

SECTION -SWIMMING POOL WATER CHEMISTRY CONTROL

1.01 SUMMARY

A. **A PROGRAMMABLE CHEMICAL AUTOMATION SYSTEM** shall be supplied for continuous monitoring of water chemistry (ORP, PPM, pH and Temperature), Langelier Saturation Index and temperature and for automatic control of the chemical feeders and heater. 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™ PC5000 PROGRAMMABLE 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 used 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 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.
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 a temperature sensor and automatic control of the heater with a seven-day energy saver program.
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 resulting calculated water 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 pressure displays available with optional installation.) 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 include an in-line filter, a flowmeter, a safety flow switch, a sampling spigot and two flow control valves, or shall include a flow cell assembly with a safety flow switch.
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 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 and alarm buzzer options. A Remote Alarm relay shall be included in parallel with alarm buzzer for operator-selectable voltage or dry contact output.
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 a seven (7) day program for automatic sensor cleaning.
15. 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.
16. The controller shall include a memory storage battery with minimum reserve power for six (6) months.
17. The controller shall include an on-board memory chip for storing of test data on operator-selectable schedules. RS-232 serial communications port shall be included for on-site downloading of the test data. Test data storage must consist of the following sensor inputs: ORP, PPM, pH, Temperature (Conductivity or TDS, Pressure influent of filter, Main flow rate available with optional sensors). The controller shall insert a test data every time power is turned on to indicate power failures. Controllers failing to data log all listed parameters will not be considered equal.
18. 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. OPTIONS

1. OPTION TDS3: The controller shall include a conductivity/temperature sensor for display 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 in for use with salt chlorine generator. The controller shall also monitor and display the water temperature in degrees Fahrenheit or Celsius with adjustable high and low alarms.
2. OPTION FLOW3: The controller shall include an electronic water flow meter for monitoring and displaying the main line water flow and cumulative flow. The operator shall be able to calibrate the flow sensor by entering its K-factor. The controller shall also include a programmable low flow alarm with operator selectable pump lockout and alarm buzzer options.
3. OPTION LEVEL3: 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. The controller shall be capable of operating the fill valve in the following operator-selectable modes of operation: OFF, Manual or AUTO. 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. During Fill cycles, all chemistry control is set in stand-by mode to prevent improper chemical treatment and a "LOW LEVEL" message is displayed on the Main Screen.
4. OPTION TANK3: The controller shall include two tank monitoring sensors with Main Screen Display of remaining gallonage or height of chemical in storage tanks. . For each tank, high and low alarm levels shall be included with operator-selectable pump lockout and alarm buzzer options. Chemical tanks shall not exceed 10-foot height. For each tank, alarm output relays shall be included for high level indication (typically used at remote fill port for bulk deliveries) and for low level indication (typically used to inform chemical supplier for refilling). When this option is in use, the PRESS3 option is not available.
5. OPTION PRESS3: The controller shall include two transducers for monitoring and displaying the influent and effluent pressures at the filter (or filters). Influent pressure shall include high and low alarms with operator selectable pump lockout and alarm buzzer options. Note: The chemical tank monitoring option is not available when this feature is in use.
6. OPTION FCA: The ORP and pH shall be mounted in a see-through flow cell with a clear cover, pre-assembled with a water spigot and (2) ball valves [Sch 80 PVC]. Optional Temperature and TDS sensors will be mounted on corner Tee inline with see-through flow cell.
7. OPTION SCA: 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. Optional Temperature and TDS sensors will be mounted on corner Tee inline with flow cell.

8. OPTION REM3: The controller shall include a modem for remote operation by PC-compatible computer. A Windows 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.
9. OPTION ETHCOM3: 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.
10. 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.
11. OPTION MULTI3: The controller shall include RS485-based multiplex communication for networking with up to thirty (30) controllers and remote operation through a host controller using options REM, ETHCOM or RS485.
12. OPTION MODBUS3: The controller shall include software-based conversion of sensor signals, setpoint, high & low alarms, cumulative 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.
13. OPTION 420M: 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.
14. OPTION TEL3: 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.
15. 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.

C. WARRANTY

1. The 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.