SPECIFICATIONS

MODULAR ODOR CONTROL SYSTEM

Modular Odor Control System

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PART 1 – GENERAL

1.1 Scope

The work specified herein shall include design, furnishing and installation of all equipment and instrumentation necessary to provide the Owner with a completely operational Odor Control System. The system shall be a "one-pass three-stage" pre-piped, wired, and packaged FRP MODULAR CONSTRUCTION odor control system. The Odor Control system shall include, but not be limited to, FRP scrubbers, demister, nozzles, internal media, chemical feed and control system, recirculation pump(s), fan, ducting, dampers, chemical storage tanks and all necessary accessories.

1.2 Process Description

A. System shall consist of Three (3) Modular Stages, configured to eliminate short-circuiting of the air stream, and to provide intimate contact with the chemical solution for the removal of odor causing compounds from the air stream via mass transfer to an aqueous solution. Mass transfer shall be accomplished via contact of the air stream with aqueous solution on random packing material in the scrubbing towers. The first scrubbing tower shall be of a vertical, countercurrent flow design. The second scrubbing tower shall be of a vertical, cocurrent flow design. The third scrubbing tower shall be of a vertical, countercurrent design. Each tower shall be of modular construction, each with an independent, integral sump and liquid recirculation system to facilitate treatment with different chemical(s) in each of the stages. When feasible the modules shall be of an integrated design, and shipped as one piece.

To facilitate shipping in some systems over 12,000 cfm the scrubber shall be fabricated in flanged modules; each section shall be provided with lifting lugs, necessary hold-downs and required hardware for field installation as a single scrubber unit. Modules will be assembled on site under the supervision of scrubber Manufacturer.

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B Design Basis: Equipment indicated on the drawings is based on equipment provided by HEE Environmental Engineering packaged system.

The Contractor shall be responsible for determining any changes to mechanical, civil and electrical design necessitated by the use of an alternate system. Any design changes shall be the Contractor's responsibility and all design and construction costs associated with any design changes necessitated shall be borne by the Contractor. All design changes shall be subject to review and approval by the Engineer.

1.3 Reference Standards

PS 15-69: National Bureau of Standards Voluntary Product Standard "Custom contact molded Reinforced Polyester Chemical Resistant Process Equipment".

ASTM D-883: "Definition of Terms Relating to Plastics".

ASTM D-2583: "Test for Indentation Hardness of Rigid Plastics by Means of Barcol Impressor".

ASTM D-2563: "Recommended Practice for Classifying Visual Defects in Glass Reinforced Plastic Laminate Parts".

ASTM D-4097-82: "Standard Specifications for Contact Molded Glass Fiber Reinforced Thermoset Resin Chemical Resistant Tanks".

Where design conflicts arise between the various standards, the most stringent design shall be used.

1.4 Quality Assurance

A. Manufacturer: The products furnished under this section shall be by a manufacturer who has been regularly engaged in the design and manufacture of FRP equipment and who has a minimum of ten (10) years experience in design, fabrication and testing of FRP fan and

scrubber systems of the size, materials and scope specified herein, and shall show evidence of at least ten (10) fan and scrubber installations in satisfactory operation. Demonstrate to the satisfaction of the Engineer that the quality is equal to equipment made by the manufacturer specifically named herein. Any manufacturer whose main business is not the manufacturing of FRP scrubbers and fans shall not be accepted as a supplier of the complete system.

The Manufacturer shall maintain a regular production facility. This facility shall be open for inspection by a representative of the Owner or Engineer at any time during the construction and testing of this equipment.

B. Materials of Construction:

1. The scrubber absorber vessel, fan and accessories shall be FRP manufactured using a premium grade vinylester resin. Any material of construction other than FRP will not be allowed.
2. Resin used in fabrication shall be a premium vinylester type such as Hetron 922 by Ashland Chemicals, Derakane 411 by Dow Chemical or approved equal. The resin shall be reinforced using a commercial grade corrosion-resistant borosilicate glass, as manufactured by Owens-Corning, PPG, or equal.

C. Fabrication:

1. General: Fabrication shall be in accordance with ASME RTP-1, NBS PS 15-69, ASTM D 3299 and ASTM D 4097. All non-molded surfaces shall be coated with resin incorporating paraffin to facilitate a full cure of the surface. All cut edges, bolt holes, secondary bonds shall be sealed with a resin coat prior to the final paraffinated resin coat. All voids to be filled with a resin paste.
2. Corrosion Liner: The inner surface of all laminates shall be resin rich and reinforced with two layers of C-veil with a total minimum thickness of 20 mils. The interior corrosion layer shall consist of two layers of 1½ oz. per sq. ft. chopped strand mat. If the application is by chopper gun spray up the glass fiber shall be ½ to 2 inches in length. The total corrosion liner thickness shall be a minimum of 100 mils and have a resin to glass ratio of 80/20. All edges of reinforcement to be lapped a minimum of one inch.
3. Structural Laminate: Structural laminates shall consist of alternating layers of 1½ oz. per sq. ft. mat or chopped glass and 24 oz. per sq. yard woven roving applied to reach designed thickness. The exterior surface shall be relatively smooth and shall have no glass fibers exposed. The exterior shall be surface coated with gel coat containing ultra violet light inhibitors.
4. Flange Connections: Standard flanged fittings shall be used on all installations. The data following applies also to other nozzles that are given separate designations because of their specialized style or function. These would include pump mounting boxes and access ports.

   Flanged nozzles shall be used for piping-up to the reinforced plastic tanks and scrubber. They shall be made of the same resin and construction as the scrubber, and be properly bonded into the scrubber wall and offer the same degree of corrosion resistance. Through-bolting shall be used in lieu of metallic thread inserts or studs.

   Flanged nozzles shall be hand laid-up as separate components with the flange face and the pipe neck formed on the mold as an integral piece. Installation shall be performed after the scrubber structure has been fabricated. Because this is a post-fabrication installation, exacting laminate amounts and sequences must be established to ensure proper rebuilding of strength in the area of the nozzle cutout. The installation laminate must maintain continuity of the inner “corrosion barrier” of

the scrubber wall right out to the flange face.

Flanged nozzles are classified as either Type 1 or Type 2 depending upon the method of installation.

Type 1 nozzles shall be used for top installations particularly where a directed flow stream into the scrubber is required.

Type 2 nozzles shall be used in all other installations that do not meet the Type 1 criteria, i.e. side or bottom installations. The cut edge of the pipe neck shall be more positively covered with the inside lay-up. Where flow rates are critical, or where accessories, such as thermal wells, are to be inserted, a larger pipe size should be used.

The standard nozzle projection shall be 4" from the face of the flange to the closest point on the scrubber wall.

Flange face and bolting correspond to ASA Standard B16.5 for 150 lb. steel flanges. Flange thickness corresponds with 25 psi rated fiberglass pipe and flanges.

Flanged nozzles shall be designed for use only with soft, full-face gaskets. Gaskets shall be 1/8" thick and between 40 and 60 durometer EPDM.

All flanged liquid connections shall be gusseted to the scrubber wall with ¼ inch thick flat plate gussets.

The scrubber shall be equipped with permanently attached lifting lugs suitable for lifting and transporting the scrubber without structural damage. Tie down or support lugs shall be designed to anchor the scrubber and contents as required.

5. Miscellaneous:

   Stainless Steel: Unless otherwise specified, all fasteners, and metal attachments, such as anchors, brackets etc. shall be 316 stainless steel.

   Gaskets: Unless otherwise specified, all gaskets shall be EPDM.

1.5 Submittals

A. The Contractor shall submit complete Shop Drawings for the Scrubber System, together with all piping, ductwork, valves and control for review by the Engineer.

B. Shop Drawings: The Contractor shall submit the following information for approval before equipment is fabricated:

   1. Drawings of system showing assemblies, arrangements, piping, electrical, mounting details, equipment outline dimensions, fitting size and location, motor data, operating weights of all equipment and sufficient information to allow the Engineer to check clearances, connections, and conformance with the specifications.
   2. Materials of construction of all equipment.
   3. Manufacturer's catalog data and operating literature. Specifications, performance data, and calibration curves for chemical recycle pumps, exhaust fan, and auxiliary components.
   4. Complete instrumentation, control, logic and power wiring diagrams in sufficient detail to allow installation of the instrumentation, controls and electrical components.
   5. Manuals: Furnish manufacturer's installation, operation and maintenance manuals, bulletins, and spare parts lists.

C. Design Calculations: The Contractor shall submit complete design calculations for the Scrubber System to confirm the following:

1. The system design calculations must demonstrate a minimum overall system removal efficiency of 99.0% at the maximum inlet design condition.

2. The system shall be capable of withstanding the imposed seismic loads specified. Certified design calculations stamped by a registered professional engineer. Calculations shall include, but not be limited to, the following:

    - Dead loads
    - Live loads
    - Seismic loading per UBC Code
    - Anchor lug attachment to the shell

PART 2 – DESIGN AND PERFORMANCE CRITERIA

2.1 Performance Criteria

Air Flow Rate, scfm: _____

Ambient Air Temperature: _____

Average Inlet H_2S Concentration, PPM: _____

Peak Inlet H_2S Concentration, PPM: _____

Minimum H_2S Removal Efficiency 99%

Average Inlet _____ Concentrations, PPM

Peak Inlet _____Concentrations, PPM

Minimum _____ Removal _____%

Process Air Temp. F 50 - 100 F

2.2 Design Criteria

System Pressure: _____

Scrubber Portion: 6" w.c.

Min, Wind Load: 100 mph

Seismic: Zone 4

2.3 Modular FRP Packaged Absorber System

General: The gas scrubber system shall be a THREE-STAGE, ONE-PASS PACKAGED ABSORBER OF INTIGRATED CONSTRUCTION, designed to remove a minimum of 99.0% of the above criteria in a single pass. The scrubber system shall consist of one gas conditioning/pre-treatment stage followed by two vertical gas absorption sections. The packed bed sections shall include a spray header to distribute the liquid evenly over the packing sections. The gases shall pass through a high efficiency mist eliminator prior to discharging into the stack. An additional mist eliminator shall be added to the first stage if used to neutralize ammonia. The scrubber system shall be equipped with two self-contained recirculation sumps. Overflow piping from last stage shall be designed with the capability to circulate through first stage. Each of the two scrubber sumps shall be fitted with a low level switch.

All piping shall be made of SCH 80 CPVC. All spray nozzles shall be made of polypropylene. The overall system size, including the chemical sumps, pumps, fan, and controls shall be as shown on the

contract drawings. Access manways shall be provided to allow access to the scrubber internals. As a minimum, access Manways shall be provided at the top and bottom of the packing sections, mist eliminator, and top of the chemical sump.

The system shall include all piping, valves, and internals. The material of construction of internals shall be as follows:

Packing Media Support:	Vinylester FRP grating
Packing Media:	Polypropylene
Liquid Distributor:	CPVC
Mist Eliminator:	Polypropylene

2.4 Packing Media

Media shall be designed with a high active surface area for gas/liquid contacting with the following criteria:

A. High mass transfer rates.
B. Low pressure drop.
C. Reduction of interlocking, or "meshing together" of packing pieces.
D. An open structure to minimize fouling and plugging.
E. Reduce channeling and chimney effect.
F. Even liquid and gas distribution.
G. Low wetting point.
H. High flooding points.
I. Chemical resistance.

Packing in each stage shall be sized to accomplish performance criteria. There shall be five feet (5') minimum of media as measured in a vertical plane in each stage (15' total).

PART 3 – EQUIPMENT

3.1 Recirculation Pumps

Each sump shall have a recirculation pump. The recirculation pump(s) shall be a seal-less, vertical, centrifugal type of CPVC construction for corrosion resistance and long service life. No seal water shall be required. The pump(s) shall be suitable for the specific percentage and Ph range of the solutions. There shall be no liquid to metal contact, no seals, no pump bearings, bushings or wearing parts. The drive motor shall be totally enclosed, fan cooled. The pump(s) shall be mounted for easy service on the scrubber system sump and shall be capable of being isolated from service by valves on the discharge sides.

The pump(s) shall be sized by the Manufacturer for proper flow rate and pressure as required for the installation. The pump(s) capacity shall be as follows:

System	**Stage 1**		**Stage 2/3**	
	Pump HP	GPM	Pump HP	GPM

3.2 Chemical Feed System

A. General: The chemical feed and dilution system takes sulfuric acid (if necessary), sodium hydroxide and sodium hypochlorite and dilutes the chemical, and delivers it to the spray nozzle where the chemical solution is circulated through the packing media. The chemical

feed and dilution system shall contain all piping and equipment necessary to deliver chemicals from storage tanks to the scrubber vessel.

B. Chemical Metering Pumps:

1. General: Positive displacement, diaphragm type chemical metering pumps shall be provided to deliver 50% sodium hydroxide, 12.5% sodium hypochlorite and sulfuric acid (if necessary) solution to the scrubber recirculation sump. All chemical metering pumps shall be suitable for 24 hour per day operation. All pumps shall have a minimum discharge pressure of 50 psig.

2. Operating Conditions:

System	Max Flow gph	No. of Pumps Required
Stage 1		
Stage 2/3		

3. The metering pumps shall be mechanically activated, diaphragm type, motor or solenoid driven. Guided ball check valves shall be provided on suction and discharge ports of liquid head and shall have replaceable seat and ball guide.

   Metering pumps with capacities of 7 GPH or more to be mechanically activated diaphragm type, motor driven with 56 c frame motor mounting. Pumps with capacities up to 7 GPH to be mechanical motor or solenoid driven. All pumps to have air gap with bleed hole to prevent product contamination.

   Pumps shall be provided with a stroke adjustment mechanism to independently adjust flow rate of each pump head. Solenoid driven pumps to have 4-20 mA controls contained in the pump housing. Mechanical pumps to have control unit in local control panel.

4. Control: Each pump shall be automatically shut off if a low level is sensed in the appropriate chemical tanks.

5. Manufacturer: The sodium hypochlorite and sodium hydroxide and sulfuric acid (if necessary) metering pumps shall be Pulsafeeder or approved equal.

3.3 Chemical Storage Tanks

A. Bulk chemical storage tanks shall be furnished for containment of 12.5% sodium hypochlorite, 50% sodium hydroxide solution, and sulfuric acid (if necessary). All tanks shall be provided by the system manufacturer.

B. Liquid level control devices shall be provided in each storage tank for each chemical metering pump to shut off the chemical metering pump when the liquid level in the appropriate chemical storage tank has reached it's lowest suction level.

C. The storage tanks shall be provided with a transparent sight glass for level monitoring.

Dimensions: The chemical storage tanks shall have the following dimensions:

Parameter	12.5% Hypochlorite	50% Hydroxide	Sulfuric Acid (If necessary)
Capacity			
Diameter			
Height			
Weight			

3.4 System Piping

All chemical feed, make-up water, and recirculation piping shall be SCH 80 CPVC. All fittings shall be solvent-welded or threaded. All flange gaskets, union seals, valve seals, and other piping seals shall be fully compatible with the chemicals to be used in the regular operation, maintenance, and cleaning of the scrubber system.

3.5 Air Ducts

A. All air ducting from the scrubber system inlet to blower discharge stack shall be supplied by the Manufacturer. Materials of construction shall be FRP.

B. Ducts shall be of sufficient diameter and design to move the air without undue pressure loss. The pressure loss of the combined scrubber system and the duct work shall not exceed the maximum pressure available from the blower.

3.6 FRP Fan

A. Exhaust Fan: Fan shall have fiberglass reinforced plastic housing and wheel, either radial or airfoil depending on volume and pressure.

B. Bearings shall be heavy duty, self-aligning grease lubricated ball type with a minimum of 100,000 hour B-10 life. FRP motor cover shall be provided. Motor shall be TEFC, with a 1.15 service factor and suitable for 3/60/230-460V. Fan shall be belt driven with adjustable drives.

C. Fan housing shall be constructed of fiberglass and reinforced with rigid bracing to increase structural integrity. Bearing support brackets shall be positioned to directly oppose belt tension forces. Fan housing shall be a curved scroll design with a 1" NPT drain connection at the bottom of the fan scroll.

D. The FRP fan shall be manufactured by the scrubber manufacturer.

E. The fan shall be designed for the following specifications:

Exhaust Fan Design Requirements		
Air Flow Rate, cfm		
S. P. up to scrubber Inlet, inches WC		
Total Pressure Drop, inches WC		
Motor HP		

F. Fan shall be HEE Environmental Engineering or equal.

G. Fan inlet shall be provided with a flex boot with 316 stainless steel band.

H. The fan shall be mounted with vibration isolators on a concrete pad or equipment skid.

I. The following spare parts shall be provided:

   a. One (1) Set of Bearings
   b. One (1) Set of Belts

3.7 Instrumentation and System Controls

A. The electrical control panel shall provide electrical control for the exhaust fan, recirculation pumps, metering pumps, pH and ORP control system. Panel shall include a 480V to 110V voltage transformer and motor starters for fan and pumps. A single 480V AC feed shall be supplied to the panel to power the system.

B. The control panel enclosure shall be of stainless steel and rated Nema 4X. The panel shall be mounted on, or adjacent to, the scrubber assembly and factory tested with all other components prior to shipment.

C. The panel shall have the following components or capabilities:

   1. System switch (ON-OFF-AUTO) which will shut all equipment down.
   2. Fan control switch (H-O-A) and push-to-test pilot lamp.
   3. Recirculation pump control switch(s) (H-O-A) and push-to-test pilot lamp for each recirculation pump.
   4. Individual chemical metering pumps switch (H-O-A) and push-to-test pilot lamp.

5. pH controllers for automatic sodium hydroxide injection via the metering pumps. The pH controller shall have an LED display, front panel menu driven operation with illuminated LED radio buttons, password set-up protection, and status indicator for self diagnostic purposes. The controller shall have a 4-20 mA isolated output to operate the chemical feed pump, as well as additional 0-1 mA and 0-5 Vdc outputs. The pH probe shall utilize a differential measurement principle with replaceable salt bridge assembly, and supplied with separate installation compression fitting for easy location in the recirculation line and shall be removable for calibration or inspection without shutdown of the odor control system. This unit shall be AquaMetrix, Inc., or equal.
6. An intendant pH controller shall be provided for Stage 1 and Stages 2 & 3.
7. ORP controller for automatic sodium hypochlorite injection via the metering pumps. The ORP controller shall have an LED display, front panel menu driven operation with illuminated LED radio buttons, password set-up protection, and status indicator for self diagnostic purposes. The controller shall have a 4-20 mA isolated output to operate the chemical feed pump, as well as additional 0-1 mA and 0-5 Vdc outputs. The ORP probe shall utilize a differential measurement principle with replaceable salt bridge assembly, and supplied with separate installation compression fitting for easy location in the recirculation line and shall be removable for calibration or inspection without shutdown of the odor control system. This unit shall be AquaMetrix, Inc., or equal.
8. Low-level switches and an alarm shall be provided for the scrubber sumps.
9. Alarm lamps indicating low level in the chemical storage tanks or the recirculation liquid sump. These alarms will also shutdown the metering pumps or the recirculating pumps to avoid dry running pumps.
10. Provide a fan flow switch and alarm on control panel which will shutdown complete system when low airflow occurs.

3.8 Optional Equipment

A. Hydrogen Sulfide Recorder/Controller System capable of measuring and recording accurately the hydrogen sulfide concentration at the inlet, mid-point and outlet for the odor control scrubber. The unit shall control chemical additions as needed, without overdosing, maintaining the lowest pH level necessary to achieve the predetermined hydrogen sulfide emission levels at the scrubber exhaust. System to be configured for a single, two or three-stage odor control scrubber.

B. Mist Eliminator Wash System consisting of a liquid distributor with nozzles shall be provided to manually spray dilute hydrochloric acid.

C. Water Softener consisting of an automatically controlled, brine regenerated, twin, alternating, resin bed type water softener system rated for the maximum design condition of the required make-up water flow.

D. Chemical Sump Heater Installation and Controls. Chemical solution sumps are to be insulated with 2” insulation and covered with an additional FRP shell for mechanical protection. An immersion heater in each sump shall be installed with an integral thermostat controller. Unit shall be corrosion resistant and powered from the unit control panel. All wiring shall be factory assembled and tested prior to shipment.

3.9 Accessories

A. Make-up Water Control: Make-up water controls shall be provided to insure a water flow to the system of constant pressure and flow rate.

B. The make-up water control system shall consist of (at a minimum):

1. One (1) main shut-off ball valve.

2. One (1) back-flow prevention check valve.
3. One (1) pressure regulator.
4. One (1) rotameter type flow meter.
5. One (1) adjustable flow control valve (may be integral part of rotameter).
6. All of the above equipment shall be sized as necessary to provide adequate pressure and flow conditions for system operation as determined by the Manufacturer.

C. Scrubber Recirculation Sump Blowdown: The scrubber shall be operated with a manual blowdown. The rate of blowdown shall be controlled by overflow to the scrubber tower drain line proportional to the make-up water added.

D. Differential Pressure Gauges: Two magnehelic type pressure gauges shall be provided to monitor pressure drop across the scrubber and the mist eliminator.

E. Overflow Control: An overflow line equipped with an internal water seal shall maintain a minimum freeboard of 6 inches as measured from the maximum liquid level to the invert of the air inlet connection at the scrubber while under normal system operating air pressure.

PART 4 – MANUFACTURER'S QUALIFICATIONS

4.1 General

The Manufacturer shall be one recognized and established in the design, production and manufacturing of FRP fan and scrubber systems.

A. The Manufacturer of this equipment shall be one that is engaged in the production of FRP equipment and shall manufacturer the fiberglass fan and scrubber in its entirety.

B. The Manufacturer shall have a minimum of ten (10) FRP fan and scrubber installations within the past ten (10) years.

C. The Manufacturer shall maintain a regular production facility. This facility shall be open for inspection by a representative of the Owner or Engineer at anytime during the construction and testing of this equipment.

D. The system shall be manufactured by:

HEE Environmental Engineering
Chino, California 91710

4.1 Substitutions

Any substitutions or deviations in equipment or arrangement from that shown on the drawings or specified Manufacturer herein shall be the responsibility of the Manufacturer or Contractor. Any deviations must be accompanied by detailed structural, mechanical, and electrical drawings and data for review by the Engineer. All costs associated with review of substitutions or deviations and costs associated with project drawing changes as a result of approval of such shall be borne by the Manufacturer or Contractor. There shall be no additional costs to the Owner due to substitutions or deviations.

PART 5 – EXECUTION

5.1 Inspection and Testing

A. The Contractor shall be responsible for the successful start-up and testing of the odor control facility. The Contractor shall provide all necessary equipment, manpower, chemicals, tools, instrumentation, and laboratory testing services required during this phase of the work.

B. Upon completion of the installation, each piece of equipment and each system shall be tested for satisfactory operation without excessive noise, vibration, overheating, etc. All equipment must be adjusted and checked for misalignment, clearances, supports, and adherence to safety standards.

5.2 Start-up

A. Test Procedures: The performance tests shall be conducted at such time as all anticipated odorous air streams are present in the scrubber inlet. The time of the tests and detailed test procedure shall be submitted for approval prior to the testing period. In the event hydrogen sulfide levels are below anticipated levels, Contractor shall augment hydrogen sulfide levels in the influent airstream so hydrogen sulfide is within $\pm$ 2 ppm of design level.

1. During testing, chemical feed and scrubber overflow, recirculation and scrubber air flow rates shall be held constant. Changes in scrubber system operating conditions shall not be permitted. All fine-tuning of operating conditions shall be performed prior to testing.
2. Design operating conditions shall be maintained for a minimum of six (6) hours. During this time, all pertinent operating parameters shall be monitored and recorded, sufficient sampling and analysis shall
be conducted to demonstrate that flow rates, temperatures and solution concentrations are at design conditions.
3. Hydrogen sulfide concentration shall be measured in each scrubber inlet and outlet. As a Minimum, the test shall be conducted for one (1) hour at the average H_2S level, one (1) hour at the peak H_2S level, and the balance of four (4) hours on actual plant odor conditions. Inlet and outlet levels shall be measured once every fifteen (15) minutes using a portable H_2S analyzer such as Interscan, Jerome or equal.
4. The performance of the system shall be demonstrated to reduce hydrogen sulfide to meet with the odor control levels set forth in these Specifications.
5. If required, Manufacturer shall make any changes to the system, at his own expense, that may be necessary to assure satisfactory and efficient operation of this system.

5.3 Operation and Maintenance Manuals

Six manuals shall be submitted prior to final acceptance of the equipment.

5.4 Chemicals

All start-up and testing chemicals shall be provided by the Contractor.

5.5 Identification

The chemical tanks shall be identified with the health flammability and reactivity of hazardous materials as required by codes.

5.6 Manufacturer's Services

The system manufacturer's representative shall be present at the job site for the following time period; travel time excluded:

1. Eight hours for inspection and certification of the installation.
2. Sixteen hours to carry out performance testing and to train Owner's staff in operation of the system, including chemical handling procedures.
3. Provide one four-day trip for tasks 1 and 2 above.

5.7 Warranty

The Manufacturer shall guarantee that the scrubber system will perform as described in these Specifications. The Manufacturer shall warrant scrubber system, complete, to be free from defects in materials or workmanship for a period of one (1) year after installation.

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