — 47, 48
G

SL-1
SL-2
SL-3
SL-4
SL-5

* COIL AND TAPE *

1

724-LCP3101A
TB05

11 — VA31CA03A
12 — VA31CA03B
13 — VA31CA03C
14
15

INTERMEDIATE PUMP STATION

OVATION PANEL

724-ICP3103
DROP: 19/79

724-C24511

VA31CA03A
VA31CA03B

IDI CH:01

1+	C1	NDJ31CA031 IPS CHANNEL AERATION BLOWER 3 ON
1–	B1	DR:19/79 BR:01 ND:LOCAL PO:03

VA31CA03C

IDI CH:02

2+	C2	XAD31CA031 IPS CHANNEL AERATION BLOWER 3 FAIL
2–	B2	DR:19/79 BR:01 ND:LOCAL PO:03

1CM - SEE E2493

SMART METER II - FLOW & POWER

TB2

ANALOG OUT 1 FLOW VALUE CFM — AO1 + 5, AO1 - 6, 7

VA31CA03A+
VA31CA03A-

724-LCP3101C
TBA07

19 — VA31CA03A+
20 — VA31CA03A-
21

4107A – SPARE
4107B – SPARE

724-S24516

VA31CA03A+
VA31CA03A-

HHPAI CH:07

P7+/A7+	A13	FI31CA031 ML CHANNEL AERATION BLOWER 3 FLOW CFM
GND	A14	
A7+/RSV	B13	DR: 19/79 BR: 04 ND: LOCAL PO: 01
RSV/A7-	B14	
RSV/SH7	C13	POWER JMPR DN:FLD
RSV	C14	

ANALOG OUT 2 POWER VALUE KW — AO2 + 8, AO2 - 9, 10

VA31CA03B+
VA31CA03B-

22 — VA31CA03B+
23 — VA31CA03B-
24

4108A – SPARE
4108B – SPARE

2

1

HHPAI CH:08

P8+/A8+	A15	JI31CA031 ML CHANNEL AERATION BLOWER 3 POWER KW
GND	A16	
A8+/RSV	B15	DR: 19/79 BR: 04 ND: LOCAL PO: 01
RSV/A8-	B16	
RSV/SH8	C15	POWER JMPR DN:FLD
RSV	C16	

KEY NOTES

1. UTILIZE SPARE WIRES AND CABLES. EXISTING WIRE & CABLE LABELS SHOW SCREENED. RE-LABEL WIRES AND CABLES PER LOOP SHEET.
2. WIRE CABLE TO PANEL INSTRUMENT, ENSURE TO ROUTE BY SUB-PANEL HINGE AND PROTECT FOR MOTION.

NO	REVISION DESCRIPTION	BY	APVD	DATE
0	BID ISSUE			4/17/2020

ch2m:

RICHARD A. PEARSON — STATE OF WASHINGTON — 35596 — REGISTERED PROFESSIONAL ENGINEER
2020.04.24 09:42:45-07'00'

DESIGNED/DRAWN: RP	CHECKED: SB
PROJECT ENGINEER: RP	SCALE: NONE
DESIGN APPROVAL: ES	FACILITY NUMBER: WP-724
PROJECT ACCEPTANCE: JRM	CONTRACT NO: C01397C20

King County

DEPARTMENT OF NATURAL RESOURCES & PARKS
WASTEWATER TREATMENT DIVISION
KING COUNTY WEST POINT TREATMENT PLANT
SECONDARY MIXED LIQUOR BLOWER REPLACEMENT

INTERMEDIATE PUMP STATION CHANNEL AERATION BLOWER 3

DATE: APRIL 2020
PROJECT FILE NO: 17-1123627
DRAWING NO: VA31CA03
SHT NO 51 / TOTAL 53
REV NO:

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PLOTTED: Apr 17, 2020-08:32:13am By rpearso6
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IMAGES:

MIXED LIQUOR BLOWER ROOM

MIXED LIQUOR BLOWER #4
CONTROL PANEL 724-FP3154
SEE - E2494

724-VA31CA04

724-FP3154
TB01

ON	45	SL-1
	46	SL-2
	47	SL-3
FAIL	48	SL-4
	G	SL-5

* COIL AND TAPE

* 1

1CM - SEE E2494
SMART METER II - FLOW & POWER

TB2

ANALOG OUT 1 FLOW VALUE CFM	AO1 +	5	VA31CA04A+
	AO1 -	6	VA31CA04A-
		7	
ANALOG OUT 2 POWER VALUE KW	AO2 +	8	VA31CA04B+
	AO2 -	9	VA31CA04B-
		10	

1

INTERMEDIATE PUMP STATION

724-LCP3101A
TB05

VA31CA04A	16	SL-1
VA31CA04B	17	SL-2
VA31CA04C	18	SL-3
	19	SL-4
	20	SL-5

724-LCP3101C
TBA07

VA31CA04A+	25	VA31CA04A+
VA31CA04A-	26	VA31CA04A-
	27	
VA31CA04B+	28	VA31CA04B+
VA31CA04B-	29	VA31CA04B-
	30	

OVATION PANEL

724-ICP3101
DROP: 17/77

724-C24501

VA31CA04A
VA31CA04B

IDI CH:05

5+	C5
5–	B5

NDJ31CA041
IPS CHANNEL AERATION
BLOWER 4 ON
DR:17/77 ND:LOCAL
BR:01 PO:03

VA31CA04C

IDI CH:06

6+	C6
6–	B6

XAD31CA041
IPS CHANNEL AERATION
BLOWER 4 FAIL
DR:17/77 ND:LOCAL
BR:01 PO:03

724-VA31CA04A

VA31CA04A+
VA31CA04A-

HHPAI CH:01

P1+/A1+	A1
GND	A2
A1+/RSV	B1
RSV/A1-	B2
RSV/SH1	C1
RSV	C2

FI31CA041
ML CHANNEL AERATION
BLOWER 4 FLOW CFM
DR: 17/77 ND: LOCAL
BR: 04 PO: 03
POWER JMPR
DN:FLD

724-VA31CA04B

VA31CA04B+
VA31CA04B-

HHPAI CH:02

P2+/A2+	A3
GND	A4
A2+/RSV	B3
RSV/A2-	B4
RSV/SH2	C3
RSV	C4

JI31CA041
ML CHANNEL AERATION
BLOWER 4 POWER KW
DR: 17/77 ND: LOCAL
BR: 04 PO: 03
POWER JMPR
DN:FLD

KEY NOTES

1 WIRE CABLE TO PANEL INSTRUMENT, ENSURE TO ROUTE BY SUB-PANEL HINGE AND PROTECT FOR MOTION.

NO	REVISION DESCRIPTION	BY	APVD	DATE
0	BID ISSUE			4/17/2020

RICHARD A. PEARSON — STATE OF WASHINGTON — 35596 — REGISTERED PROFESSIONAL ENGINEER
2020.04.09 09:41:36-07'00'

DESIGNED/DRAWN: RP	CHECKED: SB
PROJECT ENGINEER: RP	SCALE: NONE
DESIGN APPROVAL: ES	FACILITY NUMBER: WP-724
PROJECT ACCEPTANCE: JRM	CONTRACT NO: C01397C20

King County

DEPARTMENT OF NATURAL RESOURCES & PARKS
WASTEWATER TREATMENT DIVISION
KING COUNTY WEST POINT TREATMENT PLANT
SECONDARY MIXED LIQUOR BLOWER REPLACEMENT

INTERMEDIATE PUMP STATION CHANNEL AERATION BLOWER 4

DATE: APRIL 2020
PROJECT FILE NO: 17-1123627
DRAWING NO: VA31CA04
SHT NO 52 / TOTAL 53
REV NO:

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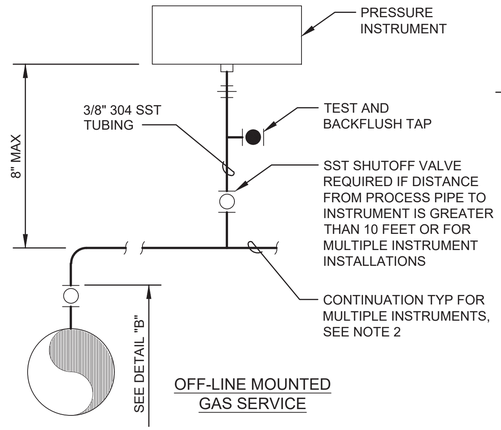
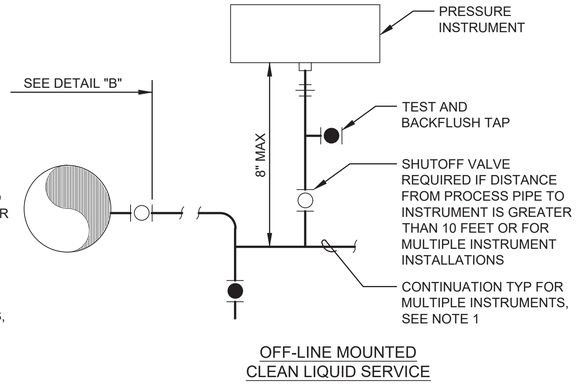
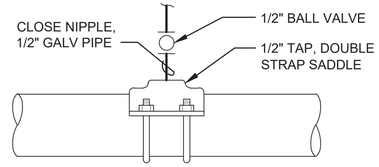


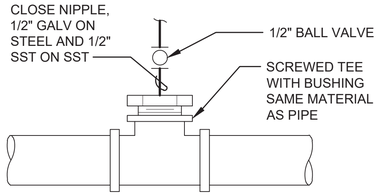
OFF-LINE MOUNTED
GAS SERVICE



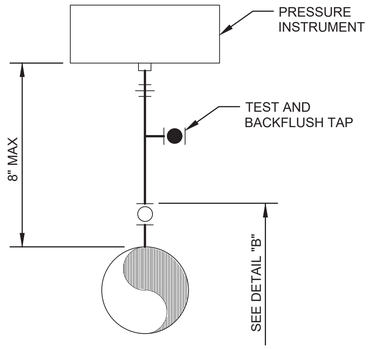
OFF-LINE MOUNTED
CLEAN LIQUID SERVICE



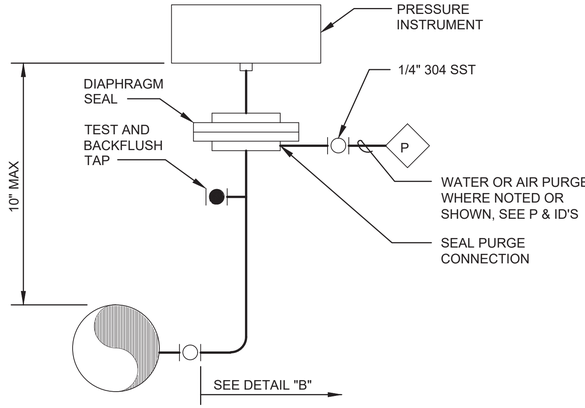
CEMENT OR GLASS LINED
STEEL PIPE, CAST IRON PIPE
AND DUCTILE IRON PIPE



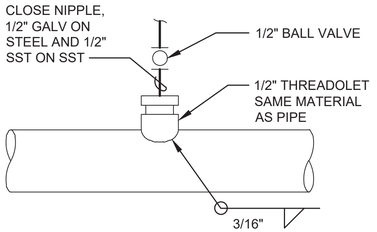
STEEL AND SST PIPE
3 1/2" AND SMALLER



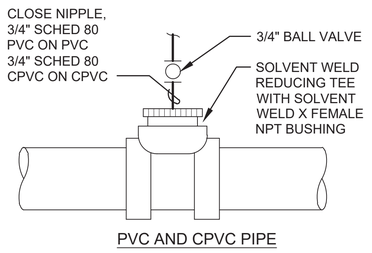
DIRECT MOUNTED GASES
AND CLEAN LIQUIDS



DIRECT MOUNTED WITH DIAPHRAGM SEAL SEWAGE, SLUDGE
AND SIMILAR PROCESS PIPING



STEEL AND SST PIPE
4" AND LARGER



PVC AND CPVC PIPE

NOTES:

1. FOR LIQUID SERVICE SLOPE ALL LINES DOWNWARD TOWARDS THE INSTRUMENT, 1/4" PER FOOT MIN.
2. FOR GAS SERVICE SLOPE ALL LINES UPWARD TOWARDS THE INSTRUMENT AT 1/4" PER FOOT MIN.
3. PROVIDE AN EXPANSION LOOP IN THE IMPULSE LINE IF SUBJECT TO VIBRATION.
4. ALL IMPULSE LINES SHALL BE SUPPORTED AS REQUIRED.
5. ALL INSTRUMENTS SHALL BE MOUNTED ON PIPE OR WALL.
6. TAP PIPING MATERIAL SHALL BE CONSISTENT WITH THE PIPING SYSTEM SPECIFIED IN SPEC SECTION 15050.
7. USE 304 SST. IF CORROSIVE ATMOSPHERE USE 316 SST.

DETAIL A
PRESSURE INSTRUMENT INSTALLATION

DETAIL B
PRESSURE CONNECTION INSTALLATION

PRESSURE INSTRUMENT INSTALLATION
SCALE: NONE

170402

NO	REVISION DESCRIPTION	BY	APVD	DATE
0	BID ISSUE			4/17/2020

ch2m:

RICHARD A. PEARSON
STATE OF WASHINGTON
35596
REGISTERED PROFESSIONAL ENGINEER
2020.04.17 09:08:30-07'00'

DESIGNED/DRAWN: RP	CHECKED: SB
PROJECT ENGINEER: RP	SCALE: NONE
DESIGN APPROVAL: ES	FACILITY NUMBER: WP-724
PROJECT ACCEPTANCE: JRM	CONTRACT NO: C01397C20

King County

DEPARTMENT OF NATURAL RESOURCES & PARKS
WASTEWATER TREATMENT DIVISION
KING COUNTY WEST POINT TREATMENT PLANT
SECONDARY MIXED LIQUOR BLOWER REPLACEMENT

INSTRUMENTATION & CONTROL STANDARD DETAILS

DATE:	APRIL 2020
PROJECT FILE NO:	17-1123627
DRAWING NO:	E2445
SHT NO / TOTAL	53 / 53
REV NO:	

REFERENCE 0 1"

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