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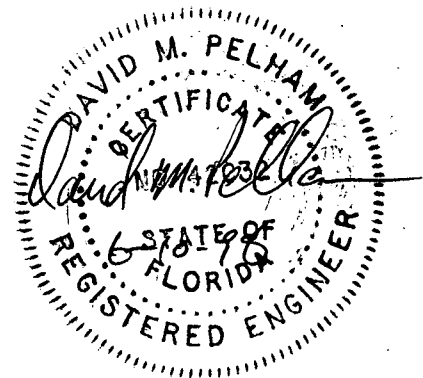
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Division 1

General Requirements

96J23

SECTION 01027

SCHEDULE OF VALUES

PART 1 - GENERAL

1.01 SUMMARY

- A. Section addresses:
 - 1. Procedures required of the Contractor regarding format, style and submittal of Schedule of Values.
- B. Related sections include but are not necessarily limited to:
 - 1. Division 0 - Bidding Requirements, Contract Forms and Conditions of the Contract.

1.02 SUBMITTALS: GENERAL

- A. Transmit Schedule of Values to:
 - HDR Engineering, Inc.
 - 5100 West Kennedy Boulevard, Suite 300
 - Tampa, FL 33609
 - Attn: Mr. David M. Pelham, P.E.
- B. Submit to the Engineer a Schedule of Values allocated to the various lump sum portions of the Work, within ten (10) days after the official Notice to Proceed.
- C. Upon request of the Engineer, support the values with data which will substantiate their correctness.
- D. The Schedule of Values, unless objected to by the Engineer, shall be used only as the basis for the Contractor's Applications for Payment.

1.03 FORM AND CONTENT

- A. Type schedule on 8-1/2 inch x 11 inch or 8-1/2 inch x 14 inch white paper furnished by the Owner. Contractor's Standard Forms and automated printout will be considered for approval by the Engineer upon Contractor's request. Identify schedule with:
 - 1. Title of Contract and location.
 - 2. Engineer and Contract number.
 - 3. Name and address of Contractor.
 - 4. Date of submission.
- B. Schedule shall list the installed value of the component parts of the Work in sufficient detail to

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serve as a basis for computing values for progress payments during construction.

- C. Utilize the Specifications Section Table of Contents as a guide to establish the format for the values of each major category.
- D. Identify each line item with the number and title of the respective major section of the specifications.
- E. For the various portions of the Work:
 - 1. Each item shall include a proportional amount of the Contractor's overhead and profit.
 - 2. For items on which progress payments will be requested for stored materials, break down the value into:
 - a. The cost of the materials, delivered and unloaded, with taxes paid. Paid invoices are required for materials upon request by the Engineer.
 - b. The total installed value.
- F. Arrange the Schedule of Values in a tabular form with separate columns to indicate the following for each item listed:
 - Generic name.
 - Related Specification Section.
 - Name of subcontractor.
 - Name of manufacturer or fabricator.
 - Name of supplier.
 - Change Orders (numbers) that have affected value.
 - Dollar value.
 - Percentage of Contract Sum to the nearest one-hundredth percent, adjusted to total 100 percent.
- G. The sum of all lump sum values listed in the Schedule shall equal the total Contract Sum.
- H. Round amounts off to the nearest whole dollar; the total shall equal the Contract Sum.
- I. Update and resubmit the Schedule of Values with monthly applications for payment and when Change Orders result in a change in the Contract Sum.

END OF SECTION

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SECTION 01060

SPECIAL CONDITIONS

PART 1 - GENERAL

- A. Furnish and install one of each of the following signs:
 - 1. Engineer's sign shown as Exhibit A attached to this Specification.
 - 2. Contractor's standard sign approved by Owner.

1.01 CONTRACTOR'S FIELD OFFICE

- A. Establish at site of Project.
- B. Equipment: Telephone, telecopy, mailing address, and sanitary facilities.
- C. Assure attendance at this office during the normal working day.
- D. At this office, maintain complete field file of shop drawings, posted Contract Drawings and Specifications, and other files of field operations including provisions for maintaining "As Recorded Drawings."
- E. Remove field office from site upon acceptance of the entire work by the Owner.

1.02 ENGINEER'S FIELD OFFICE

- A. Separate from Contractor's field office.
- B. General Construction:
 - 1. New or reconditioned mobile office trailer.
 - 2. Baked enamel aluminum siding.
 - 3. 3-1/2 IN foil-backed fiberglass insulation throughout.
 - 4. Interior paneling.
 - 5. Vinyl tile flooring.
 - 6. 8 FT high acoustic tile ceiling.
 - 7. Two private office areas, one at each end of trailer, one reception-conference room area, and private washroom.
 - 8. Windows:
 - a. Minimum two per room, except washroom, with one each on opposing walls.
 - b. Combination screen-storm windows.
 - c. Provide horizontal louver blinds on each window.
 - 9. Nominal 840 SQ. FT.
 - 10. Two exterior doors (with cylinder deadbolt locks) with outer screens, exterior lights and exterior stairs and

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railings.

11. A sketch of interior configuration shall be provided to the Engineer for approval prior to delivery of unit to Project Site.

C. Electrical System:

1. All fixtures, outlets, and wiring of Underwriters Laboratory (UL) approved devices.
2. All circuits protected by circuit breakers; fuses are not acceptable.
3. Electrical system shall meet requirements of the latest National Electric Code.
4. System suitable for 220 V, 3 PH service.
5. Any transformers or other devices required to match this supply to the mobile office shall be provided and connected.
6. Provide a circuit breaker for the incoming service.
7. Each interior room except the washroom shall have at least four 110 V duplex electrical convenience outlets.

D. Central Combination Electric Heating, Air-Conditioning System:

1. Fan-forced air.
2. Thermostatically controlled.
3. Individual room units are not acceptable.
4. Freeze protect and insulate all piping.
5. System sized to maintain 75 DegF constant temperature in each room.

E. Lighting System:

1. Fluorescent type producing 100 footcandles at desk top height.
2. Ample ceiling fixtures provided to ensure adequate lighting throughout.

F. Standard Washroom:

1. Flush toilet, sink, hot and cold running water.
2. Electric water heater.
3. Mirror.
4. Electric ceiling or wall vent.
5. Sound insulated partitions.

G. Water Supply

1. Provide bottled drinking water with electric coolers for field offices.
2. Contractor may dig well for nonpotable water needs. Contractor shall acquire all necessary permits at no additional cost to the Owner.

H. Furnishings:

1. Two desks, 36 x 72 IN long with locking lap drawer.
2. One plan table 39 x 72 x 36 IN wide, with one locking

- equipment drawer.
- 3. One 48 x 60 IN liquid marking board with minimum four-color set of compatible markers.
- 4. Three, four-drawer legal size filing cabinets.
- 5. Three cushioned swivel arm chairs.
- 6. Ten folding chairs.
- 7. Two bookcases, composed of three shelves 36 IN long and 12 IN wide. The unit shall be a minimum of 3 FT high.
- 8. Three standard size waste paper baskets.
- 9. Conference table to accommodate ten chairs.
- 10. Rain gauge.
- 11. Outdoor thermometer

I. Maintenance:

- 1. Contractor shall provide all maintenance and upkeep of trailer and equipment. Equipment breakdowns shall be repaired promptly by Contractor.
- 2. Janitorial service.
 - a. Weekly:
 - 1) Floor sweeping using dust suppressing compound.
 - 2) Wet mopping with floor detergent.
 - b. Inclement weather: Conduct weekly requirements on daily basis.
 - c. Monthly: Wash windows and clean window blinds.
- 3. Provide private touch tone telephone service with two lines and two sets capable of long distance service and three answering machines. Engineer to pay for long-distance service.
- 4. Provide facsimile and copy machines in Engineer's field office.
- 5. Pay all utilities costs.
- 6. Maintain at least until acceptance of the entire work by the Owner or until otherwise suspended by the Engineer.

J. Remove field office from site upon approval by Owner after acceptance of the entire work by the Owner.

K. Maintain conditions of access road to site such that access is not hindered as the result of construction related deterioration.

1.03 DRAWINGS AND CONTRACT DOCUMENTS FOR CONTRACTOR USE

- A. Refer to General Conditions.
- B. Contractor shall pick up all "no-charge" documents within 10 days from date of Notice to Proceed.
- C. Additional documents after "no-charge" documents will be furnished to Contractor at cost.

1.04 ORDER OF CONSTRUCTION AND CONSTRUCTION SCHEDULE

- A. Construction operations will be scheduled to allow the Owner uninterrupted operation of existing adjacent facilities. Coordinate connections with existing work to ensure timely completion of interfaced items.
- B. At no time shall Contractor or his employees modify operation of the existing facilities or start construction modifications without approval of the Owner except in emergency to prevent or minimize damage.
- C. Within 10 days after award of Contract, submit a critical path type schedule. Account for schedule of Subcontracts. Include proper sequence of construction, various crafts, purchasing time, shop drawing approval, material delivery, equipment fabrication, startup, demonstration, and similar time consuming factors. Show on schedule as a minimum, earliest starting, earliest completion, latest starting, latest finish, and free and total float for each task or item.

Evaluate schedule not less than monthly. Update, correct, and rerun schedule and submit to Engineer in triplicate with pay application to show rescheduling necessary to reflect true job conditions. When shortening of various time intervals is necessary to correct for behind schedule conditions, indicate steps to implement to accomplish work in shortest schedule. Information shall be submitted to Engineer in writing with revised schedule.
- D. If Contractor does not take necessary action to accomplish work according to schedule, he may be ordered by Owner in writing to take necessary and timely action to improve work progress. Order may require increased work forces, extra equipment, extra shifts or other action as necessary. Should Contractor refuse or neglect to take such action authorized, under provisions of this contract, Owner may take necessary actions including, but not necessarily limited to, withholding of payment and termination of contract.
- E. Upon receipt of the "Work Schedule," within 10 days, submit to Engineer an estimated payment schedule by each month of project duration. Include a composite curve to show estimated value of work complete and stored materials less specified retainage. Establish key months when work will be 50, 75, and 100 percent complete. During the course of work, update with new composite curves at key months or whenever variation is expected to be more than plus or minus 10 percent. Retain original or previous composite curves as dashed curves on all updates. Include a heavy plotted curve to show ACTUAL payment curve on all updates.

1.05 PROJECT MEETINGS

- A. The Engineer shall conduct construction meetings involving:
 - 1. Contractor's project manager.
 - 2. Contractor's project superintendent.
 - 3. Owner's designated representative(s).
 - 4. Engineer's designated representative(s).
 - 5. Contractor's subcontractors as appropriate to the work in progress.
- B. Conduct meetings once a week in the Engineer's Field Office. The time and day will be discussed in the Pre-Construction Conference.
- C. The Engineer shall take meeting minutes and submit copies of meeting minutes to participants and designated recipients identified at the Preconstruction Conference. Corrections, additions or deletions to the minutes shall be noted and addressed at the following meeting.
- D. The Engineer shall schedule meetings for most convenient time frame.
- E. The Engineer shall have available at each meeting full chronological file of all previous meeting minutes.
- F. The Contractor shall have available at each meeting up-to-date record drawings.

1.06 SPECIAL CONSIDERATIONS

- A. Contractor shall be responsible for negotiations of any waivers or alternate arrangements required to enable transportation of materials to the site.
- B. Maintain conditions of access road to site such that access is not hindered as the result of construction related deterioration.
- C. Health and Safety Plan:
 - 1. The Contractor shall complete all work involving waste relocation in conformance with the health and safety requirements stipulated in 29-CFR 1910.120, as applicable to the WORK.
 - 2. Develop a site-specific health and safety plan which shall include designations of a Site Safety Officer for the Project. This health and safety plan shall meet the requirements specified in 29-CFR Part 1910.120. Such a plan shall include at a minimum:
 - a. Project organization chart showing Contractor's Site

Safety Officer.

- b. Name of the doctor(s) and the organization that maintains the Contractor's health monitoring program.
- c. Summary of the health monitoring program.
- d. Summary of the respiratory protection and site monitoring program.
- e. Summary of protective clothing required.
- f. Summary of decontamination procedures.
- g. List of employees that have completed health and safety training and certificates received.
- h. Description of personnel and visitor access and egress controls.
- i. Site map showing hot zone/work zone, contamination reduction zone and support zone.

D. Personal Protective Equipment:

1. Determination of the appropriate level of personal protective equipment and procedures during this Project shall be made by the Contractor as a result of initial site survey, review of existing data, and a continued safety and health monitoring program performed by the Contractor's site health and safety officer for the Project.
2. Level D and/or level C protection is anticipated.

E. Equipment Decontamination:

1. All vehicles and equipment entering the limits of construction and contacting potentially hazardous materials during waste relocation on-site shall be cleaned and/or decontaminated prior to leaving the site. The Contractor shall be responsible for monitoring all vehicle activity.
2. All liquids used for decontamination shall be disposed off-site at a legally permitted facility.

F. Presence of Harmful or Dangerous Substances:

1. This landfill has received primarily municipal solid waste and has operated under a Florida FDEP permit. Construction of this Project will require special precautions because of the special conditions which typically exist in a landfill environment. These conditions include: The possible presence of potentially explosive and harmful gases resulting from decomposition of organic and other substances; the presence of leachate which is a liquid which emanates from a landfill and which contains dissolved, suspended, and or microbial contaminants from the solid waste deposits. Contact with this liquid may be harmful to human life.
2. The Contractor is advised that landfill gases including varying concentrations of methane gas are known to be present within the landfill. Methane gas is explosive in certain concentrations and also represents a hazard to life under certain conditions including but not limited to confined areas such as manholes, trenches, and buildings. Because of these conditions, the use of demolition explosives and

smoking will not be permitted within the limits of the Project. Also because of these gaseous conditions, the Contractor shall provide any monitoring required to determine the presence, composition, and concentration of gases present in order to evaluate hazard potential and take appropriate safety measures which may include, but not be limited to: special ventilation; breathing apparatus and protective clothing for its employees or subcontractors only; and explosion-proof equipment and fire protection.

3. The Contractor is also advised that leachate may be present in unknown quantities within the limits of the Project. The composition of leachate within the Project is unknown; however, it should be considered to be, but not necessarily limited to be: hazardous to human life and corrosive. The Contractor shall be responsible for determining the presence of and potential hazards of any leachate encountered and shall be responsible for implementing safety measures as are appropriate. These measures may include, but shall not be limited to: protective clothing, special breathing apparatus, and explosion proofing.
4. The Contractor shall be solely responsible for methods used and precautions taken while performing Work on the Project to insure the safety of his personnel and of other persons and operations at the landfill resulting from Work on this Project.

1.07 PROJECT SIGN

- A. Furnish and install project sign as shown in attached figure (CS).
- B. Install in location approved by Owner.
- C. Signs not listed in this specification permitted only upon approval of owner.

END OF SECTION

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SECTION 01340

SHOP DRAWINGS, PRODUCT DATA & SAMPLES; OPERATION &
MAINTENANCE MANUALS; AND MISCELLANEOUS SUBMITTALS

PART 1 - GENERAL

1.01 SUMMARY

- A. General:
 - 1. Section Addresses:
 - a. Operation and maintenance manuals, and miscellaneous submittal items.
- B. Related Sections include but are not necessarily limited to:
 - 1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
 - 2. Division 1 - General Requirements.
 - 3. Sections in Divisions 2 through 16 identifying required submittals.

1.02 DEFINITIONS

- A. Shop Drawings:
 - 1. See General Conditions.
 - 2. Product data and samples are Shop Drawing information.
- B. Miscellaneous Submittals:
 - 1. Submittals other than Shop Drawings:
 - 2. Representative types of miscellaneous submittal items include but are not limited to:
 - a. Fabrication and construction schedule.
 - b. Warranties.
 - c. Cost breakdown (Schedule of Values).

1.03 TRANSMITTALS

- A. Shop Drawings and Operation and Maintenance Manuals:
 - 1. Transmit all submittals to:

HDR Engineering, Inc.
5100 W. Kennedy Blvd., Suite 300
Tampa, FL 33609-1840
Attn: Mr. David M. Pelham, P.E.
 - 2. Submittal schedule:
 - a. Schedule of shop drawings:
 - 1) Submitted and approved within 20 days of receipt of Notice to Proceed.
 - b. Shop drawings:
 - 1) Submittal and approval prior to 50 percent

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completion.

c. Operation and Maintenance Manuals and Equipment Record Sheets:

- 1) Initial submittal within 60 days after date shop drawings are approved.

B. Miscellaneous Submittals:

1. Transmit under Contractor's standard letter of transmittal or letterhead.
2. Submit in triplicate or as specified in individual specification section.
3. Transmit to:

HDR Engineering, Inc.
5100 W. Kennedy Blvd., Suite 300
Tampa, FL 33609-1840
Attn: Mr. David M. Pelham, P.E.

1.04 PREPARATION OF SUBMITTALS

A. Shop Drawings:

1. Number transmittals consecutively beginning with 1.
2. Number transmittals of resubmitted items with the original root number and a suffix letter starting with "A" on a new transmittal form.
3. Restrict each letter of transmittal to only one Specification Section or portion thereof.
4. Provide breakout of each transmittal contents on transmittal form.
5. Provide sufficient information together with technical cuts and technical data to allow an evaluation to be made to determine that the item submitted is in compliance with the Specifications.
6. Submit items like equipment brochures, cuts of fixtures, product data sheets or catalog sheets on 8-1/2 x 11 IN pages. Indicate exact item or model and all options proposed.
7. Include legible scale details, sizes, dimensions, performance characteristics, capacities, test data, anchoring details, installation instructions, storage and handling instructions, color charts, layout drawings, parts catalogs, rough-in diagrams, wiring diagrams, controls, weights and other pertinent data. Arrange data and performance information in format similar to that provided in Contract Documents. Provide, at minimum, the detail provided in the Contract Documents.
8. If proposed equipment or materials deviate from the Contract Drawings or Specifications in any way, clearly note the deviation and justify said deviation in detail in a separate letter immediately following transmittal sheet.

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B. Operation and Maintenance Manuals:

1. Number transmittals for Operation and Maintenance Manual with original root number of the approved shop drawing for the item.
2. Submit one copy until approval is received.
3. Identify resubmittals with the original number plus a suffix letter starting with "A."
4. Submit Operation and Maintenance Manuals printed on 8-1/2 x 11 IN size heavy first quality paper with standard three-hole punching and bound in stiff metal hinged binder constructed as a three-ring style. Provide binders with titles on front and on spine of binder. Tab each section of manuals for easy reference with plastic-coated dividers. Provide index for each manual. Provide plastic sheet lifters prior to first page and following last page.
5. Reduce drawings or diagrams bound in manuals to an 8-1/2 x 11 IN or 11 x 17 IN size. However, where reduction is not practical to ensure readability, fold larger drawings separately and place in vinyl envelopes which are bound into the binder. Identify vinyl envelopes with drawing numbers.
6. Transmittal Content:
 - a. Submission of Operation and Maintenance Manuals is applicable but not necessarily limited to:
 - 1) Major equipment.
 - 2) Equipment used with electrical motor loads of 1/6 HP nameplate or greater.
 - 3) Specialized equipment including valves and instrumentation and control system components for process systems such as meters, recorders, and transmitters.
 - 4) Valves.
 - 5) Control valves.
 - b. Prepare operation and maintenance manuals to include, but are not necessarily limited to, the following detailed information, as applicable:
 - 1) Equipment function, normal operating characteristics, limiting operations.
 - 2) Assembly, disassembly, installation, alignment, adjustment, and checking instructions.
 - 3) Operating instructions for start-up, routine and normal operation, regulation and control, shutdown, and emergency conditions.
 - 4) Lubrication and maintenance instructions.
 - 5) Guide to "troubleshooting."
 - 6) Parts list and predicted life of parts subject to wear.
 - 7) Outline, cross-section, and assembly drawings; engineering data; and electrical diagrams, including elementary diagrams, wiring diagrams, connection diagrams, word description of wiring diagrams and interconnection diagrams.
 - 8) Test data and performance curves.

- 9) A list of recommended spare parts with a price list and a list of spare parts provided under these specifications.
- 10) Copies of installation instructions, parts lists or other documents packed with equipment when delivered.
- 11) Instrumentation or tag numbers relating the equipment back to the Contract Documents.

1.05 ENGINEER'S REVIEW ACTION

A. Shop Drawings and Samples:

1. Items within transmittals will be reviewed for overall design intent and will receive one of the following actions:
 - a. A - FURNISH AS SUBMITTED.
 - b. B - FURNISH AS NOTED (BY ENGINEER).
 - c. C - REVISE AND RESUBMIT.
 - d. D - REJECTED.
 - e. E - ENGINEER'S REVIEW NOT REQUIRED.

B. Operation and Maintenance Manuals:

1. Engineer will review and indicate one of the following review actions:
 - a. ACCEPTABLE.
 - b. FURNISH AS NOTED.
 - c. REVISE AND RESUBMIT.
 - d. REJECTED.
2. Acceptable submittals will be retained with the transmittal form returned with a request for five additional copies.
3. Deficient submittals will be returned along with the transmittal form which will be marked to indicate deficient areas.

END OF SECTION

96J23

SECTION 01360

RECORD DRAWINGS

PART 1 - GENERAL

1.01 SUMMARY

A. General:

1. Section Addresses:
 - a. Record drawings

B. Related Sections include but are not necessarily limited to:

1. Division 0 - Bidding Requirements, Contract Forms, Conditions of the Contract, and Technical Specifications.
2. Division 1 - General Requirements.
3. Division 2 - Site Work.

1.02 QUALITY ASSURANCE

A. Perform all work in accordance with requirements of applicable state and federal codes or regulations.

B. All survey work will be completed by a Registered Professional Land Surveyor licensed in the State of Florida.

1.03 RECORD DRAWINGS

- A. The Contractor shall keep and maintain at the job site one record set of drawings. On these, the Contractor shall mark all project conditions, locations, configurations, and any other changes or deviations which may vary from the details represented on the original Contract Drawings, including buried or concealed construction and utility features which are revealed during the course of construction. Special attention shall be given to recording the horizontal and vertical location of all buried utilities that differ from the locations indicated or which were not indicated on the Contract Drawings. Said record drawings shall be supplemented by any detailed sketches or typewritten changes to the Specifications, as necessary or directed to indicate fully the work as actually constructed. These master record drawings of the Contractor's representation of as-built conditions, including all revisions made necessary by addenda, change orders, and the like shall be maintained up-to-date during the progress of the work.

- B. Record drawings shall be accessible to the Engineer at all times during the construction period and shall be delivered to the Engineer upon completion of the work prior to final acceptance of project.
- C. Request for partial payments will not be approved if the record drawings are not kept current and not until the completed record drawings showing all variations between the work as actually constructed and as originally shown on the Contract Drawings or other Contract Documents have been inspected by the Engineer.
- D. Final payment will not be approved until the Contractor prepared record drawings have been delivered to the Engineer.
- E. Prior to final acceptance, the Contractor shall complete and deliver a complete set of record drawings to the Engineer for transmittal to the County, conforming to the construction records of the Contractor. One (1) set of reproducibles and two (2) sets of blue-line prints shall be submitted. This set of drawings shall consist of corrected plans showing the reported location of the work. The information submitted by the Contractor and incorporated by the Engineer into the record drawings will be assumed to be reliable, and the Engineer will not be responsible for the accuracy of such information, nor for any errors or omission which may appear on the record drawings as a result. The blue-line prints shall include the signed and sealed aerial survey.

END OF SECTION

96A02

SECTION 01560

ENVIRONMENTAL PROTECTION AND SPECIAL CONTROLS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Addresses:

1. Minimizing the pollution of air, water, or land; control of noise, the disposal of solid waste materials, and protection of deposits of historical or archaeological interest.

B. Related Sections include but are not necessarily limited to:

1. Bidding Requirements, Contract Forms, and Provisions of the Contract.
2. General Conditions and Special Conditions.
3. The Contractor shall comply with and will not cause a violation of the Manatee County Solid Waste Management Facility's Landfill Permit to Operate, No. SO41-211176, as modified and amended.
4. The Contractor shall comply with and will not cause a violation of any Permits held by Manatee County concerning the Lena Road Landfill.
5. The Contractor shall have an approved project health and safety plan available and in-place.

1.02 QUALITY ASSURANCE

A. Qualifications:

1.03 SUBMITTALS

A. Shop Drawings:

1. See Section 01340.
2. Prior to the start of any construction activities, submit a detailed proposal of all methods of control and preventive measures to be utilized for environmental protection. Provide a drawing of the work area, haul routes, storage areas, access routes. Drawing may be presented on a copy of the engineering drawings.
3. Contractor shall submit a detailed, site specific Health and Safety Plan, prior to the start of any construction activities. The OWNER reserves the right to review and comment on the Health and Safety Plan.

PART 2 - PRODUCTS - (NOT APPLICABLE TO THIS SECTION)

PART 3 - EXECUTION

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3.01 INSTALLATION

- A. Employ and utilize environmental protection methods, obtain all necessary permits, and fully observe all applicable local, state, and federal regulations including National Pollution Discharge Elimination System (NPDES) requirements - Storm Water Management for Construction Activities and Section 404 of the Clean Water Act.
- B. Land Protection:
 - 1. Except for any work or storage area and access routes specifically assigned for the use of the Contractor, the land areas outside the limits of construction shall be preserved in their present condition. Contractor shall confine his construction activities to areas defined for work within the Contract Documents.
 - 2. Manage and control all borrow areas, work or storage areas, access routes and embankments to prevent sediment from entering nearby water or land adjacent to the work site.
 - 3. Unless earthwork is immediately paved or surfaced, compact and protect all side slopes and backslopes immediately upon completion of final grading.
 - 4. Plan and execute earthwork in a manner to minimize duration of exposure of unprotected soils and landfill refuse.
 - 5. Except for areas designated by the Contract Documents to be cleared and grubbed, the Contractor shall not deface, injure or destroy trees and vegetation, nor remove, cut, or disturb them without approval of the Engineer. Any damage caused by the Contractor's equipment or operations shall be restored as nearly as possible to its original condition at the Contractor's expense.
- C. Erosion Protection:
 - 1. Utilize methods necessary to effectively prevent erosion and control of sedimentation and include the following:
 - a. Retardation: Mechanically retard rate of runoff by construction of diversion ditches, terraces, berms, and methods used by the Local Department Transportation. Divert run off to protect drainage courses.
 - b. Borrow constraints: Borrow soils shall only be obtained from areas designated by the landfill supervisor. Do not borrow soils from areas where environmental controls are not possible.
 - c. Remove temporary protection prior to final grading operations.
- D. Solid Waste Disposal:
 - 1. Collect solid waste on a daily basis.

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2. Provide disposal of solid waste (with prior notification and approval of the landfill superintendent) to the adjacent solid waste disposal site in accordance with OWNERS instructions.
- E. Control of Chemical Waste:
1. Store and dispose of chemical wastes in a manner approved by regulatory agencies.
 2. Take special measures to prevent chemicals, fuels, oils, greases, herbicides, and insecticides from entering the landfill or drainage ways.
 3. Do not allow water used in onsite material processing, concrete curing, cleanup, and other waste waters to enter a drainage way(s) or stream.
 4. FLUIDS RESULTING FROM MAINTENANCE OF VEHICLES OR EQUIPMENT (GASOLINE, OIL, HYDRAULIC FLUIDS, LUBRICANTS, ETC.) SHALL NOT BE DUMPED ONTO THE GROUND.
- F. Control of Dust:
1. The control of dust shall mean that no construction activity shall take place without applying all such reasonable measures as may be required to prevent particulate matter from becoming airborne so that it remains visible beyond the limits of construction. Reasonable measures may include paving, frequent road cleaning, planting vegetative groundcover, application of water or application of chemical dust suppressants.
 2. Utilize methods of construction to eliminate dust in full observance of agency regulations.
 3. The Engineer will determine the effectiveness of the dust control program and may request the Contractor to provide additional measures, at no additional cost to Owner.
- G. Burning:
1. No burning of waste materials is allowed.
- H. Control of Noise:
1. Control noise by fitting equipment with appropriate mufflers.
 2. Noise shall not exceed 60 dB at the facility property line.
- I. Completion of Work:
1. Upon completion of work, leave area in a clean condition the same as surrounding undisturbed areas.
 2. Ensure all signs of temporary construction and activities incidental to construction of required permanent work are removed with site being restored to its original condition.
- J. Leachate Control:
1. Contractor shall control any leachate encountered during the work in conformance with State and Federal laws.

K. Landfill Gas Control:

1. Contractor shall monitor and control potentially explosive landfill gas during the installation of the well systems. Work shall be completed in conformance with Landfill Permit, the Contractor's Health and Safety Plan and these specifications.

END OF SECTION

94L19

SECTION 01600

PRODUCT DELIVERY, STORAGE, AND HANDLING

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Scheduling of product delivery.
 - 2. Packaging of products for delivery.
 - 3. Protection of products against damage from:
 - a. Handling.
 - b. Exposure to elements or harsh environments.
- B. Related Sections include but are not necessarily limited to:
 - 1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
 - 2. Division 1 - General Requirements.
 - 3. Section 11550 - Landfill Gas Candlestick Flare Station.
- C. Payment:
 - 1. No payment will be made to Contractor for equipment or materials not properly stored and insured or without approved shop drawings.
 - a. Previous payments for items will be deducted from subsequent progress estimate(s) if proper storage procedures are not observed.

1.02 DELIVERY

- A. Scheduling:
 - 1. Schedule delivery of products or equipment as required to allow timely installation and to avoid prolonged storage.
- B. Packaging:
 - 1. Deliver products or equipment in containers designed and constructed to protect the contents from physical or environmental damage.
- C. Identification:
 - 1. Clearly and fully mark and identify as to manufacturer, item, and installation location.
- D. Protection and Handling:
 - 1. Provide manufacturer's instructions for storage and handling.

PART 2 - EXECUTION

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2.01 PROTECTION, STORAGE AND HANDLING

A. Manufacturer's Instruction:

1. Protect all products or equipment in accordance with manufacturer's written directions.
 - a. Store products or equipment in location to avoid physical damage to items while in storage.
 - b. Handle products or equipment in accordance with manufacturer's recommendations and instructions.
2. Protect equipment from exposure to elements and keep thoroughly dry.
3. When space heaters are provided in equipment, connect and operate heaters during storage until equipment is placed in service.

END OF SECTION

96A02

SECTION 01601

JOB CONDITIONS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Job conditions for work to be performed.
- B. Related Sections include but are not necessarily limited to:
 - 1. Bidding Requirements, Contract Forms, and Provisions of the Contract.
 - 2. General Conditions and Special Conditions.

1.02 PROJECT CONDITIONS

- A. Prior to installation of materials verify with Subcontractors, material manufacturers, and installers that the subgrade or surface to which those materials attach is acceptable for installation of those materials.
- B. Maintain approved substrate or correct unacceptable substrate until acceptable for installation of equipment or materials.
- C. Underground and overhead utilities are located in and adjacent to the Work area. The Contractor is responsible for locating and marking these utilities as well as any damage caused by the Work.
- D. Protection and avoidance of monitor wells, drainage structures, benchmarks, permanent fencing and other facility appurtenances is the responsibility of the Contractor. Contractor will be held liable for any and all damage to facilities caused by the Contractor or his Subcontractors.
- E. Contractor will minimize interruption of facility operations by the Work. Contractor shall confine his operations to those areas shown on the construction drawings. Construction traffic shall not utilize existing facility access roads used by normal waste disposal vehicles. Exceptions may be granted by the Engineer.
- F. Contractor shall arrange for access to the site outside normal facility operating hours as needed with the Engineer.
- G. Contractor shall complete Work by dates scheduled as outlined in the Contract Provisions.
- H. Contractor shall be responsible for supplying water for

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construction.

- I. Contractor shall observe all City, State, and Federal Regulations governing the Work to be performed. Special attention is called to the requirements of the Landfill Permit and the requirements of the Occupational Safety and Health Act, (OSHA 1910).
- J. Contractor shall work only during normal landfill operating hours and as specified by other State or Federal Agencies. The Contractor may request, in writing, to the Engineer for alternative working hours.

END OF SECTION

94L19

SECTION 01640

PRODUCT SUBSTITUTIONS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. The procedure(s) for requesting substitution approval for a product which is specified by descriptive or performance criteria or defined by reference to one or more of the following:
 - a. Name of manufacturer.
 - b. Name of vendor.
 - c. Trade name.
 - d. Catalog number.
 - 2. This Section does not address substitutions for major equipment. See "Instructions to Bidders."
- B. Related Sections include but are not necessarily limited to:
 - 1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of The Contract.
 - 2. Division 1 - General Requirements.
- C. Requests for Substitution - General:
 - 1. Base all bids on materials, equipment, and procedures specified.
 - 2. Certain types of equipment and kinds of material are described in specifications by means of references to names of manufacturers and vendors, trade names, or catalog numbers. When this method of specifying is used, it is not intended to exclude from consideration other products bearing other manufacturer's or vendor's names, trade names, or catalog numbers, provided said products are capable of accomplishing the same tasks as the products specifically indicated.
 - 3. Other types of equipment and kinds of material may be acceptable.

1.02 QUALITY ASSURANCE

- A. In making request for substitution or in using an approved product, Contractor represents:
 - 1. He has investigated the proposed product, and has determined that it is adequate or superior in all respects to that specified, and that it will perform function for which it is intended.
 - 2. He will provide same guarantee for substitute item as for product specified.
 - 3. He will coordinate installation of accepted substitution

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into Work, to include building modifications if necessary, making such changes as may be required for Work to be complete in all respects.

4. He waives all claims for additional costs related to substitution which subsequently arise.

1.03 DEFINITIONS

- A. Product: Manufactured material or equipment.

1.04 PROCEDURE FOR REQUESTING SUBSTITUTION

- A. Considered after award of Contract.

- B. Written requests through Contractor only.

- C. Transmittal Mechanics:

1. Follow the transmittal mechanics prescribed for shop drawings in Section 01340. Product substitution will be treated in a manner similar to "deviations," as described in paragraph 1.04-A.10.f of Section 01340. List the letter describing the deviation and justifications on the transmittal form in the space provided under the column with the heading "DESCRIPTION." Include in the transmittal letter, either directly or as a clearly marked attachment, the items listed in paragraph D below.

- D. Transmittal Contents:

1. Product identification:
 - a. Manufacturer's name.
 - b. Telephone number and representative contact name.
 - c. Specification section or drawing reference of originally specified product, including discrete name or tag number assigned to original product in the Contract Documents.
2. Manufacturer's literature clearly marked to show compliance of proposed product with Contract Documents.
3. Itemized comparison of original and proposed product addressing product characteristics including but not necessarily limited to:
 - a. Size.
 - b. Composition or materials of construction.
 - c. Weight.
 - d. Electrical or mechanical requirements.
4. Product experience:
 - a. Location of past projects utilizing product.
 - b. Name and telephone number of persons associated with referenced projects knowledgeable concerning proposed product.
 - c. Available field data and reports associated with proposed product.
5. Data relating to changes in construction schedule.
6. Data relating to changes in cost.

7. Samples:
 - a. At request of Engineer.
 - b. Full size if requested by Engineer.
 - c. Held until substantial completion.
 - d. Engineer not responsible for loss or damage to samples.

1.05 APPROVAL OR REJECTION

- A. Written approval or rejection of substitution given by the Engineer.
- B. Engineer reserves the right to require proposed product to comply with color and pattern of specified product if necessary to secure design intent.
- C. In event substitution results in a change of Contract price or time, provisions in General Conditions will be applied for adjustment.
- D. Substitutions will be rejected if:
 1. Submittal is not through the Contractor with his stamp of approval.
 2. Requests are not made in accordance with this Section.
 3. In the Engineer's opinion, acceptance will require substantial revision of the original design.
 4. In the Engineer's opinion, substitution is not equal to original product specified or will not perform adequately the function for which it was intended.

END OF SECTION

95B06

SECTION 01650

FACILITY STARTUP

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Procedures and actions, required of the Contractor, which are a necessary part of achieving and demonstrating Substantial Completion.
 - 2. Demonstration requirement for system performance capabilities in regard to both functional performance parameters and environmental criteria.
- B. Related Sections include but are not necessarily limited to:
 - 1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
 - 2. Division 1 - General Requirements.
 - 3. Division 2 - Site Work.
 - 4. Division 11 - Equipment.
 - 5. Division 15 - Mechanical.

1.02 DEFINITIONS

- A. Pre-Demonstration Period: The period of time, of unspecified duration after initial construction and installation activities during which Contractor, with assistance from others including manufacturer's representatives, performs in the following sequence:
 - 1. Finishing type construction work to ensure the Project has reached a state of Substantial Completion.
 - 2. Equipment startup.
 - 3. Personnel training.
- B. Demonstration Period: A period of time, of specified duration, following the Pre-Demonstration Period, during which the Contractor initiates process flow through the system and starts up and operates the system, without exceeding specified downtime limitations, to prove flare station has met the functional performance requirements in Section 11550, and the functional performance of the mechanical and electrical equipment and components and the control interfaces of the respective equipment and components comprising the facility as evidence of Substantial Completion.
- C. Substantial Completion: See Division 0, General Conditions.

1.03 SUBMITTALS

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- A. Submit in the chronological order listed below prior to the completion of the Pre-Demonstration Period.
1. Master operation and maintenance training schedule for approval by Owner, to include:
 - a. Target date and time for Owner witnessing of each system initial startup.
 - b. Target date and time for field Operation and Maintenance training for each system.
 - c. Target date for initiation of Demonstration Period.
 - d. Identify initial target dates for any individual manufacturer's training sessions.
 2. Provide a status report and schedule-to-complete for requirements prerequisite to manufacturer's training.
 3. Contractor's Notice of Substantial Completion and Request for Inspection.
 4. Accepted Operation and Maintenance manuals.
 5. Written notice to Owner of each system pre-demonstration startup.
 6. Equipment installation and pre-demonstration startup certifications from all equipment.
 7. Letter verifying completion of all pre-demonstration startup activities including receipt of all specified items from manufacturers or suppliers as final item prior to initiation of Demonstration Period.
 8. A log showing each equipment item subject to paragraph 3.02-B of this Section and listing what is to be accomplished during Equipment Startup. Provide a place for the Contractor to record date and person accomplishing required work.
 9. Provide certifications, without restrictions or qualifications, and deliver to OWNER:
 - a. Manufacturer's equipment installation check letters.
 - b. Instrumentation Supplier's Instrumentation Installation Certificate.
- B. Submittal Schedule:
1. Submit master operation and maintenance training schedule 30 days (minimum) prior to first training session for OWNER's personnel.
 2. Attend a schedule planning and coordination meeting 30 calendar days prior to first anticipated training session.
 3. OWNER reserves the right to insist on a minimum 7 day's notice of rescheduled training session not conducted on the master schedule target date for any reason.
 4. Approved operation and maintenance manuals received by ENGINEER minimum 1 week prior to scheduled training.
 5. Written notice for each system pre-demonstration startup received by OWNER a minimum of 1 week before scheduled training on that system.
 6. Equipment startup log submitted prior to request for substantial completion certification.

1.04 COST OF STARTUP

- A. Contractor to pay all costs associated with Project startup including pre-demonstration and demonstration periods.

PART 2 - PRODUCTS - (NOT APPLICABLE TO THIS SECTION)

PART 3 - EXECUTION

3.01 GENERAL

- A. Facility startup will be divided into two periods:
 - 1. Pre-Demonstration Period including:
 - a. Completion of construction work to bring Project to a state of Substantial Completion.
 - b. Initial shakedown of equipment.
 - c. Training of personnel.
 - d. Verification of the filing of all required submittals.
 - e. Filing of Contractor's Notice of Substantial Completion and Request for Inspection.
 - 2. Demonstration Period including:
 - a. Demonstration of functional performance of system.

3.02 PRE-DEMONSTRATION PERIOD

- A. Completion of construction work to a state of substantial completion.
- B. Initial Shakedown of Equipment:
 - 1. Requirements for individual items of equipment are included in Divisions 2 through 16 of these Specifications.
 - 2. Prepare the equipment so it will operate properly and safely and demonstrate functional performance during the Demonstration Period.
 - 3. Perform Equipment Startup to extent possible without introducing landfill gas or condensate.
 - 4. Introduce product flow to complete Equipment Startup for the following equipment:
 - a. Condensate sumps (water).
 - b. Blowers (landfill gas).
 - c. Flare and controls.
 - d. Air compressor.
 - 5. Procedures include but are not necessarily limited to the following:
 - a. 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. (See Pipe Testing in Section 15060.)
- 7) Lubrication.
- 8) Valve orientation and position status for manual operating mode.
- 9) Tankage for integrity using clean water.
- 10) Pumping equipment using clean water.
- 11) Instrumentation and control signal generation, transmission, reception, and response.
- 12) Tagging and identification systems.
- 13) All equipment: Proper connections, alignment, calibration and adjustment.
- b. Calibrate all safety equipment.
- c. Manually rotate or move moving parts to assure freedom of movement.
- d. "Bump" start electric motors to verify proper rotation.
- e. Perform other tests, checks, and activities required to make the equipment ready for Demonstration Period.

C. Personnel Training:

1. Conduct all personnel training after completion of Equipment Startup.
 - a. Personnel training on individual equipment or systems will be considered completed if:
 - 1) All pretraining deliverables are received and approved before commencement of training on the individual equipment or system.
 - 2) No system malfunctions occur during training.
 - 3) All provisions of field training specifications are met.
 - b. Training will be performed again in its entirety by the manufacturer or others at no additional cost to Owner, if requirements not in compliance with the above.
2. Field training requirements:
 - a. Hold field training on-site at the landfill.
 - b. Notify each manufacturer specified for on-site training that the Owner reserves the right to video record any or all training sessions. Organize each training session in a format compatible with video recording.
 - c. Training instructor: Familiar with "hands-on" instructions.
 - d. Training instructors: Be at classes on time. Session beginning and ending times to be coordinated with the Owner and indicated on the master schedule. Normal time lengths for class periods can vary, but brief rest breaks should be scheduled and taken.
 - e. Organize training sessions into maintenance verses operation topics and identify on schedule.
 - f. Plan for one class session with a minimum attendance of five people and provide sufficient classroom materials,

- samples, and handouts for those in attendance.
 - g. Instructors to have a typed agenda and well prepared instructional material.
 - h. In the on-site training sessions, cover the information required in the Operation and Maintenance manuals submitted according to Section 01340 and the following areas.
 - 1) Operation of equipment.
 - 2) Lubrication of equipment.
 - 3) Maintenance and repair of equipment.
 - 4) Troubleshooting of equipment.
 - 5) Preventive maintenance procedures.
 - 6) Adjustments to equipment.
 - 7) Inventory of spare parts.
 - 8) Optimizing equipment performance.
 - 9) Capabilities.
 - 10) Operational safety.
 - 11) Emergency situation response.
 - 12) Takedown procedures (disassembly and assembly).
 - i. Address above paragraphs 1), 2), 8), 9), 10), and 11) in the operation sessions. Address above paragraphs 3), 4), 5), 6), 7), and 12) in the maintenance sessions.
 - D. Verification of the filing of all required submittals including:
 - 1. Shop drawings.
 - 2. Operation and Maintenance Manuals.
 - 3. Training material.
 - 4. Testing protocols.
 - E. Filing of Contractor's Notice of Substantial Completion and Request for Inspection of Project:
 - 1. File the notice when the following have been completed:
 - a. Construction work (brought to state of Substantial Completion).
 - b. Equipment Startup.
 - c. Personnel Training.
 - 2. Engineer will inform Contractor in writing of the status of the Work reviewed.
 - 3. Upon successful completion of Demonstration Period, Substantial completion will be deemed to be complete.
- 3.03 DEMONSTRATION PERIOD
- A. General:
 - 1. Demonstrate the performance requirements of the candlestick flare (Section 11550), and the functional performance of the mechanical, electrical, and control interfaces of the respective equipment and components comprising the facility.
 - 2. Duration of Demonstration Period: Minimum 120 consecutive hours.
 - 3. If, during the Demonstration Period, the aggregate amount of time used for repair, alteration, or unscheduled adjustments

to any equipment or systems that renders the affected equipment or system inoperative exceed 10 percent of the Demonstration Period, the demonstration of functional performance will be deemed to have failed. In the event of failure, a new Demonstration Period will recommence after correction of the cause of failure. The new Demonstration Period shall have the same requirements and minimum duration as the initial Demonstration Period.

4. Conduct the demonstration of functional performance under full operational conditions.
5. Owner will provide personnel to assist in process decisions affecting project performance. Owner's and Engineer's assistance will be available only for process decisions. Contractor will perform all other functions including but not limited to equipment operation and maintenance until successful completion of the Demonstration Period.
6. Owner reserves the right to simulate operational variables, equipment failures, routine maintenance scenarios, etc., to verify the functional performance of automatic and manual backup systems safety shutdowns and alternate operating modes.
7. Time of beginning and ending any Demonstration Period shall be agreed upon by Contractor, Owner, and Engineer in advance of initiating Demonstration Period.
8. Throughout the Demonstration Period, provide knowledgeable personnel to answer Owner's questions, provide final field instruction on select systems and to respond to any system problems or failures which may occur.
 - a. Provide final field instruction on the flare station controls and alarm responses.
9. Provide all labor, supervision, utilities, chemicals, maintenance, equipment, vehicles and any other item necessary to operate and demonstrate the flare station.

END OF SECTION

94K17

SECTION 01700

PROJECT ACCEPTANCE

PART 1 - GENERAL

1.01 SUMMARY

- A. The Work will be deemed complete only when all items included in Article 1.03 are completed.
- B. The CONTRACTOR shall be responsible for the maintenance of all components of the Work until final acceptance. No additional payment shall be made for such maintenance.
- C. The CONTRACTOR's warranty period shall begin immediately following final acceptance by the OWNER.
- D. Related Sections include but are not necessarily limited to:
 - 1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
 - 2. Division 1 - General Requirements.
 - 3. Section 11065 - Landfill Gas Condensate Sumps.
 - 4. Section 11550 - Landfill Gas Candlestick Flare Station.
 - 5. Section 11551 - Landfill Gas Blower.
 - 6. Section 15866 - Air Compressor.

1.02 DEFINITIONS

- A. FDEP: Florida Department of Environmental Protection.

1.03 REQUIREMENTS FOR FINAL ACCEPTANCE

- A. All required submittals shall have been received and where necessary approved prior to final acceptance.
- B. Contractor shall provide certification and warranty that the flare is capable of destroying at least 98% VOC's.
- C. A pre-final inspection by the OWNER and ENGINEER will be performed to review compliance with Plans and Specifications. All items and issues deemed to be open or incomplete will be documented in a punch list. The ENGINEER may use any reasonable method and/or procedure to determine compliance with Plans and Specifications. The CONTRACTOR shall address all items on the punch list to the satisfaction of the OWNER prior to final acceptance.
- D. A Notice of Completion of Construction will be issued upon acceptance of the Project by the OWNER and ENGINEER. This Notice of Completion shall serve as official notice that the

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Project Construction has been completed, final construction payment is due to the CONTRACTOR.

PART 2 - MATERIALS (NOT REQUIRED FOR THIS SECTION)

PART 3 - EXECUTION (NOT REQUIRED FOR THIS SECTION)

END OF SECTION

94L19

SECTION 01710

CLEANING

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Intermediate and final cleaning of Work not including special cleaning of closed systems specified elsewhere.
- B. Related Sections include but are not necessarily limited to:
 - 1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
 - 2. Division 1 - General Requirements.

1.02 STORAGE AND HANDLING

- A. Store cleaning products and cleaning wastes in containers specifically designed for those materials.

1.03 SCHEDULING

- A. Schedule cleaning operations so that dust and other contaminants disturbed by cleaning process will not fall on newly painted surfaces.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Cleaning Agents:
 - 1. Compatible with surface being cleaned.
 - 2. New and uncontaminated.
 - 3. For Manufactured Surfaces: Material recommended by manufacturer.

PART 3 - EXECUTION

3.01 CLEANING - GENERAL

- A. Prevent accumulation of wastes that create hazardous conditions.
- B. Conduct cleaning and disposal operations to comply with laws and safety orders of governing authorities.
- C. Do not dispose of volatile wastes such as mineral spirits, oil, or paint thinner in storm or sanitary drains or sewers.

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- D. Dispose of degradable debris at landfill open face as designated by the Owner.
- E. Dispose of nondegradable debris at landfill open face as designated by the Owner.
- F. Handle materials in a controlled manner with as few handlings as possible.
- G. Do not drop or throw materials from heights greater than 4 FT or less than 4 FT if conditions warrant greater care.
- H. On completion of work, leave area in a clean, natural looking condition. Remove all signs of temporary construction and activities incidental to construction of required permanent Work.
- I. Do not burn on-site.

3.02 INTERIOR CLEANING

- A. Cleaning During Construction:
 - 1. Keep work areas clean so as not to hinder health, safety or convenience of personnel in existing facility operations.
 - 2. At maximum weekly intervals, dispose of waste materials, debris, and rubbish.
 - 3. Vacuum clean interior areas when ready to receive finish painting. Continue vacuum cleaning on an as-needed basis, until substantial completion.
- B. Final Cleaning:
 - 1. Complete immediately prior to Demonstration Period.
 - 2. Remove grease, mastic, adhesives, dust, dirt, stains, fingerprints, labels, and other foreign materials from sight-exposed surfaces.
 - 3. Wipe all lighting fixture reflectors, lenses, lamps and trims clean.
 - 4. Wash and shine glazing and mirrors.
 - 5. Polish glossy surfaces to a clear shine.

3.03 EXTERIOR (SITE) CLEANING

- A. Cleaning During Construction:
 - 1. Construction debris:
 - a. Confine in strategically located container(s):
 - 1) Cover to prevent blowing by wind.
 - 2) Haul from site minimum once a week.
 - b. Remove from work area to container daily.
 - 2. Vegetation:
 - a. Keep weeds and other vegetation trimmed to 3 IN maximum height.

3. Soils, sand, and gravel deposited on paved areas and walks:
 - a. Remove as required to prevent muddy or dusty conditions.
 - b. Do not flush into storm sewer system.

B. Final Cleaning:

1. Remove trash and debris containers from site:
 - a. Re-seed areas disturbed by location of trash and debris containers.
2. Clean paved roadways.
3. Clean out all drainage culverts impacted by construction activities.

3.04 FIELD QUALITY CONTROL

- A. Immediately prior to Demonstration Period, conduct an inspection with Engineer to verify condition of all work areas.

END OF SECTION

Division 2

Site Work

95B06

SECTION 02130

LANDFILL GAS WELLHEAD

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Construction and installation of landfill gas wellheads.
- B. Related Sections include but are not necessarily limited to:
 - 1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
 - 2. Division 1 - General Requirements.
 - 3. Section 15060 - Pipe and Pipe Fittings: Basic Requirements.
 - 4. Section 02135 - Vertical Landfill Gas Wells
- C. Unit Prices:
 - 1. Measurement:
 - a. Well heads per different size and type specified and installed, to be counted as each.
 - b. Count classes, types and sizes separately.
 - c. All fittings and appurtenances, including valves, flexible hose, and joints to be included in each well head being measured.
 - 2. Payment:
 - a. Payment for well head per each unit.
 - b. Payment constitutes full compensation for furnishing all labor, materials, equipment, supplies and supervision necessary for installation of the well head; and all other incidentals required to complete the Work in accordance with the Plans and Specifications and to the satisfaction of the Engineer.

1.02 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. American Society for Testing and Materials (ASTM):
 - a. ASTM D-638 - Test Method for Tensile Properties of Plastics.
 - b. ASTM D-696 - Linear Thermal Expansion Coefficient.
 - c. ASTM D-746 - Brittleness Temp.
 - d. ASTM D-790 - Test Method for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
 - e. ASTM D-1248 - Specification for Polyethylene Plastics Molding and Extrusion Materials.
 - f. ASTM D-1505 - Text Method for Density of Plastics by the Density Gradient Technique.
 - g. ASTM D-1525 - Vicat Softening Temp.
 - h. ASTM D-1693 - Test Method for Environmental Stress

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Cracking of Ethylene Plastics.

- i. ASTM D-2122 - Method for Determining Dimensions of Thermal Plastic Pipe and Fittings.
- j. ASTM D-2837 - Method for obtaining Hydrostatic Design Basis for Thermal Plastic Pipe Materials.
- k. ASTM D-3350 - Specification for Polyethylene Plastic Pipe and Fittings Material.
- l. ASTM F-1248 - Determination of Environmental Stress Crack Resistance (ESCR) of Polyethylene Pipe.
- m. ASTM D-4218 - Test Method for Carbon Black Content in Polyethylene Compounds by the Muffle-Furnace Technique.
- n. ASTM F-714 - Standard Specification for Polyethylene Plastic Pipe Based on Outside Diameter.
- o. A182, Standard Specification for Forged or Rolled Alloy Steel Pipe Flanges, Forged Fittings and Valves and Parts for High Temperature Service.
- p. A234, Standard Specification for Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.
- q. A774, Standard Specification for As-Welded Wrought Austenitic Stainless Steel Fittings for General Corrosive Service at Low and Moderate Temperatures.
- r. D3261, Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.
- 2. American Water Works Association (AWWA).
 - a. C207-94, Steel Pipe Flanges for Waterworks Service.
- 3. American National Standards Institute (ANSI):
 - b. B16.3, Malleable Iron Threaded Fittings.
 - c. B16.5, Pipe Flanges and Flanged Fittings.
 - d. B16.9, Factory-Made Wrought Steel Butt-Welding Fittings.
 - e. B18.2.1, Square and Hex Bolts and Screws.
 - f. B18.2.2, Square and Hex Nuts.

B. Qualifications:

- 1. Supplied equipment in reference to this section shall have been proven in a landfill type environment for no less than 1 year.

1.03 SUBMITTALS

- A. See Section 01340.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 - 1. HDPE pipe:
 - a. See Section 15065

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2. Flexhose:
 - a. Landfill Gas and Environmental Products, Inc.
 - b. Ryan Herco PVC Hose.
 - c. Kanaflex PS-101.
 - d. Hi-Tech Hose, Inc.
 - e. Or approved equal.

- B. Contractor may elect to purchase wellheads preassembled from the following vendors:
 1. EZ Products.
 2. Landtec Landfill Control Technologies.
 3. Landfill Gas and Environmental Products, Inc.
 4. Or approved equal.

- C. Submit requests for substitution in accordance with Section 01640.

2.02 WELLHEAD

- A. Wellhead pipe size:
 1. As specified in the well schedule.
 2. ASTM D3350 Cell Classification 345434C or 345444C.
- B. Control Valve:
 1. HDPE SDR 17 ball valve with Viton Seal.
 - a. EZ Flow or approved equal.
- C. Quick Connect Ports:
 1. 1/4 IN NPT positive sealing barbed lab cock fittings. Shall be constructed of either stainless steel or chrome plated brass.
- D. Fittings:
 1. All fittings shall be SDR 17 HDPE.
- E. Temperature Probe:
 1. Range 0-200 DegF, 304 or 316 stainless steel construction.
 2. Dial cover shall be water tight and suitable for outdoor use.
 3. Shall be appropriate for corrosive process application and shall be installed in the wellhead on the well side of the control valve.
 4. Temperature probes shall be installed to allow for easy replacement. No part of the temperature element shall be in direct contact with the wellhead or riser pipe.
 5. The depth of installation shall be approximately the radius of the pipe.

PART 3 - EXECUTION

3.01 PREPARATION

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- A. All materials necessary to complete the gas wellheads shall be on-site prior to installation.

3.02 INSTALLATION

A. General:

- 1. Construction:
 - a. All wellheads to be constructed of identical materials of identical dimensions in accordance with the contract documents connection to the header.
 - b. Any changes must be approved by the Engineer.
 - c. Orientation of all wellhead components shall be identical.
- 2. All wellheads will be installed on the well casing stub-outs located in the contract drawings and verified in the field. Well heads will be installed following the completion of the gas collection well construction and installation.

B. Wellhead Installation:

- 1. The wellhead shall be installed within 1/4 percent of vertical.
- 2. The wellhead shall be handled and installed according to the manufacturer's instructions.
- 3. Well head to header connection shall be made with a 6" HDPE tee reduced to 2" dia. with a flexible PVC coupling fastened with 304 stainless steel pipe clamps.
- 4. Existing well casing shall be fastened to the wellhead with a 6" x 6" flexible PVC coupling and a 6" x 2" flexible PVC bushing. Coupling to be fastened with 304 stainless steel pipe clamps.
- 5. New well casings shall be fastened to wellheads with 6" diameter cast iron flange.

END OF SECTION

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SECTION 02135

VERTICAL LANDFILL GAS EXTRACTION WELLS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Installation of vertical landfill gas extraction wells.
- B. Related Sections include but are not necessarily limited to:
 - 1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
 - 2. Division 1 - General Requirements.
 - 3. Section 15060 - Pipe and Pipe Fittings: Basic Requirements.
 - 4. Section 02130 - Landfill Gas Wellheads
- C. Unit Prices:
 - 1. Measurement:
 - a. For 36 IN auger hole measured in linear feet of specified types and sized, in place, completed and approved.
 - b. For 6 IN well casing and gravel pack measured in linear feet of specified types and sized, in place, completed and approved.
 - c. For backfill measured in linear feet of specified types in place, completed and approved.
 - d. Measure along centerline of pipe from end to end.
 - e. Include all fittings, appurtenances and joints in total footage of pipe being measured less those items covered in Section 02130.
 - 2. Payment:
 - a. Payment made at contract unit price per lineal feet for each kind of the type and size designated.
 - b. Payment constitutes full compensation for furnishing all labor, materials, equipment, supplies and supervision necessary for installation; and all other incidentals required to complete the Work in accordance with the Plans and Specifications and to the satisfaction of the Engineer.

1.02 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. American Society for Testing and Materials (ASTM):
 - a. A53, Specification for Pipe, Steel, Black, and Hot Dip Galvanized, Zinc-Coated Welded and Seamless.
 - b. C94, Specification for Ready-Mixed Concrete.
 - c. C150, Specification for Portland Cement.

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- d. D2513, Thermoplastic Gas Pressure Pipe, Tubing, and Fittings.
- e. D2683, Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter - Controlled Polyethylene Pipe and Tubing.
- f. D3261, Standard Specification for Butt Heat Fusion Polyethylene (PE Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.
- g. F480, Specification for Thermoplastic Water Well Casing Pipe and Couplings Made in Standard Dimension Ratio (SDR).
- h. ASTM D-3350 - Specification for Polyethylene Plastic Pipe and Fittings Material.
- i. ASTM F-1248 - Determination of Environmental Stress Crack Resistance (ESCR) of Polyethylene Pipe.
- j. ASTM D-1693 - Test Method for Environmental Stress Cracking of Ethylene Plastics.

B. Qualifications:

- 1. Installer shall have completed at least twenty-five successful vertical landfill gas extraction wells of similar construction within the last 5 years.

C. Miscellaneous:

- 1. Contractor's personnel health and safety plan.

1.03 SUBMITTALS

A. Shop Drawings:

- 1. See Section 01340.
- 2. Product technical data including:
 - a. Manufacturer's instruction for proper screen and well installation.

B. Project Record Documents:

- 1. Daily driller's report: During the drilling of the well, maintain daily driller's report that includes:
 - a. The number of feet drilled.
 - b. The number of hours on the job.
 - c. Names of contract personnel on the job.
 - d. Down time due to breakdown.
 - e. The feet of casing set.
 - f. Other pertinent data as may be requested by the Engineer.
- 2. Driller's log: During the drilling of the well, prepare and maintain complete log that includes:
 - a. The reference point for all depth measurements.
 - b. The depth at which each soil to refuse change occurs.
 - c. The thickness of each soil or refuse stratum.
 - d. The depth at which the leachate is encountered if applicable.
 - e. Total depth of completed extraction well.

- f. Depth of refuse and depth of undisturbed soil.
- g. Depth or location of any lost drilling materials, tools, or any other unusual occurrences.
- h. Depth and thickness of bentonite seal.
- i. Well screen interval.
- j. Gravel filter pack depth interval.
- k. Top and bottom bentonite seal depth interval.
- l. General description of refuse encountered.

- 3. Bentonite
 - a. Chemical and physical characteristics.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following Manufacturers of HDPE casing, screen, protective casing and accessories are acceptable:
 - 1. Plexco.
 - 2. Driscopipe.
 - 3. CSR/Hydroconduit.
 - 4. Approved equal.
- B. Submit requests for substitution in accordance with Section 01640.

2.02 MATERIALS

- A. Well Casing:
 - 1. As specified in the well schedule.
 - 2. High Density Polyethylene Pipe (HDPE) PE 3408 SDR11 or approved equal with ASTM D3350 Cell Classification 345434C or 345444C.
 - 3. ASTM 2513.
- B. Well Screen:
 - 1. Same material and dimensions as casing.
 - 2. Holes with a minimum open area equivalent to four 1/2 IN diameter holes spaced at 90 degrees every 4 IN of screen length. Hole size shall not exceed minimum diameter of filter pack.
 - 3. 10 or 20 FT factory-cut lengths.
 - 4. Holes to be factory installed. No holes or slots to be installed in the field.
- C. Jointing:
 - 1. All joints shall be butt fused per ASTM D3261.
 - 2. Bottom cap of screen shall be butt fused per ASTM D3261.
- D. Filter Pack:

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1. Clean washed non-calcareous gravel no more than 2% fines.
2. Gradation:
 - 0 to 15% passing 0.5-inch sieve
 - min. 95% passing 3-inch sieve
 - min. 50% retained on 1-inch sieve

E. Bentonite Seal:

1. Pellet or chip form of sodium montmorillonite.

F. Bottom Cap:

1. Same material as well casing.

PART 3 - EXECUTION

3.01 PREPARATION

- A. All materials necessary to complete the installation of the gas extraction well shall be on-site prior to drilling start-up.
- B. Contractor shall follow his Health and Safety Plan at all times.

3.02 INSTALLATION

A. General:

1. All wells will be installed in the locations shown in the Contract Drawings. The well schedule shows the design depths of the wells along with the associated screen lengths. All field changes regarding the locations, depth, or dimensions specified in the Contract Drawings shall be approved by the Engineer and documented in the record drawings by the Contractor.

B. Well Borehole Construction:

1. Drill wells using a minimum 36 IN OD core-grab bucket auger. Alternate drilling methods must be pre-approved by the Engineer.
2. All gas extraction well borings shall extend to depths as indicated on Drawings.

C. Well Installation:

1. Measure depth of boring.
2. Connect the well screen and a sufficient length of well casing including bottom cap.
3. Tremie 1 FT of gravel filter pack in the bottom of the boring prior to installing well casing.
4. Lower the well screen and casing to the gravel in the bottom of the boring.
5. Continue placement of gravel filter pack into the annulus between the well screen and the borehole wall until the filter pack is approximately 18 IN above the top of the well screen. All filter pack materials shall be placed by Tremie.

- Well screen and riser shall be centered in borehole at all times.
6. Take periodic depth soundings to monitor the level of the filter pack and detect any bridging. Soundings shall be taken at no more than 5-FT intervals.
 7. Place 12 IN of sand backfill on top of the gravel filter pack at a minimum.
 8. Place 3 FT minimum bentonite seal on sand pack.
 9. Prior to installing bentonite seal, center well casing in the bore hole.
 10. Fill the remainder of the bore hole to grade with clean backfill, compacting the fill by means pre-approved by the Engineer in maximum 18-IN lifts.
- D. Well Screen and Casing:
1. Lower screen into the well with the casing. In no instance, drive or force into position.
 2. Suspend from the ground surface until the gravel pack has been placed.
 3. Join screen and riser sections for a single interval by butt fusion methods per ASTM D3261.
 4. Assure joint(s) are straight, sand-tight and retain 100 percent of the screen/casing strength.
 5. Casing and screen will be set plumb and true to line.
 6. Extend casing to 3 FT above ground surface.
- E. Filter Pack:
1. Install filter pack from the bottom of the boring to 18 IN above the top of the well screen.
 2. Place filter pack by tremie into the annulus.
 3. Measure top of filter pack using a weighted measuring tape after tamping.
- F. Bentonite Seal:
1. Place top bentonite seal of not less than 3 FT and a maximum of 5 FT thickness in the annular space above the 12 IN sand backfill.
 2. Protect bentonite from moisture and contamination during delivery and storage.
 3. Tremie bentonite in maximum 18 IN lifts.
 4. Using a weighted tape, measure depth of bentonite seal after tamping each lift.
 5. Hydrate bentonite pellets in the bore hole per suppliers recommendations for a minimum of 1 HR after placement and prior to installing clean backfill.

END OF SECTION

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SECTION 02135b

HORIZONTAL LANDFILL GAS EXTRACTION WELLS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Construction of horizontal landfill gas extraction wells.
- B. Related Sections include but are not necessarily limited to:
 - 1. Bidding Requirements, Contract Forms, and Conditions of the Contract.
 - 2. General Conditions and Special Conditions.
 - 3. Section 15060 - Pipe and Pipe Fittings: Basic Requirements.
 - 4. Section 15065 - HDPE Pipe
- C. Unit Prices:
 - 1. Measurement:
 - a. Horizontal landfill gas collection wells to be measured in linear feet from end to end of each well.
 - b. All fittings, appurtenances, stubouts, flanges, joints and expansion joints to be included in total collection well being measured.
 - 2. Payment:
 - a. Payment made at contract unit price per lineal feet for horizontal collection well.
 - b. The contract unit price paid per linear foot of horizontal extraction wells shall include full compensation for all materials, labor, tools, equipment and incidentals, and for doing all work involved in supplying and installing horizontal extraction wells, complete in place, including but not limited to excavation, backfill, and compaction, as shown on the plans and as directed by the Engineer.

1.02 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. American Society for Testing and Materials (ASTM):
 - a. D3261, Standard Specification for Butt Heat Fusion Polyethylene (PE Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing).
 - b. C 33, Standard Specification for Concrete Aggregate.
 - c. C 131, Test Method for Resistance to Degradation of Small Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
 - d. C 535, Test Method for Resistance to Degradation of

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Large Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

- e. D 1117, Standard Methods of Testing Non-Woven Fabrics.

B. Qualifications:

- 1. Installer Contractor shall have installed a minimum of 2 landfill gas control systems in the last two years.

C. Miscellaneous:

- 1. The Contractor shall comply with and will not cause a violation of the Landfill Permit to Operate.
- 2. Have project Site Specific Health and Safety Plan available for review by the Owner.

1.03 SUBMITTALS

A. Shop Drawings:

- 1. See Section 01340.
- 2. Product technical data including:
 - a. Manufacturer's instruction for proper well and appurtenance installation.

B. Project Record Documents:

- 1. Daily report: During installation of the wells, maintain a daily report that includes:
 - a. The length of well installed in feet.
 - b. The number of hours on the job.
 - c. Names of contract personnel on the job.
 - d. Down time due to breakdown.
 - e. Other pertinent data as may be requested by the Engineer.
 - f. General description of refuse.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following Manufacturers of HDPE casing, screen, protective casing and accessories are acceptable:

- 1. Plexco.
- 2. Driscopipe.
- 3. CSR/Hydroconduit.

B. Subject to compliance with the Contract Documents, the following Manufacturers of Geotextiles are acceptable:

- 1. Fluid Systems, Inc., 7339 Montgomery Rd., PO Box 36307, Cincinnati, Ohio 45236.
- 2. Amoco Fabrics & Fibers Company, PO Box 43288, Atlanta, Georgia 30336.

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3. Tenax Corporation, 4800 E. Monument Street, Baltimore, MD 21205.
4. Synthetic Industries, 4019 Industry Drive, Chattanooga, TN 37416.

C. Submit requests for substitution in accordance with Section 01640.

2.02 MATERIALS

A. Well Casing (blank):

1. Length and diameter as specified in the project drawings.
2. High Density Polyethylene Pipe (HDPE) PE 3408 SDR17 or approved equal.
3. ASTM 3350 cell classification 345343C.

B. Well Screen:

1. Length and diameter as specified in the project drawings.
2. Holes with a minimum open area equivalent to four 1/2 IN diameter holes spaced at 90 degrees every 4 IN of screen length.
3. 20 FT lengths (minimum).
4. Holes to be factory installed. No holes to be installed in the field.

C. Jointing:

1. Butt Heat Fusion per ASTM D3261.

D. Filter Pack:

1. Gravel used as pipe embedment shall consist of washed non-calcareous gravel meeting the requirements of ASTM C-33 for coarse aggregate. The gravel shall meet the following gradation:

0 to 15% passing 0.5-inch sieve
min. 95% passing 3-inch sieve
min. 50% retained on 1-inch sieve

2. Alternative materials may be accepted conforming to gradation requirements.

E. Filter Fabric:

1. Geotextile materials shall consist of non-woven, 10 OZ/SY polypropylene, filament material manufactured from virgin, first quality resin stabilized for exposure to ultra-violet light.
2. The geotextile shall be manufactured to be free of holes, undispersed raw materials, any sign of contamination by foreign matter, or variation in thickness of more than 10 percent. Any such defect shall be cause for rejection of

the defective geotextile. Minor defects may be repaired in accordance with the manufacturer's recommendations if the repair is approved by the Engineer.

PART 3 - EXECUTION

3.01 PREPARATION

- A. All materials necessary to complete the installation of the horizontal gas extraction wells shall be on-site prior to excavation start-up construction.

3.02 INSTALLATION

- A. General:

- 1. All wells will be installed in the locations shown in the Contract Drawings. All trenching is to go no deeper than 4-1/2 FT below existing Grade. Contractor shall comply with trench ingress and egress requirements of OSHA. All field changes regarding the locations, depth, or dimensions specified in the Contract Drawings shall be approved by the Engineer and documented in the record drawings by the Contractor.

- B. Well Construction:

- 1. This horizontal system is designed so that no personnel are required to enter the trench during construction. The Contractor shall develop an installation sequence to eliminate the need for personnel to enter the trench.
 - 2. Sequence of well installation is to be coordinated with the Owner to minimize the impact on daily facility operations. Owner may alter sequence of installation with reasonable notice given to the Contractor.
 - 3. The Contractor is limited to 200 linear feet of open trench which exposes refuse. The Contractor shall coordinate well construction activities to comply with this requirement.
 - 4. All construction spoils (refuse) shall be directly excavated to a dump truck or be placed in clean piles and/or wind-rows to facilitate neat removal to the landfill working face by the Contractor. The Contractor shall coordinate the management of spoils with the Owner prior to construction of each individual trench.
 - 5. The Contractor shall be responsible for the removal and disposal of the excavated refuse on-site in accordance with these specifications.
 - 6. Clean fill material will be provided by the Contractor.
 - 7. Contractor shall schedule work so that no trench is left open at the end of the working day and that no exposed construction spoils (refuse) remains uncovered. This will require that the Contractor transports all construction spoils for the current working day to the

working face as directed by landfill operations personnel between the hours of 6:30 AM and 2:00 PM.

8. A Site Specific Health and Safety plan for the construction of the horizontal wells must be submitted to the Owner for review prior to commencement of construction. This plan shall meet, at a minimum, the requirements of OSHA 29 CFR 1910.120. Suggested reference material for the development of the Health and Safety plan - "A Compilation of Landfill Gas Field Practices and Procedures" SWANA publication #GR-LG 0101.

C. Well Installation:

1. Well locations will be identified by the Contractor with stakes in the general locations specified on the contract drawings. Stakes will indicate the two end points of each well. Contractor shall provide any additional stakes required and coordinate the installation schedule with the Owner to facilitate stake placement.
2. Beginning and termination point of each well to be installed per the contract drawings. All joints that include 4 IN casing (solid) shall be butt-fused.
3. Trench is to be excavated at a maximum depth below existing grade of 4 1/2 FT deep with at least 1 FT of refuse exposed excluding side slope areas. Contractor shall contact the Owner if this condition is not met.
4. A 1 FT gravel layer shall be placed as a bedding layer for the collection pipe.
5. Collection pipe with expansion joints shall be placed on top of the 1 FT of gravel. Well screen terminations shall meet at the center of the 6 FT expansion joints. Three (3) 6 FT long expansion joints of 6 IN diameter SDR 17 HDPE to be placed in each horizontal well. Two joints will be at either end where the screen begins and one will be in the approximate center of the well.
6. 2 FT of gravel shall be placed over the bedding layer with a minimum of 18 IN covering the collection well.
7. The nonwoven geotextile shall be placed over the gravel covering the entire width of the trench.
8. Trench is to be covered with 1 FT of clean fill dirt.

END OF SECTION

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SECTION 02260

TOPSOILING AND FINISHED GRADING

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Topsoiling and finished grading.
- B. Related Sections include but are not necessarily limited to:
 - 1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
 - 2. Division 1 - General Requirements.
 - 3. Section 02110 - Site Clearing.
 - 4. Section 02200 - Earthwork.
 - 5. Section 02270 - Soil Erosion and Sediment Control.
 - 6. Section 02930 - Sodding and Landscaping.
- C. Location of Work: All areas within limits of grading and all areas outside limits of grading which are disturbed in the course of the work.

1.02 SUBMITTALS

- A. Shop Drawings:
 - 1. See Section 01340.
- B. Project Data:
 - 1. Test reports for furnished topsoil.

1.03 SITE CONDITIONS

- A. On-site topsoil is not available.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Topsoil:
 - 1. Topsoil shall meet the requirements of Florida Department of Transportation Specification Handbook, 1991, Section 162.

2.02 TOLERANCES

- A. Finish Grading Tolerance: 0.1 FT plus/minus from required elevations. Depths and/or thickness greater than this tolerance shall not result in additional costs to the Owner unless the Contrator has prior written approval from

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the Engineer.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Correct, adjust and/or repair rough graded areas.
 - 1. Cut off mounds and ridges.
 - 2. Fill gullies and depressions.
 - 3. Perform other necessary repairs.
 - 4. Bring all sub-grades to specified contours, even and properly compacted.
- B. Loosen surface to depth of 2 IN, minimum.
- C. Remove all stones and debris over 2 IN in any dimension.

3.02 ROUGH GRADE REVIEW

- A. Reviewed by Engineer in Section 02110, Site Clearing.

3.03 PLACING TOPSOIL

- A. Do not place when subgrade is wet or frozen enough to cause clodding.
- B. Spread to loose depth of 6 IN for all disturbed earth areas.
- C. Provide finished surface free of stones, sticks, or other material 1 IN or more in any dimension.
- D. Provide finished surface smooth and true to required grades.

3.04 ACCEPTANCE

- A. Upon completion of topsoiling, obtain Engineer's acceptance of grade and surface.
- B. Make test holes where directed to verify proper placement and thickness of topsoil.

END OF SECTION

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SECTION 02444

CHAIN LINK FENCE AND GATES

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Chain link fencing and gates.
- B. Related Sections include but are not necessarily limited to:
 - 1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
 - 2. Division 1 - General Requirements.
 - 3. See Contract Documents.
- C. Unit Prices:
 - 1. Measurement: Lump sum basis requires no measurement to be made.
 - 2. Payment: Lump sum price constitutes full compensation for furnishing all labor, materials, equipment, supervision and all other incidentals required to complete the Work.

1.02 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. American Society for Testing and Materials (ASTM):
 - a. A153, Standard Specifications for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - b. A392, Standard Specifications for Zinc-Coated Steel Chain-Link Fence Fabric.
 - c. A428, Test Method for Weight of Coating on Aluminum Coated Iron or Steel Articles.
 - d. A824, Metallic-Coated Steel Marcellled Tension Wire.
 - e. F552, Definitions of Terms Relating to Chain-Link Fencing.
 - f. F567, Standard Practice for Installation of Chain Link Fence.
 - g. F626, Standard Specification for Fence Fittings.
 - h. F668, Poly(Vinyl Chloride) (PVC) Coated Chain Link fence Fabric.
 - i. F669, Standard Specification for Strength Requirements of Metal Posts and Rails for Industrial Chain Link Fence.
 - j. F900, Industrial and Commercial Swing Gates.
 - k. F934, Standard Colors for Poly(Vinyl Chloride) (PVC) Coated Chain Link Fence.
 - l. F1083, Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures.

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2. Chain Link Manufacturer's Institute for "Galvanized Steel Chain Link Fence Fabric and Accessories."

B. Qualifications:

1. Installer bonded and licensed in the Project state.
2. Installer shall have a minimum 2 years experience installing similar fencing.
3. Utilize only AWS certified welders.

1.03 DEFINITIONS

- A. See ASTM F552.

- B. NPS: Nominal pipe size, in inches.

- C. Installer or Applicator: Installer or applicator is the person actually installing or applying the product in the field at the Project site.

1. Installer or applicator are synonymous.

1.04 SUBMITTALS

- A. Shop Drawings:

1. See Section 01340.
2. Product technical data including:
 - a. Acknowledgement that products submitted meet requirements of standards referenced.
 - b. Manufacturer's installation instructions.
3. Scaled plan layout showing spacing of components, accessories, fittings, and post anchorage.
4. Mill certificates.
5. Source quality control test results.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Fence systems:
 - a. Cyclone.
 - b. Page-Wilson Corporation (Page Fence Division).
 - c. Anchor Fence, Inc.
 - d. Or approved equal.

- B. Submit requests for substitution in accordance with Specification Section 01640.

2.02 COMPONENTS

- A. Chain Link Fabric:

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1. Fabric type:
 - a. ASTM A392 zinc-coated steel:
 - 1) Coated before weaving, 2.0 OZ/SF.
 - b. PVC-coated steel:
 - 1) ASTM F668, Class 2B.
 - 2) Galvanized core wire, ASTM A641, Class 3.
2. Wire gage: 9.
3. Mesh size: 2 IN.
4. Selvage treatment:
 - a. Top: Knuckled.
 - b. Bottom: Twisted and barbed.
5. PVC color selection by Owner at time of shop drawing reviews.

B. Concrete: See Section 03002.

C. Line Post:

1. ASTM F1083 pipe:
 - a. Schedule 80, NPS 2.
2. Fusion-bonded vinyl coating 10-14 mils thick; color to match fabric.

D. Corner or Terminal Posts:

1. ASTM F1083 pipe:
 - a. Schedule 80, NPS 2-1/2.
2. Fusion bonded vinyl coating 10-14 mils thick; color to match fabric.

E. Brace and Rails:

1. ASTM F1083 pipe:
 - a. Schedule 80, NPS 1-1/4.
2. Furnish top and bottom rails.
3. Fusion bonded vinyl coating 10-14 mils thick; color to match fabric.

F. Fence Fittings (Post and Line Caps, Rail and Brace Ends, Sleeves-Top Rail, Tie Wires and Clips, Tension and Brace Bands, Tension Bars, Truss Rods):

1. ASTM F626.
2. Fusion bonded vinyl coating 10-14 mils thick; color to match fabric.

G. Swing Gate:

1. ASTM F900.
2. Materials as specified for fence framework and fabric.
3. Hardware:
 - a. Galvanized per ASTM A153.
 - b. Hinges to permit 180-degree outward gate opening.

2.03 SOURCE QUALITY CONTROL

A. Test related fence construction materials to meet the following

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standards:

1. Posts and rails:
 - a. ASTM F669, Heavy Industrial.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install in accordance with:
 1. Manufacturer's instructions.
 2. Lines and grades shown on Drawings.
 3. In accordance with ASTM F567.
- B. Do not start fence installation before final grading is complete and finish elevations are established.
- C. Drill holes in firm, undisturbed or compacted soil.
- D. Set all posts in concrete footings with crowned, steel troweled tops.
- E. Place fence with bottom edge of fabric 1 IN above grade. Correct minor irregularities in earth to maintain maximum 2 IN clearance.
- F. Space line posts at equal intervals not exceeding 10 FT OC.
- G. Provide post braces for each gate, corner pull, terminal post, and first adjacent line post.
- H. Install tension bars full height of fabric.
- I. Rails: Fit rails with expansion couplings of outside sleeve type.
 1. Rails continuous for outside sleeve type for full length of fence.
- J. Provide expansion couplings in top rails at not more than 20 FT intervals.
- K. Anchor top rails to main posts with appropriate wrought or malleable fittings.
- L. Install bracing assemblies at all end and gate posts, as well as side, corner, and pull posts.
 1. Locate compression members at mid-height of fabric.
 2. Extend diagonal tension members from compression members to bases of posts.
 3. Install so that posts are plumb when under correct tension.
- M. Pull fabric taut and secure to posts and rails.

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1. Secure so that fabric remains in tension after pulling force is released.
2. Secure to posts at not over 15 IN OC, and to rails at not over 24 IN OC.
3. Use U-shaped wire conforming to diameter of pipe to which attached, clasping pipe and fabric firmly with ends twisted at least two full turns.
4. Bend ends of wire to minimize hazards to persons or clothing.

N. Install post top at each post.

O. Gates:

1. Construct with fittings or by welding.
2. Provide rigid, weatherproof joints.
3. Assure right, non-sagging, non-twisting gate.
4. Coat welds with rust preventive paint, color to match pipe.

END OF SECTION

96J29

SECTION 02930

SODDING AND LANDSCAPING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Sodding:
 - a. Soil preparation.
 - b. Sodding.
 - c. Maintenance of new materials.

B. Related Sections include but are not necessarily limited to:

1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 1 - General Requirements.
3. Section 02260 - Topsoiling and Finished Grading.

1.02 QUALITY ASSURANCE

A. Referenced Standards:

1. American Standard for Nursery Stock (ASNS).
2. Standard Methods of the Association of Official Agricultural Chemists.
3. United States Department of Agriculture, (USDA):
 - a. Federal Seed Act.
4. Florida Department of Transportation (FDOT) Standard Specifications for Road and Bridge Construction, 1991.

1.03 SUBMITTALS

A. Shop Drawings:

1. See Section 01340.
2. Product technical data including:
 - a. Acknowledgement that products submitted meet requirements of standards referenced.
 - b. Manufacturer's installation instructions.
 - c. Source and location of sod and plant material.
3. Other documents:
 - a. Copies of invoices for fertilizer used on Project showing grade furnished, along with certification of quality and warranty. If Engineer determines fertilizer requires sampling and testing to verify quality, testing will be done at Contractor's expense, in accordance with current methods of

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Association of Official Agricultural Chemists. Upon completion of Project, a final check of total quantities of fertilizer used will be made against total area seeded. If minimum rates of application have not been met, Contractor will be required to distribute additional quantities to make up minimum application specified.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Furnish sod within 72 hours of cutting. The sod shall be live, fresh, and uninjured at the time of planting.

1.05 SEQUENCING AND SCHEDULING

- A. Installation Schedule:
 - 1. Provide schedule showing when groundcovers are anticipated to be planted.
 - 2. Indicate anticipated dates Engineer will be required to review installation for initial acceptance and final acceptance.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Sod: Viable, dense, strongly rooted, not less than 2 years old.
 - 1. Bermudagrass or bahia grass.
 - 2. Free of weeds and undesirable native grasses.
 - 3. Strips 12 to 18 inches wide or rolls.
 - 4. Mow prior to stripping from field.
 - 5. Cut so a sufficient thickness of soil is firmly attached to roots.
 - 6. Not frozen or dormant.
- B. Lime shall be dolomitic lime.
- C. Water: Water free from substances harmful to grass or sod growth. Provide water from source approved prior to use.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. General:
 - 1. Limit preparation to areas which will be planted soon after.
 - 2. Provide facilities to protect and safeguard all persons on or about premises.

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3. Protect existing trees designated to remain.
4. Verify location and existence of all underground utilities. Take necessary precaution to protect existing utilities from damage due to construction activity. Repair all damages to utility items at sole expense.
5. Provide facilities such as protective fences and/or watchmen to protect work from vandalism. Contractor to be responsible for vandalism until acceptance of work in whole or in part.

B. Sodding:

1. Notify Engineer of source and location of sod at least 30 days prior to sodding operation, to permit inspection. Submit species and percentages of purity and state botanical and common names.
2. Sod areas are designated and disturbed lawn areas which were sodded or established prior to construction.
3. Perform sodding only during climatic or weather conditions conducive to successful results. Lay within 72 hours of stripping. Do not use dormant or frozen sod. Sodding may be accomplished at all seasonal periods providing adequate provisions for sod protection are taken to ensure fitness and survival. Do not place sod when temperature is below 32 degrees F. Do not place frozen or dried out sod. Do not sod on frozen or dried out soil.
4. Lay sod to form a solid mass with tightly fitted joints. Butt ends and edges; do not overlap. Stagger joints. Tamp or roll lightly to ensure full contact with subgrade. Work sifted soil into minor cracks, avoid smothering adjacent grass.

3.02 MAINTENANCE AND REPLACEMENT

A. General:

1. Begin maintenance of planted areas immediately after each portion is planted and continue until after final acceptance.
2. Provide and maintain temporary piping, hoses, and watering equipment as required to convey water from water sources and to keep planted areas uniformly moist as required for proper growth.
3. Protection of new materials:
 - a. Provide barricades, coverings or other types of protection necessary to prevent damage to existing improvements indicated to remain. Repair and pay for all damaged items.
4. Maintain lawns by watering, fertilizing, weeding, mowing, trimming, and other operations such as rolling, regrading, and replanting as required to

- establish a smooth, uniform lawn, free of weeds and eroded or bare areas.
5. Lay out temporary lawn watering system and arrange watering schedule to avoid walking over muddy and newly sodded areas. Use equipment and water to prevent puddling and water erosion and displacement of sod.
 6. Mow lawns as soon as there is enough top growth to cut with mower set at recommended height for principal species planted. Repeat mowing as required to maintain height. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Time initial and subsequent mowings as required to maintain a height of 6 inches. Do not mow lower than 2 inches.
 7. Unacceptable plantings are those areas that do not meet the quality of the specified material, produce the specified results, or were not installed to the specified methods.
 8. Resod bare areas using same materials specified.
 9. Engineer will review final acceptability of installed areas at end of maintenance period.

END OF SECTION

Division 3

Concrete

96K14

SECTION 03002

CONCRETE

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Poured-in-place concrete and grout.
- B. Related Sections include but are not necessarily limited to:
 - 1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
 - 2. Section 05505 - Metal Fabrications.

1.02 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. American Concrete Institute (ACI):
 - a. 211.1, Standard Practice for Selecting Proportions for Normal and Heavyweight Concrete.
 - b. 212.1R, Admixtures for Concrete.
 - c. 212.2R, Guide for Use of Admixtures in Concrete.
 - d. 214, Recommended Practice for Evaluation of Compression Test Results of Field Concrete.
 - e. 301, Specification for Structural Concrete for Buildings.
 - f. 304, Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete.
 - g. 304.2R, Placing Concrete by Pumping Methods.
 - h. 305R, Hot Weather Concreting.
 - i. 306R, Cold Weather Concreting.
 - j. 318, Building Code Requirements for Reinforced Concrete.
 - k. 347, Recommended Practice for Concrete Formwork.
 - l. SP-19, Cement and Concrete Terminology.
 - m. SP-66, ACI Detailing Manual.
 - 2. American Society for Testing and Materials (ASTM):
 - a. A82, Standard Specifications for Cold Drawn Steel Wire for Concrete Reinforcement.
 - b. A185, Standard Specification for Welded Steel Wire Fabric for Concrete Reinforcement.
 - c. A615, Standard Specification for Deformed and Plain Billet Steel Bars for Concrete Reinforcement Including Supplementary Requirements S1.

- d. C31, Standard Method of Making and Curing Concrete Test Specimens in the Field.
- e. C33, Standard Specification for Concrete Aggregates.
- f. C39, Standard Method of Test for Compressive Strength of Cylindrical Concrete Specimens.
- g. C94, Standard Specification for Ready Mixed Concrete.
- h. C138, Standard Method of Test for Unit Weight, Yield, and Air Content (Gravimetric) of Concrete.
- i. C143, Standard Method of Test for Slump of Portland Cement Concrete.
- j. C150, Standard Specification for Portland Cement.
- k. C171, Standard Specification for Sheet Materials for Curing Concrete.
- l. C172, Standard Method of Sampling Fresh Concrete.
- m. C173, Standard Method of Test for Air Content of Freshly Mixed Concrete by the Volumetric Method.
- n. C192, Standard Method of Making and Curing Concrete Test Specimens in the Laboratory.
- o. C231, Standard Method of Test for Air Content of Freshly Mixed Concrete by the Pressure Method.
- p. C260, Standard Specification for Air Entraining Admixtures for Concrete.
- q. C309, Standard Specification for Liquid Membrane Forming Compounds for Curing Concrete.
- r. C476, Standard Specification for Grout for Masonry.
- s. C494, Standard Specification for Chemical Admixtures for Concrete.
- t. C496, Standard Method of Test for Splitting Tensile Strength of Cylindrical Concrete Specimens.
- u. C618, Standard Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.
- v. C1107, Standard Specifications for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
- w. D994, Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).
- x. D1751, Standard Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-Extruding and Resilient Bituminous Types).
- y. E329, Standard Recommended Practice for Inspection and Testing Agencies for Concrete, Steel, and Bituminous Materials as Used in

Construction.

3. Concrete Reinforcing Steel Institute:
 - a. Manual of Standard Practice.
 - b. Placing Reinforcing Bars.
4. Standard Building Code-1991, by SBCCI.

B. Quality Control:

1. Contractor's concrete testing agency.
 - a. Contractor to employ and pay for services of a testing laboratory to:
 - 1) Perform materials evaluation.
 - 2) Design concrete mixes.
 - b. Concrete testing agency to meet requirements of ASTM E329.
2. Do not begin concrete production until proposed concrete mix design has been approved by Engineer.
 - a. Approval of concrete mix design by Engineer does not relieve Contractor of his responsibility to provide concrete that meets the requirements of this Specification.
3. Adjust concrete mix designs when material characteristics, job conditions, weather, strength test results or other circumstances warrant.
 - a. Do not use revised concrete mixes until submitted to and approved by Engineer.
4. Owner will employ and pay for a testing laboratory to test concrete placed during construction. See Article 3.04.

- C. Qualifications: Ready mixed concrete batch plant certified by National Ready Mixed Concrete Association (NMCA).

1.03 SUBMITTALS

A. Shop Drawings:

1. See Section 01340.
2. Concrete mix designs proposed for use. Concrete mix design submittal to include the following information:
 - a. Sieve analysis and source of fine and coarse aggregates.
 - b. Proportioning of all materials.
 - c. Type of cement with mill certificate for cement.
 - d. Type of fly ash with certificate of conformance to specification requirements.
 - e. Slump.
 - f. Air content.
 - g. Brand, type, ASTM designation, and quantity of each admixture proposed for use.

- h. 28-day cylinder compressive test results of trial mixes per ACI 318 and as indicated herein.
- 3. Manufacturer and type of joint filler, joint sealant and curing agent.
- 4. Manufacturer and type of bonding and patching mortar and bonding adhesive used at construction joints.
- 5. Manufacturer and type of grout and the cure/seal compound required for the nonshrink grout.
- 6. Reinforcing steel: Show grade, sizes, number, configuration, spacing, location and all fabrication and placement details.
 - a. In sufficient detail to permit installation of reinforcing without having to make reference to Contract Drawings.
 - b. Obtain approval of shop drawings by Engineer before fabrication.
 - c. Mill certificates.
- 7. Formwork: Show manufacturers and types of proposed form materials.
- 8. Scaled drawing(s) showing proposed locations of construction joints.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Storage of Material:

- 1. Cement and fly ash:
 - a. Store in moistureproof, weathertight enclosures.
 - b. Do not use if caked or lumpy.
- 2. Aggregate:
 - a. Store to prevent segregation and contamination with other sizes or foreign materials.
 - b. Obtain samples for testing from aggregates at point of batching.
 - c. Do not use frozen or partially frozen aggregates.
 - d. Do not use bottom 6 IN of stockpiles in contact with ground.
 - e. Allow sand to drain until moisture content is uniform prior to use.
- 3. Admixtures:
 - a. Protect from contamination, evaporation, freezing, or damage.
 - b. Maintain within temperature range recommended by manufacturer.
 - c. Completely mix solutions and suspensions prior to use.
- 4. Reinforcing steel:
 - a. Support and store all rebars above ground.

B. Delivery:

1. Concrete:
 - a. Prepare a delivery ticket for each load for ready-mixed concrete.
 - b. Truck operator shall hand ticket to representative of Owner's concrete testing laboratory at the time of delivery.
 - c. Ticket to show:
 - 1) Mix identification mark.
 - 2) Quantity delivered.
 - 3) Amount of each material in batch.
 - 4) Outdoor temp in the shade.
 - 5) Time at which cement was added.
 - 6) Numerical sequence of the delivery.
 - 7) Amount of water added.
2. Reinforcing steel: Ship to jobsite with attached plastic or metal tags with permanent mark numbers.
 - a. Mark numbers to match shop drawing mark number.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:
 1. Nonshrink, nonmetallic grout:
 - a. Sika "SikaGrout 212."
 - b. Gifford Hill "Supreme Grout."
 - c. Master Builders "Masterflow 713."
 - d. Or equal.
 2. Epoxy grout:
 - a. Master Builders "Brutem MPG."
 - b. Euclid Chemical Company, "High Strength Grout."
 - c. Or equal.
 3. Asphalt expansion joint fillers:
 - a. W R Meadows.
 - b. J and P Petroleum Products.
 - c. Rubatex Corp.
 - d. Or equal.
- B. Submit requests for substitution in accordance with Specification Section 01640.

2.02 MATERIALS

- A. Portland Cement: ASTM C-150.
 1. For all general purpose structures, use Type I or III.
 2. For structures which handle or are in contact with waste water or sewage, leachate, and which are part of the stormwater and irrigation systems, use Type

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II cement.

- B. Fly Ash:
1. ASTM C618, Class F.
 2. Nonstaining.
 - a. Hardened concrete containing fly ash to be uniform light gray color.
 3. Maximum loss on ignition: 6 percent.
 4. Compatible with other concrete ingredients.
 5. Obtain proposed fly ash from a source approved by the Florida DOT for use in concrete for bridges.
- C. Admixtures:
1. Air entraining admixtures: ASTM C260.
 2. Water reducing, retarding, and accelerating admixtures:
 - a. ASTM C494 Type A through E.
 - b. Conform to provisions of ACI 212.1R and ACI 212.2R.
 - c. Do not use retarding or accelerating admixtures unless specifically approved in writing by Engineer and at no cost to Owner.
 - d. Follow manufacturer's instructions.
 - e. Use chloride free admixtures only.
 3. Maximum total water soluble chloride ion content contributed from all ingredients of concrete including water, aggregates, cementitious materials and admixtures shall not exceed 0.15 percent by weight of cement.
 4. Do not use calcium chloride.
 5. Pozzolanic admixtures: ASTM C618.
 6. Provide admixtures of same type, manufacturer and quantity as used in establishing required concrete proportions in the mix design.
- D. Water: Potable, clean, free of oils, acids and organic matter.
- E. Aggregates:
1. Normal weight concrete: ASTM C33, except as modified below.
 2. Fine aggregate: Clean natural sand.
 - a. No manufactured or artificial sand.
 3. Coarse aggregate: Crushed rock, natural gravel, or other inert granular material.
 - a. Maximum amount of clay or shale particles: 1 percent.
 4. Gradation of coarse aggregate shall conform to size #57 or #67.
- F. Concrete Grout:
1. Nonshrink nonmetallic grout:

- a. Nonmetallic, noncorrosive, nonstaining, premixed with only water to be added.
 - b. Grout to produce a positive but controlled expansion.
 - c. Mass expansion not to be created by gas liberation.
 - d. Minimum compressive strength of nonshrink grout at 28 days: 6500 psi.
2. Epoxy grout:
 - a. 3-component epoxy resin system.
 - 1) Two liquid epoxy components.
 - 2) One inert aggregate filler component.
 - b. Each component packaged separately for mixing at job site.
 3. Coarse grout for reinforced masonry: ASTM C476.
- G. Reinforcing Steel:
1. Reinforcing bars: ASTM A615, Grade 60.
 2. Welded wire fabric: ASTM A185.
 - a. Minimum yield strength: 60,000 psi.
 3. Column spirals: ASTM A82.
- H. Forms:
1. Prefabricated or job built.
 2. Lumber, plywood or fiberboard.
 3. Lumber: Straight; uniform width and thickness; and free from knot, offsets, holes, dents, and other surface defects.
 4. Cylindrical fiber tube forms.
 5. Metal forms sufficiently tight to prevent leakage. Do not use aluminum forms.
 6. Form ties: Removable end, permanently embedded body type with cones on outer ends not requiring auxiliary spreaders.
 - a. Cone diameter: 3/4 IN minimum to 1 IN maximum.
 - b. Embedded portion 1 IN minimum back from concrete face.
 - c. If not provided with threaded ends, constructed for breaking off ends without damage to concrete.
 7. Form release: Nonstaining and shall not prevent bonding of future finishes to concrete surface.
- I. Chairs, Runners, Bolsters, Spacers, and Hangers:
1. Stainless steel, epoxy coated, or plastic coated metal.
 - a. Plastic coated: Rebar support tips in contact with the forms only.
- J. Vapor Barrier: Clear 6-mil thick polyethylene conforming to ASTM C171.

- K. Membrane Curing Compound: ASTM C309, Type I-D.
1. Resin based, dissipates upon exposure to UV light.
 2. Curing compound shall not prevent bonding of any future coverings, coatings or finishes.

2.03 CONCRETE MIXES

- A. General:
1. All concrete to be ready mixed concrete conforming to ASTM C94.
 2. Provide concrete of specified quality capable of being placed without segregation and, when cured, of developing all properties required.
 3. All concrete to be normal weight.
- B. Strength:
1. Provide specified strength and type of concrete for each use in structure(s) as follows:

TYPE	WEIGHT	SPECIFIED STRENGTH*
-----	-----	-----
Flare Pad	Manufacturers Recommendation	
Bollards	Normal weight	3000 psi
Bridge Abutment	Normal weight	3000 psi

*Minimum 28-day compressive strength.

- C. Air Entrainment: Provide air entrainment in all concrete resulting in a total air content percent by volume as follows:

MAX AGGREGATE SIZE	TOTAL AIR CONTENT PERCENT
-----	-----
1 IN or 3/4 IN	5 to 7

1. Air content to be measured in accordance with ASTM C231, ASTM C173, or ASTM C138.
- D. Slump: 4 IN maximum, 1 IN minimum.
1. Measured at point of discharge of the concrete into the concrete construction member.
 2. Pumped concrete:
 - a. Provide additional water at batch plant to allow for slump loss due to pumping.
 - b. Provide only enough additional water so that slump of concrete at discharge end of pump hose does not exceed maximum slump specified above.
 3. Determine slump per ASTM C143.
- E. Selection of Proportions:
1. General - Proportion ingredients to:

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- a. Produce proper workability, durability, strength, and other required properties.
- b. Prevent segregation and collection of excessive free water on surface.
2. Minimum cement contents and maximum water cement ratios for concrete to be as follows:

SPECIFIED STRENGTH	MINIMUM CEMENT, LB/CY		MAXIMUM WATER CEMENT RATIO BY WEIGHT
	MAXIMUM AGGREGATE SIZE, IN 3/4	1	
3000	517	517	0.45
4000	686	665	0.40

3. Substitution of fly ash:
 - a. Maximum of 15 percent by weight of cement at rate of 1 LB fly ash for 1 LB of cement.
4. Submit mix design data as required by this specification section.
5. Normal weight concrete: Proportion mixture to provide desired characteristics using one of methods described below:
 - a. Method 1 (Trial Mix): Per ACI 318, Chapter 5, except as modified herein.
 - 1) Air content within range specified above.
 - 2) Record and report temperature of trial mixes.
 - 3) Proportion trial mixes per ACI 211.1.
 - b. Method 2 (Field Experience): Per ACI 318, Chapter 5, except as modified herein:
 - 1) Field test records must be acceptable to Engineer to use this method.
 - 2) Test records shall represent materials, proportions and conditions similar to those specified.
6. Required average strength to exceed the specified 28 day compressive strength by the amount determined or calculated in accordance with the requirements of paragraph 5.3 of ACI 318-89 using the standard deviation of the proposed concrete production facility as described in paragraph 5.3.1 of ACI 318-89.

PART 3 - EXECUTION

3.01 FORMING AND PLACING CONCRETE

A. General:

1. Contractor is responsible for design and erection of formwork.
2. Construct formwork so that concrete members and

structures are of correct size, shape, alignment, elevation and position.

- a. Allowable tolerances: As recommended in ACI 347.
3. Provide slabs of minimum indicated depth when sloping to drains.
 - a. For slabs on grade, slope top of subgrade to provide floor slabs of minimum uniform indicated depth.

B. Reinforcement:

1. Position, support and secure reinforcement against displacement.
2. Locate and support with chairs, runners, bolsters, spacers and hangers, as required.
3. Set wire ties so ends do not touch forms and are directed into concrete, not toward exposed concrete surfaces.
4. Lap splice lengths: ACI 318 Class B top bar tension splices unless indicated otherwise on the Drawings.
5. Extend reinforcement to within 2 IN of concrete perimeter edges.
 - a. If perimeter edge is earth formed, extend reinforcement to within 3 IN of the edge.
6. Unless otherwise indicated, provide minimum concrete cover as follows:
 - a. Concrete deposited against earth: 3 IN.
 - b. Formed surfaces exposed to weather or in contact with earth: 2 IN for reinforcing bars #6 or larger; 1-1/2 IN for reinforcing bars less than #6.
 - c. Interior surfaces: 1-1/2 IN for beams and columns.
7. Do not weld reinforcing bars.
8. Welded wire fabric:
 - a. Install welded wire fabric in maximum practical sizes.
 - b. Splice sides and ends with a splice lap length measured between outermost cross wires of each fabric sheet not less than:
 - 1) One spacing of cross wires plus 2 IN.
 - 2) 1.5 x development length.
 - 3) 6 IN.
 - c. Development length: ACI 318 basic development length for the specified fabric yield strength.

C. Embedments:

1. Set and build in anchorage devices and other embedded items required for other work that is attached to, or supported by concrete.
2. Use setting diagrams, templates and instructions

for locating and setting.

F. Preparation:

1. Clean and adjust forms prior to concrete placement.
2. Tighten forms to prevent mortar leakage.
3. Coat form surfaces with form release agents prior to placing reinforcing bars in forms.

G. Placing Concrete:

1. Place concrete in compliance with ACI 304 and 304.2R.
2. Place in a continuous operation within planned joints or sections.
3. Begin placement when work of other trades affecting concrete is completed.
4. Place concrete by methods which prevent aggregate segregation.
5. Do not allow concrete to free fall more than 4 FT.
6. Where free fall of concrete will exceed 4 FT, place concrete by means of tremie pipe or chute.

H. Consolidation:

1. Consolidate all concrete using mechanical vibrators supplemented with hand rodding and tamping, so that concrete is worked around reinforcement and embedded items into all parts of forms.

I. Protection:

1. Protect concrete from physical damage or reduced strength due to weather extremes.
2. In cold weather comply with ACI 306R except as modified herein.
 - a. Do not place concrete on frozen ground or in contact with forms or reinforcing bars coated with frost, ice or snow.
 - b. Minimum concrete temperature at the time of mixing:

OUTDOOR TEMPERATURE AT PLACEMENT (IN SHADE)	CONCRETE TEMPERATURE AT MIXING
Below 30 DegF	70 DegF
Between 30-45 DegF	60 DegF
Above 45 DegF	50 DegF
 - c. Do not place heated concrete that is warmer than 80 DegF.
 - d. If freezing temperatures are expected during curing, maintain the concrete temperature at or above 50 DegF for 7 days or 70 DegF for 3 days.
 - e. Do not allow concrete to cool suddenly.
3. In hot weather comply with ACI 305R except as

modified herein.

- a. At air temperature of 90 DegF and above, keep concrete as cool as possible during placement and curing.
- b. Do not allow concrete temperature to exceed 70 DegF at placement.
- c. Prevent plastic shrinkage cracking due to rapid evaporation of moisture.
- d. Do not place concrete when the actual or anticipated evaporation rate equals or exceeds 0.2 LBS/SF/HR as determined from ACI 305R, Figure 2.1.5.

J. Curing:

1. Begin curing concrete as soon as free water has disappeared from exposed surfaces.
2. Cure concrete by use of moisture retaining cover, burlap kept continuously wet or by membrane curing compound.
3. Provide protection as required to prevent damage to concrete and to prevent moisture loss from concrete during curing period.
4. Provide curing for minimum of 7 days.
5. Form materials left in place may be considered as curing materials for surfaces in contact with the form materials except in periods of hot weather.
6. In hot weather follow curing procedures outlined in ACI 305R.
7. In cold weather follow curing procedures outlined in ACI 306R.
8. If forms are removed before 7 days has elapsed, finish curing of formed surfaces by one of above methods for the remainder of the curing period.
9. Curing vertical surfaces with a curing compound:
Cover vertical surfaces with a minimum of two coats of the curing compound.
 - a. Allow the preceding coat to completely dry prior to applying the next coat.
 - b. Apply the first coat of curing compound immediately after form removal.
 - c. Vertical surface at the time of receiving the first coat shall be damp with no free water on the surface.
 - d. A vertical surface is defined as any surface steeper than 1 vertical to 4 horizontal.

3.02 CONCRETE FINISHES

A. Tolerances:

1. Class A: 1/8 IN in 10 FT.
2. Class B: 1/4 IN in 10 FT.

- B. Surfaces Not Exposed to View:
 - 1. Patch voids, air pockets and honeycomb areas with cement grout.
 - 2. Fill tie holes with nonshrink nonmetallic grout.
- C. Slab Float Finish:
 - 1. After concrete has been placed, consolidated, struck off, and leveled, do no further work until ready for floating.
 - 2. Begin floating when water sheen has disappeared and surface has stiffened sufficiently to permit operation.
 - 3. During or after first floating, check planeness of entire surface with a 10 FT straightedge applied at not less than two different angles.
 - 4. Cut down all high spots and fill all low spots during this procedure to produce a surface within Class B tolerance throughout.
 - 5. Refloat slab immediately to a uniform sandy texture.
- D. Troweled Finish:
 - 1. Float finish surface.
 - 2. Next power trowel, and finally hand trowel.
 - 3. Produce a smooth surface which is relatively free of defects with first hand troweling.
 - 4. Perform additional trowelings by hand after surface has hardened sufficiently.
 - 5. Final trowel when a ringing sound is produced as trowel is moved over surface.
 - 6. Thoroughly consolidate surface by hand troweling.
 - 7. Leave finished surface essentially free of trowel marks, uniform in texture and appearance and plane to a Class A tolerance.
 - 8. On surfaces intended to support floor coverings remove any defects of sufficient magnitude that would show through floor covering by grinding.

3.03 GROUT

- A. Preparation:
 - 1. Nonshrinking nonmetallic grout:
 - a. Clean concrete surface to receive grout.
 - b. Saturate concrete with water for 24 HRS prior to grouting.
 - 2. Epoxy grout: Apply only to clean, dry, sound surface.
- B. Application:
 - 1. Nonshrinking nonmetallic grout:
 - a. Mix in a mechanical mixer.
 - b. Use no more water than necessary to produce

- flowable grout.
- c. Place in accordance with manufacturer's instructions.
- d. Completely fill all spaces and cavities below the bottom of baseplates.
- e. Provide forms where baseplates and bedplates do not confine grout.
- f. Where exposed to view, finish grout edges smooth.
- g. Except where a slope is indicated on Drawings, finish edges flush at the bottom of baseplates, bedplate, member, or piece of equipment.
- h. Protect against rapid moisture loss by covering with wet rags or polyethylene sheets.
- i. Wet cure grout for 7 days, minimum.
- 2. Epoxy grout:
 - a. Mix and place in accordance with manufacturer's instructions.
 - b. Completely fill all cavities and spaces around dowels and anchors without voids.
 - c. Obtain manufacturer's field technical assistance as required to ensure proper placement.

3.04 FIELD QUALITY CONTROL

- A. Owner will employ and pay for services of a concrete testing laboratory to perform testing of concrete placed during construction.
 - 1. Contractor to cooperate with Owner and Test Lab in obtaining and testing samples. Contractor shall notify Test Lab 18 hours minimum in advance of expected concrete pour.
- B. Tests During Construction:
 - 1. Strength test - procedure:
 - a. Four cylinders, 6 IN DIA x 12 IN high, will be taken from each sample per ASTM C172 and C31.
 - b. Cylinders will be tested per ASTM C39:
 - 1) One at 7 days.
 - 2) One at 14 days.
 - 3) Two at 28 days.
 - 2. Strength test - frequency:
 - a. Not less than one test each day concrete placed.
 - b. Not less than one test for each 50 CY or major fraction thereof placed in one day.
 - c. Not less than one test for each type of concrete poured.
 - d. Not less than one test for each concrete structure exceeding 2 CY volume.
 - e. Not less than one test for each 5000 SF of

surface area for the slab-on-grade.

3. Slump test: Per ASTM C143.
 - a. Determined for each strength test sample.
 - b. Additional slump tests may be taken.
4. Air content: Per ASTM C231, C173, and C138.
 - a. Determined for each strength test sample.
5. Temperature: Determined for each strength test sample.

C. Evaluation of Tests:

1. Strength test results: Average of 28-day strength of two cylinders from each sample.
 - a. If one cylinder manifests evidence of improper sampling, molding, handling, curing or testings, strength of remaining cylinder will be test result.
 - b. If both cylinders show any of above defects, test will be discarded.

D. Acceptance of Concrete:

1. Strength level of each type of concrete shall be considered satisfactory if both of the following requirements are met:
 - a. Average of all sets of three consecutive strength tests equals or exceeds the required specified 28-day compressive strength.
 - b. No individual strength test falls below the required specified 28-day compressive strength by more than 500 psi.

E. Contractor shall employ and pay for a testing laboratory to perform materials evaluation and design concrete mixes. See paragraph 1.02 B.

F. Contractor shall employ and pay for a certified laboratory to perform materials evaluation and testing due to concrete failure to meet the required standards.

3.05 SCHEDULES

A. Form Types:

1. Surfaces not normally exposed to view:
 - a. Wood or steel forms sufficiently tight to prevent leakage of mortar.

B. Grout:

1. Nonshrinking nonmetallic grout: Base plates and general use.
2. Epoxy grout:
 - a. Grouting of dowels and anchor bolts into existing concrete.
 - b. Other uses indicated on Drawings.

3. Coarse grout: In cells of reinforced masonry columns, walls, and bond beams.

END OF SECTION

Division 5

Metals

94L19

SECTION 05120

STRUCTURAL AND MISCELLANEOUS METALS

PART 1 - GENERAL

1.01 SUMMARY

- A. This section covers all items fabricated from metal shapes, plates, sheets, rods, bars, or castings and all other wrought or cast metal except component parts of equipment and items covered by other sections.
- B. Fabricated metal items indicated on the drawing, including but not limited to, the structural skid, pipe supports, control panel backboard, and concrete imbeds shall be fabricated in accordance with the applicable requirements of this section.
- C. Except as otherwise specified or indicated on the drawings, all materials and work shall conform to the applicable provisions of the AISC "Steel Construction Manual" and AISC "Specification for the Design, Fabrication and Erection of Structural Steel for Buildings, cumulatively referred to as the "AISC Specification".
- D. Related sections include but are not limited to:
 - 1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
 - 2. Division 1 - General Requirements.
 - 3. Section 09900 - Painting.
 - 4. Section 11550 - Landfill Gas Candlestick Flare Station.

1.02 QUALITY ASSURANCE

- A. References Standards:
 - 1. American Institute of Steel Construction (AISC):
 - a. Manual of Steel Construction.
 - b. Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings.
 - 2. American Society for Testing Materials (ASTM):
 - a. A123, Standard Specifications for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - b. A307, Carbon Steel Externally Threaded Standard Fasteners.
 - 3. American Welding Society (AWS):
 - a. D1.1, Structural Welding Code - Steel.

1.03 SUBMITTALS

- A. The Contractor shall submit shop drawings of all fabricated items prior to beginning fabrication.

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- B. All of the above submittals shall conform with the provisions of Section 01340.

1.04 QUALITY OF MATERIALS

- A. All members and parts, as delivered and erected, shall be new and free of winds, warps, deformations, unspecified bends, and excessive oxidation.
- B. Holes and other provisions for field connections shall be accurately located and shop checked so that proper fit will result when the units are assembled in the field. Field erection drawings shall be prepared, and each separate piece shall be marked as indicated thereon.
- C. Structural and miscellaneous metal work shall be stored on blocking so that no metal touches the ground, and covered as required to prevent water from accumulating on finished metal. The material shall be protected against bending under its own weight or superimposed loads.

PART 2 - MATERIALS

2.01 RAW MATERIALS

- A. Structural steel shall conform with the provisions of Section 1.4.1 of AISC Specifications.
- B. Metals other than structural steel shall conform with the provisions of Section 1.4.2 of AISC Specifications.
- C. Bolts shall conform with the provisions of Section 1.4.4 of AISC Specifications.
- D. Welding materials shall conform with the provisions of Section 1.4.5 of AISC Specifications.

PART 3 - EXECUTION

3.01 FABRICATION

- A. All bolted connections between structural members shall be made using high strength bolts (ASTM A307 minimum) in accordance with Section 1.16 of the AISC Specification.
- B. All welded connections between structural members shall be made in accordance with the provisions of Section 1.17 of the AISC Specification.
- C. All galvanizing shall be a minimum of 3.4 mils thick and shall

be applied in accordance with ASTM A123. All places where galvanizing is removed for welding or other purposes shall be touched up with a coating that matches the original hot dip galvanizing in appearance and contains 95 percent zinc by dry weight (Galvilite by Z.R.C. or equivalent).

- D. All steel which is not galvanized or imbedded in concrete shall be shop primed and painted in accordance with the provisions of Section 09900.
- E. All operators welding structural steel shall be certified in accordance with AWS D1.1 or equivalent.

END OF SECTION

98E21

SECTION 05505

METAL FABRICATIONS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Custom fabricated metal items and certain manufactured units not otherwise indicated to be supplied under work of other sections.

B. Related Sections include but are not necessarily limited to:

1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 1 - General Requirements.
3. Division 3 - Concrete.
4. Section 05120 - Structural Steel.
5. Section 09900 - Painting.

1.02 QUALITY ASSURANCE

A. Referenced Standards:

1. Aluminum Association (AA):
 - a. SAS-30, Standard Specifications for Aluminum Structures.
2. American Association of State Highway and Transportation Officials (AASHTO):
 - a. Standard Specification for Highway Bridges.
3. Americans with Disabilities Act (ADA):
 - a. Accessibility Guidelines for Buildings and Facilities.
4. American Institute of Steel Construction (AISC):
 - a. Specifications for Structural Steel Buildings (referred to herein as AISC specification).
5. American National Standards Institute (ANSI):
 - a. A14.3, Ladders-Fixed-Safety Requirements.
 - b. ANSI MBG 531, Metal Bar Grating Manual.
 - c. ANSI MBG 532, Heavy-Duty Metal Bar Grating Manual.
6. American Society for Testing and Materials (ASTM):
 - a. A36, Standard Specification for Carbon Structural Steel.
 - b. A47, Standard Specification for Ferritic Malleable Iron Castings.
 - c. A48, Standard Specification for Gray Iron Castings.
 - d. A53, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
 - e. A108, Standard Specification for Steel Bars, Carbon, Cold Finished, Standard Quality.
 - f. A123, Standard Specification for Zinc (Hot-Dip

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- Galvanized) Coatings on Iron and Steel Products.
- g. A153, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - h. A197, Standard Specification for Cupola Malleable Iron.
 - i. A269, Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
 - j. A276, Standard Specification for Stainless Steel Bars and Shapes.
 - k. A307, Standard Specification Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
 - l. A325, Standard Specification of Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
 - m. A496, Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement.
 - n. A500, Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
 - o. A536, Standard Specification for Ductile Iron Castings.
 - p. A563, Standard Specification for Carbon and Alloy Steel Nuts.
 - q. A582, Standard Specification for Free-Machining Stainless Steel Bars.
 - r. A666, Standard Specification for Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
 - s. A668, Standard Specification for Steel Forgings, Carbon and Alloy, for General Industrial Use.
 - t. A780, Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dipped Galvanized Coatings.
 - u. A786, Standard Specification for Rolled Steel Floor Plates.
 - v. A924, Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
 - w. B26, Standard Specification for Aluminum-Alloy Sand Castings.
 - x. B36, Standard Specification for Brass Plate, Sheet, Strip, and Rolled Bar.
 - y. B221, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.
 - z. B308, Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Shapes.
 - aa. B632, Standard Specification for Aluminum-Alloy Rolled Tread Plate.
 - bb. F467, Standard Specification for Non-Ferrous Nuts for General Use.
 - cc. F468, Standard Specification for Non-Ferrous Bolts, Hex Cap Screws, and Studs for General Use.

- dd. F593, Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
 - 7. American Welding Society (AWS):
 - a. A5.1, Standard Specification for Carbon Steel Electrodes for Shielded Metal Arc Welding.
 - b. D1.1, Structural Welding Code Steel.
 - c. D1.2, Structural Welding Code Aluminum.
 - 8. National Association of Architectural Metal Manufacturers (NAAMM):
 - a. AMP 510, Metal Stairs Manual.
 - 9. Research Council on Structural Connections:
 - a. Specification for Structural Joints Using ASTM A325 or A490 Bolts (referred to herein as Specification for Structural Joints).
 - 10. U. S. Department of Labor, Occupational Safety and Health Administration (OSHA):
 - a. 29 CFR 1910, OSHA Safety and Health Standards for General Industry (referred to herein as OSHA standards).
- B. Qualifications:
- 1. Qualify welding procedures and welding operators in accordance with AWS.
 - a. Welding Process

Welding and weld qualification tests shall conform to the provisions of the ANSI/AWS D1.1 Structural Welding Code. The welding process shall be the gas metal arc welding (GMAW) process with filler material per AWS A5.28. Filler metal shall be as required by AWS for bare applications of ASTM A588 base metal.
 - b. Welders

Welders shall be properly accredited experienced operators, each of whom shall submit certification of satisfactorily passing AWS standard qualification tests for all positions, satisfactory evidence of experience and skill in welding structural steel with the kind of welding to be used in the work, and who has demonstrated the ability to make uniform, sound welds of the type required.
 - 2. Qualifications: Proposed suppliers must have at least five (5) years experience designing and fabricating these type structures and a minimum of five (5) successful bridge projects, of similar construction, each of which has been in service at least three (3) years. List the location, bridge size, owner, and a contract for reference for each project.

1.03 DEFINITIONS

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- A. Installer or Applicator: Installer or applicator is the person actually installing or applying the product in the field at the Project site.
 - 1. Installer or applicator are synonymous.
- B. Hardware: As defined in ASTM A153.
- C. Galvanizing: Hot-dip galvanizing per ASTM A123 or A153 with minimum coating of 2.0 OZ of zinc per square foot of metal (average of specimens) unless noted otherwise or dictated by standard.

1.04 SUBMITTALS

- A. Shop Drawings:
 - 1. See Section 01340.
 - 2. Fabrication and/or layout drawings:
 - a. Submit shop drawings for all fabrications and assemblies. All drawings shall be signed and sealed by a Professional Engineer registered in the State of Florida.
 - b. Structural Calculations
 - Structural calculations for the bridge superstructure shall be submitted by the bridge manufacturer and reviewed by the approving engineer. All calculations shall be signed and sealed by a Professional Engineer who is licensed in the State of Florida. The calculations shall include all design information necessary to determine the structural adequacy of the bridge. The calculations shall include the following:
 - * All AISC allowable stress checks for axial, bending and shear forces in the critical member of each truss member type (i.e. top chord, bottom chord, floor beam, vertical, etc.)
 - * Checks for the critical connection failure modes for each truss member, type (i.e. vertical, diagonal, floor beam, etc.) Special attention must be given to all welded tube on tube connection (see Section 2.03 A.2. c.2 for design check requirements.
 - * All bolted splice connections
 - * Main truss deflection checks.
 - * U-Frame stiffness checks (used to determine K factors for out-of-plane buckling of the top

chord) for all half through or "pony" truss bridges.

The analysis and design of triangulated truss bridges shall account for moments induced in members due to joint fixity where applicable. Moments due to both truss deflection and joint eccentricity must be considered.

3. Product technical data including:
 - a. Acknowledgement that products submitted meet requirements of standards referenced.
 - b. Manufacturer's installation instructions.
 - c. For grating, include manufacturer's standard allowable load tables.
 4. Warranty.
 - a. Provide 10-year bridge warranty.
 5. AISC Shop Certification
 6. Proposed suppliers must have at least five (5) years experience designing and fabricating these type structures and a minimum of five (5) successful bridge projects, of similar construction, each of which has been in service at least three (3) years. List the location, bridge size, owner, and a contact for reference for each project.
- B. Miscellaneous Submittals:
1. Certification of welders and welding process.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
1. Continental Bridge
 2. Approved equal.

2.02 MATERIALS

- A. Steel:
1. Unpainted steel:
 - a. Bridges which are not to be painted shall be fabricated from high strength, low alloy, atmospheric corrosion resistant ASTM A847 cold-formed welded square and rectangular tubing and/or ASTM A588, or ASTM A242, ASTM A606 plate and structural steel shapes ($F_y = 50,000$ psi).

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- The minimum corrosion index of atmospheric corrosion resistant steel, as determined in accordance with ASTM G101, shall be 5.8.
2. Bolts, nuts and washers, high strength: ASTM A325.
 - a. Provide washers with all nuts.
 3. Bolts and nuts: Unfinished, ASTM A307, Grade A.
 - a. Provide washers with all nuts.
 4. Electrodes for welding steel: AWS A5.1, E70 Series.
 5. Steel forgings: ASTM A668.
- B. Iron:
1. Ductile iron: ASTM A536.
 2. Gray cast iron: ASTM A48.
 3. Malleable iron: ASTM A47, A197.
- C. Stainless Steel:
1. Stainless steel:
 - a. ASTM A666, Type 304, Grade A.
 - b. Type 304L for welded connections.
 2. Stainless steel bolts and nuts: ASTM F593, Type 303 or 304 with minimum yield strength of 30,000 psi and minimum tensile strength of 70,000 psi.
 3. Stainless steel tubing: ASTM A269.
 4. Stainless steel bars, shapes: ASTM A276.
- D. Washers: Same material and alloy as found in accompanying bolts and nuts.
- E. Embedded Anchor Bolts:
1. Type 304 Stainless Steel with matching nut and washer.
- F. Expansion Anchors:
1. Where approved by Engineer.
 2. Manufacturer:
 - a. Kwik-Bolt II by Hilti.
 - b. Trubolt by ITW Ramset-Redhead.
 - c. Or approved equal.
 3. Stainless steel, Type 316 expansion anchors.
 4. Provide edge distance cover as recommended by manufacturer, or as indicated on Drawings.
- G. Headed Studs: ASTM A108 with a minimum yield strength of 50,000 psi and a minimum tensile strength of 60,000 psi.
- H. Deformed Bar Anchors: ASTM A496 with a minimum tensile strength of 80,000 psi and a minimum yield strength of 70,000 psi.
- I. Iron and Steel Hardware: Galvanized in accordance with ASTM A153 when required to be galvanized.

2.03 MANUFACTURED UNITS

A. Bridges:

1. General Features of Design

- a. Span: Bridge span shall be 40'-0" (straight line dimension) and shall be as measured from each end of the bridge structure.
- b. Width: Bridge width shall be 8'-0" and shall be as measured from the inside face of structural elements at deck level.
- c. Truss type: Bridge(s) shall be designed as a half-through "Pratt" truss with one (1) diagonal per panel and square end vertical members. All end vertical members, unless otherwise specified, shall be plumb. Interior vertical members shall be perpendicular to the chord faces.
 - 1) Bridges may be designed utilizing an underhung floor beam (top of floor beam welded to the bottom of the bottom chord) or in an H-Section configuration where the floor beams are placed up inside the trusses. The truss type shall be determined by the bridge manufacturer.
 - 2) The distance from the top of the deck to the top and bottom truss members shall be determined by the bridge manufacturer based upon structural and/or shipping requirements.
 - 3) The top of the top chord shall not be less than 42 inches above the deck (measured from the high point of the deck) on bridges used for pedestrian traffic.
- d. Member Components: All members of the vertical trusses (top and bottom chords, verticals, and diagonals) shall be fabricated from square and/or rectangle structural steel tubing. Other structural members and bracing shall be fabricated from structural steel shapes or square and rectangular structural steel tubing.

To provide lateral support for the top flange of open shape stringers (w-shapes or channels), a minimum of one stiffener shall be provided in each stringer at every floor beam location.

e. Attachments

- 1) Safety rails: Horizontal safety rails shall be placed on the structure up to a minimum height of 3'-6" above the deck surface. Safety rails shall be placed so as to prevent a 4" sphere from passing through the truss. Safety rails shall be 1-1/4" x 1-1/4" x 1/8" angles, welded to the inside or outside of the structure at the bridge fabricators option.

If placed inside the truss, the safety rails shall have a maximum span of 5'-8", measured from centerline to centerline of support post or truss vertical. If placed outside the structure, this maximum span may be increased to 6'-6". Safety rails placed on the inside of the truss shall have their ends sealed and ground smooth so as to produce no sharp edges.

The safety rail system shall be designed for an infill loading of 200 pounds, applied horizontally at right angles, to a one square foot area at any point in the system.

- 2) Pipe attachment: The bridge shall be provided with clip angles for the attachment of a 24" pipe on the bridge deck.

f. Camber

- 1) The bridge shall have a vertical camber dimension at midspan equal to 100% of the full dead load deflection.

g. Elevation Difference

- 1) The bridge abutments shall be constructed at the same elevation on both ends of the bridge.

2. Engineering

Structural design of the bridge structure(s) shall be performed by or under the direct supervision of a licensed professional engineer and done in accordance with recognized engineering practices and principles. The engineer shall be licensed to practice in Florida.

- a. Design Loads: In considering design and fabrication issues, this structure shall be assumed to be statically loaded. No dynamic analysis shall be required nor shall fabrication issues typically considered for dynamically loaded structures be considered for this bridge.

- 1) Dead load: The bridge structure shall be designed considering its own dead load (superstructure and decking) only. No additional dead loading need be considered.

- 2) Uniform live load

a) Pedestrian live load

Main members: Main supporting members, including girders, trusses and arches shall be designed for a pedestrian live load of 100 pounds per square foot of bridge walkway area. The pedestrian live load shall be applied to those areas of the walkway so as to produce maximum stress in the member being designed.

- 3) Concentrated load: The bridge superstructure, floor system and decking shall be designated for a 1,000 pound concentrated load and a 10,000 pound vehicle load.
- 4) Wind load:
 - a) Horizontal forces: The bridge(s) shall be designed for a wind load of 25 pounds per square foot on the full vertical projected area of the bridge as if enclosed. The wind load shall be applied horizontally at right angles to the longitudinal axis of the structure. The wind loading shall be considered both in the design of the lateral load bracing system and in the design of the truss vertical members and their connections.
 - b) Overturning forces: The effect of forces tending to overturn structures shall be calculated assuming that the wind direction is at right angles to the longitudinal axis of the structure. In addition, an upward force shall be applied at the windward quarter point of the transverse superstructure width. This force shall be 20 pounds per square foot of the deck.
- 5) Utility pipe load: The bridge shall be designed to accommodate a 24" pipe with a load of 215 pounds per lineal foot.
- 6) Top chord railing loads: The top chord, truss verticals and floor beams shall be designed for lateral wind loads (per Section 3.1.4.1) and for any loads required to provide top chord stability as outlined in Section 3.3.6; however, in no case shall the load be less than 50 pounds per lineal foot or a 200 pound point load, whichever produces greater stresses, applied in any direction at any point along the top chord.
- 7) Load combinations: The loads listed herein shall be considered to act in the following combinations, whichever produce the most unfavorable effects on the bridge superstructure or structural member concerned.
[DL=dead load; LL=live load; WL=wind load; VEH=vehicle load]

DL+ LL
 DL + VEH
 DL + WL
 DL + LL + WL
 DL + VEH + .3WL

Note: Allowable stresses may be increased $\frac{1}{3}$ above the values otherwise provided when produced by wind loading, acting alone or in combination with the design dead and live loads.

It shall be the responsibility of the foundation engineer to determine load combinations for design of the abutments.

b. Design Limitations

1) Deflection

a) Vertical deflection:

The vertical deflection of the main trusses due to service pedestrian live load shall not exceed $\frac{1}{400}$ of the span.

The deflection of cantilever spans of the structure due to service pedestrian live load shall not exceed $\frac{1}{300}$ of the cantilever arm length.

The deflection of the floor system members (floor beams and stringers) due to service pedestrian live load shall not exceed $\frac{1}{360}$ of their respective spans.

The service pedestrian live load shall be 100 PSF.

Deflection limits due to occasional vehicular traffic shall not be considered.

b) Horizontal deflection:

The horizontal deflection of the structure due to lateral wind loads shall not exceed $\frac{1}{500}$ of the span under an 85 MPH (25 PSF) wind load.

2) Minimum Thickness of Metal

The minimum thickness of all structural steel members shall be $\frac{3}{16}$ " nominal and be in accordance with the AISC Manual of Steel Construction' "Standard Mill Practice Guidelines". For ASTM A500 and ASTM A847 tubing, the section properties used for design shall be

per the Steel Tube Institute of North America's Hollow Structural Sections "Dimensions and Section Properties".

c. Governing Design Codes/References

Structural members shall be designed in accordance with recognized engineering practices and principles as follows:

1) Structural steel allowable stresses

American Institute of Steel Construction (AISC)

Structural steel design shall be in accordance with those sections of the "Manual of Steel Construction: Allowable Stress Design" related to design requirements and allowable stresses.

2) Welded Tubular Connections

American National Standards Institute/American Welding Society (ANSI/AWS)
Canadian Institute of Steel Construction (CISC)

All welded tubular connections shall be checked when within applicable limits, for the limiting failure modes outlined in the ANSI/AWS D1.1 Structural Welding Code or in accordance with the "Design Guide for Hollow Structural Section Connections" as published by the Canadian Institute of Steel Construction (CISC).

When outside the prescribed limits, the following limit states or failure modes must be checked:

- a) Chord face plastification
- b) Punching shear (through main member face)
- c) Material failure:
 - Tension failure of web member
 - Local buckling of a compression web member
- d) Weld failure (based on effective lengths)
- e) Local buckling of a main member face
- f) Main member failure:
 - Web or sidewall crippling
 - Web or sidewall buckling
 - Overall shear failure

All tubular joints shall be plain unstiffened joints (made without the use of reinforcing plates) except as follows:

- a) Floor beams hung beneath the lower chord of the structure may be designed with or without stiffener (or gusset) plates at the bridge manufacturer's option.
 - b) Floor beams which frame directly into the truss verticals (H-section bridges) may be designed with or without end stiffening plates as required by design.
 - c) Where chords, end floor beams and in high profiles the top end struts weld to the end verticals, the end verticals (or connections) may require stiffening to transfer the forces from these members into the end vertical.
 - d) Truss vertical to chord connections.
- 3) Top Chord Stability

Structural Stability Research Council (SSRC), formerly Column Research Council. The top chord of half-through truss shall be considered as a column with elastic lateral supports at the panel points. The critical buckling force of the column, so determined, shall exceed the maximum force from dead load, live load, and impact in any panel of the top chord by not less than 50 percent for parallel chord truss bridges or 100 percent for tied arch bridges. The design approach to prevent top chord buckling shall be as outlined by E.C. Holt's research work in conjunction with the Column Research Council on the stability of the top chord of a half-through truss.

The vertical truss members and the floor beams and their connections (transverse frames) in half-through truss spans shall be proportioned to resist a lateral force of not less than $1/100k$ times the top chord compressive load, but not less than .004 times that top chord load, applied at the top chord panel points of each truss. The top chord load is determined by using the larger top chord axial force in the members on either side of the "U-frame" being

analyzed. For end frames, the same applies except the transverse force is 1 percent of the axial load in the end post member.

The bending forces in the transverse frames, as determined above, act in conjunction with all forces produced by actual bridge loads as determined by an appropriate analysis.

4) Grate decking

This bridge shall be provided with a steel grate deck.

The grate decking shall utilize smooth galvanized steel bars spaced 1-3/16" on center with welded crossbars at 4" centers. The grating shall be designed to carry the imposed deck loads at the stringer or floor beam spacings used in the bridge as determined by the bridge designer.

Grate decking shall be designed for concentrated loads as specified in Section 2.03. Grate decking shall be designed using only the bars engaged by the "tire print area" unless cross bars suitable for transverse load distribution are utilized.

Grating shall be galvanized in accordance with ASTM A123.

3. Finishing

a. Blast cleaning

1) Bare applications of enhanced corrosion resistant steels.

a) All exposed surfaces of steel shall be blast cleaned in accordance with Steel Structures Painting Council Surface Preparation Specifications No. 7 Brush-Off Blast Cleaning, SSPC-SP7 latest edition.

b) Exposed surfaces of steel shall be defined as those surfaces seen from the deck and from outside of the structure. Stringers, floor beams, lower brace diagonals and the inside face of the truss below deck and bottom face of the bottom chord shall not be blasted.

4. Bearings

a. Bearing devices

- 1) Bridge bearings shall consist of steel setting or slide plate placed on the abutment or grout pad. The bridge bearing plate which is welded to the bridge structure shall bear on this plate. One end of the bridge will be fixed by fully tightening the nuts on the anchor bolts at that end.
- 2) The opposite end will have finger tight only nuts to allow movement under thermal expansion or contraction.
- 3) The bridge bearings shall sit in a recessed pocket on the concrete abutment. Minimum 28-day strength for the abutment concrete shall be 3000 PSI. The bearing seat shall be a minimum of 16" wide. The step height (from bottom of bearing to top of deck) shall be determined by the bridge manufacturer.

5. Foundations

- a. Engineering design, materials (including anchor bolts) and construction of the bridge supporting foundations (abutment, pier, bracket and/or footing) will be the contractor. The contractor shall install the anchor bolts in accordance with the manufacturer's anchor bolt spacing dimensions.
- b. Information as to bridge support reactions and anchor bolt locations will be furnished by the manufacturer after receipt of order and design is complete. The contractor shall submit a foundation design signed and sealed by a Florida P.E. with the submittals.

B. Steel Grating:

1. ANSI MBG 531.
2. Minimum depth: 1 IN.
3. Minimum rectangular bearing bar size: 1/8 IN.
 - a. Maximum 1-3/16 IN OC spacing.
4. Design live load: Not less than 100 psf plus a concentrated load of 300 LBS with a maximum deflection of 1/300 of span under a superimposed live load of 100 psf.
5. Cross bars: Welded, swagged or pressure locked to bearing beam.

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- a. Maximum spacing 4 IN/OC.
- 6. Top edges of bars: Serrated at inclined surfaces.
- 7. Grating Sections: Not wider than 3 FT where shown on Drawings to be removable.
- 8. Finish: Galvanized.
 - a. Clips and bolts: Galvanized.
 - b. Seat angles: Galvanized steel.
- 9. Ends and perimeter edges: Banded.
- 10. Openings through grating: Reinforced to provide required load carrying capacity and banded with 4 IN high toe plate.
- 11. Provide joints at openings between individual grating sections.

C. Standing Seam Aluminum Roof

- 1. Provide an aluminum standing seam roof covering the blower as shown on the Drawings. The roof shall withstand a wind loading of 110 mph.

2.04 FABRICATION

- A. Verify field conditions and dimensions prior to fabrication.
- B. Form materials to shapes indicated with straight lines, true angles, and smooth curves.
 - 1. Round all corners to 1/8 IN nominal radius.
- C. Drill or punch holes with smooth edges.
- D. Weld Permanent Shop Connections:
 - 1. Welds to be continuous fillet type unless indicated otherwise.
 - 2. Full penetration butt weld bends in stair and ladder stringers.
 - 3. Weld structural steel in accordance with AWS D1.1 using Series E70 electrodes conforming to AWS A5.1.
 - 4. Weld aluminum in accordance with AWS D1.2.
 - 5. Grind smooth welds that will be exposed.
- E. Conceal fastenings where practicable.
- F. Punch or drill for field connections and for attachment of work by other trades.
- G. Fabricate work in shop in as large assemblies as is practicable.
- H. Finishes:
 - 1. Aluminum: Mill finished unless scheduled or otherwise specified or, if approved, finished in manufacturer's standard.
 - a. Coat surfaces in contact with dissimilar materials.

See Section 09905.

2. See Section 09905 for preparation and painting of ferrous metals and other surfaces.
- I. Fabricate grating, checkered plate, stairs, ladders and accessories using galvanized steel unless shown otherwise on Drawings.
- J. Maximum tolerance for difference in depth between checker plate or grating depth and seat or support angle depth: 1/8 IN.
- K. Quality Certification: The bridge shall be fabricated by a fabricator who is currently certified by the American Institute of Steel Construction to have the personnel, organization, experience, capability, and commitment to produce fabricated structural steel for Simple Steel Bridge Structures as set forth in the AISC Certification Program.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Prior to installation, inspect and verify condition of substrate. Installation of product constitutes installer's acceptance of substrate condition for product compatibility.
- B. Correct surface defects or conditions which may interfere with or prevent a satisfactory installation.
 1. Field welding aluminum is not permitted unless approved in writing by Engineer.

3.02 INSTALLATION

- A. Set metal work level, true to line, plumb.
- B. Shim and grout as necessary.
- C. Bolt Field Connections: Where practicable, conceal fastenings.
- D. Grind welds smooth where field welding is required.
- E. Remove all burrs and radius all sharp edges and corners of miscellaneous plates, angles, framing system elements, etc.
- F. Unless noted or specified otherwise:
 1. Connect steel members to steel members with 3/4 IN DIA ASTM A325 high strength bolts.
 2. Connect aluminum to aluminum with 3/4 IN DIA aluminum

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- bolts.
- 3. Connect aluminum to structural steel using 3/4 IN DIA stainless steel bolts. Provide dissimilar metals protection.
- 4. Connect aluminum and steel members to concrete and masonry using 3/4 IN DIA stainless steel expansion bolts unless shown otherwise. Provide dissimilar materials protection.
 - a. Expansion bolts to have a minimum embedment of 4 IN into concrete and masonry unless indicated otherwise on Drawings.
- 5. Provide washers for all bolted connections.
- G. Install and tighten ASTM A325 high-strength bolts in accordance with 9th Edition of Manual of Steel Construction.
 - 1. Provide hardened washers for all ASTM A325 bolts. Provide the hardened washer under the element (nut or bolt head) turned in tightening.
- H. Secure metal to wood with lag screws of adequate size with appropriate washers.
- I. Do not field splice fabricated items unless said items exceed standard shipping length or change of direction requires splicing. Provide full penetration welded splices where continuity is required.
- J. Provide each fabricated item complete with attachment devices as indicated or required to install.
- K. Anchor aluminum and metal work so that work will not be distorted nor fasteners overstressed from expansion and contraction.
- L. Setting Beam and Column Base Plates:
 - 1. Set beam and column base plates on nonshrink grout in accordance with Division 3.
 - 2. Construct top of bearing surface to an elevation that is lower than elevation of bottom of base plate by dimension indicated. If not indicated, provide minimum of 1 IN grout thickness under base plates.
 - 3. Set and anchor each base plate to proper line and elevation.
 - a. Use metal wedges, shims, or setting nuts for leveling and plumbing columns and beams. Wedges, shims and setting nuts to be of same metal as base plate they support.
 - b. Fill space between bearing surface and bottom of base plate with nonshrink grout. Fill space until voids are completely filled and base plates are fully bedded on wedges, shims, and grout.
 - c. Do not remove wedges or shims. Where they protrude,

cut off flush with edge of base plate.

- M. Tie anchor bolts in position to embedded reinforcing steel using wire. Tack welding prohibited. Coat bolt threads and nuts with heavy coat of clean grease. Anchor bolt location tolerance: 1/16 IN. Provide steel templates for all column anchor bolts.
- N. Accurately locate and place frames for openings before casting into floor slab so top of plate is flush with surface of finished floor. Keep screw holes clean and ready to receive screws.
- O. Attach grating to end and intermediate supports with grating saddle clips and bolts.
 - 1. Maximum spacing: 2 FT OC with minimum of two per side.
 - 2. Attach individual units of aluminum grating together with clips or attachments at 2 FT OC maximum with a minimum of two clips per side.
- P. Prepare and paint ferrous metals in accordance with Section 09905.
- Q. Coat aluminum surfaces in contact with dissimilar materials in accordance with Section 09905.
- R. Repair damaged galvanized surfaces in accordance with ASTM A780.

END OF SECTION

Division 9

Finishes

94L19

SECTION 09900

PAINTING

PART 1 - GENERAL

1.01 SUMMARY

- A. All components of the candlestick flare station and Landfill Gas Recovery System shall be prepared, primed and painted in accordance with this section.
- B. All carbon steel parts which are not galvanized or electroplated shall be painted.
- C. All shop fabricated items shall be painted.
- D. All field fabricated items shall be field painted.
- E. The Contractor shall use skilled workmen who are thoroughly trained and experienced for performance of the work specified under this section.

1.02 ITEMS NOT TO BE PAINTED

- A. Anodized aluminum, stainless steel, chromium plated metal, copper, bronze, galvanized steel and other materials not readily oxidized under ambient conditions, shall not be painted.
- B. Moving parts such as valve operators, linkages, and motor shafts shall not be painted.
- C. Sensors shall not be painted.
- D. All labels, equipment identification tags, model numbers, manufacturer's identification marks, name plates, or nomenclature plates shall be properly protected during painting and shall not be painted over.

1.03 SUBMITTALS

- A. The Contractor shall submit all applicable product data from the manufacturer including physical data, application data (typical uses), temperature limitations, environmental data, warranty, thinner, etc.

PART 2 - MATERIALS

2.01 GENERAL

- A. Primer and finish coat material shall be Ameron, Carboline, or approved equal industrial quality coatings.

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- B. Finish paint shall be compatible with the primer. Finish paint color shall be gray.
- C. All paint shall conform to air quality regulations at the point of application. Any paint material which cannot be guaranteed by the manufacturer to comply, whether or not approved under this specification, shall not be used.
- D. All new paint products used to paint over or touch up old painted surfaces shall be chemically compatible with the old paint.
- E. Paint used in successive finish coats shall be of the same type by the same manufacturer unless otherwise specified. Alternate coats shall be of contrasting color.
- F. Bolted assemblies shall be prime painted prior to assembly and finish painted after assembly.

PART 3 - EXECUTION

3.01 SURFACE PREPARATION

- A. Surface preparation shall be in accordance with the requirements of the paint manufacturer, and shall, at a minimum include solvent cleaning, wire brushing, and removal of scale to the criteria of SSPC-SP10.
- B. All items which are not to be painted shall either be removed or properly protected prior to surface preparation and painting.

3.02 PAINTING

- A. The prime and finish coats shall be of the thickness recommended by the manufacturer.
- B. The Contractor shall touch up all damaged paint prior to final acceptance. A one gallon can of prime and finish coatings shall be forwarded to the site for field touch-up as required.
- C. Factory painted equipment need not be re-painted per this section.

END OF SECTION

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Division 11

Equipment

95B06

SECTION 11005

EQUIPMENT: BASIC REQUIREMENTS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Requirements of this Section apply to all equipment provided on the Project including that found in Divisions 11, 12, 13, 14, 15, and 16, even if not specifically referenced in individual "Equipment" articles of those Specifications.
- B. Related Sections include but are not necessarily limited to:
 - 1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
 - 2. Division 1 - General Requirements.
 - 3. Section 09900 - Painting.
 - 4. Section 15060 - Pipe and Pipe Fittings: Basic Requirements.
 - 5. Section 16010 - Electrical: Basic Requirements.

1.02 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. American Bearing Manufacturers Association (ABMA).
 - 2. American Gear Manufacturers Association (AGMA).
 - 3. American Society for Testing and Materials (ASTM):
 - a. F593, Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
 - 4. Institute of Electrical and Electronics Engineers (IEEE):
 - a. 112, Standard Test Procedure for Polyphase Induction Motors and Generators.
 - 5. National Electrical Manufacturers Association (NEMA):
 - a. 250, Enclosures for Electrical Equipment.
 - b. ICS 6, Enclosures for Industrial Control and System.
 - c. MG 1, Motors and Generators.
 - 6. National Fire Protection Association (NFPA):
 - a. 70, National Electrical Code (NEC).
- B. Miscellaneous:
 - 1. A single manufacturer of a "product" to be selected and utilized uniformly throughout Project even though:
 - a. More than one manufacturer is listed for a given "product" in Specifications.
 - b. No manufacturer is listed.
 - 2. Equipment, electrical assemblies, related electrical wiring, instrumentation, controls, and system components shall FULLY comply with specific NEC requirements related to area classification and to NEMA 250 and ICS-6 designations defined in Section 16010.

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1.03 DEFINITIONS

- A. Product: Manufactured materials and equipment.
- B. Major Equipment Supports - Supports for Equipment:
 - 1. Located on or suspended from elevated slabs with supported equipment weighing 2000 LBS or greater, or:
 - 2. Located on or suspended from roofs with supported equipment weighing 500 LBS or greater, or:
 - 3. Located on slab-on-grade or earth supported with equipment weighing 5000 LBS or more.
- C. Equipment: One or more assemblies capable of performing a complete function. Mechanical, electrical, instrumentation or other devices requiring an electrical, pneumatic, electronic or hydraulic connection. Not limited to items listed under "Equipment" article within specifications.
- D. Installer or Applicator: Installer or applicator is the person actually installing or applying the product in the field at the Project site.
 - 1. Installer or applicator are synonymous.

1.04 SUBMITTALS

- A. Shop Drawings:
 - 1. General for all equipment:
 - a. See Section 01340.
 - b. Acknowledgement that products submitted comply with the requirements of the standards referenced.
 - c. Manufacturer's delivery, storage, handling, and installation instructions.
 - d. Equipment identification utilizing numbering system and name utilized in Drawings.
 - e. Equipment installation details:
 - 1) Location of anchorage.
 - 2) Type, size, and materials of construction of anchorage.
 - 3) Anchorage setting templates.
 - 4) Manufacturer's installation instructions.
 - f. Equipment area classification rating.
 - g. Shipping and operating weight.
 - h. Equipment physical characteristics:
 - 1) Dimensions (both horizontal and vertical).
 - 2) Materials of construction and construction details.
 - i. Equipment factory primer and paint data.
 - j. Manufacturer's recommended spare parts list.
 - k. Equipment lining and coatings.
 - l. Equipment utility requirements include air, natural gas, electricity, and water.
 - 2. Mechanical and process equipment:

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- a. Operating characteristics:
 - 1) Technical information including applicable performance curves showing specified equipment capacity, rangeability, and efficiencies.
 - 2) Brake horsepower requirements.
 - 3) Copies of equipment data plates.
- b. Piping and duct connection size, type and location.
- c. Equipment bearing life certification.
- d. Equipment foundation data:
 - 1) Equipment center of gravity.
 - 2) Criteria for designing vibration, special or unbalanced forces resulting from equipment operation.
- 3. Electrical and control equipment:
 - a. Electric motor information:
 - 1) Nameplate data.
 - 2) Service factor on motors 1/2 HP and above.
 - 3) Motor enclosure type.
 - 4) NEMA frame size.
 - 5) NEMA design code.
 - 6) Insulation type and temperature rise.
 - 7) Motor current, efficiency and power factor at:
 - a) Full load, 3/4 load, 1/2 load and no load.
 - 8) Locked rotor current.
 - b. Control panels:
 - 1) Panel construction.
 - 2) Point-to-point wiring diagrams.
 - 3) Scaled panel face and subpanel layout.
 - 4) Technical product data on panel components.
 - 5) Panel and subpanel dimensions and weights.
 - 6) Panel access openings.
 - 7) Nameplate test.
 - 8) Panel anchorage.
- B. Operation and Maintenance Manuals:
 - 1. See Section 01340.
- C. Miscellaneous Submittals:
 - 1. Sample form letter for equipment field certification.
 - 2. Certification that equipment has been installed properly, has been initially started up, has been calibrated and/or adjusted as required, and is ready for operation.
 - 3. Certification for major equipment supports that equipment foundation design loads shown on the Drawings or specified have been compared to actual loads exhibited by equipment provided for this Project and that said design loadings are equal to or greater than the loads produced by the equipment provided.
 - 4. Field noise testing reports if such testing is specified in narrow scope sections.
 - 5. Field vibration testing reports.
 - 6. Notification, at least 1 week in advance, that motor testing

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- will be conducted at factory.
7. Certification from equipment manufacturer that all manufacturer-supplied control panels that interface in any way with other controls or panels have been submitted to and coordinated with the supplier/installer of those interfacing systems.
 8. Motor test reports.
 9. Certification prior to Project closeout that electrical panel drawings for manufacturer-supplied control panels truly represent panel wiring including any field-made modifications.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 1. Motors:
 - a. Siemens.
 - b. Baldor.
 - c. General Electric.
 - d. US Motors.
- B. Submit requests for substitution in accordance with Specification Section 01640.

2.02 MANUFACTURED UNITS

- A. Electric Motors:
 1. Provide motors designed and applied in compliance with NEMA, IEEE, and the NEC for specific duty imposed by driven equipment.
 2. Where used in conjunction with adjustable speed drives, provide motors fully compatible with the variable speed controllers.
 3. Where frequent starting applications are specified, design for frequent starting duty equivalent to duty service required by driven equipment.
 4. Rate for continuous duty at 40 DegC ambient. Design in accordance with the NEMA Standards for Class F insulation with Class B temperature rise above 40 DegC ambient on continuous operation or intermittent duty at nameplate horsepower.
 5. Design for full voltage starting.
 6. Design bearing life based upon actual operating load conditions imposed by driven equipment.
 7. Size for altitude of Project.
 8. Size motors so that, under maximum continuous load imposed by driven equipment, motor nameplate horsepower for continuous operation is minimum of 15 percent more than

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- driven load or provide motor with 1.15 service factor in which case maximum continuous load imposed shall not exceed nameplate horsepower rating of motor.
9. Provide encapsulated windings in areas designated as wet and for outdoor applications.
 - a. Provide encapsulation using a silicone or epoxy seal after the windings have been dried to less than 1 percent moisture.
 10. Furnish with clamp-type grounding terminals inside motor conduit box. Furnish corrosion-resistant motors for use in areas designated as corrosive.
 11. Furnish with oversized external conduit boxes.
 12. Furnish with stainless steel nameplates with information to include all data as required by paragraph 430-7 of the National Electric Code, NFPA 70.
 13. Use of manufacturer's standard motor will be permitted on integrally constructed motor driven equipment such as appliances and hand tools specified by model number in which a redesign of complete unit would be required in order to provide a motor with other features as may be specified herein.
 14. Electrical motors greater than 10 HP.
 - a. 230/460 V, 60 HZ, 3 PH supply voltage.
 - b. Totally enclosed fan cooled (TEFC).
 - c. Specially insulated for use in damp locations below 20 DegC.
 - d. Oil or grease lubricated antifriction bearings conforming to AFBMA Standards. Design bearing life for 90 percent survival rating at 50,000 HRS of operation.
 15. Motors 15 HP and above having a locked rotor inrush KVA greater than 6.3 times motor horsepower are not acceptable.
 16. Motors shall be labeled as "premium efficiency" or "energy efficient" type and shall meet the latest IEEE and NEMA standards for energy efficient motors.

2.03 COMPONENTS

- A. Gear Drives and Drive Components:
 1. Size drive equipment capable of supporting full load including losses in speed reducers and power transmission.
 2. Design drive units for 24 HR continuous service, constructed so oil leakage around shafts is precluded.
 3. Utilize gears, gear lubrication systems, gear drives, speed reducers, speed increasers and flexible couplings meeting applicable standards of American Gear Manufacturers Association.
 4. Gear reducers:
 - a. Provide gear reducer totally enclosed and oil lubricated.
 - b. Utilize antifriction bearings throughout.
 - c. Provide worm gear reducers having a service factor of at least 1.20.

- d. Furnish other helical, spiral bevel, and combination bevel-helical gear reducers with a service factor of at least 1.50.

2.04 ACCESSORIES

A. Guards:

1. Provide each piece of equipment having exposed moving parts with full length, easily removable guards, meeting OSHA requirements.
2. Exterior applications:
 - a. Construct from 16 GA stainless steel or aluminum.
 - b. Construct to preclude entrance of rain, snow, or moisture.
 - c. Roll to conform to shaft or coupling surface.
 - d. Connect to equipment frame with stainless steel bolts and wing nuts.

B. Anchorage:

1. Cast-in-place anchorage:
 - a. Provide ASTM F593, Type 316 stainless steel anchorage for all equipment.
 - b. Configuration and number of anchor bolts shall be per manufacturer's recommendations.
 - c. Provide two nuts for each bolt.
2. Drilled anchorage:
 - a. Threaded rods same as cast-in-place.

C. Data Plate:

1. Attach a stainless steel data plate to each piece of rotary or reciprocating equipment.
2. Permanently stamp information on data plate including manufacturer's name, equipment operating parameters, serial number and speed.

D. Gages:

1. Provide at the following locations:
 - a. Inlet and outlet of all reciprocating, centrifugal and positive displacement mechanical and process equipment.
 - b. At locations identified on Drawings.
2. Utilities tapping sleeves for mounting per Section 15060.

E. Lifting Eye Bolts or Lugs:

1. Provide on all equipment 50 LBS or greater.
2. Provide on other equipment or products as specified in the narrow specifications.

2.05 FABRICATION

- A. Design, fabricate, and assemble equipment in accordance with modern engineering and shop practices.

- B. Manufacture individual parts to standard sizes and gages so that repair parts, furnished at any time, can be installed in field.
- C. Furnish like parts of duplicate units to be interchangeable.
- D. Ensure that equipment has not been in service at any time prior to delivery, except as required by tests.
- E. Furnish equipment which require periodic internal inspection or adjustment with access panels which will not require disassembly of guards, dismantling of piping or equipment or similar major efforts. Quick opening but sound, securable access ports or windows shall be provided for inspection of chains, belts, or similar items.
- F. Provide common, lipped base plate mounting for equipment and equipment motor where said mounting is a manufacturer's standard option. Provide drain connection for 3/4 IN PVC tubing.
- G. Machine the mounting feet of rotating equipment.
- H. Fabricate equipment which will be subject to corrosive environment in such a way as to avoid back to back placement of surfaces that can not be properly prepared and painted. When such back to back fabrication can not be avoided, provide continuous welds to seal such surfaces from contact with corrosive environment. Where continuous welds are not practical, after painting seal the back to back surfaces from the environment in accordance with Section 07900.

2.06 SHOP OR FACTORY PAINT FINISHES

- A. Electrical Equipment:
 - 1. The standard factory-applied paint coating system(s) of the approved manufacturers of the following equipment are acceptable:
 - a. Panel boards.
 - b. Electrical panels.
 - c. Safety switches.
 - d. Motor starter equipment.
 - e. Motor control centers.
 - f. Transformers.
 - 2. As an alternate to the acceptable standard factory-applied paint coating systems, a manufacturer may provide a paint coating system in accordance with Section 09900.
- B. Other Equipment: In accordance with Section 09900.

2.07 SOURCE QUALITY CONTROL

- A. Motor Tests:
 - 1. Test motors in accordance with NEMA and IEEE procedures.

Include the following:

a. Routine test:

- 1) Running no-load amperes.
- 2) Locked rotor amperes.
- 3) Winding resistance, DC.
- 4) High-potential test at twice rated voltage plus 1000 V, with a minimum of 2200 V for 1 minute, winding to ground.
- 5) Vibration check.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install equipment as shown on Drawings and in accordance with manufacturer's directions.
- B. Utilize templates for anchorage placement for slab-mounted equipment.
- C. For equipment having drainage requirements such as seal water, provide 3/4 IN PVC or clear plastic tubing from equipment base to nearest floor or equipment drain. Route clear of major traffic areas and as approved by Engineer.
- D. DO NOT construct foundations until major equipment supports are approved.
- E. Extend all non-accessible grease fittings using stainless steel tubing to a location which allows easy access of fittings.
- F. Construct subbases, either concrete, steel or cast iron, level in both directions. Particular care shall be taken at hold-down bolt locations so these areas are flat and level.
- G. Machine Base:
 1. Mount machine bases of rotating equipment on subbases in manner that they are level in both directions according to machined surfaces on base. Use machinist level for this procedure.
 2. Level machine bases on subbases and align couplings between driver and driven unit using steel blocks and shims.
 - a. Size blocks and shims to provide solid support at each anchor bolt location. Area size of blocks and shims shall be approximately 1-1/2 times area support surface at each anchor bolt point.
 - b. Provide blocks and shims at each anchor bolt. Blocks and shims that are square shape with "U" cut out to allow blocks and shims to be centered on anchor bolts.
 - c. After all leveling and alignment has been completed and before grouting, tighten anchor bolts to proper torque

value.

- d. Do not use nuts below the machine base on anchor bolts for base leveling.

H. Couplings:

1. Align in the annular and parallel positions.
 - a. For equipment rotating at 1200 rpm or less, align both annular and parallel within 0.001 IN tolerance for couplings 4 IN size and smaller. Couplings larger than 4 IN size: Increase tolerance 0.0005 IN per inches of coupling diameter, i.e., allow 6 IN coupling 0.002 IN tolerance, and allow a 10 IN coupling 0.004 IN tolerance.
 - b. For equipment rotating at speeds greater than 1200 rpm allow both annular and parallel positions within a tolerance rate of 0.00025 IN per inch coupling diameter.
2. If equipment is delivered as a mounted unit from factory, verify factory alignment on site after installation and realigned if necessary.
3. Check surfaces for runout before attempting to trim or align units.

I. Grouting:

1. After machine base has been shimmed, leveled, couplings aligned and anchor bolts tightened to correct torque value, a dam or formwork shall be placed around base to contain grouting. Extend dam or formwork at least 1/2 IN above the top of leveling shims and blocks.
2. Saturate top of roughened concrete subbase with water before grouting. Add grout until entire space under machine base is filled to the top of the base underside. Puddle grout by working a stiff wire through the grout and vent holes to work grout in place and release any entrained air in the grout or base cavity.
3. When the grout has sufficiently hardened, remove dam or formwork and finish the exposed grout surface to fine, smooth surface. Cover exposed grout surfaces with wet burlap and keep covering sufficiently wet to prevent too rapid evaporation of water from the grout. When the grout has fully hardened (after a minimum of 7 days) tighten all anchor bolts and recheck driver-driven unit for proper alignment.

3.02 INSTALLATION CHECKS

- A. For all equipment specifically required in detailed specifications, secure services of experienced, competent, and authorized representative(s) of equipment manufacturer to visit site of work and inspect, check, adjust and approve equipment installation. In each case, representative(s) shall be present during placement and startup of equipment and as often as necessary to resolve any operational issues which may arise.

- B. Secure from equipment manufacturer's representative(s) a written report certifying that equipment:
 - 1. Has been properly installed and lubricated.
 - 2. Is in accurate alignment.
 - 3. Is free from any undue stress imposed by connecting piping or anchor bolts.
 - 4. Has been operated under full load conditions and that it operated satisfactorily. Secure and deliver a field written report to Owner immediately prior to leaving jobsite.

- C. No separate payment shall be made for installation checks. All or any time expended during installation check does not qualify as O&M training or instruction time when specified.

3.03 IDENTIFICATION OF EQUIPMENT AND HAZARD WARNING SIGNS

- A. Identify equipment and install hazard warning signs.

3.04 FIELD PAINTING AND PROTECTIVE COATINGS

- A. For required field painting and protective coatings, comply with Section 09900.

3.05 WIRING CONNECTIONS AND TERMINATION

- A. Clean wires before installing lugs and connectors.
- B. Terminate motor circuit conductors with copper lugs bolted to motor leads.
- C. Tape stripped ends of conductors and associated connectors with electrical tape, having a thickness 150 percent of the conductor insulation.
- D. Connections to carry full ampacity of conductors without temperature rise.
- E. Terminate spare conductors with electrical tape.

3.06 FIELD QUALITY CONTROL

- A. Furnish equipment manufacturer services as specified in the individual equipment specifications.
- B. Inspect wire and connections for physical damage and proper connection.
- C. Check rotation of motor before connection to driven equipment, before couplings are bolted or belts installed. Before motor is started to check rotation, determine that motor is lubricated.

- D. Subbase that supports the equipment base and that is made in the form of a cast iron or steel structure that has supporting beams, legs and cross member that are cast welded or bolted, shall be tested for a natural frequency of vibration after equipment is mounted. Keep the ratio of the natural frequency of the structure to the frequency of the disturbing force out of the range from 0.5 to 1.5.

3.07 DEMONSTRATION

- A. Demonstrate equipment in accordance with Section 01650.

END OF SECTION

95B06

SECTION 11065

LANDFILL GAS CONDENSATE SUMPS AND KNOCKOUTS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Construction and installation of landfill gas condensate sumps.
 - 2. Construction and installation of landfill gas condensate knockouts.
- B. Related Sections include but are not necessarily limited to:
 - 1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
 - 2. Division 1 - General Requirements.
 - 3. Section 02135b - Horizontal Landfill Gas Wells
 - 4. Section 11076A - Pumping Equipment: Controllerless Pneumatic
 - 4. Section 15065 - HDPE Pipe
 - 5. Section 15060 - Pipe and Pipe Fittings: Basic Requirements.
- C. Install the condensate sumps and knockouts in-line with the landfill gas headers. The contractor may order the sump vault, pump, inlet line, level detector, pipe and fittings as a package separate from the sump. Inlet line and level detectors shall be installed to maintain the level of condensate in the sump a maximum depth of not less than 6 inches below the lowest horizontal pipe invert.

1.02 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. American Society for Testing and Materials (ASTM):
 - a. D3350, Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.
- B. Qualifications:
 - 1. Supplied equipment in reference to this section shall have been proven in a landfill type environment for no less than 1 year.
 - 2. A minimum of three references from landfill operators/owners must be provided for the equipment selected by the Contractor as a condition of approval by the Engineer.
- C. Miscellaneous:
 - 1. Contractor's Health and Safety Plan.

1.03 SUBMITTALS

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- A. The Contractor shall submit the following documents to the Engineer for approval prior to constructing, assembling, or installing the sumps.
 - 1. The Manufacturer's installation procedures.
 - 2. Warranty Information.
 - 3. Drawings and specifications provided by the sump pump Manufacturer.
 - 4. Operation and Maintenance (O&M) manual.
 - 5. Air consumption, air pressure, and condensate flow rate curves.
 - 6. Factory test results.
- B. See Section 01340.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following Manufacturers of condensate sumps are acceptable:
 - 1. Landtec Landfill Control Technologies.
 - 2. Landfill Gas & Environmental Products, Inc.
 - 3. EZ Products.
- B. Submit requests for substitution in accordance with Section 01640.

2.02 MATERIALS

- A. General:
 - 1. Landfill gas condensate sumps shall be a packaged type system and completely prefabricated prior to site delivery.
 - 2. All bolts, washers, nuts, screws, and steel tubing used in the construction and/or installation of the sump shall be stainless steel.
 - 3. Backfill material shall be as specified by the manufacturer.
- B. Sump:
 - 1. Constructed of SDR 17 HDPE.
 - 2. Shall be liquid and gas tight and able to withstand 100 IN of water vacuum and a positive pressure of 5 psig.
 - 3. Minimum storage capacity of 15 GAL below invert of lowest pipe.
 - 4. Sump shall contain sufficient volume to contain settling solids without impeding the operation of the pump.
 - 5. Provide separate 6-IN FIP vacuum tight opening for pump installation compatible with system function as shown in the drawings.
- C. Pump:
 - 1. Shall be air operated, positive displacement, and self priming

as described in Section 11076A.

2. Capable of pumping landfill gas condensate.
3. Seals and diaphragms shall be constructed of VitonTM and TeflonTM.
4. Pump shall be capable of operating within an air pressure range of 40 - 200 psig.
5. Condensate outlet fittings shall be 1/2 IN NPT.
 - a. Inlet line shall be HDPE.
 - b. Outlet line within the vault shall be HDPE hose capable of withstanding the maximum and minimum system pressures.
6. The pump shall be designed to pump a minimum of 5 gpm at 20-FT TDH.

D. Compressed Air Supply:

1. Compressed air fittings shall be 1/4 IN NPT.
2. Shall include Filter, Lubricator, Regulator, (FLR) meeting the requirements of the pump manufacturer.
3. Compressed air system shall be rated for 150 psig.
4. Contractor is responsible for calibrating and supplying oil for the filter, lubricator, and regulator.
5. Compressed air lines within vault shall be 1/4 IN stainless steel pipe.

E. Level Control:

1. Floatless pneumatic level control, mechanical floats with pneumatic level switch, or Engineer approved equal.
2. All materials shall be stainless steel.
3. Pressure range of 40 - 100 psig.
4. Temperature Range 35 - 200 DegF.

F. Vault:

1. All sump components shall be enclosed in a lockable vault made of suitable material to withstand weather conditions.
2. Vault shall have appropriate fittings installed to accept the air supply line, condensate discharge line, and pressure equalizing line.
3. All vault penetrations shall be sealed with rubber grommet.

G. Landfill Gas Knockout:

1. All knockouts shall be constructed of the same materials and construction as the Sumps above.
2. Install knockouts as shown in Drawings with minimum 5 percent grade on drain lines to existing leachate manholes.

2.03 SOURCE QUALITY CONTROL

A. Factory Test:

1. The condensate sump system shall be tested prior to delivery on site.

PART 3 - EXECUTION

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3.01 PREPARATION

- A. All materials necessary to complete the condensate sump installation shall be on-site prior to installation.

3.02 INSTALLATION

- A. Installation shall be performed in accordance with the Manufacturer's instructions.
- B. All lines shall be free and clear of debris prior to connecting. All pipes shall be connected using appropriate engineering methods.
- C. Provide backfill material and bedding material in accordance with Section 02221.
- D. The supply air shall be connected from the field to the vault using a flexible tubing meeting the manufacturer's recommendations.
- E. The condensate discharge shall be installed using a HDPE to threaded epoxy coated steel transition fitting.
- F. The Contractor shall ensure that kinking or excessive bend diameters of the pipe do not occur to any pipe during the installation process.

END OF SECTION

96A02

SECTION 11076A

PUMPING EQUIPMENT: CONTROLLERLESS PNEUMATIC

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Low-drawdown pneumatic LFG condensate sump pump and accessories
- B. Related Sections include but are not necessarily limited to:
 - 1. Bidding Requirements, Contract Forms, and Conditions of the Contract.
 - 2. Division 1 - General Provisions.
 - 3. Section 01340 - Shop Drawings, Product Data, and Submittals.
 - 4. Section 11065 - Landfill Gas Condensate Sumps and Knockouts
 - 5. Section 15065 - HDPE Pipe
 - 6. Section 15866 - Air Compressor
- C. All equipment specified in this section shall be warranted by Manufacturer for a period of not less than one year from acceptance

1.02 SUBMITTALS

- A. Shop Drawings:
 - 1. Requirements in Section 01340.
 - 2. Source quality control test reports.
- B. Operation and Maintenance Manuals:
 - 1. See Section 01340.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Provide Clean Environment Equipment, Inc., Low Drawdown AP-4 BL or approved equal.
- B. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 - 1. Submersible non-clog leachate pumps:
 - a. Clean Environment Equipment, Inc.
 - b. QED Groundwater Specialists
 - c. Ejector Systems, Inc.
 - d. Approved equal.
- C. Submit requests for substitution in accordance with Specification Section 01640.

2.02 MATERIALS

- A. Condensate Pump:
 - 1. Pump Body: 304 Stainless Steel or Fiberglass Rein. Plastic.
 - 2. O-rings: Teflon or Viton.
 - 3. Bolts and nuts: 304 Stainless steel.
 - 4. Guide rails: 304 Stainless steel.
 - 5. Fittings: Brass
 - 6. Checkballs: Teflon
- B. Accessories as described in appropriate sections.

2.03 EQUIPMENT

- A. Performance and Configuration Requirements:
 - 1. Condensate Pump:
 - a. Design condition: 5 gpm at 20 FT TDH
 - b. Pump configuration: Submersible.
 - c. Minimum solids passage: Silt.
 - d. Pump Diameter: 4 IN diameter
 - e. Minimum Head (drawdown): 12 IN
 - f. Intake Configuration: Bottom loading, screened intake
 - g. Controls: Controllerless, Automatic
 - 2. Air Pressure Regulator
 - a. Designed for maximum supply pressure of 200 psi.
 - b. Designed to regulate air pressure per pump supplier's recommendations.
 - c. Shall include single stage 5 micron air filter with metal bowl and screw-fit drain plug.

2.04 ACCESSORIES

- A. Tubing:
 - 1. Provide nylon supply air, liquid discharge, and air exhaust tubing of sufficient size, strength, and capacity for the pump
- B. Clamps
 - 1. Provide stainless steel clamps appropriate for tubing connection
- C. Well Cap
 - 1. Provide Well Cap compatible with condensate sumps (non pressure)

2.05 SOURCE QUALITY CONTROL

- A. Secure from the pump manufacturer the following inspections and tests on each pump before shipment from factory:
 - 1. Check for compliance with Specification.
 - 2. Test pump operation.
- B. Factory test of head (FT) versus flow (gpm).

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install pump in condensate sump 6 IN FIP opening at location shown on the drawings per the pump manufacturer's recommendations.
- B. Connect to air supply line with pressure regulator.
- C. Connect discharge to condensate line.

3.02 FIELD QUALITY CONTROL

- A. Provide services of equipment manufacturer's field service representative(s) to:
 - 1. Inspect equipment covered by these Specifications.
 - 2. Supervise pre-start adjustments and installation checks.
 - 3. Conduct initial startup of equipment and perform operational checks.
 - 4. Provide a written statement that manufacturer's equipment has been installed properly, started up and is ready for operation by Owner's personnel.
 - 5. Instruct Owner's personnel for the specified minimum number of hours at jobsite on operation and maintenance of pumping equipment:

END OF SECTION

95B06

SECTION 11550

LANDFILL GAS CANDLESTICK FLARE STATION

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Installation and start-up assistance of a skid-mounted landfill gas candlestick flare station.

a. Acceptable Suppliers:

- 1) Flare Industries, Inc.
- 2) Landtec.
- 3) LFG Specialties.
- 4) NAO Flare Equipment.
- 5) Ameron.
- 6) EPG Companies.
- 7) John Zink, Inc.
- 8) Or approved equal.

B. Related Sections include but are not necessarily limited to:

1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 1 - General Requirements.
3. Section 01340 - Shop Drawings, Product Data and Samples, O & M Manuals and Miscellaneous Submittals.
4. Section 01600 - Product Delivery, Storage and Handling.
5. Section 01650 - Facility Startup
6. Section 05120 - Structural and Miscellaneous Metals.
7. Section 09900 - Painting.
8. Section 11551 - Landfill Gas Blower.
9. Section 11553 - Skid Assembly.
10. Section 11554 - Landfill Gas Demister.
11. Section 13440 - Instrumentation for Process Control: Basic Requirements.
12. Section 15866 - Air Compressor.
13. Section 16010 - Electrical: Basic Requirements.

C. Minimum Requirements and Exceptions to these Specifications:

1. It is the desire of the Owner to acquire a reliable, economical candlestick flare station, fabricated to at least the minimum material and workmanship standards as outlined in this specification and all bids shall be submitted in absolute conformance with these specifications as written.
2. In order to permit the manufacturer or vendor the benefit of their experience and expertise in the design and fabrication of a candlestick flare station that will best meet the needs of the Owner, no information relative to actual equipment or component sizing has been given except where considered

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necessary for the coordination of the station's equipment with other site system components and requirements. It is, however, required that the candlestick flare station shall meet or exceed all of the performance and operational requirements of these specifications without exception. Vendors and manufacturers are encouraged to submit specific exceptions and/or substitutions to the individual material components of these specifications whenever such exceptions are specifically listed as optional changes to the specifications and are accompanied with a specific optional price reduction from the primary bid for the equipment as specified. Any options or changes from these specifications not specifically identified in the bid, and said option and cost reduction not specifically accepted by the owner shall be considered unacceptable.

1.02 QUALITY ASSURANCE

A. Referenced Standards:

1. American National Standards Institute (ANSI).
2. American Steel Construction Institute (ASCI):
 - a. Steel Products Manual.
3. Factory Mutual (FM).
4. Florida Department of Environmental Protection (FDEP)
5. Underwriters Laboratories (UL).
6. US Environmental Protection Agency (EPA).
7. EPA Federal Regulation 40 CFR Part 60.18 - April 15, 1994.

1.03 REGULATORY REQUIREMENTS

- ##### A.
- The flare performance shall meet the requirements of the US Environmental Protection Agency (EPA) 40 CFR Part 60.18, and the Florida Department of Environmental Protection (FDEP), Chapter 62-296. It is the responsibility of the Contractor to bring to the attention of the Engineer any conflict between the requirements of the Plans and Specifications and the requirements of the EPA and/or the FDEP.

1.04 SUBMITTALS

- ##### A.
- The Contractor shall make all submittals in conformance with Section 01340 and this section.
- ##### B.
- Submittals required under this section include the following:
1. Flare shop drawings with sufficient detail to demonstrate compliance with Specifications.
 2. Written guarantee that the flare will meet the performance requirements as given herein.
 3. Bill of materials.
 4. Operation and Maintenance manual for the flare (to be included in the O&M manual for entire system).
 5. Structural calculations signed by a structural engineer

- registered in the State of Florida.
6. Blower fan performance curves.

C. Pipe and Instrumentation Diagram (P&ID)

PART 2 - MATERIALS

2.01 STRUCTURAL AND MISCELLANEOUS METALS

- A. Unless otherwise indicated on the Drawings and Specifications, structural and miscellaneous metals shall comply with the requirements of Section 05120.
- B. All components of the enclosed flare in contact with the burner flame shall be constructed of ANSI Type 316L stainless steel.

2.02 PAINTING

- A. Painting shall comply with the requirements of Section 09900.

2.03 ASSEMBLY ITEMS

- A. The following items at a minimum shall be included as part of the landfill gas candlestick flare station:
1. Landfill Gas Flare Stack Assembly.
 2. Burner Unit and Shroud.
 3. Pilot Light/Sparking Assembly.
 4. Landfill Gas Blower Fan.
 5. 3-Phase Blower Motor.
 6. Motor Starters, Distribution Panel and Disconnects.
 7. Flame Arrestor.
 8. Condensate Collection Pot.
 9. Instrument and Field Air Compressor.
 10. Landfill Gas Demister.
 11. Auxiliary Gas Storage Tank.
 12. Air Compressor, Control Panel and Receiver Tank.
 13. Total Flow Instrumentation and Instrumentation Panels and Enclosures.
 14. Flame Monitoring System (Thermocouple).
 15. Autodialer.
 16. All interconnecting Piping, Tubing conduit and Wiring.
 17. All required Connectors and connecting hardware.
 18. All electrical termination hardware.
 19. Pneumatically actuated shut-off valve placed upstream of the blower.
- B. The entire Landfill Gas Candle Stick Flare Station shall be shipped as an integral or modular unit including all components required for a complete and operational unit. All components shall be prepiped, prewired, preassembled and interconnected onto the skid or skid sections to the maximum extent possible to

facilitate field installation. The vertical portion of the stack assembly may be shipped disconnected from its associated skid to facilitate shipping. The skid and/or all skid sections shall be fabricated to permit a bolt-up assembly in the field between skid sections, field utilities and Landfill Gas piping. Landfill gas connection at the site shall consist of a flanged 24 IN SDR 21 HDPE stub-out. Electrical service will be 120/240V, 3 phase, 4 wire available at a nearby service metering pole. A 120/240 volt, 80 amp three phase 4 wire service will be brought to the distribution panel on the station skid by the field installation contractor. It will be the responsibility of the Landfill Gas Candlestick Flare Station manufacturer to ensure coordination with the field installation contractor during the design of the units for location and compatibility of the field/skid interconnections. All skid/field interface connections shall be located at the edge of the skid. Detailed design of the flare station shall be engineered by the manufacturer to meet, at a minimum, the requirements for performance as outlined in this and associated specification sections as well as contain the minimum components as detailed in this and associated sections and meet the minimum requirements as mandated by the standards of good engineering practice in the landfill flare industry and applicable law.

2.04 LANDFILL GAS FLARE STACK ASSEMBLY

- A. The Landfill Gas Flare Stack assembly shall include, but not limited to, the following components, which shall meet, at a minimum, the following requirements:
1. Flare Stack: The flare stack shall be constructed from a minimum of schedule 40 type A-53 seamless pipe and shall be of a height suitable to the installed location. Minimum height shall be 24 feet. Flare stack and supports shall be of all continuous welded construction except for final field connection of the stack to the skid, which shall be a bolted connection. A drain port shall be provide at the base of the stack. Lifting lugs shall be provided to facilitate field erection.
 2. Flare Mounting/Support System: a four-leg (minimum) flare base and mounting system shall be provided as an integral part of the flare stack. This system shall be fabricated from structural ASTM A-36 carbon steel and shall be of all continuous welded construction both between its own members and the flare stack assembly. Sufficient reinforcement shall be incorporated into the support structure for a 110 mph wind- load and to prevent erratic or excessive movement under loads as would be sustained during service operations. A means of access or components to facilitate access (i.e. ladder guides, supports) to the burner unit shall be provided in the design of the support system and flare stack assembly. Support system shall incorporate a bolt-up connection to the

skid assembly.

3. Burner: The burner unit shall be constructed from a minimum of type 304L or type 316L schedule 40S stainless steel pipe and shall be a minimum of 2 feet in length. It shall consist of the burner nozzle, vanes and an impingement assembly. It shall be sized and designed to allow the efficient burning of the full range of landfill gas flow rates without flame yellowing, flame lift-off or flash-back. It shall perform in accordance with the destruction efficiencies specified in Section 3.01 of this section. Burner section shall be installed onto the stack in a manner that will facilitate removal for servicing.
4. Flare Shroud: The flare shroud/windshield shall be constructed of type 304L or type 316L stainless steel and shall be sized and positioned to protect the integrity of the flame for efficient combustion. The shroud shall be provided with solid ceramic or calcium silicate insulation, as necessary, for personnel protection and to ensure the long life and durability of the assembly. Insulation shall be coated for weather protection. See also 2.06, of this section for insulation requirements.

2.05 PROPANE PILOT SYSTEM AND IGNITION SYSTEM

- A. The flare system shall include a propane pilot gas system for igniting the landfill gas that includes, at a minimum, the following components:
 1. A type 316L stainless steel pilot nozzle and tip with integral electronic ignitor assembly. Pilot assembly shall be capable of service removal from outside of the flare/burner/shroud assembly.
 2. Two 5 gallon, minimum, refillable propane gas storage tanks with connectors as appropriate for local utility servicing and re-fill. All pressure regulating and relief/safety devices as required by local utility regulations. The two tank header manifold shall be provided in the propane feed system to permit the removal of one tank for re-filling without affecting system operation.
 3. An automatic Flame Monitoring system to provide flame confirmation, sequenced reignition, safety shut-down and audible/silent alarm. The flame monitoring system shall include alarms for flame-out/failed re-ignition, power-out situations that will result in automatic shut down and notification of designated agency representatives through the use of an autodialer system incorporated into the flare station.

4. All controls and interconnection piping, conduit and subassemblies or systems necessary to furnish a complete and operational automatic pilot and ignition control system shall be provided in a prewired and prepipe condition to the maximum extent possible. Equipment furnished shall include, but not be limited to all transformers, switches, software, controllers manual and automatic valves, pressure regulators, strainers, thermocouples, pressure and temperature transmitters, pressure and temperature gauges. System shall also include fail-safe system orientation and a gas pressure manometer connection port.

These and any other components that require servicing shall be installed such that they can be conveniently and quickly disassembled and removed from outside the flare housing. All parts of the pilot assembly installed inside the flare shall be fabricated from 316L stainless steel.

2.06 HEAT PROTECTION

- A. The flare shall be insulated such that the maximum outside skin temperature does not exceed 250 DegF, and the exhaust heat flux at normal head height adjacent to the flare shall not exceed 400 Btu/HR/FT². The flare manufacturer shall submit calculations demonstrating compliance with these requirements.
- B. The insulation in the combustion zone shall be suitable for the maximum combustion temperature or 2,200 DegF, whichever is higher. Metal retainers required to hold the insulation in place shall be suitably heat resistant.
- C. A heat shield shall be provided in areas of the flare that are over 140 DegF to an elevation of 10 FT. above skid level.

2.07 OTHER MAJOR EQUIPMENT

- A. The landfill gas candlestick flare station shall include the following integral skid mounted equipment:
 1. Air compressor, control panel and compressed air storage and distribution system furnished in compliance with specification sections 13440 and 15866 sized to provide control air for all operational needs of the flare station and to provide a normally available supply of air capable of operating all air operated diaphragm pumps located in the condensate sumps on site. The sizing of the compressor and the receiver tank shall be such as to allow the maximum continuous discharge of 35 scfm at 50 psig for one hour to the pump System without allowing the internal pressure of the receiver tank to fall below the minimum operating pressure requirements of the flare station instrumentation and control system. A regenerative desiccant air dryer shall be provided downstream of the receiver tank to service the candlestick flare station instrumentation and control air system.

Connection of the Pump system may be directly to the Receiver Tank. The Compressed air system shall be furnished with an interlocking safety system comprised of pressure switches and automatic shut-off valving that will automatically isolate the Candlestick Flare Station Instrumentation and Control system from the pump system in the event of a break in the air line servicing the Pump system. The compressed air system shall be linked with the autodialer system of the flame monitoring system to notify the appropriate authorities of any such anomalies in the compressed air system, without station shut-down. All pressure regulating devices for both the station I&C system and for the pump system header shall be furnished as skid mounted equipment. The flare manufacturer shall coordinate the pump system header requirements with the field contractor.

2. A Landfill Gas Blower shall be provided in accordance with the requirements of Specification 11551 and shall be sized to meet the performance requirements of this section. The Blower shall be matched with an appropriate 3-phase motor, in a TEFC enclosure, provided in accordance with Section 11005. The gas blower shall be capable of compressing 3000 SCFM of landfill gas to a discharge pressure of 10 inches w.c. and shall achieve a suction pressure of -50 inches w.c. at the fan inlet at normal design conditions. Fan performance shall be relatively flat across the operating range of the flare to permit a full 10 to turndown ratio while still maintaining specified combustion efficiency. The blowers shall be capable of operating down to 220 SCFM without surging.
3. Field Gas pressure and flow data display and recording equipment will be provided on the skid at the inlet of the flare station gas line. This equipment will include at a minimum a field vacuum "magnahelic" differential pressure indicating transmitter and orifice assembly for flow and pressure indications, digital and/or analog flow and pressure indication and an appropriate circular or tape chart recorder for both flow and field pressure. Acceptable manufacturers include Dwyer or approved equal.
4. Landfill Gas Demister shall be provided in accordance with Section 11554. The demister shall be capable of removal of all particles and water droplets having a dimension greater than 6 microns in size. Demister shall be located on the skid with clearances as required to facilitate maintenance. Maximum allowable pressure drop through the demister shall be 2 inches w.c. at design conditions. Condensate removal piping shall be installed and prepiped into the skid condensate collection system.

2.08 ELECTRICAL AND INSTRUMENTATION EQUIPMENT

- A. Electrical power and instrumentation equipment furnished with the

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flare shall be enclosed in NEMA 4 enclosures.

- B. Electrical equipment and the electrical distribution system shall be provided in accordance with specification sections 13440, Division 16 and all applicable codes.
- C. Electrical system included on the skid shall incorporate the distribution and use of the available site voltage and its conversion and/or transformation into various equipment voltages, currents and phase needs as required by the system equipment. The electrical system shall include, but not be limited to, all circuit breakers, motor starters, switches, connectors, rigid aluminum conduit, cables, wires, junction boxes, supports, terminations, transformers, timers, control and instrumentation devices that are necessary to provide a complete and operational system.
- D. A main power distribution panel meeting the requirements of Section 16150 shall be furnished suitable for a 100 amp, 120/240 volt, 3-phase, 4 wire 60 HZ power supply.
- E. Include a 70 watt high pressure sodium security light with photocell and on/off switch.
- F. Also include a 120 V, 15 amp, GFCI type duplex weather protected receptacle.
- G. Motor starters for equipment furnished shall be NEMA rated magnetic, full voltage, with externally operable manual resettable thermal overload relay.
- H. A control panel for the entire system shall be furnished in a NEMA Type 4 enclosure. The panel shall include, as a minimum but not be limited to, the following components:
 - 1. A relay-based control system to receive all the signals from the various safeties, controls and monitoring equipment, and to automatically control all the various components of the system. Motor starters may be mounted separately.
 - 2. An operator control panel to allow either manual or automatic selection for the control of the various operation components of the system.
 - 3. A weather/heat shield shall be provided to protect the control panel against radiated heat (solar and/or flare) and rain. The control system shall be designed and manufactured for an outdoor environment.
 - 4. Safeties: The system shall be equipped with the following safeties as a minimum:
 - a) Blower motor overcurrent - Shutdown.
 - b) Flare failure - Shutdown.
 - 5. Gauges: The system shall be equipped with the following gauges as a minimum:
 - a) Inlet Gas Temperature Indicator.

- b) Demister/Filter Pressure Drop Indicator.
- c) Blower outlet Temperature Indicator.
- 6. Control Panel Face Mounted Devices: The system shall be equipped with the following control panel face mounted devices as a minimum:
 - a) Alarm and shutdown annunciators.
 - b) Landfill gas flow meter.
 - c) Hand/Off/Auto Switch for the blower.
 - d) Hand/Off/Auto Switches for the flare.
 - e) Run indicators for the blowers.
 - f) Flame failure indicator for the flare.
 - g) Lower LFG Flow indicator.
- I. All pilot devices and switches shall be labeled using engraved nameplates. Nameplates shall be white background with black letters, 2-1/4 IN wide x 5/8 IN high.
- J. The control panel shall be fabricated to JIC standard. Terminal blocks shall be installed for all field-wire devices and all wires going to door-mounted devices. Spare terminals equal to 10 percent of the required amount (10 minimum) shall be furnished. Plastic wire ways shall be utilized for routing wiring within the panel. Door wiring shall be neatly routed and tied with nylon tie straps. A minimum of eight spare wires shall be included in the door loom. The spare wires shall be identified as S1, S2, etc., on both ends. They shall be neatly coiled and tied at the door end, and coiled and stowed in the terminal strip raceway at the other end.
- K. Panel wire shall be minimum AWG 16 GA stranded and shall be type MTW or THWN. 120 V wiring shall be red with a white grounded neutral wire. All wires shall be identified at both ends with wire numbers corresponding to the wiring diagrams. All interlock wiring from other systems shall be yellow. Control circuit disconnectors shall be furnished on the terminal strip for all interlock wires.
- L. Door-mounted devices shall be neatly grouped and arranged in a logical manner for ease of operation. They shall be horizontally spaced on 2-1/4 IN centers and vertically spaced on 2-1/2 IN centers.
- M. All panel-mounted devices shall be attached to the mounting panel with machine screws into tapped holes or self tapping screws. Nuts behind the mounting plate shall not be used. Plastic wire ways shall be fastened with rivets. Double-faced tape shall not be used.
- N. Hoffman Engineering A-HCI-5E or equal corrosion inhibitor shall be installed in the control panel prior to shipping.
- O. Freeze Protection - Thermostatically controlled heat tracing

shall be provided on all piping and components capable of sustaining damage or malfunction as a result of sub-freezing temperature. Control of the freeze protection system shall be incorporated into the skid mounted control panel. All components and/or controls shall be provided and sized to provide freeze protection and heat tracing of the off-skid connecting pipe systems for a distance of 10 feet from the skid.

2.10 FLAME ARRESTOR

- A. The flare shall include a flame arrestor that shall impose no more than a 3 inch w.c. pressure drop through the system at design conditions. Flame arrestor shall be horizontal, manufactured out of cast aluminum and connected into the system utilizing flanged connectors to facilitate removal. Internal elements shall be replaceable without removing the flame arrestor body from the gas line. Acceptable manufacturers include Varec, Groth or approved equal.

2.11 CONDENSATE COLLECTION POT

- A. A minimum 5 gallon condensate collection pot shall be provided as a skid mounted unit to collect condensate generated from the skid mounted equipment. The condensate pot shall be furnished with flanged connections to permit connection to the field condensate system. Slope of all lines and the design of the condensate pot shall be such as to accommodate the gravity flow from the skid mounted equipment to the condensate pot and from the condensate pot to the nearest field condensate sump. J-traps shall be provided as necessary to preserve the field line vacuum and station line pressures. Internal components of the condensate system shall be fabricated from a corrosion resistant material or shall be coated for resistance to acidic condensate. Condensate pot shall be furnished with a removable access cover and isolation valving to facilitate cleaning.

2.12 AUTOMATIC DIALER

- A. An automatic cellular dialing system shall be provided, linked to both the fire monitoring and the station compressed air system to provide notification to appropriate authorities in the event of a system failure. Acceptable manufacturers include Raco Manufacturing and Engineering or approved equal. The dialer shall be mounted in the control panel.

2.13 SKID CONSTRUCTION

- A. Skid and/or skid section construction shall be in accordance with the requirements of specification 11553. All skid sections shall be prepped or wired to the maximum extent possible to facilitate field erection. All skid sections shall be interconnecting and shall have been pre-assembled in the factory prior to shipment to

ensure proper alignments. Skid sections shall be subdivided based upon shipping size limitations only. Maximum number of skid sections shall be four plus the stack assembly.

2.14 PIPING, CONDUIT, AND WIRING

- A. All carbon steel piping on the station shall be ASTM type A-53 schedule 40 as a minimum. All stainless steel piping shall be ASTM type 304L schedule 40S as a minimum. All connections shall be screwed (2-1/2 inch or less) or flanged (3 inch or greater) as appropriate using components of a minimum 150# ANSI rating. Instrumentation tubing shall be stainless steel. Dielectric fittings shall be provided for dissimilar metals protection where appropriate. All skid conduit and fittings shall be rigid aluminum manufactured of 6063-TI alloy. Conduit shall be UL approved and shall conform to Federal Specification WW-C-540 and ANSI C80.5. Minimum conduit size shall be 3/4 inch. All installations shall be provided as required for outdoor weatherproof service.
- B. Skid wiring shall conform to the requirements of Section 16011.

2.15 Spare Parts List

- A. Provide one spare part for the following components: thermocouple and electronic ignitor assembly.

PART 3 - EXECUTION

3.01 Performance Requirements

- A. The gas flare shall be designed and constructed to meet the following performance specifications:

Maximum Btu/hour high heating value (HHV) the flare is capable of burning and still meet all specifications	65 MMBtu/hour
Minimum turndown based on Btu/hour from maximum flow rate	10:1
Maximum flare design flow	3000 SCFM
Normal flare design flow	3000 SCFM
Maximum flare back pressure at 3000 SCFM measured upstream of the automatic shutdown valve	7 IN w.c.
Methane Concentration in Gas	30 to 60 percent
Carbon dioxide concentration in gas	30 to 60 percent

Nonmethane hydrocarbon content in gas	Trace
Oxygen concentration in gas	< 1 percent
Hydrogen sulfide concentration in gas	Trace
Nitrogen concentration in gas	1-3 percent
Minimum flare retention time	0.6 seconds at 65 MMBtu/hr
Normal operating temperature range for the flare (Note: The flare combustion temperature will be controlled to optimize the destruction efficiency while minimizing CO and NOx emissions. The vendor should indicate in the proposal the temperature range the flare can be operated over and still meet the emission guarantees.)	1400 - 1800 DegF
Maximum allowable skid & foundation temperature under flare	200 DegF
The noise level (maximum)	85 dBA at 3 feet from the flare housing
Maximum allowable external flare skin temperature	250 DegF
Maximum allowable heat flux at six feet above grade, excluding solar radiation	400 Btu/HR/FT ²
Maximum allowable water entrainment rate as an instantaneous slug in the gas without causing operating problems or loss of flare performance	0.5 GAL
Minimum and maximum allowable flare height	24 FT minimum - 35 FT maximum
Minimum NMOC destruction efficiency	98 percent by weight
Ambient Conditions	
Ambient air temperature	20 to 110 DegF
Elevation above sea level	500 FT
Wind (for flare performance)	

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& not stack design)

0-20 mph

- B. The particulate emissions from the flare (other than combustion air particulates) shall not exceed 30 LB/day or 1.25 LB/HR.

3.02 SHOP FABRICATION

- A. The flare shall be completed and assembled prior to delivery to the job site accept as required for shipment. Items which could be damaged in shipment shall be removed from the flare stack and boxed for shipment.
- B. All Equipment, piping and electrical installation shall be rigidly or resiliently supported (as required) onto the skid to prevent excessive vibration and/or inducing excessive strain or forces on mountings or connections.

3.03 DELIVERY SCHEDULE

- A. Product delivery shall be provided in accordance with Section 01600 and shall be coordinated with the needs of the field installation contractor to minimize the field storage of the equipment.

3.04 INSTALLATION

- A. The flare shall be installed by the field contractor on a gravel subgrade with concrete footings or piers as indicated on the shop drawings and as designed by the Flare Manufacturer.

3.05 WARRANTY

- A. The manufacturer shall warrant that the landfill gas candlestick flare station in its entirety as well as all individual components provided in this Section as its integral units shall perform as specified, as represented on the shop drawings and data submittals, and as required to meet present EPA/FDEP emissions standards for a period of 12 months from the date of final acceptance of the completed flare station.

3.06 START-UP ASSISTANCE

- A. The manufacturer shall, as part of the purchase price, furnish an on-site advisor and start-up technician (one person) to be present on site during the final installation and start-up activities on site. This start-up assistance shall be budgeted for a minimum of two full work days (not including travel days) and shall be coordinated to meet the scheduled needs of the installing contractor.

3.07 PERFORMANCE TESTING

- A. Performance testing will be performed as required under applicable law by the contractor, under the guidance of the manufacturers representative. Any supplemental field service required, resulting from the flare stations failure to meet performance requirements shall not be billable to the contractor or Owner unless due to Contractor or Owner fault, respectively.

END OF SECTION

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SECTION 11551

LANDFILL GAS BLOWER

PART 1 - GENERAL

1.01 SUMMARY

- A. The Manufacturer shall provide all labor, equipment and material for the complete installation of the blower unit as described in this Section.
- B. Related Sections include but are not necessarily limited to:
 - 1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
 - 2. Division 1 - General Requirements.
 - 3. Section 01340 - Shop Drawings, Product Data and Samples, O & M Manuals and Miscellaneous Submittals.
 - 4. Section 01600 - Product Delivery, Storage and Handling.
 - 5. Section 05120 - Structural and Miscellaneous Metals.
 - 6. Section 09900 - Painting.
 - 7. Section 11550 - Landfill Gas Candlestick Flare Station.
 - 8. Section 11553 - Skid Assembly.
 - 9. Section 11554 - Landfill Gas Demister.
 - 10. Section 13440 - Instrumentation for Process Control: Basic Requirements.
 - 11. Section 15866 - Air Compressor.
 - 12. Section 16010 - Electrical: Basic Requirements.

1.02 SUBMITTALS

- A. The Manufacturer shall submit sufficient data to the Engineer to determine compliance of the blowers with the requirements of the Specifications including but not limited to:
 - 1. Exhauster curve.
 - 2. Motor specifications.
 - 3. Noise and vibration data.
 - 4. Coatings.
 - 5. Materials of construction.
- B. Submittals shall be in accordance with the provisions of Section 01340.

PART 2 - MATERIALS

2.01 PHYSICAL REQUIREMENTS

- A. The blower shall be manufactured by Lamson, New York, Hoffman or approved equal conforming with following specifications:
 - 1. Configuration: belt drive, horizontal inlet and outlet.

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- Drive shaft on suction side.
- 2. Impellers: aluminum, 500 feet per second maximum tip speed.
- 3. Vibration: 1.5 mils max in any direction.
- 4. Inlet and outlet compatible with ANSI 150# flat-face flanges.
- 5. Shaft seal: mechanical, 1.0 cfh max leakage.
- 6. Noise Level: 58dBA max at property line.
- 7. Motor:
 - a. 3 PH, 60 HZ., horsepower to be determined by manufacturer.
 - b. 1.15 service factor.
 - c. TEFC.
 - d. Area classification is Class I, Division II, Group D.
 - e. 91 percent efficient (min) at full load.
- B. The blower shall be identified with nameplates securely riveted or screwed to it. The following minimum information shall be stamped or engraved on the plate:
 - 1. Manufacturer model number.
 - 2. Blower serial number.
 - 3. Maximum design horsepower (HP).
 - 4. Maximum design flow (SCFM).
 - 5. Minimum design flow (SCFM).
 - 6. Design specific gravity of gas.
 - 7. Suction and discharge pressure at maximum design flow.
 - 8. Purchaser's PO number.
 - 9. Maximum allowable blower speed (rpm).
- C. The motor coupling shall be rated for at least 150 percent of the maximum rated blower load.
- D. Spare parts list. Provide spare parts for each of the following: One starter motor, four spare belts and two shaft seals.

2.02 PERFORMANCE REQUIREMENTS

- A. The blower shall meet the following performance requirements:
 - 1. Maximum flow: 3000 SCFM.
 - 2. Suction vacuum: 50 IN w.c. min, at 3000 scfm at station inlet.
 - 3. Discharge pressure: 10 IN w.c. min, at 3000 scfm.
 - 4. Maximum suction temperature: 110 DegF.
 - 5. Max temp increase through blower: 30 DegF.
 - 6. Minimum blower efficiency:
 - a. 100 percent flow: 60 percent.
 - b. 50 percent flow: 50 percent.
 - c. 25 percent flow: 40 percent.
 - d. 10 percent flow: 25 percent.
- B. The blower shall be designed to perform as an integral element of the Candlestick Flare Station described in Section 11550.

2.03 LANDFILL GAS CHARACTERISTICS

- A. The blower materials shall be suitable for long-term service with landfill gas with the following characteristics:
 - 1. Methane: 30-60 percent.
 - 2. Carbon dioxide: 30-60 percent.
 - 3. Nitrogen and oxygen: Balance.
 - 4. Water Saturated at inlet conditions with some water carryover; no slugs of water.
 - 5. Specific gravity: 0.98.
 - 6. Trace contaminants: Up to 0.5 percent of various non-methane hydrocarbons, including aromatic and chlorinated hydrocarbons, and hydrogen sulfide.

2.04 SITE CHARACTERISTICS

- A. The blower shall be suitable for use under the following ambient conditions.:
 - 1. Location: Outdoors.
 - 2. Area classification: Class I, Division II, Group D.
 - 3. Maximum ambient air temperature: 110 DegF.
 - 4. Minimum ambient air temperature: -20 DegF.
 - 5. Elevation above mean sea level: 40 FT.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. The blowers shall be mounted and plumbed as an integral part of the skid assembly prior to shipment.
- B. The blowers shall be located on the skid such that the motors and blower housings are easily accessible.

END OF SECTION

94L19

SECTION 11553

SKID ASSEMBLY

PART 1 - GENERAL

1.01 SUMMARY

- A. The Manufacturer shall furnish all labor, materials and incidentals required for the detailing, shop fabrication, shop testing, field installation, and field testing of the skid assembly as described in the Specifications.
- B. The Specifications are intended to identify the general layout of the equipment and assembly items. It is the responsibility of the Manufacturer to perform the detailed engineering, and produce the shop drawings required for the fabrication of the skid assembly.
- C. Related Sections include but are not necessarily limited to:
 - 1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
 - 2. Division 1 - General Requirements.
 - 3. Section 05120 - Structural and Miscellaneous Metals.
 - 4. Section 09900 - Painting.

1.02 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. American Welding Society (AWS):
 - a. D1.1, Structural Welding Code - Steel.

1.03 SUBMITTALS

- A. All Manufacturer submittals shall be in accordance with Section 01340.
- B. Manufacturer submittals required under this section include:
 - 1. Shop drawings:
 - a. Structural skid.
 - b. Details.
 - 2. Material submittals:
 - a. Structural steel certifications.
 - b. Paint and coatings.
 - c. Structural fasteners.

PART 2 - MATERIALS

2.01 EQUIPMENT

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- A. The Manufacturer shall supply all equipment and material installed onto the skid for a completely operational system.

2.02 Materials

- A. Structural Steel - Structural steel shall conform with the requirements of Section 05120.
- B. Miscellaneous Metals - Miscellaneous metals shall conform with the requirements of Section 05120.
- C. Coating - Paint, primer, and coating shall comply with the requirements of Section 09900.

PART 3 - EXECUTION

3.01 SHOP FABRICATION

- A. The skid shall be constructed of structural steel and be designed to support the loads from all equipment attached to and supported by it, including seismic loads, wind loads, transportation and installation.
- B. All equipment attachments to the structural skid shall be bolted.
- C. Equipment mounted on the skid shall be provided with vibration isolators of the type and quantity recommended by the manufacturer of the equipment.
- D. Holes shall be provided in the appropriate locations on the skid for anchoring the skid in the field in conformance with the foundation plan submitted in accordance with Sections 11550 and 01340.
- E. An adequate number of leveling bolts shall be provided on the skid, and bolts shall be at least 3 IN long. Allowable skid deflection shall not exceed 1/1000 of the span between screws. Leveling screws shall be placed not more than 10 FT apart.
- F. The skid shall be provided with an adequate number of lifting lugs appropriately placed to allow for proper balancing of the skid when lifted in the horizontal position.
- G. Skid resistant metal flooring shall be installed on the skid.
- H. Bolts shall be located for convenience of maintenance whenever possible, and shall not require the use of special tools.
- I. Welding shall be performed by qualified operators certified in the process and position that the job requires in accordance

with AWS D1.1.

3.02 PAINTING

- A. Painting shall be in accordance with Section 09900

3.03 SHIPMENT

- A. The complete skid assembly unit including all items, parts, attachments and spools for field connection shall be suitably packed and properly prepared for shipment and outdoor storage.
- B. The Manufacturer shall be responsible for all preparations for shipment. The cost of shipping to the jobsite shall be included in the Manufacturer's base bid. The Manufacturer shall inform the Contractor in writing of all shipments arrangements and preparations. All arrangements shall be mutually agreed upon prior to shipment.
- C. The Manufacturer shall provide necessary covering, bracing, supports, and rigging in order to prevent damage to the skid assembly during transportation, loading and unloading.
- D. All loose equipment shall be packed, securely fastened, and protected from weather damage during transportation to the site. Each item shipped shall be documented on a packing list or other suitable document so that the Contractor may verify the contents upon delivery.
- E. The Manufacturer shall assume full responsibility for shipping damage.

END OF SECTION

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SECTION 11554

LANDFILL GAS DEMISTER

PART 1 - GENERAL

1.01 SUMMARY

- A. The Manufacturer shall provide all labor, equipment and material for fabrication of the landfill gas demister as required for the knockout at the candelstick flare station.
- B. The landfill gas demister shall be installed on the skid assembly prior to delivery of the skid to the job site.
- C. The demister shall be constructed in accordance with ASME Code Section 8, latest edition, requirements for pressure vessels.
- D. The demister skirt shall have access holes spaced at 90 degree intervals.
- E. Minimum vessel and head thickness shall be 3/16 IN.
- F. Related Sections include but are not necessarily limited to:
 - 1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
 - 2. Division 1 - General Requirements.

1.02 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. American National Standard Institute (ANSI).
 - 2. American Society of Mechanical Engineers (ASME).

PART 2 - MATERIALS

2.01 COMPONENTS

- A. All components of the gas demister except for the skirt shall be constructed of 304 SS.
- B. The gas demister skirt may be constructed of carbon steel or stainless steel.
- C. All bolting used inside the vessel shall be 304 SS or better.
- D. The 316 SS wire mesh mist extractor shall be 6 IN thick by 12 LBS/FT³ density with 0.011 IN diameter wire.

PART 3 - EXECUTION

3.01 SHOP FABRICATION

- A. Flange bolt holes are to straddle natural center lines.
- B. Skirts for vertical vessels shall have two 2 IN diameter gas vents near the attachment of the skirt to the vessel.
- C. The gas demister skirt shall be designed with a minimum of 1/16 IN corrosion allowance. The skirt shall be welded to the vessel shell using full penetration butt welds.
- D. Blind flanges and/or manways supplied with vessel shall be hinged or davited when they weigh in excess of 75 LBS, Blind flanges less than 75 LBS but more than 25 LBS shall have hand grips. All flanges shall be ANSI 150 LB raised face unless otherwise noted on vessel drawings.
- E. The minimum allowable grade stud and nut for flanges shall be SA-193 B7 and SA-194 2H, respectively.
- F. The gas demister shall be free standing on the skid without need of additional guy wires or braces.
- G. All bolts and nuts shall be easily accessible for tightening.
- H. Nozzles and couplings shall be not less than 2 IN from any vessel weld seam.
- I. All reinforcing elements shall have a 1/4 IN telltale hole and shall be pressure tested. If reinforcing pads must cross a vessel weld, 100 percent x-ray inspection of the vessel will be performed prior to installation of pad.

3.02 TESTING

- A. Hydrotest pressure shall be the maximum allowable for the vessel new and cold. The maximum new and cold hydrotest pressure shall be shown on the vessel fabrication drawing based on the maximum possible vessel pressure rating using zero corrosion allowance.
- B. Welding shall be visually inspected at a minimum.

END OF SECTION

Division 13

Special Construction

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SECTION 13440

INSTRUMENTATION FOR PROCESS CONTROL: BASIC REQUIREMENTS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Basic requirements for instrumentation system for process control of candlestick flare station and appurtenances.
- B. Related Sections include but are not necessarily limited to:
 - 1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
 - 2. Division 1 - General Requirements.
 - 3. Section 11550 - Landfill Gas Candlestick Flare Station.
 - 4. Section 15866 - Air Compressor.
 - 5. Division 16 - Electrical.

1.02 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. American Society of Mechanical Engineer (ASME).
 - 2. American Society for Testing and Materials (ASTM).
 - 3. Institute of Electrical and Electronic Engineers (IEEE).
 - 4. Instrument Society of America (ISA).
 - 5. National Institute of Standards and Technology (NIST).
- B. Miscellaneous:
 - 1. Comply with all electrical classifications and NEMA enclosure requirements as required by applicable code or as specified whichever is more stringent.

1.03 SYSTEM DESCRIPTION

- A. Control System Requirements:
 - 1. This Specification Section 13440 provides the general requirements for the instrument and control system.
 - 2. The instrument and control system consists of all primary elements, transmitters, switches, controllers, computers, recorders, indicators, panels, signal converters, signal boosters, amplifiers, special power supplies, special or shielded cable, special grounding or isolation, auxiliaries, software, wiring, and other devices required to provide complete control of the flare station as specified.
- B. Unless otherwise required for instrument compatibility, electric control signals shall be 4 to 20 milliamperes, 24 V DC and pneumatic signals shall be 3 to 15 psi.

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- C. All signals shall be directly linearly proportional to measured variable unless specifically noted otherwise.
- D. The manufacturer will be responsible for functional operations of all systems, performance of control system engineering, supervision of installation, final connections, calibrations, preparation of drawings and operation and maintenance manuals, startup, training, demonstration of substantial completion and all other aspects of the control system.

1.04 SUBMITTALS

- A. Shop Drawings:
 - 1. See Section 01340.
 - 2. Product technical data:
 - a. Manufacturer's installation instructions.
 - b. Instrument component technical brochures.
 - c. Instrument data sheets:
 - 1) ISA S20 or approved equal.
 - 2) Separate data sheet for each type of instrument.
 - d. Materials of construction.
 - e. Minimum and maximum flow ranges.
 - f. Pressure loss curves.
 - g. Physical limits of components including temperature and pressure limits.
 - h. Size and weight.
 - i. Electrical power requirements and wiring diagrams.
 - j. NEMA rating of housings.
 - 3. Loop diagrams per ISA S5.4.
 - a. Each loop diagram and description on a separate 8-1/2 x 11 IN sheet.
 - b. Each sheet shall contain the following minimum information.
 - 1) All loop devices clearly identified.
 - 2) Identification of the loop and each loop component, including connections to such things as recorders and computers.
 - 3) All interconnections with identifying numbers for:
 - a) Electrical cables.
 - b) Conductor pairs.
 - c) Pneumatic or hydraulic tubing.
 - 4) Identification of connections including:
 - a) Junction boxes.
 - b) Terminals.
 - c) Bulkheads.
 - d) Ports.
 - e) Computer input/output connections.
 - f) Grounding systems.
 - 5) Signal levels and ranges.
 - 6) Device location.
 - 7) Energy sources designating voltage, pressure, and

- other applicable requirements.
- 8) Enough process lines and equipment to clearly show the process side of the loop and provide clarity of control action. This includes:
 - a) What is being measured.
 - b) What is being controlled.
 - c) Other information required to complete the process loop.
- 9) Reference to supplementary records and drawings to show inter-relation to other control loops.
- 10) Controller action.
- 11) Control valve action upon electronic, hydraulic, or pneumatic failure.
- 4. Process connected instrument installation details containing the following minimum information:
 - a. Bill of materials providing as a minimum the following information:
 - 1) Tube material and size.
 - 2) Connection size.
 - 3) Fitting size, material, and rating.
 - 4) Valve type and material.
 - 5) Instrument description.
 - 6) Pipe stand size and material.
 - b. Tube slope requirements.
 - c. Minimum clearances.
 - d. Required elevations and dimensions.
- 5. Comprehensive set of point-to-point wiring diagrams showing all interconnections between packaged systems or equipment control panels, motor control centers, instrumentation and all other electrical equipment as required to depict a complete and functional plant-wide electrical control system. Instrumentation wiring already shown on loop diagrams need not be included on point-to-point wiring diagrams.
 - a. Diagrams shall provide the following minimum information:
 - 1) Terminal block identification.
 - 2) Wire size.
 - 3) Wire type.
 - 4) Wire color.
 - 5) Wire shielding and insulation type.
 - 6) Conductor quantities and associated conduit size.
 - 7) Ground points.
 - 8) Interconnection requirements to existing systems or equipment furnished by Others.
 - b. Diagrams shall be provided on Drawings of sufficient size so as to minimize the number of drawings.
 - 1) Maximum drawing size 24 x 36 IN.
 - 2) Minimum drawing size: 8 x 11 IN.
- 6. Electrical schematic control diagrams. Diagrams shall include:
 - a. Terminal identification.

- b. Unique identification of all control devices and contacts.
- c. Wire identification.
- d. Equipment identification.
- e. Indication of remote and local devices and wiring.
- f. Overcurrent protection indication.
- g. Voltage.
- h. All control logic.
- 7. Panel fabrication drawings.
- 8. Warranties: Provide copies of warranties and list of factory authorized service agents.

B. Operation and Maintenance Manuals:

- 1. See Section 01340.

PART 2 - PRODUCTS

2.01 TUBING AND FITTINGS

A. Acceptable Manufacturers:

- 1. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 - a. Tube fittings:
 - 1) Parker CPI.
 - 2) Swagelok.

B. Instrument Tubing and Fittings:

- 1. Material:
 - a. Tubing: ASTM A269, Grade TP 316 stainless steel.
 - b. Straight fittings: 316 stainless steel per ASME SA-479 or ASTM A276.
 - c. Shaped bodies: ASME SA-182 F316 stainless steel.
- 2. Design and fabrication:
 - a. Tubing:
 - 1) Seamless.
 - 2) Fully annealed.
 - 3) Maximum hardness: 80 Rb.
 - 4) Free from surface scratches and imperfections.
 - b. Fittings:
 - 1) Flareless.
 - 2) Compression type.

C. Pneumatic Signal Tubing:

- 1. Material: Copper per ASTM B75.
- 2. Design and fabrication:
 - a. Soft annealed.
 - b. Free from surface scratches and imperfections.
 - c. Wall thickness:
 - 1) 0.030 IN for 1/4 IN OD.
 - 2) 0.035 IN for 3/8 IN OD.

D. Pneumatic Tube Fittings:

1. Material:
 - a. Straight fittings: Brass per ASTM B16 and B453.
 - b. Shaped bodies: Brass per ASTM B124 Alloy 377 or ASTM B283.
2. Design and fabrication:
 - a. Flareless.
 - b. Compression type.

2.02 INSTRUMENT VALVES

A. Process instrument multi-valve manifolds, isolation, vent and blow-down valves:

1. Acceptable manufacturers:
 - a. Whitey Co.
 - b. Anderson-Greenwood USA, Inc.
 - c. Or Approved Equal.
2. Materials:
 - a. Packing:
 - 1) 450 DegF and above: Graphite.
 - 2) Below 450 DegF: Graphite or teflon.
 - b. Body: 316 stainless steel per ASTM A479.
 - c. Stem: 316 stainless steel per ASTM A276.
 - d. Ball: 316 stainless steel per ASTM A276.
 - e. Support rings: 316 stainless steel per ASTM A276.
 - f. Seats:
 - 1) Metal:
 - a) 316 stainless steel per ASTM A276.
 - 2) Soft:
 - a) Teflon, Delrin, or equivalent.
 - b) Only utilized on applications where manufacturer's temperature and pressure ratings exceed process design conditions.
3. Design and fabrication:
 - a. Either of the following:
 - 1) Ball valve with 1/4 turn activation.
 - 2) Free-swiveling ball stem.
 - b. Provide body wall thickness sufficient for process design conditions.
 - c. Temperature: Manufacturer's temperature rating for all components shall exceed process design conditions.

B. Isolation Valves in Instrument Air Tubing:

1. Acceptable manufacturers:
 - a. Whitey Co.
 - b. Or equal.
2. Materials:
 - a. Packing: Graphite or teflon.
 - b. Body: Brass per ASTM B16.
 - c. Stem: 316 stainless steel per ASTM A276.
 - d. Ball: 316 stainless steel per ASTM A276.
 - e. Support rings: 316 stainless steel per ASTM A276.

- f. Seats:
 - 1) Metal:
 - a) 316 stainless steel per ASTM A276.
 - 2) Soft:
 - a) Teflon, Delrin, or equivalent.
 - b) Only utilized on applications where manufacturer's temperature and pressure ratings exceed process design conditions.
- 3. Design and fabrication:
 - a. Ball valve with 1/4 turn activation.
 - b. Provide body wall thickness sufficient for process design conditions.

2.03 MATERIALS

- A. Support Angle for Tubing:
 - 1. 2 x 2 IN x 12 GA aluminum or galvanized finish steel.
 - 2. Aluminum or galvanized steel bolts, nuts, and accessories.

2.04 PERFORMANCE AND DESIGN REQUIREMENTS

- A. System Operating Criteria:
 - 1. Stability: After controls have taken corrective action, as result of a change in the controlled variable or a change in setpoint, oscillation of final control element shall not exceed two cycles per minute or a magnitude of movement of 0.5 percent full travel.
 - 2. Response: Any change in setpoint or change in controlled variable shall produce a corresponding corrective change in position of final control element and become stabilized within 30 seconds.
 - 3. Agreement: Setpoint indication of controlled variable and measured indication of controlled variable shall agree within 3 percent of full scale over a 6:1 operating range.
 - 4. Repeatability: For any repeated magnitude of control signal, from either an increasing or decreasing direction, the final control element shall take a repeated position within 0.5 percent of full travel regardless of force required to position final element.
 - 5. Sensitivity: Controls shall respond to setpoint deviations and measured variable deviations within 1.0 percent of full scale.
 - 6. Performance: All instruments and control devices shall perform in accordance with manufacturer's specifications.
- B. Equipment Surge Protection:
 - 1. Provide power supplies for electronic equipment to successfully withstand surges in AC power circuits per the wave form, voltage amplitude, current amplitude, and frequency provided in IEEE C62.41.
 - a. Successfully withstanding transients requires that none of the following conditions occur as a result of the

transient:

- 1) Erroneous output.
- 2) Component failure.
- 3) Calibration change exceeding normal tolerances.

2.05 ACCESSORIES

- A. Provide instruments with manufacturer's identification nameplate showing:
1. Manufacturer's model number.
 2. Manufacturer's serial number.
 3. Range. (English units)
 4. Power supply requirement.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install instrument mounting pipe stands level and plumb.
- C. Instrument Valves:
1. Orient stems for proper operation.
 2. Install arrays orderly and neat in appearance with true horizontal and vertical lines.
 3. Provide a minimum of 2 IN clearance between valve handle turning radii where there are multiple valve handles appearing in a straight line.
 4. Valves shall have bonnets and any soft seals removed during welding or soldering into the line. When cool, reassemble the valves.
 5. Support each valve individually. The tubing system does not qualify as support for the valve.
- D. Locate instrument piping and tubing so as to be free of vibration and interference with other piping, conduit, or equipment.
- E. Keep foreign matter out of the system.
- F. Remove all oil on piping and tubing with solvent before piping and tubing installation.
- G. Plug all open ends and connections to keep out contaminants.
- H. Tubing Installation:
1. General:
 - a. Install such that tube shows no sign of crumpling, bends of too short a radius, or flattening, etc.
 - b. Make tube runs straight and parallel or perpendicular to

- the floor, equipment and piping runs.
- c. For liquid and steam applications, slope continuously from the process to the instrument with a minimum slope of 0.50 IN per foot.
- d. For gas and air applications, slope continuously from the instrument to the process with a minimum slope of 0.50 IN per foot.
- e. If the sensing line cannot be continuously sloped, install high point vents and low point drains.
- f. Keep instrument tubing clean during all phases of work.
- g. Blow out with clean, dry, oil-free air immediately before final assembly.
- 2. Stainless steel tubing:
 - a. Cut by sawing only and debur.
 - b. Make each bend with tube bender of the correct size for the tube.
 - c. Make all bends smooth and continuous.
 - d. Rebending is not permitted.
 - e. Make bends true to angle and radius.
 - f. Maintain a true circular cross section of tubing without buckling or undue stretch of tube wall.
 - g. Allowable tolerance for flattening out of tubing bends: Maximum of 8 percent of the OD for stainless steel tubing.
 - h. Minimum bending radius.

TUBE OD INCHES	MINIMUM BENDING RADIUS, INCHES
=====	=====
1/4	9/16
3/8	15/16
1/2	1-1/2

- 3. Tubing support:
 - a. Intermittently support by clamping to support angle.
 - b. Install supports to be self-draining, supported by hangers, or structural beams.
 - c. Support at 5 FT-0 IN maximum spans for horizontal or vertical runs.
 - d. Use tubing trays in areas where spans between supports are greater than 5 FT and for all signal tubing support.
 - e. Support each tubing tray at 10 FT maximum spans.
 - f. Align tubing in orderly rows and retain in the tray by bolted clips. The use of spring or speed clips is not acceptable.
 - g. Maintain order of the tubing throughout the length of the tray.
 - h. Locate angle, channel and tray installation to protect tubing from spills and mechanical damage.
 - i. Locate support members to clear all piping, conduit, equipment, hatchways, monorails, and personnel access ways and allow access for equipment operation and

- maintenance.
- j. Support trays to prevent torsion, sway or sag.
- k. Permanently attach supports to permanent structural members.
- l. Arrange supports and trays so that they do not become a trough or trap.
- 4. Routing and orientation:
 - a. Route to maintain a minimum headroom clearance of 8 FT where applicable.
 - b. Locate and orient valves and specialties so that they are accessible for operation and maintenance. Do not route through or over equipment removal areas, below monorails or crane access positions nor above or below hatches.
- 5. Expansion and vibration provisions:
 - a. Provide horizontal expansion loops at the process connections.
 - b. Route tubing parallel to relative motion through sleeved supports that allow linear tube movement.
 - c. Cold springing of tubing to compensate for thermal expansion is prohibited.
 - d. Utilize flexible hoses to connect pneumatic tubing to air users which may move or vibrate.
- I. Air Supply:
 - 1. Connect all instruments requiring air to air supply piping and tubing. Provide connections as follows:
 - a. Terminate branch supply line not more than 36 IN from the device with a 1/2 IN isolation valve.
 - b. For remaining line, use 1/4 or 3/8 IN tubing of a length to allow for normal equipment movement and vibration.
 - c. Use flexible hoses to connect pneumatic tubing to air users which may experience significant movement or vibration.
 - d. Make branch connections to individual instruments from the top of the supply header.
 - e. Purge instrument air piping of extraneous material by blowing clean, dry, oil-free air through the system prior to final connection.
- J. Threaded Connection Seals:
 - 1. Use Tite-Seal or acceptable alternate.
 - 2. Use of lead base pipe dope or teflon tape is not acceptable.
 - 3. Do not apply Tite-Seal to tubing threads of compression fittings.
- K. Capillary Tubing:
 - 1. Route capillary tubing in tubing tray.
 - 2. Install capillary tubing with a 2 IN minimum bend radius which does not kink or pinch the capillaries.
 - 3. Do not cut or disconnect at any point.
 - 4. Coil excess capillary tubing and secure at the instrument.

- L. Temperature Elements:
 - 1. Assemble in the following sequence:
 - a. Remove temperature sensor sheaths and terminal blocks from the head and nipple assembly.
 - b. Connect nipple and head to thermowell installed in the pipe.
 - c. Insert sheath and terminal block until it seats in the thermowell.
 - d. Connect to the head.
- M. Use bottom entry for all conduit entry to instruments and junction boxes.
- N. Instrument Mounting:
 - 1. Mount all instruments where they will be accessible from fixed ladders, platforms, or grade.
 - 2. Mount all local indicating instruments with face forward toward the normal operating area, within reading distance, and in the line of sight.
 - 3. Mount instruments level, plumb, and support rigidly.
 - 4. Mount to provide:
 - a. Protection from heat, shock, and vibrations.
 - b. Accessibility for maintenance.
 - c. Freedom from interference with piping, conduit and equipment.
 - 5. Do not mount current-to-pressure transducers on the control valves unless the transducers are received from the Manufacturer already valve mounted and tubed, or specific instructions to valve mount the transducers are given on the Drawings.
- O. Connect surge arresters to ground.
- P. Panel-Mounted Instruments:
 - 1. Mount and wire so removal or replacement may be accomplished without interruption of service to adjacent devices.
 - 2. Locate all devices mounted inside NEMA4 enclosures so terminals and adjustment devices are readily accessible without use of special tools and with terminal markings clearly visible.
- Q. All installation shall be consistent with the standards of installation for outdoor service.

3.02 QUALITY CONTROL

- A. Instrumentation Calibration:
 - 1. Verify that all instruments and control devices are calibrated to provide the performance required by the specifications.

2. Calibrate in accordance with the manufacturer's specifications.
 3. Bench calibrate pressure and temperature gages.
 4. Calibrate each transmitter and gage across its specified range at 0, 25, 50, 75, and 100 percent. Check for both increasing and decreasing input signals to detect hysteresis.
 5. Stroke control valves with clean dry air to verify control action, positioner settings, and solenoid functions.
 6. Mark range, date, setpoint and calibrator's initials on each instrument by means of blue or black ink on a waterproof tag affixed to the instrument.
 7. Certify calibration equipment by an independent agency with traceability to NIST immediately prior to utilization of the equipment on this Project. Re-certify calibration equipment if the accuracy of the equipment is questioned by the Engineer.
- B. Loop checkout requirements are as follows:
1. Check control signal generation, transmission, reception and response for all control loops under simulated operating conditions by imposing a signal on the loop at the instrument connections. Closely observe controllers, recorders, alarm and trip units, remote setpoints, ratio systems, and other control components. Make corrections as required. Following any corrections, retest the loop as before.
 2. Stroke all control valves, cylinders, drives and connecting linkages from the local control station and from the control room operator interface.
 3. Check all interlocks to the maximum extent possible.
 4. In addition to any other as-recorded documents, record all setpoint and calibration changes on all affected Contract Documents and turn over to the Owner.
- C. Provide certification of system assembly, power, ground, and I/O tests.

END OF SECTION

Division 15

Mechanical

95B06

SECTION 15060

PIPE AND PIPE FITTINGS: BASIC REQUIREMENTS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Process piping systems.
- B. Related Sections include but are not necessarily limited to:
 - 1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
 - 2. Division 1 - General Requirements.
 - 3. Section 02135 - Vertical Landfill Gas Wells
 - 4. Section 02135b - Horizontal Landfill Gas Wells
 - 4. Section 09900 - Painting.
 - 5. Section 11005 - Equipment: Basic Requirements.
 - 6. Section 15065 - HDPE Pipe
- C. Unit Prices:
 - 1. Measurement.
 - a. The length of pipe shall be measured in linear feet of pipe in place, completed, and approved. It shall be measured along the centerline of the pipe from end or inside face of structure to the end or inside face of structure whichever is applicable. The several classes, types and sizes shall be measured separately. All fittings shall be included in the footage as typical pipe sections in the pipe being measured.
 - 2. Payment:
 - a. Payment will be made at the contract unit price per linear foot for each kind of pipe of the type and size designated.
 - b. These prices shall be full compensation for furnishing all materials and for all preparation, excavation, backfilling and installation of these materials; and for all labor, equipment, tools, and incidentals necessary to complete the item.

1.02 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. American Association of State Highway and Transportation Officials (AASHTO):
 - a. M252, Interim Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Use as Mineral Admixture in Portland Cement Concrete.
 - 2. American Society for Testing and Materials (ASTM):
 - a. A53, Standard Specification for Pipe, Steel, Black and

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- Hot-Dipped, Zinc-Coated Welded and Seamless.
- b. A182, Standard Specification for Forged or Rolled Alloy Steel Pipe Flanges, Forged Fittings and Valves and Parts for High Temperature Service.
- c. A234, Standard Specification for Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.
- d. A312, Standard Specification for Seamless and Welded Austenitic Stainless Steel Pipes.
- e. A774, Standard Specification for As-Welded Wrought Austenitic Stainless Steel Fittings for General Corrosive Service at Low and Moderate Temperatures.
- f. D2513, Thermoplastic Gas Pressure Pipe, Tubing, and Fittings.
- g. D2683, Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter- Controlled Polyethylene Pipe and Tubing.
- h. D3261, Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.
- i. D3350 - Specification for Polyethylene Plastic Pipe and Fittings Material.
- j. F1248 - Determination of Environmental Stress Crack Resistance (ESCR) of Polyethylene Pipe.
- k. D4218 - Test Method for Carbon Black Content in Polyethylene Compounds by the Muffle-Furnace Technique.

- B. Coordinate flange dimensions and drillings between piping, valves, and equipment.

1.03 DEFINITIONS

- A. Hazardous Gas Systems: Landfill gas.

1.04 SYSTEM DESCRIPTION

- A. Piping Systems Organization and Definition:
 - 1. Piping services are grouped into designated systems according to the chemical and physical properties of the fluid conveyed, system pressure, piping size and system materials of construction.
 - 2. See PIPING SPECIFICATION SCHEDULES in PART 3.

1.05 SUBMITTALS

- A. Shop Drawings:
 - 1. See Section 01340.
 - 2. Product technical data including:
 - a. Acknowledgement that products submitted meet requirements of standards referenced.
 - b. Copies of manufacturer's written directions regarding

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- material handling, delivery, storage and installation.
3. Test reports:
 - a. Copies of pressure test results on all piping systems.
 - b. Pipe and fitting mill certifications.
 - c. Welding certifications for operators welding steel, stainless steel, or HDPE pipe.
 - d. Notification of time and date of piping pressure tests.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Prevent damage to pipe during transit. Repair abrasions, scars, and blemishes. If repair of satisfactory quality cannot be achieved, replace damaged material immediately.

PART 2 - PRODUCTS

2.01 PIPING SPECIFICATION SCHEDULES

- A. Piping system materials, fittings and appurtenances are subject to requirements of specific piping specification schedules located at the end of PART 3 of this Section.

2.02 COMPONENTS AND ACCESSORIES

- A. Reducers:
 1. Furnish appropriate size reducers and reducing fittings to mate pipe to equipment connections. Connection size requirements may change from those shown on Drawings depending on equipment furnished.
- B. Underground Warning Tape:
 1. See Drawings for location in gas header trenches.
- C. Valves:
 1. See Drawings

PART 3 - EXECUTION

3.01 EXTERIOR BURIED PIPING INSTALLATION

- A. 36 IN earth cover over exterior buried piping conveying water, fluids, or solutions subject to freezing.
- B. Laying Pipe In Trench:
 1. Excavate and backfill trench in appropriate Sections.
 2. Clean each pipe length thoroughly and inspect for foreign material prior to final connections.
 3. Lay pipe in suitable weather only with good trench conditions. Do not lay pipe in water except where approved by Engineer.
 4. Seal open end of line with watertight plug if pipe laying

stopped.

5. Remove water in trench before removal of plug.
6. All trench water shall be collected and disposed of in an off-site sewer system.

- C. All low points in the LFG piping shall drain into a sump or knockout unless otherwise indicated on the Plans.
- D. All carbon steel pipe laid underground shall be wrapped with tapewrap suitable for temperatures of -40 to 150 DegF.
- E. Flange alignment shall be perpendicular to pipe center line and shall not exceed $\pm 1/32$ IN in tolerance measured at the flange OD.
- F. Install underground hazard warning tape as shown on Drawings.

3.02 INTERIOR AND EXPOSED EXTERIOR PIPING INSTALLATION

- A. Use reducing fittings throughout piping systems. Bushings will not be allowed unless specifically approved.
- B. Equipment Drainage and Miscellaneous Piping:
 1. Provide drainage for process piping at locations shown on Drawings in accordance with Drawing details.
- C. Unions:
 1. Install in position which will permit valve or equipment to be removed without dismantling adjacent piping.
 2. Mechanical type couplings may serve as unions.
 3. Additional flange unions are not required at flanged connections.
- D. Install expansion devices as necessary to allow expansion/contraction movement.
- E. Provide full face gaskets on all systems.
- F. Equipment Pipe Connections:
 1. Equipment - General:
 - a. Exercise care in bolting flanged joints so that there is no restraint on the opposite end of pipe or fitting which would prevent uniform gasket pressure at connection or would cause unnecessary stresses to be transmitted to equipment flanges.
 - b. Tighten flange bolts at uniform rate which will result in uniform gasket compression over entire area of joint. Provide tightening torque in accordance with manufacturer's recommendations.
 - c. Support and match flange faces to uniform contact over their entire face area prior to installation of any bolt between the piping flange and equipment connecting

flange.

- d. Permit piping connected to equipment to freely move in directions parallel to longitudinal centerline when and while bolts in connection flange are tightened.
- e. Align, level, and fit equipment into place during fitting and alignment of connecting piping.

G. Gages:

- 1. Assure gage position is clear of equipment functions and movements and location is protected from maintenance and operation of equipment.
- 2. Assure gage is readable from an accessible standing position.
- 3. Tap piping 4 IN and larger and all non-metallic pipe for gage installation.
- 4. For piping to 4 IN, utilize tee with branch reduced for gage.

H. Pipe Supports:

- 1. Detailed engineering may indicate the need for supports other than those shown on the Plans. It is the responsibility of the Contractor to provide any such additional supports.
- 2. All piping shall be rigidly supported so that there is no movement or visible sagging of pipe between supports.
- 3. Pipe supports shall be located to prevent excessive deflection and to avoid excessive bending stress.
- 4. Pipe supports shall be designed to properly support the weight of the pipe, to provide for the necessary thermal expansion and contraction of the pipes and to account for all lateral loads.
- 5. All pipe supports and anchors shall be hot-dip galvanized after fabrication.
- 6. Pipes shall be supported independently at equipment connections in such a manner that the weight of pipe is not supported by the equipment.

3.03 PRESSURE GAGES

- A. Provide at locations shown on the Drawings and specified.

3.04 FIELD QUALITY CONTROL

A. Pipe Testing - General:

- 1. Test piping systems as follows:
 - a. Exposed piping:
 - 1) Non-insulated piping systems; upon completion of system.
 - 2) Insulated piping systems; upon completion of system but prior to application of insulation.

- b. Test buried piping prior to backfilling.
- 2. Utilize pressures, media and pressure test durations as specified on Piping Specification Schedules.
- 3. Isolate equipment which may be damaged by the specified pressure test conditions.
- 4. Perform pressure test using calibrated pressure gages and calibrated volumetric measuring equipment to determine leakage rates.
 - a. Select each gage so that the specified test pressure falls within the upper half of the gage's range.
 - b. Notify the Engineer 24 HRS prior to each test.
- 5. Acknowledge satisfactory performance of tests and inspections in writing to Engineer prior to final acceptance.
- 6. Bear the cost of all testing and inspecting, locating and remedying of leaks and any necessary retesting and re-examination.

B. Pressure Testing:

- 1. Testing medium: See Schedules.
- 2. When pressure testing, because of the high energy content of compressed air, extreme caution should be used when working around the pipe being tested.
- 3. Hydrostatic pressure testing methodology:
 - a. General:
 - 1) All joints, including welds, are to be left exposed for examination during the test.
 - 2) Provide additional temporary supports for piping systems designed for vapor or gas to support the weight of the test water.
 - 3) Provide temporary restraints for expansion joints for additional pressure load under test.
 - 4) Isolate equipment in piping system with rated pressure lower than pipe test pressure.
 - 5) Do not paint or insulate exposed piping until successful performance of pressure test.
- 4. Gas systems - testing methodology:
 - a. Maintain specified test pressure until each joint has been thoroughly examined for leaks by means of soap suds and glycerine.
 - b. Wipe joints clean after test.
- 5. Air testing methodology:
 - a. Place plugs in line and pressure to 25 psig.
 - b. Check pneumatic plugs for proper sealing.
 - c. Use test gage conforming to ANSI B40.1 with 0 to 15 psi scale and accuracy of 1 percent of full range.
 - d. Allow 2 minutes for air pressure to stabilize.
 - e. After stabilization period (3.5 psig minimum pressure in pipe) discontinue air supply to line segment.
 - f. Record pressure at beginning and end of test.

3.05 CLEANING

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- A. Probe Cleaning:
 - 1. Clean interior of piping systems thoroughly before installing.
 - 2. Maintain pipe in clean condition during installation.
 - 3. Before jointing piping, thoroughly clean and wipe joint contact surfaces and then properly dress and make joint.
- B. Pipe Cleaning:
 - 1. Remove foreign materials in piping system prior to final system closure and testing.

3.06 PIPE INSULATION

- A. All exposed condensate return lines shall be insulated with 1/2" fiberglass insulation pipe jacket appropriate for outdoor use. Pipe jacket shall be installed and joined to completely cover pipe and in accordance with the manufacturer's recommendations.

3.07 SCHEDULES

A. PIPING SPECIFICATION SCHEDULE - BELOW-GROUND LANDFILL GAS PIPING

- 1. General:
 - a. Piping symbol and service:
 - 1) See contract documents.
 - b. Test requirements:
 - 1) Test medium: Air.
 - 2) Pressure: 10 psig or weakest component of the pipe system.
 - 3) Duration: 2 HRS.
- 2. System components:
 - a. Pipe size: Through 24 IN.
 - 1) Buried service:
 - a) Materials: PE 3408, high density polyethylene, SDR-17 (horizontal).
 - b) Reference: ASTM D2513.
 - c) All vertical below ground piping shall be constructed of SDR 17 HDPE.
 - d) Fittings: butt fusion fittings complying with D3261.
 - e) Joints: Fusion jointing system.
- 3. Underground Piping Installation:
 - a. Install buried pipe as indicated on Drawings.
 - b. HDPE pipe joints shall be fused on the surface prior to installation into the trench. Alternative methods of fusing shall be approved by the Engineer.
 - c. All top of pipe must be a minimum of 36 IN below final grade.
 - d. All vertical below ground piping shall be constructed of SDR 17 HDPE.
 - e. The Contractor shall insure that kinking or excessive bend diameters of the pipe do not occur during the

- installation process.
- f. Each joint must be visually inspected inside and outside for damage, dirt, moisture, or any other abnormalities prior to fusing.
- g. The Contractor shall insure that the pipe installed in the trench is firmly supported.
- h. The Contractor shall cap all open pipe ends at the end of the work day.
- i. All joint fusion shall be performed in strict accordance with the manufacturer's specifications.
- j. All fusion equipment must be approved by the manufacturer and operated by qualified operators. Cost for testing and certifying personnel shall be born by the contractor.
- k. All installed valves shall be tested in the presence of the Engineer. All repairs deemed necessary by the Engineer shall be made by the Contractor at Contractor's cost.
- l. Contractor shall remove any cave-in portions of the trench prior to placing sand bagging around the pipe.
- m. All HDPE pipe and fittings shall conform with ASTM specifications for Type III, Class C polyethylene pipe.
- n. The standard dimension ratio (SDR) of HDPE pipes shall be as indicated on the Plans.
- o. HDPE pipe and fittings shall be by the same manufacturer. The minimum strength of the fittings shall not be less than that of the pipe.

B. PIPING SPECIFICATION SCHEDULE - ABOVE-GROUND LANDFILL GAS PIPING

- 1. General:
 - a. Piping symbol and service:
 - 1) See contract drawings.
 - b. Test requirements:
 - 1) Test medium: Air.
 - 2) Pressure: 10 psig or weakest component of the pipe system.
 - 3) Duration: 2 Hrs.
- 2. System components:
 - a. Pipe Size: 8, 10, and 24 inch.
 - 1) Butt Fused HDPE Pipe.
 - a) Material: SDR 17 HDPE.
 - b) References: ASTM D2513, ASTM D2683 and D3261.
 - c) Fittings (exposed and buried): SDR 17 HDPE meeting ASTM D1784.
 - d) Joints: Butt fused per ASTM D-3261.
 - b. Recommended manufacturer.
 - 1) See appropriate Section
- 3. Piping Installation:
 - a. Install pipe and fittings as recommended by pipe manufacture

C. PIPING SPECIFICATION SCHEDULE - ABOVE-GROUND TEMPORARY

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LANDFILL GAS PIPING

1. General:
 - a. Piping symbol and service:
 - 1) See contract drawings.
 - b. Test requirements:
 - 1) Test medium: Air.
 - 2) Pressure: 10 psig or weakest component of the pipe system.
 - 3) Duration: 2 Hrs.
2. System components:
 - a. Pipe Size: 6 and 8 inch.
 - 1) Smooth Interior Corrugated Polyethylene Pipe.
 - a) Material: Virgin P.E. Cell Class 324420C.
 - b) References: ASTM D3350, ASTM D2412.
 - c) Fittings: 6" Corrugated Polyethylene Pipe.
 - d) Joints: 6" Corrugated Snap Fitting.
 - b. Recommended manufacturer.
 - 1) Advance Drainage Systems or approved equal.
3. Piping Installation:
 - a. Install pipe and fittings as shown on the Contract drawings.
 - b. Transition to final header manifold at ditch crossing with Series 300 stainless steel pipe clamps.
 - c. Temporary header is to be placed on grade within the limits shown on the contract drawings.
 - 1) Temporary header to be placed at a minimum of 1% grade flowing to sump locations as shown on contract drawings.
 - 2) Anchor temporary header to slope with "U" shaped #4 rebar.
 - 3) Connect joints and fittings using snap coupling made of similar material.

D. PIPING SPECIFICATION SCHEDULE - PNEUMATIC AND CONDENSATE FORCE MAIN

1. General:
 - a. Piping symbol and service:
 - 1) See contract documents.
 - b. Test requirements:
 - 1) Test medium: Air.
 - 2) Pressure: 125 psi or weakest component of the piping system.
 - 3) Duration: 2 HRS.
2. System components:
 - a. Pipe size: Through 2 IN.
 - 1) Exposed service:
 - a) Material: Double-wrapped carbon steel, Schedule 40 Grade B.
 - b) Reference: ASTM A53.
 - c) Coating: Paint.
 - d) Fittings: Welded steel meeting ANSI B16.9, ASTM A234.

- e) Joints: Welded or threaded.
- f) Threaded transitions fittings are from Driscopipe or approved equal.
- 2) Buried service:
 - a) Material: PE 3408, high density polyethylene, SDR-11.
 - b) Reference: ASTM D2513.
- b. Fittings: butt fusion.
- 3. Underground Piping Installation:
 - a. Install buried pipe as indicated on Drawings.
 - b. Provide minimum 2 percent slope gradient toward condensate drip legs.
 - c. HDPE pipe joints shall be fused on the surface prior to installation into the trench. Alternative methods of fusing shall be approved by the Engineer.
 - d. All top of pipe must be a minimum of 1 foot below final grade to avoid freezing.
 - e. All exposed condensate return lines shall be insulated in accordance with Section 3.07.
 - f. The Contractor shall insure that kinking or excessive bend diameters of the pipe do not occur during the installation process.
 - g. Each joint must be visually inspected inside and outside for damage, dirt, moisture, or any other abnormalities prior to fusing.
 - h. The Contractor shall insure that the pipe installed in the trench is firmly supported.
 - i. The Contractor shall cap all open pipe ends at the end of the work day.
 - j. All joint fusion shall be performed in strict accordance with the manufacturer's specifications.
 - k. All fusion equipment must be approved by the manufacturer and operated by qualified operators. Cost for testing and certifying personnel shall be born by the contractor.
 - l. All installed valves shall be tested in the presence of the Engineer. All repairs deemed necessary by the Engineer shall be made by the Contractor at Contractor's expense.
 - m. Contractor shall remove any cave-in portions of the trench prior to placing sand bagging around the pipe.
 - n. All HDPE pipe and fittings shall conform with ASTM specifications for Type III, Class C polyethylene pipe.
 - o. The standard dimension ratio (SDR) of HDPE pipes shall be as indicated on the Plans.
 - p. HDPE pipe and fittings shall be by the same manufacturer. The minimum strength of the fittings shall not be less than that of the pipe.

END OF SECTION

SECTION 15065

HDPE PIPE

PART 1 - GENERAL

1.01 DESCRIPTION

A. General:

1. Furnish all labor, materials, tools, equipment and services for all pipe in accordance with provisions of the Contract Documents.
2. Completely coordinate with work of all other trades.
3. Although such work is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound and complete installation.

B. Work included in this specification consists of:

1. Installation of Horizontal Landfill Gas Extraction Wells.
2. Installation of Vertical Landfill Gas Extraction Wells.
3. Installation of SDR 17 HDPE Landfill Gas Headers and Laterals.
4. Installation of 11/2 IN, SDR 11 HDPE pressurized air supply line.
5. Installation of 2 IN, SDR 17 HDPE condensate forcemains.

C. Related Sections include, but are not necessarily limited to:

1. Bidding Requirements, Contract Forms and Conditions of the Contract.
2. Section 02135b - Horizontal Landfill Gas Extraction Wells.
3. Section 02135 - Vertical Landfill Gas Extraction Wells.
4. Section 15060 - Pipe and Pipe Fittings: Basic Requirements.
5. Section 11076A - Pumping equipment: Controllerless Pneumatic.
6. Section 11065 - Landfill Condensate Sumps

1.02 QUALITY ASSURANCE

A. Referenced Standards:

1. American Society for Testing and Materials (ASTM):
 - a. ASTM D-638 - Test Method for Tensile Properties of Plastics.
 - b. ASTM D-696 - Linear Thermal Expansion Coefficient.
 - c. ASTM D-746 - Brittleness Temp.
 - d. ASTM D-790 - Test Method for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
 - e. ASTM D-1248 - Specification for Polyethylene Plastics Molding and Extrusion Materials.
 - f. ASTM D-1505 - Text Method for Density of Plastics by the

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Density Gradient Technique.

- g. ASTM D-1525 - Vicat Softening Temp.
- h. ASTM D-1693 - Test Method for Environmental Stress Cracking of Ethylene Plastics.
- i. ASTM D-2122 - Method for Determining Dimensions of Thermal Plastic Pipe and Fittings.
- j. ASTM D-2837 - Method for obtaining Hydrostatic Design Basis for Thermal Plastic Pipe Materials.
- k. ASTM D-3350 - Specification for Polyethylene Plastic Pipe and Fittings Material.
- l. ASTM F-1248 - Determination of Environmental Stress Crack Resistance (ESCR) of Polyethylene Pipe.
- m. ASTM D-4218 - Test Method for Carbon Black Content in Polyethylene Compounds by the Muffle-Furnace Technique.
- n. ASTM F-714 - Standard Specification for Polyethylene Plastic Pipe Based on Outside Diameter.
- o. A182, Standard Specification for Forged or Rolled Alloy Steel Pipe Flanges, Forged Fittings and Valves and Parts for High Temperature Service.
- p. A234, Standard Specification for Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.
- q. A774, Standard Specification for As-Welded Wrought Austenitic Stainless Steel Fittings for General Corrosive Service at Low and Moderate Temperatures.
- r. D3261, Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.
- 2. American Water Works Association (AWWA).
 - a. C207-94, Steel Pipe Flanges for Waterworks Service.
- 3. American National Standards Institute (ANSI):
 - b. B16.3, Malleable Iron Threaded Fittings.
 - c. B16.5, Pipe Flanges and Flanged Fittings.
 - d. B16.9, Factory-Made Wrought Steel Butt-Welding Fittings.
 - e. B18.2.1, Square and Hex Bolts and Screws.
 - f. B18.2.2, Square and Hex Nuts.

- B. The pipe manufacturer shall provide certifications and test reports indicating that samples of the production pipe from which the furnished materials were obtained have been tested in accordance with ASTM D-2837. The minimum hydrostatic design basis shall be 1600 psi at 73.4°F and 800 psi at 140°F.

1.03 SUBMITTALS

- A. See Section 01340.
- B. Sodium Montmorillonite Bentonite
 - 1. Five pound sample
 - 2. Chemical characteristics.

PART 2 - PRODUCTS

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2.01 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:
1. Pipe:
 - a. Plexco.
 - b. CSR Polypipe PE 3408
 - c. Driscopipe 1000.
 - d. Approved equal.
- B. Submit request for substitutions in accordance with Specification Section 01640.

2.02 PIPE AND APPURTENANCES

- A. Materials:
1. Pipe: High Density Polyethylene Pipe, 4-IN perforated, 6-IN and 2-IN solid wall shall conform to requirements of ASTM D-1248 with an SDR of 17.
 2. Polyethylene for the manufacture of pipe shall be high-density polyethylene. Pipe shall conform to ASTM D3350 Cell Classification 345434C or 345444C.
 3. Pipe and fittings shall be butt fusible at 440°F or 500°F.
 4. Pipe shall be manufactured in accordance with ASTM F-714.
 5. Accept as indicated on construction drawings, fittings shall be butt fusion type, meeting the requirements of ASTM D-3261 and this specification. All fittings shall be pressure rated to match the system piping to which they are fused. At the point of fusion, the outside diameter and minimum wall thickness specifications of ASTM F-714 for the same size of pipe. The side slope riser fittings shall be factory fabricated and shall have a smooth interior surface.
 6. All 4 IN perforated pipes shall be perforated by the Manufacturer as shown on the Drawings.
- B. Requirements:
1. Workmanship: Exterior and interior surfaces shall be smooth with no sharp projections. The surfaces shall be free of foreign inclusions and major surface defects. Polyethylene pipe shall be as uniform as commercially practical in color, opacity, density, and other physical properties. The product function shall be considered when judging external defects.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Horizontal Landfill Gas Extraction Wells:
1. Install all pipe, fittings and appurtenances in accordance

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- with manufacturers recommendations.
 - 2. Install to line and grade as indicated on Drawings.
 - 3. Refer to Section 02135 - Horizontal Landfill Gas Extraction Wells.
 - 4. Only butt fusion welding of HDPE pipe is acceptable as indicated on the drawings. Interior connections shall be made by placing a 6-FT long, 8-IN SDR 17 HDPE expansion joint over the ends of two contiguous pipe lengths as shown in the Drawings.
 - 5. If the certified personnel are not available to complete all connections, the manufacturer shall provide the services of a field technician for one day to instruct, direct, and certify the Contractor's personnel in the proper procedures for making field connections. All training shall be at no additional cost to the Owner.
 - 6. Also refer to Section 02135b - Horizontal Landfill Gas Extraction Wells.
 - 7. Contractor shall visually inspect each pipe joint for proper installation in accordance with manufactured recommendations and these specifications prior to covering the pipes. If all joints are acceptable, he shall notify the Inspector of such and await his approval to cover pipes.
- B. Condensate Forcemain Installation:
- 1. Contractor shall complete forcemain installation as shown on the Drawings as expediently as practicable. The Contractor shall have no more than 100 linear feet of trench open in one construction area at any time. No section of trench may be kept open for more than 30 hours.
 - 2. Contractor is responsible for the health and safety of his personnel, spill prevention, and decontamination related to his activities.
 - 3. Pressure test new pipelines to manufacturers recommendations.
- C. Air Supply Line:
- 1. Install pressure line as indicated on the Drawings.
 - 2. Ensure proper safety precautions are taken for line tie-in.
 - 3. Install line and valves using butt fusion techniques, except where connection to other systems is made.
- D. Landfill Gas Collection Headers and Laterals
- 1. Install all pipe, fittings and appurtenances in accordance with manufacturers recommendations.
 - 2. Contractor shall conduct Health and Safety Meeting prior to each days work on the gas collection system. Special attention shall be given to the dangers of working in a potentially combustible or explosive atmosphere.
 - 3. Pressure test lines as outlined in Section 3.04 below
- E. All Lines Installed In Existing Final Cover Areas
- 1. The Contractor shall be responsible for any damage done to the geosynthetic materials in the existing landfill cap as

shown on the Drawings. The Contractor shall immediately bring to the Owner's attention any damage done to these materials. The Contractor shall be responsible for completing all repairs to these materials in accordance with the material manufacturer's specifications including; all labor, materials, testing, certifications and other incidentals related to repairing geosynthetics damaged by the Contractor.

F. Slurry Trench Penetration

1. Material for backfilling the slurry trench shall consist of the natural excavated materials properly mixed and wetted with slurry. It is the responsibility of the Contractor to adjust the soil-to-bentonite ratios to ensure that the resultant backfill meets the standards and requirements as described below or at a minimum shall be of like material removed from the existing slurry trench. No admixtures shall be used except as approved in writing by the Engineer.
2. The width of the soil-bentonite cut-off wall shall be equal to or greater than 30 inches.
3. The slurry wall shall be overexcavated to extend a minimum of 12 inches below new installed gas lines. Material excavated from the trench shall be examined by the Engineer or Geotechnical Inspector. The top of the slurry wall shall be at least 12 inches above the water table and leachate levels in the trench at all times during construction. Dewatering may be required to achieve the 12-inch freeboard on either side of the slurry wall.
4. The density of slurry shall not be less than 67 lbs./ cubic foot measured at the point where fresh slurry is discharged in the trench.
5. Sufficient bentonite slurry shall be added and mixed uniformly and homogeneously with all soil backfill such that the soil-bentonite backfill mixture: (1) has a minimum bentonite content to 2.5 percent by dry weight of soil: (2) exhibits a coefficient of permeability less than or equal to 1×10^{-7} cm/sec at the in-situ density; and (3) has a saturated paste placement consistency and water content corresponding to a slump cone value of 4 to 6 inches. For determining compliance with the permeability specification, a backfill coefficient of permeability of 1×10^{-7} cm/sec.
6. The bentonite used shall consist of high plasticity premium grade sodium montmorillonite bentonite. The Contractor shall submit samples of the bentonite being used.
7. Soil used as backfill material shall have no less than 10 percent material by dry weight passing the U.S. Standard No.

200 sieve size, i.e., the soil-bentonite mixture shall have no less than 12.5 percent by dry weight passing the No. 200 sieve, and no less than 80 percent material by dry weight passing the U.S. Standard No. 20 sieve size. Soil excavated from the trench may be used provided it is homogenized and meets the criteria. Other soil materials sources may be approved.

8. The bentonite slurry viscosity prior to mixing with the backfill shall be no less than 40 seconds-Marsh as determined by a Marsh Funnel. The bentonite slurry in the trench must maintain fluid enough to pass through a Marsh Funnel and its total unit weight must be at least 15 pcf lighter than the soil-bentonite backfill. Filtrate loss of the bentonite slurry shall be less than or equal to 30 cc in 30 minutes @ 100 p.s.i.
9. Care shall be exercised during mixing and backfilling to ensure that the backfill flows and displaces the slurry in the trench and to ensure that a uniform and homogeneous soil-bentonite slurry cut-off wall is construction.
10. The soil-bentonite backfill must not shrink, consolidate or otherwise settle more than 2 inches beneath the top elevation of the slurry trench during the first 24 hours after filling or more than 6 inches prior to capping the wall level with the adjacent ground surface. If settlement in excess of these specifications occurs, the Contractor shall be required to refill the trench with approved soil-bentonite backfill at his sole expense.
11. Upon completion of backfill placement and before drying of the backfill can occur, the cut-off trench shall be capped. A 10 oz./SY, non-woven geotextile shall be placed to extend five feet beyond the repaired trench in each direction. At a minimum, a six-inch (6") thick cap of aggregate material shall be placed immediately upon completion of backfill placement and before the backfill can dry out. The material shall be compacted as approved by the ENGINEER.

3.02 FIELD QUALITY CONTROL

- A. The first butt fusion of each day, for each fusion machine, shall be destructively tested by the "bent strap" test. This test method is presented in PLEXCO Bulletin Nos. 105Y and 106.
- B. All exposed HDPE piping shall be installed and anchored to allow for thermal expansion and contraction in accordance with manufacturer's recommendations. Anchors should be of suitable plastic or stainless steel ties attached to the base of the pipe supports.

3.03 CLEANING

- A. Keep inside of all pipe, fittings, and valves clean and free from dirt and debris.
- B. Thoroughly clean piping as specified by manufacturer.

3.04 INSPECTION AND TESTING

- A. Piping shall be tested as described in 3.02.
- B. All pressurized piping and valves shall be pressure tested after final installation, but before operation. All piping assemblies shall be tested at 125 psi for two hours with 5% maximum allowable pressure drop over the test duration.

END OF SECTION

96A03

SECTION 15100

VALVES: BASIC REQUIREMENTS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Leachate access manifold valving and valving appurtenances.
- B. Related Sections include but are not necessarily limited to:
 - 1. Bidding Requirements, Contract Forms, and Conditions of the Contract.
 - 2. Division 1 - General Provisions.
 - 3. Section 11005 - Equipment: Basic Requirements.
 - 4. Section 15060 - Pipe and Pipe Fittings: Basic Requirements.

1.02 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. American Water Works Association (AWWA):
 - a. C500, Gate Valves for Water and Sewerage Systems.
 - b. C504, Rubber-Seated Butterfly Valves.
 - c. C550, Protective Epoxy Interior Coatings for Valves and Hydrants.
 - d. C606, Grooved and Shouldered Joints.
 - 2. Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS).

1.03 SUBMITTALS

- A. Shop Drawings:
 - 1. See Section 01340.
 - 2. Product technical data including:
 - a. Acknowledgement that products submitted meet requirements of standards referenced.
 - b. Manufacturer's installation instructions.
 - c. Valve pressure and temperature rating.
 - d. Valve material of construction.
 - e. Special linings.
 - f. Valve dimensions and weight.
 - g. Valve flow coefficient.
 - h. Wiring and control diagrams for electric or cylinder actuators.
 - 3. Test reports.
- B. Operation and Maintenance Manuals:
 - 1. See Section 01340.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Refer to individual valve specification sections.

2.02 MATERIALS

- A. Refer to individual valve specification sections.

2.03 VALVE ACTUATORS

- A. Valve Actuators - General:
 - 1. Provide actuators as shown on Drawings or specified.
 - 2. Counter clockwise opening as viewed from the top.
 - 3. Direction of opening and the word OPEN to be cast in handwheel or valve bonnet.
 - 4. Size actuator to produce required torque with a maximum pull of 80 LB and withstand without damage a pull of 200 LB.
- B. Buried Valve Actuators:
 - 1. Provide screw or slide type adjustable cast iron box, 5 IN minimum diameter, and identifying cover.
 - 2. Box base to enclose buried valve gear box or bonnet.
 - 3. Provide 2 IN AWWA standard valve actuator nut.
 - 4. Provide stem extension to grade with guide bushing to center extension.
 - 5. Provide cast iron floor stands where shown on Drawings. Stands to be furnished by valve manufacturer with actuator.
 - a. Stand or actuator to include thrust bearings for valve operation and weight of accessories.
- C. Manual Actuators:
 - 1. Provide for all exposed valves not having electric or cylinder actuators.
 - 2. Provide handwheels for gate and globe valves.
 - a. Size handwheels for valves in accordance with AWWA C500.
 - 3. Provide lever actuators for plug valves, butterfly valves and ball valves 3 IN DIA and smaller.
 - a. Lever actuators for butterfly valves to have a minimum of 5 intermediate lock positions between full open and full close.

2.04 FABRICATION

- A. End Connections:
 - 1. Provide the type of end connections for valves as required in the Piping Schedules presented in Section 15060 or as shown on the Drawings.
 - 2. Comply with the following standards:
 - a. Threaded: ANSI B1.20.1.
 - b. Flanged: ANSI B16.1 Class 125 unless otherwise noted or

AWWA C207.

- B. Refer to individual valve sections for specifications of each type of valve on Project.
- C. Nuts, Bolts, and Washers:
 - 1. Wetted or internal to be bronze or stainless steel. Exposed to be zinc or cadmium plated.
- D. On Insulated Piping: Provide valves with extended stems to permit proper insulation application without interference from handle.
- E. Epoxy Interior Coating:
 - 1. Provide epoxy interior coating for all ferrous surfaces in accordance with AWWA C550.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Setting Buried Valves:
 - 1. Set valves and valve boxes plumb.
 - 2. Place valve boxes directly over valves with top of box being brought to surface of finished grade.
 - 3. Install in closed position.
- C. Support exposed valves and piping adjacent to valves independently to eliminate pipe loads being transferred to valve and valve loads being transferred to the piping.
- D. For threaded valves, provide union on one side to allow valve removal.
- E. Install valves accessible for operation, inspection, and maintenance.

3.02 ADJUSTING

- A. Adjustment valves, actuators and appurtenant equipment to comply with Section 01650. Operate valve, open and close at system pressures.

END OF SECTION

92B24

SECTION 15103

BUTTERFLY VALVES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Landfill Gas Header Butterfly Valves.

B. Related Sections include but are not necessarily limited to:

1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 1 - General Requirements.
3. Section 15060 - Pipe and Pipe Fittings: Basic Requirements.
4. Section 15100 - Valves: Basic Requirements.

1.02 QUALITY ASSURANCE

A. Referenced Standards:

1. American National Standards Institute (ANSI):
 - a. B16.1, Pipe Flanges and Flanged Fittings.
2. American Society for Testing and Materials (ASTM):
 - a. A48, Specifications for Gray Iron Castings.
 - b. A126, Gray Iron Castings for Valves, Flanges and Pipe Fittings.
3. American Water Works Association (AWWA):
 - a. C504, Rubber Seated Butterfly Valves.
4. Manufacturers Standardization Society of the Valve and Fittings Industry (MSS):
 - a. SP-67, Butterfly Valves.

1.03 SUBMITTALS

A. Shop Drawings:

1. See Section 15100.

B. Operation and Maintenance Manuals:

1. See Section 01340.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers of AWWA C504 valves are acceptable:

1. DeZurik.
2. Clow.
3. Dresser.

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4. Mueller.
5. Pratt.

B. Subject to Engineers Review and compliance with the Contract Documents, the following manufacturers of thermoplastic valves are acceptable:

1. ASAHI/America (thermoplastic).
2. Hayward (thermoplastic).
3. Chemtrol Chem-Aire (thermoplastic).

C. Submit requests for substitution in accordance with Specification Section 01640.

2.02 BUTTERFLY VALVES (AWWA C504)

A. Comply with AWWA C504 to work with landfill gas.

B. Materials:

1. Valve bodies:
 - a. ASTM A126, Class B or ASTM A536 Grade 65-45-12 ductile iron.
 - b. Wafer valves may be constructed of ASTM A48, Class 40 cast iron.
2. Valve shafts:
 - a. Stainless steel, 18-8, Type 304 or 316.
3. Valve discs:
 - a. Landfill gas and similar applications: ASTM A48, Class 40 cast iron:
4. Valve seats:
 - a. Landfill gas.
 - 1) Hypalon.
5. Mating surfaces:
 - a. Valves less than 30 IN: ASTM A276, 18-8, stainless steel or bronze.
 - b. Valves 30 IN and larger: ASTM A276, 18-8, stainless steel.

C. Design Requirements:

1. Seat type: Resilient. Comply with AWWA C504.
2. Exposed and buried valves 3 through 20 IN.
 - a. Body type: Wafer or short body flange (laying length may vary from AWWA C504).
 - b. Working pressure: Rated for 75 psi (Class 75A per AWWA C504). Rated for 50 in WC vacuum.
 - c. Equip wafer type with fully tapped anchor lugs drilled per ANSI B16.5.
3. Direct buried valves:
 - a. All valves: Working pressure rated for 75 psi (Class 75A per AWWA C504). Rated for 50 in WC vacuum.

2.03 BUTTERFLY VALVES (Thermoplastic)

- A. Comply with industry standards.
- B. Materials:
 - 1. Valve bodies:
 - a. Wafer body: PVC, CPVC, PP, PVDF.
 - 2. Valve shaft or stem:
- a. Stainless steel.
 - 3. Valve disc:
 - a. PP, PVDF
 - 4. Valve seat:
 - a. Valve seat shall be a full body seat isolating stem and body from flow. Seats shall be fabricated from materials that are resistant to landfill gas.
- C. Design Requirements:
 - 1. Exposed and buried valves 3 IN through 20 IN.
 - a. Body type: Wafer.
 - b. Working pressure: Rated for 50 in WC vacuum.
 - c. Equip with fully tapped anchor lugs drilled per ANSI B16.5.

2.04 ACCESSORIES

- A. Refer to Drawings and/or valve schedule for type of actuators. Furnish actuator integral with valve.
- B. Refer to Section 15100 for actuator requirements.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. See Section 15100. Coordinate orientation, location and type of lever with ENGINEER prior to installation.

END OF SECTION

95B06

SECTION 15866

AIR COMPRESSOR

PART 1 - GENERAL

1.01 SUMMARY

- A. The Contractor shall furnish all labor, materials, and equipment necessary for installation of an air compressor, receiver, and dryer as required for the operation of the candlestick flare and condensate sump system. All electrical control equipment shall be furnished prewired to the extent possible.
- B. Related Sections include but are not necessarily limited to:
 - 1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
 - 2. Division 1 - General Requirements.
 - 3. Section 11550 - Landfill Gas Candlestick Flare Station.

1.02 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. American Society of Mechanical Engineers (ASME).
 - 2. National Electrical Manufacturers Association (NEMA).

1.03 SUBMITTALS

- A. Submittals shall be in accordance with Section 01340.
- B. The manufacturer shall submit catalogue data to the Engineer for the following items:
 - 1. Air compressor/receiver.
 - 2. Air dryer.

PART 2 - MATERIALS

2.01 AIR COMPRESSOR

- A. The air compressor shall be a two-stage cast iron-type with the following minimum specifications:
 - 1. Pressure: As required for system operation per Section 11550.
 - 2. Material: Cast iron.
 - 3. Stages: 2.
 - 4. Service factor: 1.15.
 - 5. Motor: 3 phase, 230 V, 60 Hz, TEFC.
- B. The compressor shall include an integral magnetic NEMA rated motor starter.

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2.02 RECEIVER

- A. The receiver shall be an ASME code vessel.
- B. The receiver shall include a pressure indicator.
- C. The receiver shall include a pressure relief valve set at the maximum rated tank pressure.
- D. The receiver shall include a ball valve, and strainer upstream of a 115 volt, single phase, 60 HZ solenoid drain valve with timer. Timer shall have adjustable cycle time.

2.03 AIR DRIER

- A. A regenerative desiccant air dryer shall be supplied downstream of the air receiver tank. The air drier shall be capable of supplying dry compressed air with a dewpoint of -40 DegF at 125 psi or at a pressure as required by the flare manufacturer to the skid mounted instrumentation of the candlestick flare station. The dryer may be heatless or heated and shall meet the following specifications:
 - 1. Flowrate: 35 SCFM.
 - 2. Purge flowrate: Less than 5 SCFM.
 - 3. Controls: Automatic cycling, automatic draining.
 - 4. Voltage: 110 V AC, 1 PH, 60 HZ.
 - 5. Vessels: ASME 150 psi.
 - 6. Filtration: Integral, 1 Micron.

2.04 ACCEPTABLE MANUFACTURERS

- A. Ingersol-Rand.
- B. Worthington.
- C. Atlas-Coper.
- D. Pall.
- E. Or approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. The air compressor, control panel, receiver, and air dryer shall be mounted and plumbed as an integral part of the skid assembly, prior to shipment.
- B. The air compressor, control panel, receiver and air dryer shall be located on the skid such that all maintenance access requirements are maintained.

END OF SECTION

Division 16

Electrical

94L19

SECTION 16010

ELECTRICAL: BASIC REQUIREMENTS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Basic requirements for electrical work.
- B. Install and wire all landfill gas candlestick flare station equipment, and perform all tests necessary to assure conformance to the Specifications and ensure that equipment is ready and safe for energization.
- C. Related Sections include but are not necessarily limited to:
 - 1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
 - 2. Division 1 - General Requirements.
 - 3. Section 01340 - Shop Drawings, Project Data & Samples; Operations & Maintenance Manuals; and Miscellaneous Submittals.
 - 4. Section 09900 - Painting.
 - 5. Section 11550 - Landfill Gas Candlestick Flare Station.
 - 6. Section 13440 - Instrumentation for Process Control: Basic Requirements.

1.02 AREA CLASSIFICATIONS

- A. All areas shall be considered wet.

1.03 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. American Iron and Steel Institute (AISI).
 - 2. American Society for Testing and Materials (ASTM).
 - 3. National Electrical Manufacturers Association (NEMA).
 - 4. National Fire Protection Association (NFPA):
 - a. 70, National Electrical Code (NEC).
 - 5. Underwriters Laboratories, Inc (UL).
- B. When a specific code or standard has not been cited, the applicable codes and standards of the following code-making authorities and standards organizations shall apply:
 - 1. American Iron and Steel Institute (AISI).
 - 2. American Society for Testing and Materials (ASTM).
 - 3. ETL Testing Laboratories, Inc (ETL).
 - 4. National Electrical Manufacturers Association (NEMA).
 - 5. National Fire Protection Association (NFPA).
 - 6. Underwriters Laboratories Inc (UL).

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- C. In case of conflict or disagreement between codes, standards, laws, ordinances, rules, regulations, drawings and specifications, or within either document itself, the more stringent condition shall govern.

1.04 SYSTEM DESCRIPTION

- A. Provide functioning systems in compliance with manufacturer's instructions, performance requirements specified and modifications resulting from reviewed shop drawings and field coordinated drawings.

1.05 SUBMITTALS

- A. Shop Drawings:
 1. See Section 01340.
 2. Submit shop drawings prior to purchase or fabrication of equipment.
 3. Prior to submittals of shop drawings, coordinate electrical equipment, particularly motor control equipment, control panels, and instrumentation, with all applicable equipment and systems interfacing with that equipment.
 4. Submittals shall be made in the following combinations:
 - a. Motor control equipment, safety switches, dry-type (specialty) transformers, panelboards, grounding.
 - b. Alarm systems, communication systems and telephone systems.
 5. For each product, clearly identify manufacturer by name.
 6. Provide manufacturer's technical information on products to be used, including:
 - a. Product descriptive bulletin.
 - b. Electrical data pertinent to the Project and necessary to assure compliance with Specifications.
 - c. Equipment dimensions, where applicable.
 7. When general data sheets are provided as part of the submittal, specifically identify the products to be used on this Project.
 8. For all equipment, provide manufacturer's installation instructions.
- B. Operation and Maintenance Manuals:
 1. See Section 01340.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. See Section 01600.
- B. Ensure that equipment is not used as steps, ladders, scaffolds, platforms, or for storage-either inside or on top of enclosures.
- C. Protect nameplates on electrical equipment to prevent defacing.

- D. Repair, restore or replace damaged, corroded and rejected items at no additional cost to the Owner.

1.07 RECORD DRAWINGS

- A. Provide actual motor size, starter size, and heater size, along with all other protective equipment for all motor circuits as part of the one-line record drawings.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Trade names and catalog numbers may be used in the Specifications to establish quality standards and basics of design.
 - 1. Other listed manufacturers in the applicable specification sections with equal equipment may be acceptable.
 - 2. If no other manufacturer is listed, then manufacturers of equal equipment may be acceptable.
- B. Listed:
 - 1. Where UL test procedures have been established for the product type, electrical equipment shall be approved by UL or ETL and shall be provided with the UL or ETL label.
- C. Structural Steel Supports:
 - 1. Galvanized steel: ASTM A36.
 - a. PVC coated in Class I and in corrosive areas.
 - 2. Stainless steel: AISI Type 316.
- D. Warning Tape:
 - 1. Approved manufacturers and catalog numbers:
 - a. W. H. Brady Company, Catalog S-10, #91296.
 - 2. Material: Polyethylene.
 - 3. Thickness: 3.5 mils.
 - 4. Tensile strength: 1750 psi.
 - 5. Size: 6 IN wide (minimum).
 - 6. Legend: Preprinted and permanently imbedded:
 - a. Message continuously printed.
- E. Equipment Nameplates:
 - 1. Phenolic or thermoplastic laminate 1/16 IN thick with holes for screw mounting.
 - 2. 3/16 IN high lettering, unless otherwise indicated.
 - 3. Engrave letters through top surface into contrasting color core:
 - a. Colors: Black top surface, white core, unless otherwise indicated.
 - 4. Stainless steel self-tapping screws.

5. Size as required for the legend.

F. Warning Signs:

1. For mounting on equipment such as MCC's, control panels, etc., and containing specific messages such as "Danger, 120 V AC from external sources in this cubicle":
 - a. Plastic laminate 1/16 IN thick with holes for screw mounting.
 - b. 3/4 IN high letters for the words "WARNING," "DANGER," and "CAUTION"; all other lettering 3/16 IN high unless otherwise indicated.
 - c. Engrave letters through top surface into contrasting color core:
 - 1) Colors: Red for "DANGER" and "WARNING" signs; yellow for "CAUTION" signs.
 - d. Stainless steel self-tapping screws.
 - e. Size as required for the legend.

2.02 FABRICATION

A. Shop or Factory Finishes:

1. See Section 09900.
2. Interiors of other painted equipment shall be gray.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Make arrangements and pay for all necessary inspections, permits, and licenses.
- B. Equipment shall be installed in accordance with the requirements of the NEC.
- C. Enclosures for Use with Electrical Equipment:
 1. NEMA 4:
 - a. Use in wet outdoor locations.
- D. Coordinate the interconnection of field and skid electrical equipment with other trades.
- E. Install equipment in accordance with the manufacturer's instructions.
- F. Equipment Access:
 1. Install equipment so it is readily accessible for operation and maintenance.
 2. Equipment shall not be blocked or concealed.
 3. Do not install electrical equipment such that it interferes with normal maintenance requirements of other equipment.

- G. Equipment shall be installed plumbed, square and true with the building construction and shall be securely fastened.
- H. Screen or seal all openings into equipment to prevent the entrance of rodents and insects.
- I. Equipment fabricated from aluminum shall not be placed in direct contact with earth or concrete.
- J. Provide all necessary anchoring devices and supports.
 - 1. Use supports as specified.
 - a. Use supports and anchoring devices rated for the equipment load and as recommended by the manufacturer.
 - 2. Supports and anchoring devices shall be rated and sized based on dimensions and weights verified from approved equipment submittals.
 - 3. Hardware shall be malleable type, corrosion resistant and shall be supported by heavily plated machine screws or brass, bronze or stainless steel bolts.
 - 4. Do not cut, or weld to, building structural members.
 - 5. Do not mount safety switches and external equipment to other equipment enclosures, unless enclosure mounting surface is properly braced to accept mounting of external equipment.
- K. Contractor and manufacturer shall verify exact rough-in location and dimensions for connection to electrical items furnished by Others.
- L. Material that may cause rusting or streaking on a finished surface shall not be used.
- M. Avoid interference with structural members and equipment. Particular attention shall be paid to door swings, piping, and structural steel.
- N. Provide tagging of electrical equipment, conduits, and conductors.
 - 1. Each piece of equipment shall be provided with a nameplate identifying the equipment.
 - 2. Each control device shall be provided with a nameplate identifying the controlled equipment.
- O. Provide electrical danger, caution, warning and safety instruction signs.
- P. Field paint in accordance with Section 09900.

3.02 FIELD QUALITY CONTROL

- A. Make all electrical penetrations water and weather-tight.
- B. After installation, all equipment shall be tested as recommended

by the manufacturer.

- C. Verify all components are operational.
- D. Perform ground-fault performance testing as required by NEC Article 230-95(c).
- E. Test Equipment Interface:
 - 1. Verify systems coordination and operation.
- F. Set all adjustable trip protective devices as required for system protection and coordination.
- G. Verify all system and equipment ground continuity.
- H. Adjust installed equipment for proper operation of all electrical and mechanical components.
- I. Prior to Shipment:
 - 1. Test to ensure all equipment is free of short circuits and improper grounds.
 - 2. Test to ensure all equipment is operational.

3.03 CLEANING

- A. Clean dirt and debris from all surfaces.
- B. Apply touch-up paint as required to repair scratches, etc.
- C. Replace nameplates damaged during installation.
- D. Thoroughly vacuum the interior of all enclosures to remove dirt and debris.

END OF SECTION

95B06

SECTION 16011

MISCELLANEOUS ELECTRICAL

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes conduit raceways, fittings, boxes, starters, fuses and safety switches.
- B. Related sections include but are not necessarily limited to the following:
 - 1. Division 0 - Bidding Requirements, Contract Forms and Conditions of the Contract.
 - 2. Division 1 - General Requirements.
 - 3. Section 11550 - Landfill Gas Candlestick Flare Station.
 - 4. Section 16010 - Electrical: Basic Requirements.
 - 5. Section 16450 - Grounding.

1.02 QUALITY ASSURANCE

- A. References Standards:
 - 1. National Electrical Manufacturer's Association (NEMA).
 - 2. National Fire Protection Association (NFPA):
 - a. 70, National Electrical Code (NEC).
 - 3. Underwriter's Laboratories (UL).

1.03 SUBMITTALS

- A. All submittals shall be in conformance with Sections 01340 and 16010.
- B. The Contractor shall provide catalogue data for all electrical components.

PART 2 - MATERIALS

2.01 GRADE

- A. The Contractor shall provide and use only new materials of the type and quality specified. UL and FM approved materials shall be used where applicable.

2.02 CONDUCTORS

- A. All conductors shall be of soft-drawn, annealed copper having conductivity of not less than 98 percent of that of pure copper, uniform in cross-section, free from flaws, scale and the imperfections. Conductors shall be stranded wires.

- B. All branch wiring shall be Type XHHW or THWN 600 volt, and a minimum of AWG 12 gage except for control wiring which shall be stranded and a minimum of AWG 14 gage.
- C. Wire AWG 2 gage and larger (or as noted on the Drawings). Shall be Type XHHW wire 600 volt. Wire smaller than AWG 2 may be THWN or XHHW.
- D. Manufacturers shall be Simplex, General Cable, Okonite, Rome Cable, Anaconda, General Electric or approved equal.
- E. Thermocouple wire shall be Type K Thermocouple extension wire with glass insulation.
- F. Shielded signal wire shall be Belden 87 series.

2.03 CONDUIT RACEWAYS

- A. Underground conduit shall be continuous, Polyvinylchloride (PVC) Schedule 80, and exposed conduit shall be rigid aluminum unless otherwise specified or indicated on Drawings. Conduit size shall be no less than 3/4 IN except for final connection to equipment, which may be 1/2 IN.
- B. All joints shall be made with standard couplings or unions; use of running threads is prohibited.
- C. Conduit ends shall be reamed after cutting, and double lock nuts shall be used at terminations.
- D. Final conduit to motors and other equipment liable to vibrate shall be PVC-coated Flexible Galvanized Steel (Liquid-tight).
- E. Unless otherwise noted or specified, tops of underground conduit shall not be less than 30 IN below grade.

2.04 CONDUIT FITTINGS

- A. Provide double locknuts and bushings at all rigid conduit terminations except at threaded hubs. Bushings shall be O.Z. type "A" molded bakelite except for 2 IN conduit and larger shall be O.Z. type "B" or type "BL" where grounding is required. Use "Meyers" type hubs on all NEMA 3R, and NEMA 4 enclosures.
- B. Threadless fittings shall not be used.

2.05 GUTTERS, PULL BOXES AND JUNCTION BOXES

- A. Wireway gutters and junction boxes shall be watertight all

welded construction with neoprene gasket screwed covers NEMA Type 4.

2.06 NAMEPLATES AND IDENTIFICATION

- A. Provide adhesive backed nameplates for all starters and switches. Letter size shall be at least 3/16 IN high. Provide lamicoid nameplates for all distribution switches, breakers, lighting and power panels, showing proper and complete identification.

2.07 OUTLETS

- A. All outlet boxes shall be cast boxes and suitable plates.
- B. Boxes for outdoor weatherproof receptacles shall be Type FD unilets with screw hubs.

2.08 FUSES AND CIRCUIT BREAKERS

- A. Fuses shall be high capacity, current limiting, low peak or dual element as indicated. Dual element fuses shall be used for all motor loads.
- B. The Contractor shall furnish two sets of spare fuses for each size used below 100 A and one set for each size 100 A and above.
- C. Circuit breakers shall be molded case thermal magnetic, non-interchangeable, non-adjustable, rated 10,000 amperes interrupting. Provide with service entrance lable where required. NEMA 4 enclosures, with external operating handle padlockable in OFF for up to 3 padlocks.

2.09 SAFETY SWITCHES

- A. Safety switches, unless otherwise indicated on the drawings, shall be heavy duty type, 600 V, of the number of poles required. The switch size shall be as required by code the switches shall be weatherproof NEMA 4.

2.10 MOTOR STARTERS

- A. Motor starters shall be NEMA rated with the size, type and rating for the equipment to be served and the short circuit current available. Motor starters shall conform to all applicable requirements of the NEMA and the NEC.
- B. All starters shall be complete with the accessories required for the operation specified or intended.
- C. All starters shall be horsepower rated with interchangeable thermal overloads in each ungrounded phase. Install overloads

as a field item, coordinated to match the motor nameplate rating.

- D. Overload relays shall be manually reset from outside the enclosure by depressing an insulated button.
- E. The overload relay shall be of the thermal, bimetallic type.

2.11 COMBINATION STARTERS

- A. Combination motor starters shall conform to all of the requirements for motor starters, plus have a circuit breaker circuit protective disconnect in the same enclosure conforming to the NEC requirements for the motor. Disconnect shall be sized for available fault current. The disconnect shall be interlocked with the cover door to prevent opening door unless disconnect is in open position. A maintenance means to defeat the door interlock shall be included.
- B. The combination starter unit disconnect shall be of the high speed instantaneous magnetic trip motor circuit protector type, designed to suit motor characteristics.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Mechanical equipment shall be wired complete and in accordance with the manufacturer's wiring diagrams and instructions.
- B. Wire single phase equipment and lighting so there is a minimum of disturbance. Conductors shall be continuous and of such lengths that no splice occurs except within outlet, junction or pull box, panel board, switch, motor starter, conduit fittings, or other similar devices or equipment. Splices shall join conductors securely together both mechanically and electrically.
- C. Make connections and splices for AWG 10 gage wire and smaller with Buchanan "B-Cap", 3-M "Scotchlok", or Ideal "Wing Nut" pre-insulated wire connectors (sizes as recommended by manufacturer). Make connections and splices for AWG 8 gage conductors and larger with solderless pressure or compression type connectors by O.Z., Burndy, Buchanan, T & B, or Illsco. Tape all splices with plastic so insulation is at least equivalent to insulation of conductor. Thoroughly clean ends before splicing. Where plastic tape is used and there is any danger of insulation damage from pressure of joint against non-current carrying metal parts, use friction tape for additional protection. Vinyl plastic tape shall be Scotch #33 or Plymouth.

- D. All wires in panel boards, gutters, wireways and pull boxes shall be neatly arranged with terminations located directly opposite terminals and routed in a neat and workmanlike manner through spaces where the wire passes.
- E. Exercise due care when pulling wire and cable through raceways, to prevent conductors from kinking and injuring insulation. UL approved pulling compounds may be applied to the conductors to ensure ease of pulling. Under no circumstances shall any medium containing water, acid, or petroleum base be used.
- F. Leave no less than 6 IN of wire at each outlet for connection to lighting fixture, switch receptacle, and other pieces of equipment. Neatly tuck a 6 IN long loop in the bottom of box.
- G. All branch circuit conductors shall be color coded as follows:
 - 1. For all 120V to ground circuits:
 - a. Phase A: Black.
 - b. Phase B: Red.
 - c. Phase C: Blue.
 - d. Neutral: White
- H. All control conductors shall be color coded as follows:
 - 1. Underground 120 volt: Red.
 - 2. Grounded 120 volt: White.
 - 3. Interlock from other systems: Yellow.
 - 4. Control wiring and all other stranded wiring to screw connections shall be provided with T & B "STA-KON" terminals.
- I. The neutral conductors and all other exposed non-current carrying metal parts shall be grounded as required by Code. Grounding bushings shall be used as required and shall be O.Z. insulated Type "BL", or approved equal. No grounding shall be made to gas piping. Where equipment or devices are served by non-metallic ducts, enclosures shall be grounded by means of a code size bar or green insulated equipment ground wire installed in the duct with the current carrying conductors and be bonded securely in the cabinet where the ground wire terminates. Copper jumpers shall bridge flexible conduit and be installed with ground wire.
- J. Install all motor control equipment as required. Maintain adequate working clearances around the installed electrical apparatus.
- K. Make the required connections to motors and equipment to ensure proper motor rotation.
- L. Provide complete acceptance testing procedure to the Engineer no later than two weeks prior to shipping.

- M. Thermocouple extension wire shall be pulled as a continuous wire between the thermocouple and end connection point.

END OF SECTION

94K17

SECTION 16020

CONTROL LOGIC

PART 1 - GENERAL

1.01 SUMMARY

- A. The Contractor shall provide all labor and software to program the PLC to control the system in accordance with the basic control logic described herein and in accordance with Contractor's approved submittal of detailed logic diagrams.
- B. Related Sections include but are not necessarily limited to:
 - 1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
 - 2. Division 1 - General Requirements.
 - 3. Division 11 - Equipment.
 - 4. Section 16010 - Electrical: Basic Requirements.
 - 5. Section 16011 - Miscellaneous Electrical.

1.02 QUALITY ASSURANCE

- A. Contractor shall incorporate flare and blower skid manufacturer's control logic requirements into the basic control logic requirements described herein.
- B. Refer to Section 16010.

1.03 SUBMITTALS

- A. Shop Drawings:
 - 1. Refer to Sections 01340 and 16010.
- B. Final control logic and programming diagrams as recommended and approved by flare and blower skid suppliers.
- C. Certification of acceptance of final control logic and programming diagrams from flare and blower skid suppliers.

1.04 NORMAL OPERATION

- A. For normal operation, the flare is activated by pulling the "EMERGENCY STOP" buttons out, placing the "PLC POWER" key switch in the "ON" position, placing the "LANDFILL GAS VALVE" in the "AUTO" position, placing one of the two "BLOWER" switches in the "AUTO" position, and placing the "FLARE" switch in the "ON" position (usually in that order). When this is done, the following sequence of events occurs:
 - 1. The following indicator lights on the front panel illuminate:
 - a. POWER ON.

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- b. PURGE.
 - c. LANDFILL GAS VALVE CLOSED.
 - 2. The flare dampers move to the full open position for 3 minutes to purge the flare.
 - 3. After the purge cycle, the pilot propane solenoid valve (SOV 402) opens, the propane spark igniter is energized, the flame supervision system is activated, the "PILOT ON" indicator light illuminates, and the "PURGE" indicator light turns off.
 - 4. If the flame supervision system does not detect a pilot flame after a period of 10 seconds, SOV 402 and the pilot spark are deactivated, the "PILOT FAIL" indicator light illuminates, and the "PILOT ON" light turns off. Pushing the "reset" button on the front panel turns off the indicator light.
 - 5. If the flame supervision system detects a pilot flame, SOV 401 is energized opening SDV 401, and the selected blower is turned on. The spark igniter turns off and the following lamp indications are shown:
 - a. POWER ON.
 - b. PILOT ON.
 - c. LANDFILL GAS VALVE OPEN.
 - d. BLOWER RUN.
 - 6. After a period of 60 seconds after SOV 401 is energized opening SDV 401, SOV 402 is de-energized, the pilot flame turns off, and the "PILOT ON" indicator lights turns off.
 - 7. If, after the pilot turns off, the flame supervision system does not detect a flame, the blower shuts off, the shut down valve closes, and the start-up sequence terminates. The following lamp indications are shown:
 - a. POWER ON.
 - b. LANDFILL GAS VALVE CLOSED.
 - c. FLAME FAILURE.
 - 8. If, after the pilot turns off, the flame supervision system detects a flame, the "FLAME ON" indicator light illuminates and the system will run continuously until automatic or manual shutdown is initiated. During normal operation, the following lamp indications are shown:
 - a. POWER ON.
 - b. LANDFILL GAS VALVE OPEN.
 - c. BLOWER RUN.
 - d. FLAME ON.
- B. Under normal operation, the flame temperature will be maintained within a range of ± 20 degrees of the setpoint, normally around 1550 DegF, by control of the pneumatic air louvers by the temperature transmitter and PLC.
- C. Under normal operation, the system will be operated at a set blower speed (to be determined). As an option, the system will be controlled on flowrate to within ± 5 percent of the flow setpoint (to be determined). The output of the flow

transmitter (FT 201) provides analog input to the PLC.

1.05 TIMED FLARE OPERATION

- A. The logic for timed operation is identical to that of normal operation except that the flare will operate on a timed cycle (to be determined). The flare will operate in the timed mode when the "FLARE" switch is placed in the "TIMED" position rather than the "ON" position (see Paragraph 1.02-B).

1.06 MANUAL OPERATION

- A. Manual controls require only that the "POWER" switch be on and the "EMERGENCY STOP" push buttons be out. The PLC does not need to be on, and no PLC programming is required to accommodate manual controls. The following manual operations are permitted by the controls:
 - 1. Blower 1 OR Blower 2 on ("TEST" position on the blower switch). Logic will prevent both blowers from operating simultaneously.
 - 2. Shutdown valve SDV 401 open ("OPEN" position on the LFG valve switch).
 - 3. Condensate tank pump run ("HAND" position on the condensate pump switch).

1.07 OUTPUTS TO DIALER

- A. The PLC will give an output signal to the dialer for any of the following conditions:
 - 1. If the flare temperature exceeds the high temperature setpoint (to be determined).
 - 2. If the flare temperature falls below the low temperature setpoint (to be determined).
 - 3. If the LFG flow exceeds the high flow setpoint (to be determined).
 - 4. If the LFG falls below the low flow setpoint (to be determined). This setpoint will be recalculated and reset for different blower speeds.
 - 5. If the blower stops operating for any reason other than normal switching.
 - 6. If the flame quits for any reason other than normal switching.
 - 7. If the condensate tank liquid level exceeds the alarm set point (determined by the displacer position).
 - 8. If the VFD stops operating for any reason other than normal switching.

1.08 SHUTDOWNS

- A. The events given in this subsection will cause automatic shutdown of the system, and the dialer to dial out to telephone numbers to be given by the Engineer. Automatic

shutdown will cause the blower to turn off, and the shutdown valve to close. The first out alarm will be indicated on the front control panel by a flashing light, and the second out alarm will be indicated by a steady light.

1. Flare temperatures below the low temperature setpoint will cause an automatic shutdown. The following lamp indications are shown for a low temperature shutdown:
 - a. POWER ON.
 - b. LANDFILL GAS VALVE CLOSED.
 - c. FLARE LOW TEMPERATURE.
2. Flare temperatures above the high temperature setpoint will cause an automatic shutdown. The following lamp indication are shown for a high temperature shutdown:
 - a. POWER ON.
 - b. LANDFILL GAS VALVE CLOSED.
 - c. FLARE HIGH TEMPERATURE.
3. Excessive blower vibration as indicated by the activation of the blower vibration switch (preset by the contractor to manufacturer's recommended setting) will cause an automatic shutdown. The following lamp indications are shown for a blower vibration shutdown:
 - a. POWER ON.
 - b. LANDFILL GAS VALVE CLOSED.
 - c. BLOWER VIBRATION.
4. Flame failure as indicated by the flame supervision system will cause an automatic shutdown. The following lamp indications are shown for a flame failure shutdown:
 - a. POWER ON.
 - b. LANDFILL GAS VALVE CLOSED.
 - c. FLAME FAILURE.
5. Inlet separator high liquid level as indicated by activation of the separator level switch will cause an automatic shutdown. The following lamp indications are shown for a separator high liquid level shutdown:
 - a. POWER ON.
 - b. LANDFILL GAS VALVE CLOSED.
 - c. INLET SEPARATOR HIGH LIQUID LEVEL.
6. Landfill gas flow below the LFG low flow setpoint will cause an automatic shutdown. The following lamp indications are shown for a blower low flow shutdown:
 - a. POWER ON.
 - b. LANDFILL GAS VALVE CLOSED.
 - c. LANDFILL GAS LOW FLOW.
7. Landfill gas flow above the LFG high flow setpoint will cause an automatic shutdown. The following lamp indications are shown for a blower low flow shutdown:
 - a. POWER ON.
 - b. LANDFILL GAS VALVE CLOSED.
 - c. LANDFILL GAS HIGH FLOW.
8. VFD failure will cause an automatic shutdown. The following lamp indications are shown for a VFD failure shutdown:

- a. POWER ON.
- b. LANDFILL GAS VALVE CLOSED.
- c. VFD FAILURE.

1.09 ALARMS

- A. The events given in this subsection will cause lamp indications on the front panel, and the dialer to dial out to telephone numbers to be given by the Engineer. Automatic shutdown will not occur for these events.
 - 1. Condensate tank high level alarm will be activated when the liquid in the condensate tank rises above the alarm level set point. The following lamp indications are shown for the condensate tank high level alarm.
 - a. POWER ON.
 - b. CONDENSATE TANK HIGH LEVEL.
 - 2. Under normal conditions, the following lamp indications will also be shown:
 - a. LANDFILL GAS VALVE OPEN.
 - b. BLOWER RUN.
 - c. FLAME ON.

1.10 CONDENSATE DESTRUCTION SYSTEM

- A. The pneumatic condensate pump solenoid valve (SOV 102), and the atomizing air solenoid valve (SOV 103) will be activated when the liquid level in the condensate tank rises above the high level (not alarm level) set point and the flare is up to temperature. The activation of SOV 103 will lead the activation of SOV 102 by 5 seconds.
- B. The pneumatic condensate pump solenoid valve (SOV 102), and the atomizing air solenoid valve (SOV 103) will be de-activated when the liquid level in the condensate tank falls below the low level set point.

PART 2 - MATERIALS

- A. The Contractor shall use software compatible with the PLC used in the system. The software shall be the latest version for the Allen Bradley SLC 500 PLC or approved equal meeting the following specifications:
 - 1. The software shall be remotely downloadable and accessible via standard (Hayes compatible) modem to the PLC.
 - 2. The software shall support user created custom screens for on-line viewing of operational parameters such as performance, alarms, setpoints, and stored data (3 day minimum data storage capacity).
 - 3. The software shall be menu driven.

PART 3 - EXECUTION

3.01 GENERAL

- A. The Contractor shall make use of subroutines where appropriate. The program shall be easy to read, debug, and customize if necessary.
- B. The program shall contain, at a minimum, the following screens:
 - 1. Setpoints including "current" and "change to" fields.
 - 2. Current Operating Parameters including flare temp, blower speed, LFG flow, condensate tank level status.
 - 3. Alarm Status.
- C. The use of temporary setpoints for the purpose of startup shall be approved by the engineer prior to start-up, and the actual setpoints shall be determined by the engineer during system shakedown.
- D. Contractor shall engage the services of the PLC manufacturer's field service engineer to program and install the software logic on the PLC.

3.02 INSTALLATION

- A. The Contractor shall have the program ready to download to the PLC before substantial completion of the system.
- B. The Contractor shall install a legal copy of the software on the Owner's compatible microcomputer.

3.03 TESTING

- A. The Contractor shall test all program subroutines, custom screens, and remote monitoring and control capabilities of the software by logging on to the PLC from the Owner's microcomputer.
- B. The Contractor shall perform all debugging required to make the system operate in accordance with the plans and specifications.

END OF SECTION

95B6

SECTION 16150

PANELBOARDS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Lighting panelboards and distribution panelboards.
- B. Related Sections include but are not necessarily limited to:
 - 1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
 - 2. Division 1 - General Requirements.
 - 3. Section 16010 - Electrical: Basic Requirements.
 - 4. Section 16011 - Miscellaneous Electrical.
 - 5. Section 16450 - Grounding.

1.02 QUALITY ASSURANCE

- A. Referenced Sections:
 - 1. National Electrical Manufacturers Association (NEMA):
 - a. PB 1, Panelboards.
 - 2. National Fire Protection Association (NFPA):
 - a. National Electric Code (NEC).
 - 3. Underwriters Laboratories, Inc (UL):
 - a. 67, Panelboards.
 - b. 50, Cabinets and Boxes.
 - c. 489, Molded Case Circuit Breakers.
 - d. 943, GFCI.

1.03 SUBMITTALS

- A. Shop Drawings:
 - 1. See Sections 01340 and 16010.
 - 2. Panel layout with alphanumeric designation, branch circuit breaker sizes and types, as indicated in the panel schedules.
- B. Operation and Maintenance Manuals:
 - 1. See Section 01340.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 - 1. Panelboards and circuit breakers:

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- a. General Electric.
- b. Square D.
- c. Cutler-Hammer/Westinghouse.
- d. Siemens.

B. Submit requests for substitution in accordance with Specification Section 01640.

2.02 MANUFACTURED UNITS

A. Panelboards:

- 1. UL 67 listed.
- 2. Designed in accordance with NEC Article 384.
- 3. Dead-front type.
- 4. Fronts:
 - a. Steel reinforced.
 - b. Concealed or semi-concealed hinges.
 - c. Trim adjusting screws.
 - d. Directory card mounted inside front door.
 - e. Corrosionproof lock with retractable latch.
 - f. Surface or flush mounting as required.
- 5. Bus bars:
 - a. Sequenced phased.
 - b. Fully insulated from the cabinet.
 - c. Drilled and tapped on circuit pole centers.
 - d. Copper.
- 6. Main lugs:
 - a. Solderless type.
 - b. Approved for copper UL listed wire.
- 7. Solid neutral bar with solderless mechanical type connectors.
- 8. Non-insulated grounding strip including:
 - a. Main ground lug.
 - b. Individual grounding terminals for each circuit breaker and circuit breaker space.
- 9. Maximum panel voltage:
 - a. 240 V AC.

B. Panel Boxes and Cabinets:

- 1. UL 50 listed.
- 2. Gutter space per NEC and UL requirements.
- 3. Code gage galvanized steel.
- 4. Furnish with knockouts in side, top and bottom panels.
- 5. Nominal 5-3/4 IN deep.
- 6. NEMA Type 4 rating.

C. Circuit Breakers:

- 1. Thermal-magnetic type, UL listed:
 - a. Over-center, toggle handle operated.
 - b. Quick-make, quick-break action.
 - 1) Independent of toggle handle operation.
 - c. Common tripping of all poles.

- d. Molded-in ON and OFF markings on breaker cover.
- e. Bolt-on type.
- f. Three-position handles indicating ON, OFF and TRIPPED.
- g. Removable from front of panelboard without disturbing adjacent circuit breakers.
- h. Rated 10,000 AIC, minimum, unless a higher interrupting rating is noted on the Drawings.
- i. Tandem or half-size circuit breakers shall not be used.
- 2. GFCI type, UL listed:
 - a. Characteristics as indicated for the thermal-magnetic type above:
 - 1) Provide for general purpose receptacle circuits.
 - 2) Plus the following features:
 - a) Class A ground fault circuit.
 - b) Trip on 5 mA ground fault (4-6 mA range).
- 3. Provide minimum of four (4) single pole 20 amp breakers as spares.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install per manufacturer's instructions.
- B. Install in accordance with the NEC.
- C. Provide each panelboard with a typed "as installed" directory.

END OF SECTION

95B06

SECTION 16450

GROUNDING

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Grounding.
- B. Related Sections include but are not necessarily limited to:
 - 1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
 - 2. Division 1 - General Requirements.
 - 3. Section 16010 - Electrical: Basic Requirements.
 - 4. Section 16011 - Miscellaneous Electrical.

1.02 QUALITY ASSURANCE

- A. Assure ground continuity is continuous throughout the entire Project.
- B. Referenced Standards:
 - 1. American Society for Testing and Materials (ASTM):
 - a. B8, Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft.
 - 2. National Fire Protection Association (NFPA):
 - a. National Electric Code (NEC).
 - 3. Underwriters Laboratories, Inc. (UL):
 - a. 467, Electrical Grounding and Bonding Equipment.

1.03 SUBMITTALS

- A. Shop Drawings:
 - 1. See Sections 01340 and 16010.
 - 2. Grounding system details for:
 - a. Equipment grounding.
 - 3. After installation is complete:
 - a. Test reports:
 - 1) Ground rod and grid test results.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 - 1. Wire and cable:
 - a. As specified in Section 16011 except as modified in the

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- following.
- 2. Conduit:
 - a. As specified in Section 16011.
- 3. Ground rods:
 - a. Thompson.
 - b. Joslyn.
 - c. Heary Brothers.
- 4. Grounding clamps and connectors:
 - a. Thompson.
 - b. Burndy.
 - c. Heary Brothers.
 - d. Joslyn.
- 5. Exothermic weld connections:
 - a. Erico Products Inc., Cadweld.
 - b. Burndy.
- 6. Fall-of-potential test device:
 - a. "Ground Megger" device:
 - 1) James G. Biddle Co.

B. Submit requests for substitution in accordance with Specification Section 01640.

2.02 COMPONENTS

- A. Wire and Cable:
 - 1. As specified in Section 16011 except as modified by the following.
 - 2. Grounding electrode conductor:
 - a. Insulated copper ground cable:
 - 1) Soft drawn stranded bare copper cable.
 - 2) ASTM B8.
 - b. Sized as required by Table 250-94 of the NEC, except where a larger size conductor is shown on the Contract Drawings.
 - 3. Grounding conductor:
 - a. Insulated copper ground cable:
 - 1) Soft drawn stranded bare copper cable.
 - 2) ASTM B8.
 - 4. Equipment grounding conductor:
 - a. Green copper conductor: Identical insulation to phase conductors.
 - b. Sized as required by Table 250-95 of the NEC, except where a larger size conductor is shown on the Contract Drawings.
- B. Conduit: As specified in Section 16011.
- C. Grounding Clamps:
 - 1. High copper alloy content: Compression type.
 - 2. UL 467 listed.
 - 3. Noncorrosive.

- D. Ground Rods:
 - 1. 3/4 IN x 10 FT, except as otherwise indicated on the Contract Drawings.
 - 2. Stainless steel.
 - a. 302/304 alloy (minimum).
 - 3. UL listed.
- E. Exothermic Weld Connections:
 - 1. Copper oxide reduction by aluminum process.
 - 2. Molds properly sized for each application.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. General:
 - 1. Install products in accordance with manufacturer's instructions.
 - 2. Remove paint, rust, or other nonconducting material from contact surfaces before making ground connections.
 - 3. Where ground conductors pass through floor slabs or building walls, sleeves of intermediate metal conduit of the required size, shape, and length shall be provided, unless otherwise specified or shown on Drawings.
 - 4. Drive top of rod to minimum depth of 2 FT-6 IN below grade unless otherwise noted on Contract Drawings.
 - 5. Use driving studs or other suitable means to prevent damage to threaded ends of sectional rods.
 - 6. Do not splice grounding electrode conductor.
 - 7. Provide excavation required for installation of ground conductors buried in earth.
 - 8. Allow sufficient slack to prevent conductor breakage during backfill or due to ground movement.
 - 9. Leave taps, junctions, and splices uncovered until inspected by Engineer.
 - 10. All buried ground conductors shall be insulated copper conductors. Cadweld conductors to stainless steel ground rod and apply bitumastic coating to copper conductor and cadweld connection.
 - 11. Bond underground metal piping to the ground grid in accordance with NEC 250. Grounding clamps may be utilized on piping if exothermic welds may damage structural integrity.
 - 12. All underground connections: Exothermically welded.
 - 13. Complete grid system:
 - a. Resistance of 5 ohms or less.
 - b. Drive additional rods as required.
- B. Raceway Grounding Conduit:
 - 1. All metallic conduit electrically continuous.
 - 2. Provide grounding-type insulating bushings:

- a. For all equipment not supplied with a conduit hub.
- b. On ends of ductbank conduit.
- 3. Bond all conduit, at entrance and exit of equipment, to equipment ground bus or ground lug.
- 4. Use double locknuts at all panels.
- 5. Provide bonding jumpers if conduit are installed in concentric knockouts.
- 6. Make all metallic raceway fittings and grounding clamps tight to ensure equipment grounding system will operate continuously at ground potential to provide low impedance current path for proper operation of overcurrent devices during possible ground fault conditions.
- 7. Provide bonding jumper from equipment ground lug to conduit, if flexible conduit is utilized for equipment connections.
- 8. Provide bonding jumpers identical in conductor size to the largest ground conductor run within the conduit.

C. Equipment Grounding:

- 1. Ground all voltage levels at the supply transformer from the secondary neutral to the ground grid.
- 2. Ground all equipment supplied from an MCC or panelboard through the equipment ground bus. Provide an equipment grounding conductor connected to the ground bus and equipment ground lug.
- 3. Ground all equipment fed from lighting panels through the lighting panel ground bus. Provide ground conductors for all connections.
- 4. Consider control devices (switches, indicating lights, meters, starters, relays, etc.) mounted in MCC's, control panels, or other metal enclosures to be adequately grounded, if the enclosure ground lug or ground bus is properly grounded.
- 5. Do not splice grounding conductors.
- 6. Run all equipment grounding conductors in conduit.
- 7. Ground unused and spare power and control cable at both ends.
- 8. Size all grounding conductors in accordance with Tables 250-94 and 250-95 of the NEC unless larger size is shown on the Drawings.

3.02 FIELD QUALITY CONTROL

- A. Test resistance of installed ground system after backfilling and before connection to any other grounded system including underground piping, utility services or other building ground systems.
 - 1. Test ground grid resistance by fall-of-potential method.

END OF SECTION

94I29

SECTION 16501

LAMPS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Lamps.
- B. Related Sections include but are not necessarily limited to:
 - 1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
 - 2. Division 1 - General Requirements.
 - 3. Section 16010 - Electrical: Basic Requirements.

1.02 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. Refer to Section 16010.
- B. Miscellaneous:
 - 1. Lamps are identified for each luminaire in the Lighting Fixture Schedule on the Drawings.

1.03 SUBMITTALS

- A. Shop Drawings:
 - 1. See Sections 01340 and 16010.
- B. Operation and Maintenance Manuals:
 - 1. See Section 01340.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. See Section 16010.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 - 1. General Electric.
 - 2. Phillips.
 - 3. Osram-Sylvania.

2.02 MATERIALS

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- A. General:
 - 1. See lighting fixture schedule on drawings for wattage, voltage and number required.
- B. Fluorescent Lamps:
 - 1. Rapid start.
 - 2. Cool white.
 - 3. Energy efficient.
- C. High-Pressure Sodium Lamps:
 - 1. Bulb finish: Clear.
 - 2. Any burning position.

2.03 MAINTENANCE MATERIALS

- A. Spare Parts:
 - 1. Furnish Owner with a minimum of two lamps or 20 percent of total of each type and watt rating, whichever is greater.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install lamps in all luminaires.
- B. Replace all incandescent lamps operated during construction and all failed fluorescent, and high pressure sodium lamps with new lamps prior to final acceptance by Owner.
 - 1. Relamping is to be done at end of Project at Contractor's expense.

END OF SECTION

94K17

SECTION 16670

LIGHTNING PROTECTION SYSTEM

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Lightning protection requirements.
- B. Related Sections include but are not necessarily limited to:
 - 1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
 - 2. Division 1 - General Requirements.
 - 3. Section 16450 - Grounding.

1.02 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. Lightning Protection Institute (LPI):
 - a. 175, Installation Code.
 - 2. National Fire Protection Association (NFPA):
 - a. 70, National Electrical Code (NEC).
 - b. 78, Lightning Protection Code.
 - 3. Underwriters Laboratories, Inc (UL):
 - a. 96A, Installation Requirements for Lightning Protection Systems.

1.03 DEFINITIONS

- A. Installer: Installer is the person actually installing the product in the field at the Project site.
- B. Classification of Buildings:
 - 1. Class I: Any commercial, industrial, or residential building less than 75 FT in height.
 - 2. Class II: Any commercial, industrial, or residential building 75 FT or taller.
 - 3. Class II (modified): Heavy-duty stacks.
 - 4. Heavy-duty stacks: Any smoke or vent stack with a flue cross-section area greater than 500 SQ IN and a stack height greater than 75 FT.

1.04 SUBMITTALS

- A. Shop Drawings:
 - 1. See Sections 01340 and 16010.
 - 2. Acknowledgement that products submitted are in compliance with LPI or UL.
 - 3. Verification that the installation shall comply with the

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requirements of, and shall qualify for the UL Master Label.

4. Roof penetration details.
5. Plan drawing showing type, size, and locations of all lightning protection hardware.

B. Operation and Maintenance Manuals:

1. See Section 01340.
2. Requirements for, and frequency of, periodic inspections.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Thompson Lightning Protection, Inc.
2. Robbins Lightning Protection Company.
3. Heary Brothers.
4. A-C Lightning Security, Inc.

B. Submit requests for substitution in accordance with Specification Section 01640.

2.02 MATERIALS

A. Air Terminals:

1. Class I applications:
 - a. Solid or tubular copper nickel tip type.
 - b. Solid copper terminals shall be a minimum of 3/8 IN in diameter. Tubular copper shall be a minimum of 5/8 IN DIA.
 - c. Minimum height of 10 IN above object being protected.

B. Air terminal bases shall be cast bronze with bolt pressure cable connectors.

C. All main and secondary conductors shall be copper cable or copper solid strip sized according to Tables 3-4 and 3-5 of NFPA 78.

1. Except where structural steel is utilized as the main and secondary conductors.
2. Conductors within 25 FT of the top of a stack shall be lead covered.

D. Conductor fasteners, connector fittings, bonding fittings, conductor splicers and thru-wall or thru-roof assemblies shall be cast bronze, brass or copper with bolt pressure connectors.

E. Ground rods shall be in accordance with Section 16450.

- F. All bolts, nuts, and screws shall be stainless steel.
- G. Stacks:
 - 1. Copper and bronze materials used on the upper 25 FT of the stack shall have a continuous covering of lead to resist corrosion by flue gases.
 - 2. Air terminals shall be solid copper at least 5/8 IN in diameter and not less than 18 IN or more than 30 IN. Mount perimeter terminals at 30-degree angles outward at intervals not exceeding 8 FT.
 - 3. Conductors shall be copper, weighing not less than 375 LBS per 1000 FT.
 - 4. A minimum of two down conductors on opposite sides of the stack shall be provided. Connect to ground grid or create individual grid for the stack if necessary. Ensure that down conductors are interconnected at the bottom of the stack. Provide down conductors from physical damage for a minimum distance of 8 FT above ground.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Installation and materials shall be in accordance with LPI and NFPA standards.
- C. Air terminals less than 2 FT in height shall be placed a maximum of 20 FT apart along the perimeter of a flat or gently sloping roof. Air terminals 2 FT or higher shall be placed a maximum of 25 FT apart along the perimeter.
- D. Air terminals shall be placed within 2 FT of the ends of ridges, or edges and corners of roof. All air terminals along the perimeter shall be interconnected by the main roof conductor loop.
- E. Flat or gently sloping roofs which exceed 50 FT in width or length shall have additional air terminals within the periphery at intervals not exceeding 50 FT. Main conductor cross runs shall be used to connect these terminals to the main roof conductor loop.
- F. Support air terminals against overturning. Air terminals exceeding 2 FT in height shall be supported at a point not less than one-half its height.

- G. Provide a minimum of two unspliced down conductors with a maximum spacing of 100 FT along the perimeter of a building.
 - 1. Unless structural steel is utilized as the down conductor.
- H. All exterior metal objects on non-metallic roofs, or metal siding within 6 FT of a primary conductor or air terminal, shall be bonded to the primary conductor.
- I. All roof-mounted metallic objects on non-metallic roofs having an area of 400 SQ IN or greater, a volume of 1000 CU IN or greater, or a height equal to or greater than the adjacent air terminal shall be bonded to the lightning protection system. Use bonding plates having a surface area of not less than 3 SQ IN.
- J. Metal objects less than 3/16 IN thick that are required to be bonded shall be protected by an air terminal.
- K. Securely attach conductors to the building using non-corrosive fasteners spaced no more than 3 FT apart.
- L. Do not install copper conductors or fasteners in contact with aluminum surfaces.
- M. Down conductors shall be encased in conduit from a minimum of 2 FT below grade to a minimum of 8 FT above grade.
 - 1. Metal conduit shall be bonded to the conductor at both ends.
- N. Provide connection to incoming electric and telephone service ground per NEC for common bonding.
- O. Connection to ground grid shall be made in accordance with Section 16450.
- P. All components shall be installed to blend in with the appearance of the building so that they appear as part of the building. Down conductors shall be mounted in locations along the structure walls where they are least observable.
- Q. Surge arrestors shall be placed on electric and telephone service entrances.
- R. Surge arrestors shall be placed on electric and telephone service entrances. Place surge arrestors on all incoming utility lines.
- S. Reinforcing steel shall be electrically continuous and bonded to the lightning protection system.
- T. Class I Steel-Framed Buildings:

1. Steel columns shall be utilized as the down conductors.
 2. Steel roof beams and trusses shall be utilized as the main and secondary conductors.
 3. Air terminals shall be bonded to the steel columns, roof beams, or trusses.
 - a. Building penetration shall be with thru-roof type fittings.
 4. Verify electrical continuity of the framing system.
- U. Class II (modified) Heavy-Duty Metal Stacks or Vents:
1. Steel stacks fabricated of greater than 3/16 IN thick steel shall:
 - a. Not require air terminals.
 - b. Be bonded to the lightning protection system at grade level.

3.02 FIELD QUALITY CONTROL

- A. Installation shall be performed in accordance with UL and NFPA.
- B. The completed installation shall qualify for and receive the UL Master Label.
- C. Provide a nameplate, attached to the structure, that includes the name and address of the Contractor responsible for the installation of the lightning protection system.

END OF SECTION

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