

## **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™ 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. 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 and/or requiring special signal generating equipment to service will not be considered equal.
2. 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.
3. The controller shall include seven-day programs for shocking (superchlorination), deshock and chemical saver level.
4. The controller shall include automatic control of a chemical feeder for Automated Chloramine Treatment (A.C.T.)
5. The controller shall have the capability to operate an Ozone generator utilizing an internal spare relay with high ORP lockout.
6. The controller shall include an electronic temperature sensor and automatic control of the heater with a seven-day energy saver program.
7. 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.
8. 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".
9. 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.
10. The sensor bypass line shall be equipped with an in-line filter, a flowmeter, a safety flow switch and a sampling spigot. The ORP, pH and temperature sensors shall be mounted in a see-through flow cell with a clear cover located inside a lockable fiberglass enclosure with a window.
11. 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.

12. 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.
13. 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.
14. 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.
15. The controller shall include an adjustable seven (7) day program for automatic sensor cleaning with a chemical pump.
16. 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 run time limits for all control functions.
17. The controller shall include a memory storage battery with minimum reserve power for six (6) months.
18. The controller shall include an on-board memory chip for storing of test data on operator-selectable schedules. RS-232 and RS-485 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.
19. 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
20. 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.

## **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, influent pressure or differential pressure, as follows:
    - i. TIMER mode sets a cycle schedule with a fixed interval of days between successive backwash operations. Pressure differential is 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 exceeds the set amount.

5. The operator shall be able to adjust each element of the backwash sequence, 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. 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 (999) minutes. This feature enables burping (air release) of vacuum sand filters.

#### **E. OPTIONS**

1. 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.
2. OPTION 4-20 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.
3. OPTION 4-20 mA CONTROL: A five (5)-channel converter board shall be provided to convert the control output signals for acid, sanitizer, oxidizer, deoxidizer and base feed into analog 4-20 mA for connection to electronic feed devices accepting a 4-20 mA control signal.

## **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.