

SECTION XXXXX

GRANULAR ACTIVATED CARBON ADSORPTION SYSTEMS

PART 1 - GENERAL

1.01 SCOPE OF WORK GENERAL DESCRIPTION

- A. Provided for a complete operable GAC (Granular Activated Carbon) Adsorption System as the TIGG model CP20K-10. The design shall include two-stage (lead/lag) and parallel flow pattern operation for maximum carbon utilization. The system design shall include allowance for effective backwash capacity for up to 30% bed expansion during backwash. The Carbon Adsorption System (SUPPLIER) shall be responsible for a complete system that is pre-piped and ready to be set in place. The GAC system design shall provide for 20,000 pound carbon capacity for each adsorber (40,000 pound carbon capacity system design). The process piping battery limits of this system end with the influent, effluent, backwash and vent connection flanges at the fabricated pipe module.
- B. This Scope of Work shall include the supply of all equipment necessary to comprise a complete dual vessel adsorption system as follows:
- i. Two (2) 10 foot diameter down flow design carbon adsorbers with an internal stainless steel underdrain.
 - ii. Eight (8) inch diameter carbon steel process (influent, effluent and backwash) piping with 150 lb flanged cast iron pipe fittings.
 - iii. Independent stainless steel GAC fill and discharge piping including full bore stainless steel shutoff valves, flush connections and transfer hose connections.
 - iv. Vent, pressure relief, flush water and motive air connections for GAC transfers, pressure gauges and sample points.
 - v. Instrumentation
 - vi. Delivery of the Adsorption System.
 - vii. Training of Site operators by qualified SUPPLIER personnel.
- C. This GAC Adsorption System is the basis of design and each Contractor will supply a bid based on supplying this equipment. Should any Contractor desire to offer an alternate design and/or supplier, that design / supplier shall be submitted to the Consulting Engineer or Owner no less than ten (10) days before the bid date, along with such submittals as necessary to fully evaluate the alternative design/supplier. These submittals will be prepared at the cost of the Contractor.

1.02 RELATED SECTIONS

- A. Division XX, General Requirements
- B. Section XXXXX, Painting
- C. Section XXXXX, Granular Activated Carbon Media

1.03 SUBMITTALS

- A. To assure that the Pre-Engineered Modular Adsorption System will satisfy all of the technical requirements of the site condition and treatment process, both design and technical content submittals shall be provided. These project submittals shall be

provided within 4 weeks after receipt of purchase order.

- i. Scope of Supply and general equipment/material specifications.
- ii. Flow Diagram showing system flow patterns and instrumentation. Flow Diagram shall include line sizes, valve arrangement, utility line sizes and all interface points needed for external piping.
- iii. Equipment Arrangement Drawing showing battery limit location(s), overall system dimensions and system weight.
- iv. Seller General Terms of Sale
- v. Piping and Instrumentation Flow Diagram Drawing with notations for materials, valves, instruments and system accessories.
- vi. General Arrangement Plans and Elevations Drawing with dimensional interface connection points including detail and location of base anchor bolt holes.
- vii. Adsorber Vessel and Underdrain Drawing showing nozzle schedule and ASME Code information. (The ASME U-1A Data Sheet shall be included with the Operating manual after shipment is made.)
- viii. Bill of Materials for all components and any other special materials supplied with the system including written specification description and/or catalog cut sheets of all equipment items being supplied.
- ix. List of recommended spare parts, identifying those spare parts that are available from the suppliers.

B. Before delivery and startup of the Carbon Adsorption System, one electronic copy of the Operation and Maintenance Manual shall be provided by the SUPPLIER. This manual shall incorporate all pertinent data relating to prior exchange of drawing and technical information beginning with the purchase order award. The Operating section of this manual shall include complete instructions describing staging of adsorbers and backwashing of the carbon bed. The manual shall also include identification of SUPPLIER personnel available to BUYER for the purpose of on-going technical support.

1.04 REFERENCE STANDARDS

- A. American Society of Mechanical Engineers (ASME)
- B. National Electrical Manufacturers Association (NEMA)
- C. Underwriters Laboratories (UL)
- D. National Electric Code (NEC)
- E. Occupational Health and Safety Administration (OSHA)
- F. American Water Works Association (AWWA)
- G. ANSI/NSF International Standards

PART 2 – PRODUCTS

2.01 PROCESS DESCRIPTION

- A. Carbon Adsorption
 - i. This Carbon Adsorption System consists of two process adsorbers (vessels) and the system pipe network to allow the adsorbers to be operated in either

- a series (lead/lag) or parallel mode. Each adsorber shall be capable of containing twenty thousand (20,000) pounds of granular activated carbon.
- ii. Influent liquid flow in the adsorbers shall be from the top inlet distributor of the vessels with down flow through the granular activated carbon materials.
 - iii. An internal underdrain collection system at the bottom of the adsorber shall be supplied to allow passage of treated liquid out of the adsorber while retaining the media in the vessel. The underdrain collection system shall provide a method for removing the clean treated fluids and permit a uniform flow of water for backwashing media.

2.02 EQUIPMENT DESCRIPTION

A. GAC Pressure Vessels

i. General

1. Adsorber vessels shall be 10 foot diameter x 10 foot straight side, vertical cylindrical pressure vessels with an overall height of no more than 20 feet.
2. Each adsorber shall have 2:1 elliptical top and bottom heads and be designed, constructed and stamped in accordance with the ASME Code, Section VIII with design pressure rating of 125 psig at 150 degrees F.
3. Each adsorber is fabricated of carbon steel construction typically using SA-516-70 steel. All skip and full penetration welds, sharp edges, scabs, slivers and slag shall be corrected (removed and/or ground smooth) for lining surface preparation.
4. Each adsorber shall have four "I" beam legs coped to the bottom head, and at a minimum, shall be W8 x 35 members. Each leg shall have a 12" wide x 12" long x 1" thick base plate continuously welded to the structural leg at the bottom to allow for anchoring to a base pad.

ii. Nozzles

1. Each adsorber shall include one 20" diameter round, flanged manway on the lower straight side and one 14" x 18" elliptical manway (provided with safety chain) on the top head.
2. Each adsorber shall include 4" nozzles for carbon fill and carbon discharge, and 8" nozzles for influent and effluent connection. The backwash source connection to an integral pipe rack shall be provided and piping designed to allow backwash water to enter into the outlet nozzle on the bottom side shell of the vessel and exit out the top 8" flange on the top side shell of the vessel
3. Each adsorber shall be designed to allow slurry or dry carbon fill and shall be capable of being slurry emptied through a bottom carbon discharge line or vacuumed through the top elliptical manway.
4. Each vessel will have three 2" sample ports evenly spaced within the vertical height of the carbon bed area, fitted with 304 SS sample screen and ball valve. The sample probes shall be inserted into the carbon bed far enough so there is no wall effect.

iii. Interior and Exterior Lining

1. All surfaces shall be degreased prior to surface preparation. The adsorber internal surface will be blasted to a white metal surface (SSPC-SP5) to provide an anchor pattern in the metal corresponding to a degree of profile of 4 mils, minimum. The exterior of the adsorber is

blasted or power tool cleaned to the degree specified by SSPC-SP2-63.

2. The interior surface shall be lined with a thick film catalyzed vinyl ester NSF approved coating (Plasite 4110). Application of this lining material in conformance with the manufacturer's instructions shall produce a 35-45 mil dry film thickness. Inspection of the lining shall be done with a Tinker Razor high voltage tester to prove a pinhole free lining exists throughout the interior of the vessel. **All wetted parts shall be coated with the Plasite 4110 and shall meet the recommended thickness above.**
3. Each adsorber shall be finish painted with a single coat of two part catalyzed epoxy followed by a urethane top coat (International 990HS or equal) of approximately 2 mils. The final DFT shall be approximately 6 – 10 mils.

iv. Underdrain Collection System

1. Each adsorber shall be equipped with an 8" schedule 10, 304 stainless steel header with 2" wedge wire laterals. The laterals are constructed of 304 SS wound wedge wire with 0.008" slot openings. No Plastic or PVC materials shall be used in the underdrain system.

v. Inlet Distribution System

1. Each adsorber unit shall have an 8", schedule 10, 304 stainless steel top inlet header designed with outlets which have an open area equal to or greater than the inlet nozzle. This header is used to distribute water across the 10ft diameter of the vessel.

B. Process, Utility and Carbon Fill/Discharge Piping

i. Process

1. The process pipe network shall allow parallel flow with valve adjustments. After flowing through the two carbon beds the effluent from each adsorber is combined by the pipe network to a single system effluent connection point.
2. During parallel operation a flow use of both adsorbers shall produce a lower or equal pressure drop as during series flow. In either case, the total system pressure drop shall be less than 15 psig.
3. The pipe network shall allow a backwash operation for each adsorber. The adsorber requiring backwash shall be isolated from the system process flow. A backwash (in) water connection to the carbon adsorption system shall be provided to allow an uncontaminated backwash water source to be piped to the pipe rack module. Piping shall be capable of conveying backwash water at a rate capable to produce approximately a 30% bed expansion with 55 degree water. Backwash water shall exit the top of the carbon bed and flow through the pipe network to the backwash out connection point.

ii. Construction

1. The process and backwash pipe shall be 8" diameter Schedule 40, ASTM A53, Grade B rated for 150 psig @ 500 deg. F.
2. Pipe flange fittings shall be ASTM A-105 slip-on or weld neck. Other process pipe fittings such as tees and elbows shall be ASTM A126, 125 pound, Class B.

3. Carbon fill and discharge piping shall be 4" diameter, 304SS Schedule 10 pipe rated for 150 psig at 22 deg. F.
4. Utility connections shall be ¾" diameter weld-O-lets for steel pipe. Each utility connection point shall include a ¾" nipple.
5. Gaskets shall be 1/8" thick, EPDM
6. The process pipe network shall include four (4), 8" diameter coupling joints for ease of installation. Each expansion joint shall be a Dresser style compression coupling or equal.
7. Exterior pipe surfaces shall be brush blasted to SSPC 6 and coated with International epoxy 670HS (or equal) with a top coat of International 990 HS urethane (or equal) top coat for a total 6 to 10 mil dry film thickness (6MDFT) of the finish exterior coating thickness.

C. Process, Utility and Carbon Fill/Discharge Valves

i. Process Valves

1. The process piping shall include positive shut-off valves for the purpose of isolation and flow control. Butterfly valves shall mate to Class 125 ANSI flanges. Butterfly valves shall be cast iron wafer body, rated for 200 psig @ 180 DEG F in the closed position, include a one piece aluminum bronze disc and 416SS shaft, Teflon shaft bushings and EPDM liner vulcanized to a hard phenolic backing. Valves shall be AWWA C-504 compliant.

ii. Carbon Transfer, Fill and Discharge Isolation Valves

1. Valves shall be corrosion and abrasion resistant to accommodate liquid slurry movement of carbon. Carbon shut-off valves shall be designed for manual operation, and shall be ANSI 150# flanged 316 stainless steel split body type with 316 stainless steel ball and stem (full port) with reinforced Teflon seats, Belleville spring-loaded RTFE stem packing, and Teflon body seals.

iii. Utility Valves

1. Valves shall be 2" diameter, for flush water connections, sample points, pressure gauge isolation and compressed air connections. These valves shall be constructed of bronze, forged brass or bar stock brass body, and be regular port ball valves, rated for 200 psig at 100 DEG F.

iv. Air release valve

1. One (1) 2" valve shall be provided to continually remove any air degassed from the system. This valve will be located top, center of each vessel and piped down to operator level.

D. Miscellaneous Pipe System Accessories

i. Transfer Hose and Utility Quick Disconnect Adaptor Connections

1. The ends of the carbon transfer and fill pipe shall include Quick Disconnect Adaptor couplings. Transfer hose connectors shall be 4" diameter. Quick Disconnect Adaptors shall be employed to facilitate ease of slurry carbon transfers using flexible transfer hose between the adsorber carbon transfer pipe and pressurized carbon trailers. Utility water and air connections shall include 3/4" diameter quick disconnect adaptor. All Quick Disconnect Adaptors shall be stainless steel material.

- ii. Flush Water, Compressed Air, Sample Point Connections and Pressure Gauge Isolation
 - 1. Utility connections shall be provided. One utility connection shall be provided on each side of the carbon transfer shutoff valve (8 total valves). An air utility connection shall be included at the adsorber influent pipe spool (2 total valves). A pressure gauge isolation/sample point valve arrangement to isolate pressure gauges and sample system water at three points (6 total valves) shall be provided.
- iii. Pressure Relief
 - 1. The carbon vessel pressure relief shall be accomplished by way of a graphite rupture disk located in a separate vent line. One 3" graphite rupture disk per vessel is required. No valves or possible shut offs shall be provided between the rupture disk and the pressure vessel. Disks shall be sandwiched between two ANSI or ASME 150# flanges and rated for +/-5% of full scale on burst pressure.
- iv. Pressure Gauges
 - 1. The system pipe network shall include three (3) pressure gauges to indicate water pressure at three positions of the carbon system: total system influent pressure, effluent water pressure and pressure between adsorbers.
 - 2. Each gauge shall be 4 1/2" face diameter, 0-150 psig range with accuracy of 1% of full range and includes a stainless steel bourdon tube in glycerin filled stainless steel housing.
- v. Pipe Frame Support
 - 1. A prefabricated pre-engineered central pipe rack shall be attached by U-bolts to a pipe frame support. This pipe frame shall function as the central pipe rack support and also the base for attaching the prefabricated module to a foundation.
 - 2. The pipe frame shall consist of horizontal and vertical steel members.
 - 3. The carbon steel pipe frame shall be finish painted with 6 to 10 mil DFT epoxy/urethane paint system.
- vi. Pipe Rack Sample Points
 - 1. The pipe rack module shall include four (4) sample points. The sample points shall be employed to collect water at influent, intermediate, and effluent positions in the adsorption system.
 - 2. Each sample point shall be fabricated of carbon steel pipe. The sample point assembly shall include a 3/4" diameter pipe nipple with a 3/4" manual shutoff valve.
- E. Quality Control Reporting
 - i. A quality control report will be issued with each vessel. The report shall include, but not be limited to the following:
 - 1. Blasting report to assure a proper anchor pattern
 - 2. Internal coating report to measure the dry film thickness of the coating
 - 3. External coating report showing the dry film thickness of the paint
 - 4. Holiday testing report to assure the lining has no discontinuities such as pin-holes and voids.
- F. Product Manufacturer

- i. Provide the GAC adsorption system as follows:
 - 1. TIGG Corporation, CP20K-10 adsorption system
 - 2. Pre-approved equal

PART 3 – EXECUTION

3.01 Equipment Installation

- A. CONTRACTOR to install the GAC adsorption system and appurtenances as shown on the drawings and according to the SUPPLIER's standards and recommendations. The vessels will be installed level according to the SUPPLIER's recommended tolerances.
- B. CONTRACTOR shall coordinate and adjust all piping based upon the GAC adsorption system actually provided to result in properly positioned connections between pipe fittings supplied with the system and yard piping provided by the CONTRACTOR.
- C. Method of installation to be selected by the CONTRACTOR.

3.02 Cleaning, Pressure Testing and Disinfection

- A. CONTRACTOR will be responsible for all piping, hoses, valves, pumps, equipment chemicals and bacteriological sampling and testing, cleaning and disinfection.
 - i. Cleaning
 - 1. The CONTRACTOR shall clean the interior of each unit by removing all visible dirt and debris that may have entered the vessel during installation. The piping shall be flushed with potable water.
 - ii. Hydrostatic Pressure Testing
 - 1. The CONTRACTOR shall pressure test the GAC vessel and piping as a system. Test pressure shall be 125 psig for a minimum of 24 hours.
 - iii. Disinfection
 - 1. After completion of the pressure testing, the CONTRACTOR shall disinfect the system per the OWNER's SOP.

3.03 GAC Media Installation

- A. The GAC media shall be installed in each vessel in accordance with Section **XXXXXX**, Granular Activated Carbon Media.

3.04 Supplier Oversight and Start-Up Assistance

- A. A qualified representative of the SUPPLIER shall be on site for the following:
 - i. Inspection of the installed equipment
 - ii. Start-Up assistance
 - iii. Troubleshooting
 - iv. Operator Training
- B. On-site time shall not exceed one trip and two (2) workdays.

END OF SECTION