SECTION - SWIMMING POOL WATER CHEMISTRY AND FILTRATION CONTROL

1.01 SUMMARY

A. **AN INTEGRATED POOL AUTOMATION SYSTEM** shall be supplied for continuous monitoring of water chemistry (ORP, PPM and pH), temperature, Total Dissolved Solids, Langelier Saturation Index, flow rate, influent and effluent pressures and for automatic control of the chemical feeders, bleed and fill valves, heater, main recirculation pump and filter backwash. The controller shall include a programmable microprocessor with an eight (8)-line display screen and a sixteen (16)-key keyboard for operator access.

B. The system shall be a **CHEMTROL$_{TM}$ PC6000 INTEGRATED CONTROLLER** of current design and model manufactured by SANTA BARBARA CONTROL SYSTEMS of Santa Barbara, California or a technically equal system certified by the specifying agent as capable of providing equal performance for all operating functions.

C. Exceptions to the specifications shall be described in detail together with a list of ten (10) similar operating systems of same model and manufacture, with the name, address and telephone number of operating personnel.

1.02 SPECIFICATIONS

A. WATER CHEMISTRY CONTROL

1. The controller shall automatically activate the appropriate chemical feeders in order to maintain the sanitizer level within +/-0.1 parts per million (PPM) or +/- 10 mV (millivolts) of Oxidation-Reduction Potential (ORP) and the pH within +/- 0.1 pH unit of the setpoints selected by the operator. ORP and Sanitizer functions shall include seven-day, level-based chemical saver programs. All setpoint and calibration levels shall be adjustable with a numeric keypad mounted on the front panel of the unit. Controllers with internal switches or calibration adjustments will not be considered equal.

2 A solid-state PPM SENSOR shall monitor and display the Free Chlorine concentration in water in PPM or mg/l and shall be able to control the chlorine feed device. The sensor readings must be accurate to 0.01 PPM and be compatible with CYA levels in excess of 20 PPM. PPM values derived from ORP sensors readings will not be acceptable. The PPM sensor shall not require the use of chemical reagents and/or a special flow cell for water flow and pressure regulation.

3 The controller shall be capable of actuating all outputs in the following operator-selectable modes: off, manual, automatic and timer cycle. In the automatic mode, the operator shall be able to choose between on/off control with adjustable deadband or proportional feed control with adjustable deadband and progressive control zones.

4 The controller shall include a programmable seven-day shock program with operator selectable ON and OFF times for each day of the week and optional separate chemical feeder relay control.

5 The controller shall include automatic control of a chemical feeder for Automated Chloramine Treatment (A.C.T.)

6 The controller shall have the capability to operate an Ozone generator utilizing an internal spare relay with high ORP lockout.

7 The controller shall include an electronic temperature sensor and automatic control of the heater with a seven-day energy saver program.

8 The controller shall include a conductivity sensor for control of TDS in parts per millions or conductivity in microSiemens/cm. It shall automatically control a water dump valve for automatic purging of saturated water, or injection of a saline solution for use with salt chlorine generators.

9 The controller shall continuously calculate and display the Langelier Saturation Index using either sensor data and/or manual input for pH, temperature, total alkalinity and calcium hardness. The water saturation condition shall be displayed on the main screen as either "Scaling", "Corrosive" or "OK".

10 The controller shall be contained in a NEMA Type 4X (rain and splash proof) lockable fiberglass cabinet with an LCD graphic display screen of eight (8) lines of twenty two (22) alphanumeric characters. The main screen shall display current readings, control modes and operational status for ORP, PPM, pH, temperature, flow rate, influent and effluent pressures. A 16-key touch pad shall be provided for direct access to all the menus and submenus and for entering numerical data. Controllers with smaller displays or displays that require scrolling through menus will not be considered equal. All screens shall have the capability of being displayed at any time in unabbreviated English, French or Spanish and in US or metric units.

11 The sensor bypass line shall be equipped with an in-line filter, a flowmeter, a safety flow switch and a sampling spigot. The ORP and pH sensors shall be mounted in a see-through flow cell with a clear cover located inside a lockable fiberglass enclosure with a window. The Temperature and TDS sensors will be mounted on corner Tee inline with flow cell.

12 The controller shall be factory set to water treatment industry standards. The operator shall be able at any time to adjust all programmable functions to preferred settings. The controller shall have a reset mode to reset all or selected functions to the original factory standards.

13 The controller shall have the capability to calibrate all sensor inputs, depending on the accuracy needed, using either 1, 2, or 3-point calibration to determine respectively the origin, slope and curvature of the calibration curve.

14 The controller shall include programmable high and low alarm levels for all control functions with operator selectable feed lockout, alarm call out and alarm buzzer options. A Remote Alarm relay shall be included in parallel with alarm buzzer for operator-selectable voltage or dry contact output.

15 The controller shall continuously monitor and alert for failure of ORP and pH probes using dynamic probe testing before the water chemistry gets out of range. Failure alarms based on safety timers or out-of-range alarms will not be considered equal.

16 The controller shall include an adjustable seven (7) day program for automatic sensor cleaning.

17 The controller shall record and display the elapsed run time for each activation event and a cumulative run time resettable at any time by the operator. The controller shall provide for operator-adjustable event run time limits and total run time alarms for all control functions.

18 The controller shall include a memory storage battery with minimum reserve power for six (6) months.

19 The controller shall include an on-board memory chip for storing of test data on operator-selectable schedules. RS-232 serial communications ports shall be included for on-site downloading of the test data. Test data storage must consist of the following sensor inputs. Controllers failing to data log all listed parameters will not be considered equal.

a. ORP
b. PPM calculated and/ or calibrated
c. pH
d. Temperature
e. TDS or Conductivity
f. Pressure influent reading of filter, (or vacuum influent)
g. Main recirculation flow rate.

20 The controller shall include a DATA VOICE modem for remote operation by PC-compatible computer. A Windows software program shall be supplied with true duplex operation representing the actual controller screen display with automatic downloading and visual graphics representation of test data. Controllers using simulation or virtual representation of the display screen shall not be considered equal

21 The controller shall have telephone voice communication capability including report of test data, adjustment of controller and automatic dial to six (6) telephone numbers to report alarm conditions.

22 The controller shall include an on-screen visual display of all test data logged in memory. Controllers that require the use of external accessories or equipment, such as portable computers or remote access computers, to retrieve or display test data shall not be considered equal.

B. AUTOMATIC FILTER BACKWASH CONTROL

1. The automatic filter backwash control shall be integrated with the water chemistry control as one complete unit and manufactured by the same company.

2. The controller shall include two transducers for monitoring the influent and effluent pressures, (or influent vacuum) at the filter (or filters) and a program for sequential backwashing for up to six (6) banks of filters with an optional priority valve. Backwash operation shall be controlled with up to six (6) double-pole, double-throw (DPDT) relays to allow sequential closing and opening of backwash valves. The controller shall have one relay to control the main recirculation pump with a programmable 7 day timer for energy savings and pump override for filter valve cycling. The controller shall have one relay for heater cool down prior to shutting down the recirculation pump or initiation of the backwash cycle.

3. During backwash operation, all chemistry control shall be set in stand-by mode to prevent improper chemical treatment. In addition, a "BACKWASH CYCLE" message shall be displayed on the Main Screen.

4. The controller shall be capable of operating the filter backwash sequence in the following operator-selectable modes of operation: OFF, Manual or AUTO.

    a. OFF disables all backwash operations. If a backwash cycle is in progress, it is terminated immediately.
    b. MANUAL initiates an immediate backwash cycle.
    c. AUTO: In this mode, the backwash cycle is initiated under programmable parameters, using a time schedule, differential pressure, flow rate, volume of water since last backwash as follows. Also, a programmable seven-day program shall be included for AUTO mode with operator selectable ON and OFF times for each day of the week.

        i. TIMER mode sets a cycle schedule with a fixed interval of days between successive backwash operations. Pressure differential, flow rate and volume of water are not considered.
        ii. PRESSURE DIFFERENTIAL mode causes a backwash to be initiated when the difference between the influent and effluent pressures at the filter exceeds the set amount.
        iii. TIME OR PRESSURE mode causes a backwash to be initiated when EITHER the specified interval number of days has passed OR the specified difference between the influent and effluent pressures exceeds the set amount.

        iv. TIME AND PRESSURE mode causes a backwash to be initiated when BOTH the specified interval number of days has passed and the specified difference between the influent and effluent pressures exceed the set amount.
        v. FLOW RATE mode causes a backwash to be initiated when the flow rate measured by main line flow sensor reaches below the set amount.
        vi. VOLUME OF WATER mode causes a backwash to be inititated when the volume of water recirculated through the main line since the last backwash exceeds the set amount.
        vii. VOLUME OR PRESSURE mode causes a backwash to be inititated when EITHER the volume of water recirculated through the main line since the last backwash OR the specified difference between the influent and effluent pressures exceeds the set amount.
        viii. VOLUME AND PRESSURE mode causes a backwash to be inititated when BOTH the volume of water recirculated through the main line since the last backwash AND the specified difference between the influent and effluent pressures exceed the set amount.

5. The operator shall be able to adjust each element of the backwash sequence depending on selected control mode, including:

    a. Start date of the first backwash operation;
    b. Start time of the backwash operation;
    c. Duration of filter backwash cycle;
    d. Duration of filter rinse cycle;
    e. Duration of delay time between filters;
    f. Number of filters (maximum of 6)
    g. Use of a priority valve;
    h. Duration of pump override cycle to shut off the main pump during cycling of the backwash valves;
    i. Duration of time for heater cool down prior to backwash cycle.

6. The controller shall monitor the main recirculation line flow rate at the end of the backwash sequence. If flow is not restored to its pre-backwash value - indicating mechanical failure - the pump is shut off automatically.

7. The controller shall monitor the influent and effluent pressures at the end of backwash. If the differential remains above the setting after backwash, the backwash is turned off and an alarm is initiated.

8. The controller shall include a heater delay (Fireman) safety program for heater cooldown before shutoff of the main recirculation pump. It is used to protect the heater from overheating due to lack of water circulation.

9. The controller shall be capable of monitoring a high water level in the backwash pit to prevent flooding of the equipment room. With the optional high level alarm activated, the controller will terminate the backwash sequence and reset the program to normal filter mode.

C. WATER LEVEL CONTROL

1. The controller shall include a water level sensor and automatic water level control of a water fill valve. The sensor is an electro-optical sensor, which can be located in the pool or in the surge pit.

2. The controller shall be capable of operating the fill valve in the following operator-selectable modes of operation: OFF, Manual or Automatic.

3. A programmable seven (7) day program shall be included for AUTO mode with operator selectable ON and OFF times for each day of the week.

4. During Fill cycles, all chemistry control can be programmed to be in a stand-by mode to prevent improper chemical treatment, and a “LOW LEVEL” message is displayed on the Main Screen.

D. MAIN PUMP CONTROL

1. The controller shall be capable of controlling the main recirculation pump in a OFF, MANUAL, AUTOMATIC or TIMER MODE.

    a. OFF: If at any time the pump is in an off mode, the controller will be in stand by and will not allow any control parameters to be activated.
    b. MANUAL: When cycled to manual the pump will run 24-hours a day unless needed to shut down during backwash cycles.
    c. AUTO: If controller is programmed in Automatic, a programmable 7-day, 24-hour clock will control the On and Off cycle to enable the main pump to be shut down at night or during closed hours.
    d. TIMER: The timer mode can be programmed for a duration of minutes for an ON/OFF cycle up to (546) minutes. This feature enables burping (air release) of vacuum sand filters.

E. OPTIONS

1. OPTION PPM SENSOR: A solid-state PPM SENSOR shall monitor and display the Free Chlorine concentration in water in ppm or mg/l and shall be used to control the chlorine feed device. The sensor readings must be accurate to 0.01 PPM and must not be affected by Cyanuric Acid and/or oxidizers. PPM values derived from ORP sensor readings shall not be acceptable. The PPM sensor shall not require the use of chemical reagents and/or of a special flow cell for water flow and pressure regulation. This option is required for all A.C.T. programs.

2. OPTION ETHCOM6: The controller shall include an Ethernet / Internet modem for remote operation by PC-compatible computer using Ethernet / Internet network communication. A Windows-based software program shall be supplied with true duplex operation capability representing the actual controller screen display with automatic downloading and visual graphics representation of test data. Controllers using simulation or virtual representation of the display screen shall not be considered equal.

3. OPTION MODBUS6: The controller shall include software-based conversion of sensor signals, setpoint, high & low alarms, cummulative run time and total feed time for ORP, pH, PPM, Temperature, (Conductivity, Pressure influent and effluent, and Flow available with optional sensors) into MODBUS protocol for monitoring on Building Management Systems. The controller shall also allow MODBUS writing for changing control modes and setpoints from Building Management Systems.

4. OPTION RS485: The controller shall include a communication converter and RS485-based multiplex communication for remote operation by PC-compatible computer linked directly to the controller. A Windows-based software program shall be supplied with true duplex operation capability representing the actual controller screen display with automatic downloading and visual graphics representation of test data. Controllers using simulation or virtual representation of the display screen shall not be considered equal.

5. OPTION 420 mA SIGNAL: A five (5)-channel converter board shall be provided to convert the sensor digital signals for ORP, pH, PPM, temperature and conductivity (TDS) into analog 4-20 mA signals for monitoring on Building Management Systems.

6. OPTION PRINTER: A 110V or 230V (specify) 40-column thermal printer with an RS-232 connection cable shall be provided for on-site printing of test data stored in the controller memory.

F. WARRANTY

1. The integrated controller shall be covered by a standard manufacturer warranty of five (5) years. Special extensions of more limited warranties shall not be considered acceptable. All sensors will be covered by a standard one (1) year warranty. Other parts shall be covered by their own manufacturer's warranty. The controller shall not require a service technician for annual calibration, seasonal start up, or whenever chemicals supplier or type are changed.

2. The manufacturer shall supply a complete instruction, operating and maintenance manual. Check-out of installation, start up, and instruction of operating personnel shall be performed by an authorized and properly trained manufacturer representative.