

PART 1. GENERAL

- A. The general provisions of the Contract, including General and Supplementary Conditions, apply to the work detailed in this specification.

PART 2. RELATED WORK

- A. Site Work
- B. Concrete
- C. Mechanical
- D. Electrical

PART 3. QUALITY ASSURANCE

- A. **Experience:** The system shall be produced by a manufacturer of established reputation with a minimum of five (5) years experience supplying the specified equipment in similar applications.
- B. **Installation:** Provide a qualified manufacturer's representative to supervise the work related to equipment installation, check out and start up.
- C. **Training:** Provide a technical representative to train Owner's maintenance personnel in the operation and maintenance of specified equipment.

PART 4. SUBMITTALS

A. Product Data

- 1. Submit Product Data in strict accordance with the requirements of these specifications.
- 2. Restrict submitted material to pertinent data. For instance, do not include a manufacturer's complete catalog when pertinent information is contained on a single page.

B. Engineering Drawings

- 1. Submittal engineering drawings must include the following:
 - a) Equipment general layout
 - b) Electrical layout
 - 1. Provide UL listing card or equivalent document of a Nationally Recognized Testing Laboratory from the company building the electrical panel(s) and attach with the electrical drawings indicating that the electrical panels will be built to the required standards (see section 11.10 Electric Control Panel).

- c) Mechanical layout
- d) Floor plan view
- e) Isometric view with bill of materials
- f) Any related in-ground electrical or mechanical installation

C. Operation and Maintenance Manual

1. Assemble and provide copies of manual in 8.5 x 11 inch format. Fold out diagrams and illustrations are acceptable. Manuals shall be reproducible by dry copy method.

D. Supplier Qualifications

1. The supplier shall have been regularly engaged in the design and supply of the type of equipment specified herein, for a period of not less than five (5) years.
2. The wash system, high pressure cleaning systems, pumping stations and all electrical controls shall be designed and supplied by one supplier.
3. All similar items shall be the products of one manufacturer.
4. The equipment specified herein is based on the system model Ultra as supplied by InterClean Equipment, Llc. (800-468-3725) or engineer-approved equal.

E. Approved Equal Status

1. No deviations from these specifications will be allowed unless approved by the Owner in writing prior to bid closing.
2. All bidders with an "Approved Equal Status" shall submit the following with their bid package:
 - a) A complete list of three brush roll over systems manufactured and installed by the bidder. The list shall include all such installations made by the bidder in the last five (5) years, including the duration of service and application. Should the reference list have more than twenty-five (25) names, a list of the last twenty-five (25) installations shall suffice.
 - b) Provide the name of a contact person at each location that is familiar with the operation and maintenance of the wash system.
 - c) Based on the information supplied and discussions with the contact persons named, the engineer will determine the acceptability of the proposed supplier and the equipment.

PART 5. WARRANTY

- A.** Warranty work specified herein is for one (1) year from the date of substantial completion against defects in materials. Defects shall include, but not be limited to:
1. Operation: Noisy, rough or substandard operation
 2. Parts: Loose, damaged and missing parts
 3. Finish: Abnormal deterioration

PART 6. SCOPE OF WORK

- A.** To furnish a completely automatic, combination three brush roll over/touchless vehicle wash system which washes the front, roof, rear, sides, wheels and chassis of the owner's specified vehicles a water recycling system shall also be furnishes.
- B.** The supplier is to be responsible for the supply of necessary equipment, materials and service for the complete assembly and erection of the equipment so that it is ready for operation as per these specifications.

PART 7. WASH SYSTEM PERFORMANCE

- A.** The equipment specified herein is based on the system model Ultra Gantry Wash System as supplied by InterClean Equipment, llc. (800-468-3725) or engineer approved equal.
- B.** Regardless of the Owner's approval for any deviations and/or changes, the supplier is solely responsible for the performance of the supplied equipment per these specifications. All equipment and equipment functions must be built and designed to these specifications.
- C.** Should the equipment not perform as per these specifications, the supplier shall modify, add and/or alter the equipment supplied at his own expense until the performance is satisfactory.
- D.** The equipment offered shall be the latest standard product, modified as necessary to meet the requirements of this specification, of a type that has been commercially available and in satisfactory use for at least five years.
- E.** Entry traffic light shall indicate the wash is ready for use. Green light signals the driver the wash is ready. Red light signals the driver the wash is in use or there is a system fault.
- F.** Vehicles entering the wash area will receive a chassis wash, and stop just prior to the Ultra gantry. The driver shall be signaled to stop by a red traffic light on the gantry frame.

- G.** The chassis wash and gantry will start automatically unless the driver has placed the wash from Auto to Standby Mode via a push button control box prior to entering the vehicle.
- H.** The gantry will first apply softened water detergent solution to the vehicle from the front to the back. Solution will be applied to completely cover the front, roof, sides and back.
- I.** Once the gantry reaches the back of the vehicle the chemical application will stop and return to the start point.
- J.** When the gantry gets to the front of the vehicle and the detergent solution has loosened the soil, the brushes and, or high pressure will start. The wash program will allow for adjustment for the amount of dwell time for the detergent before the next wash pass.
- K.** The brushes move into the front of the vehicle. The front area of the vehicle is cleaned by overlapping side brushes and or the roof brush depending on the wash program selected.
- L.** High Pressure Spray Cycle. The gantry machine will have a high pressure spray arch to allow for touchless cleaning of the vehicle. The high pressure spray arch will allow for touchless cleaning of the front, sides, top, and rear of the vehicle. The vertical spray arches will pivot to allow water to be directed at the front and rear of the vehicle. High pressure pump will be 30 HP capable of 130 psi and 200 gallons per minute. High pressure water shall be recycled water. Electric motor for 30 HP pump shall have a soft start for reduced power usage during starting.
- M.** Brushes will automatically continue to wash the side and top brush the roof of the vehicle working to the rear of the vehicle.
- N.** Side brushes will move into the back of the vehicle cleaning with an overlapping side brush and or top brush depending on the wash program selected.
- O.** While the side brushes are scrubbing the sides of the vehicle and the machine travels to the rear the top brush will clean the top surfaces of the vehicle.
- P.** Rinse Cycle, following the Brush and/or High Pressure Spray Cycles, the gantry will complete a final rinse pass.
- Q.** Once the final rinse pass is complete a traffic light will turn green signaling the drive to exits the wash bay.
- R.** The supplier is responsible to design the equipment to satisfactorily wash up to 10 vehicles per hour. The vehicle wash shall be able to remove all visible heavy dirt accumulation and most of the road film

from the Owner's vehicles using only a mild alkaline detergent. The amount of detergent used per vehicle to remove road film shall not exceed 0.1 gallons. The evaluation of the system capability to remove road film shall be determined only after washing has been completed and the vehicles have dried.

- S. The vehicle wash system must be capable of washing specified vehicles up to **13' in height** depending on the wash program selected, including the following:
 1. Cars, Pick-ups, Vans
 2. Buses, including articulated 60'

PART 8. WATER RECLAMATION PERFORMANCE

- A. The water reclamation system shall be capable of reclaiming water from the vehicle washer and process it by means of settling pits, in-line filters, centrifugal filter system, and bio-remediation system. The system must be able to continuously supply an adequate amount of water for the high-pressure pump regardless of traffic volume through the washer.
- B. Prior to final acceptance of the system by the owner, the supplier shall demonstrate the continuous operating capacity of the reclamation system in relation to the bus wash system by running (on manual override) both the high pressure wash system and the water reclamation system for a period of 60 minutes (without a pause, except to reset for the maximum cycle time interruption). During the 60 minute test, no manual or automatic solenoid shall be allowed to fill the reclamation tank with fresh water should the sump pump capacity be not able to keep the recycled water tank full.
- C. Regardless of technical specifications, the equipment supplier explicitly assumes the responsibility to design the water reclamation system for the intended purpose and has made themselves familiar with all performance requirements prior to bidding.
- D. All equipment located outside the immediate wash bay area, including reclamation tank, high pressure pump, sump pump, aeration pump, booster pump, cyclonic separators, electrical panel, bio-remediation, and all float switches, must be mounted **on a single, modular skid assembly and shall not require any more than 30 square feet of floor space.**

- E. The reclaim equipment module shall be tested for all plumbing connections (**pressure tested**), all electrical circuitry, pump rotations and for all component functions at the factory prior to shipping.
- F. **Odors must be kept in total control without the use of any chemicals including ozone, enzymes, bacteria or masking agents.** Algae build-up in wash water that will results in objectionable odors is not acceptable to the Owner.
- G. The above ground tank or tanks must be of self-cleaning type and shall be designed not to accumulate any dirt build-up.
- H. A Bio-Remediation system shall be included in the total system design. The bio-remediation system shall be designed to eliminate and/or reduce the total load of hydrocarbon loading within the recycled water body. The system shall include and consist at least the following components:
 - 1. Enzyme dispensing system
 - 2. Accelerator dispensing system
 - 3. Dissolved oxygen and aeration system.
- I. Pick up pump for water from the pick up pit to be 7.5 horse power with a soft start.

PART 9. MECHANICAL INTERCONNECTING PIPING

- A. All field plumbing and mechanical work will be done by the Mechanical Contractor or General Contractor, including:
 - 1. Water and gas utilities up to and connecting to the equipment.
 - 2. Interconnecting piping between various equipment components located in the equipment room.
 - 3. Interconnecting piping between the equipment located in the equipment room and the equipment located in the wash bay.
 - 4. Furnish and installation of:
 - a) Backflow preventer
 - b) Grating for trench
 - c) Duct for Water Heater

PART 10. ELECTRICAL INTERCONNECTING WIRING

- A. All field electrical work will be done by the Electrical Contractor or General Contractor, including:
 - 1. Electrical service up to and connecting to the equipment panel.
 - 2. Interconnecting wiring between various equipment components located in the equipment room.

3. Interconnecting wiring between the equipment located in the equipment room and the equipment located in the wash bay.
4. Furnish and installation of:
 - a) Underground conduits (if required) to be laid when concrete pad is being poured.

PART 11. WASH SYSTEM TECHNICAL SPECIFICATIONS

A. Gantry Structure

1. All main frames of the gantry shall be hot dipped galvanized steel. Aluminum frames are unacceptable. The frame structure of the gantry is to be enclosed with stainless steel splash guards. Fabric side covers are not acceptable. All motors and gearboxes contained on the gantry shall be protected from water infiltration. Floor rails are to be hot dipped galvanized. Gantry machine shall be equipped with anti-derailing protection devices. The gantry drive system shall be a direct drive system using VFD drives.

B. Brushes

1. The gantry system shall be equipped with two vertical side brushes and one horizontal roof brush. Brush motors to be three horse power motors with high efficiency helical-bevel gearboxes allow for smaller motors to be used, thus minimizing power consumption. Stainless steel splash guards minimize over spray. The side brushes shall be suspended from the top and be of full length to cover the sides of the owners vehicles. The side brushes shall also be capable of washing the fronts and rears of the vehicles multiple times with overlapping movement. The wash system shall be capable of multiple wash programs to accommodate the various vehicles in the owner's fleet. All brush movements will be controlled by electric motors drive by variable frequency drives (VFDs). The brushes will maintain brush crush via a torque feedback mechanism. VFG amperage will be monitored by the gantry PLC controller. The PLC will use a proportional, integral, and derivative (PID) closed loop to adjust brush position based upon the amperage readings from the VFDs. In addition to this reactive control, brush locations will be positively identified and tracked by the PLC at all times. The operator will be able to use

the torque feedback loop for reactive brush crush control or establish a pre-programmed brush path that the machine will automatically follow. Both brush position and brush rotational speed will be programmable if the pre-programmed path is desired. Gantry system shall also have a built in over torque safety alarm in the case of a malfunction or operator error. If the system senses the fault it will automatically shut down and announce the fault on the touch screen. Resetting the system shall be by resetting the alarm or breaker switch.

2. The side brushes shall also have a mirror detection system that will move the side brush away from mirrors to minimize any potential damage to the side mirrors. Brush shall also have a built in over pressure safety alarm in the case of a malfunction or operator error. If the system senses the fault it will automatically shut down and announce the fault on the touch screen. Resetting the system shall be by resetting the alarm or breaker switch.
3. Bristles shall be polyethylene material that is "X" grooved to help facilitate water and chemical delivery to the vehicle surfaces. The tips of the brushes shall be flagged to provide a soft touch to reduce the effect of transference of the poly material onto the vehicle surfaces which gives the appearance of scratching. Each brush section shall have of a pliable plastic backing which is mounted to the 4-3/4 inch diameter hot dipped galvanized core. The wall thickness of the core shall be 0.16 inch minimum.
4. Each brush will have a manifold to spray on a mixture of water and detergent. Spray manifolds to be stainless steel with stainless steel nozzles. Galvanized, aluminum, pvc, and brass are not acceptable for manifold and or nozzles.
5. Detergent injector for brushes shall be Inject-O-Meter, InterClean DM or engineer approved equal with adjustable chemical injection ratio from 1:20 to 1:100. The ratio of detergent delivery (by the injector) must be readable on the injector calibrated settings. The detergent injector must be of the positive displacement type.
6. The system shall have a water 3 horse power minimum booster pump with pressure regulator to ensure even water pressure.
7. The chemical spray components located in the equipment room must be assembled in a modular, wall-mounted assembly.
8. A water softener for the detergent arch is required to be included by the supplier if the domestic water exceeds 3 grains of hardness.

Should the water softener not be needed, the supplier shall provide to the Owner testing results proving the water hardness is acceptable (3 grains or lower).

9. Water Heater for detergent arch – Chemical arch shall be supplied soft water, heated by a 199,000 BTU natural gas heater supplied as a part of the equipment package.

C. Supply cables, water lines and utility support.

1. A festoon system shall be supplied to carry the electric and water utilities to the gantry. All steel components of the festoon system shall be hot dipped galvanized.

D. High Pressure Rinse

1. The high pressure rinse shall be located on the gantry and supplied with reclaimed water.
2. The gantry mounted arch shall have appropriate amount of nozzles to cover the entire bus.
3. It is solely the supplier's responsibility to design and build the high pressure arches to meet the specified operational characteristics. All high pressure arches shall use recycled water and all recycled water shall be filtered via the reclaim equipment module.
4. All bidders are notified and are aware of the fact that the sides of most transit buses are not well suited to be washed by high pressure due to the issues related to leaking (high pressure water penetrating inside of the bus). It is bidder's responsibility to design the system taking this into consideration.
5. It is the supplier's responsibility to design the system to be safe for all buses and still be able to provide adequate cleaning performance on fronts, sides roofs, wheels and rears of the buses.

E. Tire Guides

1. Tire guides shall be fabricated from 4 inch diameter galvanized steel pipe headings, supported at 5 foot intervals, to provide guide runs on both sides of the vehicle. There shall be two sets of tire

guides one set at the entrance of the wash and one set at the home position of the gantry.

2. The system shall have an angled entry. The ends of the rails are capped, and all headings are smoothly finished to prevent tire damage. Brackets supporting the pipe shall be made of a minimum 3/8" steel plate that is welded to concrete imbedded cleats or anchor bolted to the concrete.
3. One set of stainless-steel skid plates shall be provided at the entrance guide rail to assist in vehicle alignment.

F. Controls Panel and Components, motor starter panel, gantry panel and master control panel.

1. The panel and controls must be built according to these specifications. No substitutions shall be allowed.
2. The industrial control panel shall be manufactured and evaluated in accordance with the Underwriters Laboratories, Inc. (UL) standard 508A (Industrial Control Panels). In addition, the panel shall be evaluated for high capacity short circuit withstand and shall bear the appropriate UL marks including the short circuit withstand value mark as part of the official UL label.
3. Electric panels that are not UL approved are not acceptable.
4. The industrial control panel shall be designed for operation on a 460 Volt, 3 Phase, 60 Hertz system, with a short circuit capacity of 25,000 amperes RMS Symm. Available at the incoming line terminals of the control panel.
5. The industrial control panel shall be designed to meet the requirements of the National Electric Code (NEC) Articles 430 and 670, and the National Fire Protections Association (NFPA) Standard 79 (Industrial Machinery).
6. A graphical user interface (touch screen) shall be supplied in order to set up different wash programs, monitor and report all system function in near real time to the owner. Screen display shall be 18 inch minimum. System to have capability of a minimum of eight different wash programs.
7. System shall record a total wash count and a wash count for each wash package.

G. Water Reclamation System

1. Reclaim system shall have a low level float installed in pick up chamber to automatically shut down the system should the water level drop below a set point for pump protection. Provide a second pit fill float located in pick up chamber.
2. **Sump Pump**
 - a) Self priming type for transferring water from sump pit to the above ground recycled water tank through the filtration system. Minimum capacity shall be 300 GPM of cleaned water.
 - b) The capacity of sump pump shall allow for the pressure losses from two cyclone separators used in series and GPM after the pressure losses shall be bigger or equal to the high pressure wash water usage.
 - c) The sump pump shall be designed to handle solids that will be found in wash water. Pump motor to be 7.5 HP minimum with soft start.
3. **Cyclone Separators**
 - a) **Two** (minimum) **cyclone separator systems used in series**, the cleaned water from the first cyclone shall pass through the second cyclone separator to ensure maximum solid removal performance. Two cyclone separators shall be provided in series with at least one of them being in-line. (no substitutions)
 - b) Cyclone Centrifugal Separators shall provide second and third stage filtration.
4. **Cyclone Solid Removal**
 - a) Downflows (purge water from cyclone separators containing solids) from cyclones separators shall pumped back to the exit end of the trench pit with a solid handling pump. The pump to be 2 horse power minimum. The 2 horse power pump shall also pick up (in take pipe) water from the last recycle pit chamber to clean the pickup chamber under the stainless steel pump pick up filter below. Solid removal from cyclone separators by gravity alone shall not be acceptable.
5. **Aeration System**
 - a) Aeration system shall provide air into the trench pit to prevent algae and odor build-up. Aerated water shall be evenly distributed throughout the pit even when the wash system is not operational. The system shall be designed to have no odors

from algae. No odor masking deodorants or other chemical use to kill odors shall be allowed.

6. Stainless Steel Pump Intake Filter

- a) Stainless Steel Intake Filter Screen to provide first stage filtration for sump pump intake. The pump intake filter shall be InterScreen or engineer approved equal and shall be sized 0.015" or smaller.
- b) The intake filter shall be made of stainless steel and shall have slotted orifices, wire mesh filters are not acceptable. Intake filter shall prevent any dirt from clogging the recycled water spray nozzles under all circumstances.
- c) Intake filter screen shall be equipped with high-pressure air back wash system that is automatically activated by the reduced flow into the pump intake. System manufacturer to supply 20 gallon 120 volt air compressor for back wash

7. Reclamation Tank

- a) Reclamation Tank shall be made of linear low-density polyethylene with a minimum holding capacity to allow recycling a minimum of 300 GPM continuous operational flow.
- b) The tank shall be 500 gallon minimum and have conical bottom with minimum of 35-degree slope equipped with a 6" bottom manhole, float switch connections and other required fittings. The tank to be equipped with the steel support structure with 1/2" thick polyethylene continuous support for the cone part of the tank.

8. Enzyme-Catalyzed Water Treatment System

- a) A biological water treatment system shall be included in total system design. This water treatment system, the Enzyme-Catalyzed Water Treatment System, shall be designed to eliminate and/or reduce the total petroleum hydrocarbon loading within the recycled water body. When used in conjunction with the specified recycling equipment, the systems shall remove both organic contaminants and inorganic particulate from the reclaimed water stream.
- b) The Enzyme-Catalyzed Water Treatment System shall be equipped with an automatic product injection system for delivery of specialized biological products and enhancements. These biological products shall be specifically suited for wash water treatment applications, including degradation of petroleum

hydrocarbon components commonly found in vehicle wash systems. This system will treat the reclaim wash water generated during the vehicle wash process. The bulk of the treatment process shall take place in the wash water pit, where continuous biological treatment of organic wastes in the vehicle wash water shall occur.

- c) The Enzyme-Catalyzed Treatment System shall deliver a constant supply of biological products, bio-enhancements, and oxygen to support degradation of organic constituents. The biological products and enhancements shall be injected directly into the circulation/aeration discharge pipeline of the recycling system, where they will then subsequently be discharged into the wash water pit. Oxygen shall be provided by the aeration pumping and mixing system.
- d) The automatic product injection system shall consist of low-flow injector pumps that inject biological products on a continuous basis.
- e) Water recycle system to include a ozone and UV water treatment system.

H. Entry Chassis Wash

- 1. Chassis wash shall be provided at the entrance of the wash. The chassis wash shall have a 2 inch schedule 80 galvanized manifold with minimum 9 25-60 HU nozzles. Chassis manifold installed below finished floor.
- 2. Chassis wash to be recycled water, electric motor to be minimum 5 horse power TEFC.
- 3. Activation of chassis wash will be by photo eyes, cutler hammer 24 volt DC. Stands for photo eyes to be 304 Stainless Steel.

I. Blower System Optional

- 1. Blower frame to be constructed of hot dipped galvanized steel tubing, aluminum or 304 stainless steel and have appropriate angle braces.

The frame shall be totally self-supporting, no braces to the wall or ceiling to be required.

2. Blower producer housings to be constructed of roto molded high density plastic, aluminum or stainless steel.

3 The (6) blower housings shall be configured on the frame as follows:

4. (2) blower housings on the top, and (2) blower housings on each side.

5. Each blower housing shall be adjustable in both up and down directions. The blower shall attach to the main frame with a clamping device to allow for field adjustments.

6. Electric motors shall be 10 HP 480V, 3 phase, TECF with minimum efficiency of 88.5%. Each blower producer shall deliver 4,200 CFM @ 135 MPH air velocity.

7. Air intake of blower housing shall have a screen mesh to prevent debris from entering blower fans.

13 Blower Electric Panel and Components

1. The panel must be built to these specifications. The panel shall include all motor starters and disconnect switch. The enclosure shall be NEMA 4X stainless steel minimum.

2. The panel will have the ability to stagger start the motors in order to minimize the inrush amps at start up.

3. Electric Panels that are not UL approved are not acceptable.

4. Electric panel must communicate and report to the master bus wash controller, located at the master control panel. The communication must utilize the same software as the master controller. Communication shall be done via ethernet, with remote i/o board built into the blower electric control panel.

5. Photo eyes for activation shall be water resistant and designed for wet environments. Stands for photo eyes shall be 304 stainless steel.

14. Reverse Osmosis (RO) System Optional

- a. RO system shall be capable of producing a minimum of 6,600 gallons per day of permeate water.
- b. System design shall be based upon the hardness test of city water supply and shall produce water quality that will provide spot free, non-etching quality rinse water for bus wash systems.
- c. RO system shall include the following as standard equipment:
 - 1) Water softener
 - 2) Activated carbon filter
 - 3) Cartridge pre-filter
 - 4) 925 gallon reject RO water tank
 - 5) 925 gallon accepted RO water tank
 - 6) Piping and connection between equipment shall be provided as required for complete an operable system.
 - 7) Control Panel
- d. Water Softener:
 - 1) The water softening system shall be used as a pretreatment system prior to delivering water to the RO system
 - 2) Water softening system shall reduce the hardness to less than 3 grains of hardness.
 - 3) Water softener shall be capable of handling a flow rate of 43 gallons per minute at a continuous pressure of 50 PSI with a pressure loss not exceeding 15 PSI.
 - 4) The system shall have a softening capacity of not less than 60,000 grains of softening capacity per regeneration when a salt dosage of 18 pounds per tank is used.
 - 5) Resin tank shall be sufficient to allow adequate expansion of the resin during backwashing. Tanks shall be designed for an operating pressure up to 120 PSI.
 - 6) Each resin tank shall be manufactured of fiberglass reinforced polyester and reinforced by a continuous roving

glass filament overwrap. The tanks shall be supported by a molded polypropylene structural base.

- 7) Each softener tank shall be equipped with a soft water collector and backwash water distributor consisting of a plastic riser pipe with a fine-slotted plastic strainer attached to the bottom of the pipe, covered with a minimum of 3 inches of underbed sand to ensure even distribution of water.
- 8) Each softener tank shall be equipped with an upper distributor that distributes water laterally to ensure maximum water softening capacity.
- 9) Each softener tank shall be provided with 3 cubic feet of resin having an exchange capacity of 30,000 grains per cubic foot when regenerated with 15 pounds of salt. The media shall be solid, not more than 4 percent through 40 mesh U.S. standard screens.
- 10) Combination salt storage and brine tank with cover shall be molded of corrosion-proof, high-density polyethylene.
- 11) The brine tank shall be equipped with an elevated plate for brine collection, and a chamber to house a brine valve assembly.
- 12) The brine valve shall automatically open to admit brine to the resin tank during eduction and close automatically to prevent introduction of air into the resin tank. During refill, the brine valve shall regulate the flow of soft water into the brine tank working with the timed refill feature of the softener control valve.
- 13) The brine valve shall include a float-operated safety shut-off valve, as a back-up to the time refill valve on the control, to prevent brine tank overflow.
- 14) The control valve shall be of all-brass construction and have a 1-1/2 inch NPT inlet and outlet.
- 15) Control valve shall be a motor-driven, mechanically-activated design with six positions to accomplish the regeneration steps of backwash, brine draw-slow rinse, fast-rinse, re-fill and standby in addition to the service position.
- 16) The control shall be fitted with a fixed orifice eductor nozzle and a self-adjusting backwash flow control.

- 17) The automatic control shall include a meter located on the outlet side of the water softener. The meter shall be directly connected to the cycle timer by a cable.
 - 18) An electrically-operated timer shall be provided to control the regeneration and to alternate the tank in service. The timer shall activate a motor drive which shall shift the standby tank to the service position, perform the regeneration functions on the exhausted tank and leave it in the standby position. The timer shall allow individual adjustment for the length of the backwash, brine-rinse, fast rinse, and refill cycles.
 - 19) RO permeate final rinse to be 21 gallons per minute
 - 20) RO reject water shall be stored in a separate water holding tank to allow for the reject water to be used in either the chemical application or a pre rinse. Water storage tank to be 975 gallons minimum. Top for tank shall have a overflow to the sanitary sewer or back to the below ground water recycle tanks.
- e. Stainless steel frame: RO components are mounted over a stainless steel fabricated frame. The frame dimensions are:
- 1) Width: 28 inches
 - 2) Length: 32 inches
 - 3) Height: 54 inches
- f. RO membrane elements are thin-film composite (TFC), 4 inch diameter and 40 inches long. The design salt rejections shall be 98 percent based on 2000-PPM water and 225 PSI at 77 degrees F. Three RO elements are used to get 6600 GPD of clean water (permeate).
- g. RO element housings shall be constructed of composite material. Clamps hold the end caps in place. Each housing assembly is complete with O-rings.
- h. The single activated carbon filter shall be properly sized for the inlet flow rate of the RO assembly. The filter shall remove chlorine and prevent RO membrane damage. Automatic backwashing system removes the trapped contaminants within the filter and washes them down the drain. Activated carbon filter shall be connected by a 1 inch hose.
- i. Cartridge pre-filter shall be attached at the inlet of the RO system. The filter shall be rated for 5 micron nominal. The filter housing

will include a built in pressure relief valve to collect any particles larger than 5 microns.

- j. The pressure sensor at the inlet pump shall monitor the inlet pressure. If the flow drops below a certain value, it will cause the HP pump to stop. It will also trigger the inlet solenoid to stop the flow of water.
- k. The pressure sensor at the outlet pump shall monitor the system pressure. The operating pressure shall be 230 PSI. The sensor shall stop the HP pump if the system pressure rises above 250 PSI. The minimum operating pressure should be no less than 200 PSI.
- l. The inlet solenoid valve shall shut off/on the water supply to the RO system.
- m. A pressure gauge shall be provided to monitor the pump outlet.
- n. A pump throttle valve shall be included to control the pressure.
- o. A flow control valve shall control the concentrate at the outlet of the RO system. The valve along with the pump throttle valve should be used to adjust the systems pressure and flow rate of concentrate and permeate.
- p. The concentrate outlet solenoid valve open and closes during automatic flushes.
- q. The flow meter shall measure the flow of permeate and concentrate at the product and concentrate line. These flow meter are panel mount type with horizontal connection, range 1 to 10 GPM.
- r. The High pressure pump will be used to produce an operating pressure of 230 PSI at the inlet of the RO membrane.
- s. Control Panel: The control panel shall consist of a PLC and HMI to control the pumps and valves mounted to the RO frame. The PLC shall be an Allen-Bradley MicroLogix 1100 or better. The HMI screen shall be at least 7", a touch screen, and an Allen-Bradley PanelView 800 or better.
- t. The control panel shall allow for manually operating the inlet valve and flush valve, as well as jogging pumps.
- u. From the HMI, the control panel shall allow for the adjusting of the following set points:
 - 1) Inlet pressure minimum PSI

- 2) Outlet pressure minimum PSI
- 3) Outlet pressure maximum PSI
- 4) Outlet conductivity maximum Siemens
- 5) Flush activation time on
- 6) RO auto flush activation
- 7) Inlet pressure minimum fault on delay
- 8) Outlet pressure minimum fault on delay
- 9) Outlet pressure maximum fault on delay
- 10) Outlet conductivity maximum fault on delay
- 11) Tank fill on delay
- 12) Tank fill off delay

v. The control panel shall show faults for the following:

- 1) Emergency stop pressed
- 2) Pump fault
- 3) Circuit breaker tripped
- 4) Inlet pressure minimum
- 5) Outlet pressure minimum
- 6) Outlet pressure maximum
- 7) Outlet conductivity maximum

- A. Equipment shall be installed in accordance with manufacturer's supplied installation drawings.
- B. Equipment supplier shall undertake the commissioning of the system and make all required adjustments to ensure proper operation.
- C. The equipment manufacturer shall start up the system. The Owner shall have all operating personnel present during the start up and equipment training.
- D. The supplier shall arrange for an adequate amount of detergent to be available for the performance testing. Minimum 5 gallons of detergent and 5 gallons of brush lube product.
- E. The Owner's personnel shall be trained for a minimum of three (32) hours in the system's operation and maintenance.
- F. The supplier shall provide the Owner with the names and addresses of all local service and maintenance personnel to assist in future service.
- G. Manufacturer shall provide the owner three sets of operation and maintenance manuals at time of training.

PART 13. UTILITY REQUIREMENTS

- A. Water: 2 inch cold water at 60 psi feed with back flow preventer provided by general contractor to a mutually agreed to service point such as the pump room and or wash bay.
- B. Electrical: To be completed with Wash Equipment suppliers Electrical Drawing
- C. Concrete pad with center drain, grating, and six-inch overflow to oil/water separator and sanitary sewer.