Contract Documents
for
Binghamton-Johnson City
Joint Sewage Treatment Plant
Solids Handling Improvements
Vestal, New York

Contract No. 10 – General
Contract No. 11 – Electrical
Contract No. 12 – HVAC
Contract No. 13 – Plumbing

GHD CONSULTING SERVICES INC.
One Remington Park Drive
Cazenovia, New York

VOLUME II OF II

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SECTION 11370

DIGESTER GAS TREATMENT AND ENERGY RECOVERY SYSTEM

PART 1 GENERAL

1.01. SUMMARY

A. This section specifies requirements for furnishing and installing a digester gas treatment and energy recovery system, complete and ready to operate, including all necessary equipment, instrumentation, controls, piping, valves, accessories, spare parts, and manufacturer's services in accordance with the Contract Documents and as shown on the Contract Drawings.

B. The digester gas treatment and energy recovery system is comprised of the following major components:

1. A pre-engineered system consisting of standalone and skid-mounted equipment, piping, valves, instrumentation, controls and accessories necessary for treating and compressing digester gas for use as fuel to power microturbine generators.

2. Five (5) grid-connect 65 kW microturbine generators, each equipped with integrated exhaust heat recovery module and renewable fuel accessory option kit.

C. The system shall be furnished by a single source (System Supplier) having overall responsibility for certifying proper installation, startup, field testing, and initial operation and performance of the entire system.

D. The System Supplier shall serve as the sole source of information submitted for review and approval, regardless of the manufacturing source.

E. The System Supplier shall include any and all royalties and licensing fees associated with the use of devices or systems protected by existing or pending patents and shall protect the Owner and Engineer from any litigation or other legal action associated with any allegation of patent infringement.

F. Contractor shall provide pipe, fittings and supports necessary for connecting the supplied equipment and pre-piped skids to the piping shown on the Contract Drawings.

1.02. RELATED SECTIONS

A. The specification sections listed below are an integral part of this equipment specification. The General Contractor shall be responsible for providing these sections to the System Supplier.

1. Section 01300 – SUBMITTALS

2. Section 01600 – MATERIALS AND EQUIPMENT

3. Section 01640 – EQUIPMENT-GENERAL

4. Section 01660 – TESTING AND STARTUP

5. Section 09900 – PAINTING

6. Section 11990 – OEM CONTROL PANELS

7. Section 15060 – ABOVEGROUND PROCESS PIPING

8. Section 15100 – ABOVEGROUND PROCESS VALVES

9. Section 15140 – SUPPORTS AND ANCHORS

10. Section 15170 – MOTORS

11. Section 16480 – VARIABLE FREQUENCY DRIVES

B. Unless otherwise specified in this section, all control panels, electrical equipment and wiring furnished as part of the digester gas treatment and energy recovery system shall comply with applicable requirements specified in Division 16 Electrical.

1.03. REFERENCES

A. All components of the digester gas treatment and energy recovery system shall comply with local codes and ordinances, state and federal laws, and guidelines as specifically detailed herein and in accordance with applicable portions of the following codes.

1. American Gas Association (AGA)

2. American National Standards Institute (ANSI)

a. ANSI B16.5 - Pipe Fittings and Flanged Fittings

3. American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE)

4. American Society of Mechanical Engineers (ASME)

a. ASME B31.3 - Process Piping

b. ASME Section VIII, Division 1 - Pressure Vessels

5. Institute of Electrical and Electronics Engineers (IEEE)

a. IEEE 519 - Standard for Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy Resources

b. IEEE 1547 - Standard for Interconnecting Distributed Resources with electric Power Systems

6. Instrument Society of America (ISA)

7. National Electrical Manufacturers Association (NEMA)

8. National Fire Protection Association (NFPA)

a. NFPA 70 - National Electric Code

b. NFPA 497 - Classification of Flammable Liquids, Gases, or Vapors and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas

c. NFPA 820 - Fire Protection in Wastewater Treatment and Collection Facilities

9. Underwriters Laboratories Inc. (UL)

a. UL 508A - Standard for Safety of Industrial Control Panels

b. UL 698A - Standard for Safety of Industrial Control Panels Relating to Hazardous (Classified) Locations

c. UL 1741 - Standard for Inverters, Converters, Controllers and Interconnection System Equipment for Use with Distributed Energy Sources

d. UL 2200 - Standard for Stationary Engine Generator Assemblies

B. Where reference is made to one of the standards listed above, the revision in effect at the time of bid opening shall apply.

1.04. SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

A. Digester Gas Treatment System

1. The digester gas treatment system shall provide capacity for compression and treatment of digester gas over the range of 62.5 to 125 scfm.

2. Digester gas treatment shall include removal of particulates, moisture, hydrogen sulfide, and siloxanes as necessary for use of digester gas as fuel for microturbine generators based on the following inlet digester gas characteristics:

Parameter	Value
Inlet gas temperature (range)	90-100 degrees F
Inlet gas pressure (range)	8 to 10 inches W.C.
Relative humidity (maximum)	100 percent
Hydrogen sulfide (H_2S) concentration (maximum)	500 ppmv
Siloxanes concentration (maximum)	1000 ppbv

3. The gas treatment system shall include a minimum of one hydrogen sulfide removal unit. Unit size shall be minimum 96-inch ID with a minimum 10 feet straight sidewall height.

4. The gas treatment system shall include a minimum of three siloxane removal units. Units shall be configured for operation in series and shall be minimum 18-inch ID with minimum 10 feet straight sidewall height.

B. Microturbine Generators

1. Each microturbine generator set shall be designed for continuous operation using digester gas as fuel with a high heat value (HHV) ranging from 550 to 750 BTU/scf

2. Nominal electrical output of each microturbine generator set shall be 65 kW at ISO conditions

3. Each microturbine generator set shall be designed for continuous operation over the range of no net electrical output to full power output.

4. Power output connections shall be 480 VAC, 3-phase, four-wire

5. Output current harmonic distortion shall be less than 5 percent THD and compliant with IEEE 519

6. Each microturbine generator set shall use utility grid for startup and shall not require batteries for grid connect only operation.

7. Microturbine generator sets shall not require liquid for lubrication or cooling.

8. Each microturbine generator set shall be designed to operate continuously with a total exhaust backpressure of up to 5 inches of water

9. Microturbine generator sets shall be capable of being connected together such that one set acts as the master to start and stop all sets together and to provide automatic load sharing and synchronizing between all sets.

10. Nominal rated output at full heat recovery shall be 235,600 BTU per hour of hot water with the microturbine operating at full 65 kW electrical power output under ISO conditions with an inlet water temperature of 140 degrees F and a water flow rate of 40 gallons per minute.

11. Microturbine generators shall be designed for inverter-based output with integrated protective relaying, listed with UL 1741, and compliant with IEEE 1547.1 and utility interconnection requirements established by the New York State Public Service Commission.

12. Microturbine generator sets shall be designed to operate with exhaust heat recovery units operating in full thermal bypass mode.

13. Each microturbine generator set shall be designed to operate for at least 40,000 hours before overhaul of the microturbine engine is required.

14. Microturbine exhaust emissions shall comply with applicable state and local government requirements

15. Noise emissions shall be less than 65 dBA at a distance of 33 feet with the microturbine operating at full load.

1.05. SUBMITTALS

A. Furnish the following submittals in accordance with requirements specified in Sections 01300 and 01640:

1. Shop drawings (single complete and comprehensive submittal including, but not limited to, manufacturer's performance affidavits, equipment product data, equipment installation and wiring diagrams, control panel drawings, and equipment delivery, storage and handling instructions for all system components). The System Supplier shall furnish performance affidavits from manufacturers of the two major system components. Performance affidavits shall comply with requirements specified in Section 01640.

2. Certification of equipment compliance.

3. Shop test results.

4. Manufacturer's operation and maintenance manual (single complete and comprehensive submittal including instructions for overall system operation and maintenance as well as detailed operation and maintenance instructions for all individual system components).

5. Manufacturer’s Installation Certificate - Manufacturer's certification that all components comprising the digester gas treatment and energy recovery system have been properly installed and that the system is ready for startup, field testing, and initial operation.

6. System Supplier's warranty and factory service plan documents.

1.06. QUALITY ASSURANCE

A. The System Supplier shall have a minimum of five years of experience furnishing integrated municipal digester gas treatment and energy recovery systems similar to the system specified. That experience shall include integrating a minimum of four installations that have demonstrated successful operation for at least three years.

B. The System Supplier shall maintain a continuously staffed (24 hours per day, 7 days per week) service center and shall employ at least two factory-trained and manufacturer-authorized microturbine service providers who are based within 500 miles of the project site.

C. The manufacturer of the digester gas treatment system furnished under this section shall have a minimum of five years of experience designing and fabricating equipment of similar type and size to the equipment specified. That experience shall include a minimum of five installations (125 scfm capacity or greater) designed to treat and compress municipal digester gas to fuel quality suitable for use in microturbine generators. Each installation shall have demonstrated successful operation for at least three years.

D. The manufacturer of the microturbine generator set furnished under this section shall have a minimum of five years of experience designing and fabricating equipment similar in both type and size to the specified equipment. That experience shall include a minimum of five installations that incorporate one or more power modules (65 kW capacity or greater with integrated heat recovery) designed for operation using digester gas as fuel. Each installation shall have demonstrated successful operation for a minimum of three years.

1.07. WARRANTY AND FACTORY SERVICE PROTECTION PLAN

A. The System Supplier shall furnish a warranty and factory service protection plan for the digester gas treatment system and microturbine generator sets. The warranty and factory service protection plan shall be for 5 years, or 39,999 turbine run hours, whichever comes first. Equipment warranties provided by the manufacturers of system components, and passed through by System Supplier, shall extend for a period of 12 months from the date that startup, field testing and initial operation of the system is successfully completed.

B. The factory protection plan shall cover the cost of any and all parts and labor necessary for all scheduled (preventive) maintenance recommended by the System Supplier and manufacturer of the microturbine generator set. In addition, the factory protection plan shall also cover the cost of any and all parts and labor necessary for any unscheduled (emergency) maintenance that may be required for the microturbine generator set during the extended warranty period.

C. The factory service plan shall cover the cost of any and all parts and labor necessary for all scheduled (preventive) maintenance recommended by the System Supplier and manufacturers of the digester gas treatment system.

D. Scheduled (preventive) maintenance shall include all manufacturers' recommended maintenance intervals, including 10 complete replacements of hydrogen sulfide removal media and 5 complete replacements of siloxane removal media over the 5-year warranty period.

E. The warranty and factory service plan shall start on the date that startup, field testing, and initial operation of the system is successfully completed. Contractor and System Supplier shall coordinate equipment delivery accordingly.

PART 2 PRODUCTS

2.01. SYSTEM SUPPLIER

A. All equipment, instrumentation, controls, and accessories specified in this section shall be furnished by a single System Supplier. The System Supplier shall be responsible for supervising and certifying proper installation, start-up, field testing, and initial operation of the entire system. The System Supplier shall be GEM Energy of Walbridge, OH; or equal.

B. Acceptable manufacturers for major subsystem components shall include the following:

1. The digester gas treatment system specified herein shall be furnished by a single manufacturer (Unison Solutions, Inc. of Dubuque, IA; or equal).

2. The microturbine generators specified herein shall be Model C65 Integrated CHP (ICHP) units as manufactured by Capstone Turbine Corporation of Chatsworth, CA; or equal.

C. The General Contractor shall be responsible for any and all additional costs incurred by the Owner, including costs associated with the work by other prime Contractors, resulting from the selection of other acceptable manufacturer's products for incorporation in the work.

2.02. DIGESTER GAS TREATMENT SYSTEM

A. General

1. The digester gas treatment system shall be comprised of the following major components:

a. A pre-engineered skid consisting of equipment and appurtenant piping, valves, instrumentation and controls for compressing and treating digester gas for removal of moisture, particulates and siloxanes.

b. A pre-engineered hydrogen sulfide removal vessel, including appurtenant equipment, piping, valves, instrumentation and controls.

c. A pre-engineered glycol chiller system, including appurtenant equipment, piping, valves, instrumentation and controls.

d. A digester gas treatment system control panel.

e. An energy recovery control panel

2. Parts and equipment comprising the digester gas treatment system shall be amply proportioned for all stresses that may occur during fabrication, transportation, handling erection, and normal operation.

3. Modifications to manufacturers' standard products shall be made, as necessary, to comply with requirements specified in this section and contained in codes and regulations issued by public agencies.

4. Equipment shall not have been in service, except for shop tests, at any time prior to delivery. The equipment shall be furnished factory assembled to the extent possible and ready for installation.

5. All surfaces exposed to digester gas shall be manufactured of material suitable for exposure to hydrogen sulfide.

6. Stainless steel nameplates shall be firmly attached to all items of equipment, instrumentation and controls comprising the gas treatment system. Nameplates shall comply with requirements specified in Section 01640.

B. Gas Compression/Moisture Removal/Siloxane Removal Skid

1. Hydrogen Sulfide Removal Inlet and Gas Compressor Inlet Moisture/Particulate Filters

a. Filters shall be designed to remove 99 percent, or greater, of particulates and liquid droplets of 3.0 micron size and larger.

b. Filters shall be manufactured of stainless steel (Type 304L, minimum) and equipped with 150-lb. ANSI B16.5 inlet and outlet connections.

c. Each filter unit shall be furnished with the following:

1) Cleanable polypropylene structured mesh filter element.

2) Differential pressure gauges.

3) Sight glass for liquid level indication.

4) Level switch above the condensate drain to warn of failure.

5) Bottom drain with strainer.

6) Interconnected piping and valves for manual bypass.

2. Pre-Cooler

a. Pre-cooler shall be designed to cool digester gas to a temperature of 70 degrees F.

b. Pre-cooler shall include a gas-to-glycol finned tube core consisting of aluminum fins on stainless steel (Type 304L) tubes

c. Pre-cooler shall be equipped with 150 lb. ANSI B16.5 inlet and outlet connections.

3. Gas Compressor System

a. Digester gas compressor shall be oil-flooded, direct drive, twin screw compressor.

b. Compressor motor shall be 40 HP (maximum), inverter duty, 480 volt, three-phase, 60 Hertz, rated for use in NEC Class I, Division 1 hazardous areas.

c. Compressor motor speed shall be controlled by a variable frequency drive (VFD). VFD shall comply with requirements specified in Section 16480.

d. Except for the compressor head, all gas and oil components shall be constructed of stainless steel and/or aluminum.

e. Gas compression system shall be furnished with gas inlet and discharge flex connectors, gas inlet check valve, and discharge pressure safety valve.

f. Oil handling system shall include an oil handling reservoir, coalescing filter, pressure safety valve, oil cooler, three way thermal bypass valve, and an oil particulate filter.

4. Oil/gas separator shall be manufactured of stainless steel (Type 304L minimum) and furnished with ASME stamp (Boiler and Pressure Vessel Code Section VIII, Division 1), 150 lb. ANSI B16.5 inlet and outlet connections, and discharge check valves.

5. Oil cooler shall include air-to-oil fin tube core (aluminum fins and tubes) and 150 lb. ANSI B16.5 inlet and outlet pipe connections. Oil cooler motor shall be direct drive, 1 HP (maximum), 480 VAC, 3 phase, 60 Hertz, rated for use in NEC Class I, Division 1 hazardous areas.

6. Oil particulate filter shall be manufactured of aluminum and furnished with inlet and outlet connections (2-inch, 4-bolt), and 10-micron spin on filter elements.

7. Gas-to-gas heat exchanger shall include brazed plate, stainless steel body (Type 304L minimum) with nickel/chrome brazing and 150 lb. ANSI B16.5 inlet and outlet pipe connections.

8. Gas-to-glycol heat exchanger shall include brazed plate, stainless steel body (Type 304L minimum) with nickel/chrome brazing and 150 lb. ANSI B16.5 inlet and outlet pipe connections.

9. Moisture separator shall be centrifugal style (no element to be cleaned or changed), manufactured of stainless steel (Type 304 L, minimum), and furnished with ASME stamp (Boiler and Pressure Vessel Code Section VIII, Division 1), 150 lb. ANSI B16.5 inlet and outlet connections, integral level switch for drain control, and bottom drain with strainer, solenoid valve, check valve and piping with isolation valve for manual bypass.

10. Gas recirculation backpressure regulator shall be provided to allow excess gas to flow from the system discharge back to the inlet of the gas compressor. Connecting piping from downstream of the siloxane removal final particulate filter to upstream of the gas compressor shall be provided by the manufacturer as part of the skid.

11. Siloxane Removal Vessels

    a. Siloxane removal vessels shall be of stainless steel construction (Type 304L minimum) with flat bottom, flanged top, internal septa for even gas distribution through media, and 150 lb. ANSI B16.5 inlet and outlet connections.

    b. Vessels shall be free-standing on four legs manufactured of stainless steel (Type 304L minimum).

    c. Each vessel shall be equipped with a flanged access nozzle on top, pressure relief valve, bottom manual condensate drain with stainless steel ball valve, and test/purge ports with ball valves on vessel inlet and outlet.

    d. Piping and valves shall be furnished for operation of siloxane removal media vessels in series.

    e. The manufacturer shall furnish siloxane removal media for initial charging, startup, and field testing of each vessel (385 lb per vessel, minimum). Media shall be specifically engineered for removing siloxanes and similar contaminants.

12. The skid shall be furnished with a work platform manufactured of powder-coated carbon steel and equipped with aluminum ladder and grating for access to top of siloxane removal vessels for maintenance. Work platform and ladder shall be OSHA compliant.

13. A cartridge-style filter shall be provided downstream of the siloxane removal vessels for final particulate removal. The filter shall be designed to provide 99 percent removal or greater of particulates of 0.5-micron size and larger. The filter housing shall be fabricated of stainless steel (Type 304L minimum) and furnished with 150 lb. ANSI B16.5 inlet and outlet connections

14. The skid base shall be fabricated of powder-coated carbon steel. 24-volt and 120-volt electrical components shall be wired to junction boxes at the edge of skid. Condensate drains piped to edge of the skid base.

15. Instrumentation

    a. All instrumentation provided shall be designed for gas service and rated for use in a NEC Class I, Division 1 Group D area.

    b. Instrumentation to be furnished by the manufacturer as part of the digester gas treatment system shall include the following as a minimum:

        1) Digester Gas Compression/Moisture Removal/Siloxane Removal Skid

            a) Digester gas inlet pressure indicating transmitter.

            b) Level switches at each condensate drain.

            c) Level indicators at each condensate drain.

d) Resistive temperature detectors to monitor glycol temperature and digester gas temperature at each point of temperature change.

e) Bi-metal thermometers to monitor digester gas temperature at each point of temperature change.

f) Pressure transmitter to monitor digester gas compressor discharge pressure.

g) Pressure transmitter to monitor digester gas delivery pressure.

2) Hydrogen Sulfide Removal Vessel - Pressure indicating transmitter to monitor digester gas pressure at vessel inlet.

c. Pressure gauges shall be as manufactured by Ashcroft, Dwyer, or equal.

d. Pressure indicating transmitters shall be as manufactured by Endress & Hauser or equal.

e. Differential pressure gauges shall be as manufactured by Dwyer or equal.

f. Level switches shall be as manufactured by Endress & Hauser or equal.

g. Level indicators shall be as manufactured by Lube Devices, Thomas Products, or equal.

h. Resistive temperature detectors shall be as manufactured by Reotemp or equal

i. Bi-metal thermometers shall be as manufactured by Ashcroft or equal.

16. Piping

a. Digester gas piping shall be welded stainless steel pipe (SA-312 TP304/304L, Schedule 10S, minimum).

b. Threaded stainless steel pipe shall be minimum Schedule 40S.

c. Flange connections shall be ANSI B16.5, SA-182 F304/304L Class 150.

d. Pipe welding shall comply with ASME B31.3 Process Piping.

e. Welded pipe shall be visually inspected and pressure tested.

17. Valves

a. Ball valves shall be full port stainless steel valves with PTFE or RTFE seat as manufactured by Sharpe or equal.

b. Butterfly valves shall be lug style iron body valves with stainless steel disc, stainless steel stem, and FKM seat as manufactured by Ultraflo, ABZ, or equal.

c. Check valves shall be ball or dual-door type as manufactured by Apollo, Techno, ABZ, or equal. Ball check valves shall be stainless steel with RTFE ball. Dual-door check valves shall be wafer style body (aluminum or stainless steel) with FKM seat.

d. Globe valves shall be stainless steel with PTFE packing as manufactured by Sharpe, or equal.

18. Fasteners shall be stainless steel (ASTM F593 Type 304 minimum).

C. Hydrogen Sulfide Removal Vessel

1. Hydrogen sulfide removal vessel shall be rated for 5.0 psig pressure and 1.0 psig vacuum.

2. Vessel shall be of stainless steel construction (Type 304L minimum) with flanged top, dish bottom. Inlet and outlet connections shall be 150 lb. ANSI B16.5 connections.

3. Vessel shall be free-standing on four stainless steel (Type 304L minimum) legs and equipped with top and side manway openings (24-inch diameter minimum), internal supports and grating for media, pressure/vacuum relief valves, two top vents with stainless steel ball valves, and bottom manual condensate drain with stainless steel ball valve.

4. An OSHA-compliant work platform fabricated of welded carbon steel with powder-coated finish and equipped with galvanized steel ladder and aluminum grating shall be provided by the manufacturer for access to the top of the vessel as necessary for maintenance.

5. The manufacturer of the gas treatment system shall furnish iron sponge media necessary for initial charging, startup and field testing of the gas treatment system (252 cubic feet, minimum).

D. Glycol Chiller System

1. The glycol chiller system shall utilize a mixture of propylene glycol solution and water.

2. The system shall be sized for the process heat load and designed to operate over the range of 25 to 100 percent of rated capacity.

3. The system shall be furnished as a preassembled skid-mounted system suitable for outdoor installation with all components mounted, pre-piped and pre-wired within an enclosure consisting of a galvanized steel member frame with powder-coated aluminum cover panels.

4. The chiller system shall include one refrigeration circuit with one compressor sized for 100 percent capacity. Circuit shall include electric motor-driven condenser fan, aluminum micro-channel air-cooled condenser, stainless steel (Type 316L) evaporator, sealed core filter dryer, liquid line solenoid valve, liquid line isolation valve, sight glass moisture indicator, and electronic expansion valve.

5. System shall be furnished with one glycol circulation pump sized for 100 percent capacity. Pumps shall be stainless steel end suction centrifugal pump with TEFC motor.

6. Glycol reservoir shall be a closed tank manufactured of stainless steel (Type 304, minimum).

7. Initial fill of propylene glycol solution shall be furnished by the System Supplier.

8. Glycol circulation piping shall be copper with anti-corrosion coating and Armaflex insulation. Glycol circulation piping shall include pump suction isolation valve and pump discharge check valve and isolation valve.

9. System shall include a UL Type 4 painted carbon steel UL 508A-listed control panel. The control panel shall be designed for 480 VAC, 3 phase, 60 Hertz power supply and include the following:

    a. 480V disconnect switch.

    b. Microprocessor-based controller with full text LCD display.

    c. 480VAC to 24VAC transformer.

10. The glycol chiller system shall be factory tested and shipped with R410a refrigerant charge.

E. Digester Gas Treatment System Control Panel

1. Control panel enclosure shall be UL 508A-listed Type 4 painted carbon steel industrial control panel.

2. Panel shall be rated for indoor installation in ambient temperature ranging from 40 to 104 degrees F.

3. Control panel shall include the following:

    a. Fused disconnect for 480 VAC, three phase, 60 Hertz power supply.

    b. Fuses for over current and branch circuit protection.

    c. 480 VAC transient voltage surge suppressor and 120 VAC surge filter.

    d. 40 HP rated VFD for gas compressor motor (VFD to comply with applicable requirements specified in Section 16480).

    e. 2 HP rated motor starter overload for oil cooler motor.

    f. 1/2 HP rated motor starter for inlet moisture/particulate filter condensate pump.

    g. Programmable logic controller (Allen-Bradley CompactLogix PLC and I/O, or equal).

    h. Human-machine interface (Allen Bradley PanelView Plus Performance, or equal) with 12-inch diagonal TFT color LCD display (800 x 600 pixels).

    i. Terminal strips for termination of 480 VAC power supply, 120 VAC power supply, and instrument wiring.

j. Control panel to comply with applicable requirements specified in Section 11990, OEM Control Panels.

F. Energy Recovery Control Panel

1. Control panel enclosure shall be UL 508A-listed Type 4 painted carbon steel industrial control panel.

2. Panel shall be rated for indoor installation in ambient temperature ranging from 40 to 104 degrees F.

3. Control panel shall include the following:

a. Programmable logic controller (Allen-Bradley CompactLogix PLC and I/O, or equal).

b. Human-machine interface (Allen Bradley PanelView Plus Performance, or equal) with 12-inch diagonal TFT color LCD display (800 x 600 pixels).

c. Modbus TCP network to communicate with PLC network and digester gas treatment skid control panel.

d. Relay contacts for Start/Stop control of microturbines.

e. 16-port Ethernet switch (Stratix, or equal).

4. The control panel shall perform sequential operations for thermal load following, electric load following, and emergency shutdown.

5. The control panel shall comply with applicable requirements specified in Section 11990, OEM Control Panels.

2.03. MICROTURBINE GENERATOR SET

A. General - Each microturbine generator set shall consist of an integrated package that includes a high pressure digester gas fired microturbine with a hot water heat exchanger mounted on top, an exhaust diverter, and field-installed Ethernet interface, with an external fuel accessory kit.

B. Mounting Frame

1. The mounting frame for each microturbine generator set shall be of adequate strength and rigidity to maintain alignment of mounted components.

2. The mounting frame shall be free of sharp edges and corners and equipped with lifting attachments arranged for lifting with slings without damage to components.

C. Microturbine generator sets shall be equipped with an air cleaner having a replaceable dry filter element.

D. Control and Monitoring

1. Functional Description

a. Controls shall provide ability to start and stop each unit remotely using contacts, serial communication or Ethernet communication

b. Specified system or equipment failures shall automatically shut down the microturbine generator set and communicate alarm status using contacts, serial communication or Ethernet communication

c. Each microturbine generator set shall include indicating and protective devices and controls capable of reporting the following using serial of Ethernet communication:

1) Engine Power

2) Engine Speed

3) Output Power

4) AC Volts

5) AC Amps

6) AC Frequency

d. Manufacturer shall make software available for installation on a Windows compatible PC for remote data display, setpoint adjustment, and control

E. Integrated Heat Recovery Module

1. Shall be constructed of a stainless steel core heat exchanger

2. Shall mate to the top of the microturbine

3. Shall be equipped with a linear actuator to bypass exhaust based on a software setting.

4. Shall be capable of operating continuously with unit in full thermal bypass mode

F. Renewable Fuel Accessory Option Kit

1. Fuel kit components shall include particulate/coalescing filter, pressure regulator, shutoff ball valve, bleed ball valve, and pressure gauge.

2. Fuel kit components shall be factory-mounted and piped together on support frame.

2.04. MOTORS AND DRIVES

A. Unless otherwise specified in this section, all motors shall comply with applicable requirements specified in Section 15170, Motors.

2.05. FABRICATION REQUIREMENTS

A. Unless otherwise specified in this section, all shop and field painting, including surface preparation, shall comply with applicable requirements specified in Section 09900.

B. Piping, valves and supports shall comply with applicable requirements specified in Sections 15060, 15100, and 15140.

C. Grease fittings shall be standardized in accordance with Section 01600.

PART 3 EXECUTION

3.01. SHOP TESTING

A. Shop tests shall be performed on Microturbine Generators to test compliance with UL 2200, UL 1741 and IEEE 519.

B. Shop tests shall be performed on the digester gas treatment system using ambient air at the manufacturer’s facility prior to shipment.

3.02. EQUIPMENT DELIVERY AND INSTALLATION

A. All assemblies shall be protected to prevent damage or deterioration from time of shipment until installation is completed and the units and equipment are ready for operation.

B. The equipment shall be delivered as fully assembled as transportation will allow. Factory assembled parts and components shall not be dismantled for shipment unless permission is received in writing from the Engineer.

C. Finished surfaces of all exposed opening shall be protected by wooden blanks, strongly built and securely bolted thereto.

D. Each box or package shall be properly marked to show its net weight in addition to its contents.

E. Install equipment in accordance with manufacturer's instructions and Section 01600.

F. Major system components and connected piping shall be installed to provide access per manufacturer's instructions, without removing connections or accessories, for periodic maintenance.

G. Microturbine generators shall be grounded and wired in accordance with applicable requirements specified in Division 16.

H. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values.

I. Furnish all necessary oil, grease, scrubber media and coolant required for initial operation.

3.03. FIELD TESTING AND INITIAL OPERATION

A. Tests, trials and initial operation of the equipment specified in this section shall be performed in accordance with manufacturer's written instructions and requirements specified in Section 01660.

B. Final acceptance of equipment will be made after major components of the system have met the performance requirements specified in Article 1.04 of this section, including verification that motors are not overloaded in normal operating conditions.

C. The following field tests and inspections shall be performed on the microturbine generators:

1. Air intake and exhaust clearance check.

2. Service clearance check.

3. Fuel supply check.

4. Fuel leak check.

5. Electrical power and ground check.

6. Microturbine generators start and full load power check.

D. Tests shall be coordinated, and run concurrent, with tests for transfer switches or other grid-isolation devices.

3.04. SERVICES OF MANUFACTURER'S REPRESENTATIVE

A. Provide services of the equipment manufacturer or their approval representative in accordance with Section 01640, Equipment-General,and as specified herein.

B. The manufacturer’s certified representative shall be on site for a minimum of two days during start-up to provide commissioning, testing, demonstrate equipment operation, and personnel training. A signed inspection report shall be submitted per Section 01300.

C. A written report shall be submitted in accordance with Section 01300 confirming that the manufacturer's commissioning checklist has been completed and any non-conforming installation items have been corrected.

D. The System Supplier shall maintain a service center capable of 24 hours per day, 7 days per week response.

END OF SECTION