DESIGN STANDARDS FOR: ENERGY MANAGEMENT CONTROL SYSTEMS (EMCS)

PART 1 - GENERAL

1.01 The control system shall be a complete direct digital system of automatic controls (DDC) with remote control capability via telephone modems to achieve the performance specified in the scope of work for this project. The Standalone Controller Unit (SCU) for the DDC system shall be Siemens Technology (Landis Division) & Powers System 600. No substitutions will be acceptable to the Seattle Parks and Recreation (SPR). Acceptable manufacturers to SPR for the control devices such as valves, dampers and actuators are Siemens Technology (Landis Division), Honeywell and Barber Colman.

1.02 System Programmable Control Capabilities

The SCU's shall be capable of performing the following functions through DDC computer programming:

A. Peak demand limiting.
B. Time-of-day scheduling.
C. Holiday scheduling.
D. Start-stop time, optimization of building equipment based on demand and occupancy.
E. Duty cycling.
F. Night setback.
G. Enthalpy changeover.
H. Economizer cycle.
I. Point alarming and trending capability.
J. Point controlling and monitoring.
K. Boiler and chiller water temperature and supply air temperature re-setting.

1.03 The system shall be listed by Underwriters Laboratories standard, with the manufacturer to insure ongoing parts availability and trained technical support. New parts which replace old or obsolete parts shall be compatible with the existing system.

1.04 All appropriate devices, equipment, and software programs shall be tested before they are delivered to the site. All calibration and test reports shall be submitted to the owner.

1.05 Sensors and control devices (e.g., valves, dampers, etc.) shall be compatible to suit remote control and monitoring from the SPR's Central EMCS located at 4209 West Marginal Way SW in Seattle.

1.06 The control system shall be installed by the control manufacturer using personnel directly and regularly employed by the manufacturer. The system may be installed by the control manufacturer's authorized representative, so that the complete installation has the control manufacturer's back up of engineering capabilities and warranty. The various system components shall be the product of a single manufacturer.

1.07 Shop drawings shall include single line straight forward electric/electronic control and interlock wiring schematic diagrams to enable easy visual comprehension. With each diagram provide details of all component parts in order that each function is clearly displayed. Submit a written description indicating sequence of operation. Show control damper drive arrangements. Provide maintenance manual data.

1.08 Submit complete descriptive information on the following products if applicable:

A. Temperature sensors.
B. Humidity sensors.
C. Differential pressure sensors.
D. Flow switches.
E. Flow sensors.
F. Dampers and damper actuators.
G. 3-way mixing valves, solenoid valve and valve actuators.

1.09 Hardware:

Submit complete descriptive information on the following products:

A. Standalone control unit.
B. Temperature sensors.
C. Differential pressure sensors.
D. Flow switches (if used).
E. Dampers and damper actuators.
F. 3-way mixing valves.

1.10 Software: Submit three complete sets of software manuals which shall include:

A. A reduced-size control diagram of the system.
B. Control programs, including codes, variables, set points, time periods, passwords, and other information necessary to load, alter, and operate the system.
C. User instruction on programming and reprogramming.
D. Complete description of programming language, including commands, editing, and writing programs, logs, etc.: also, operations required for mathematical calculations.
E. Instructions for testing programs, verifying error status, and initiating/disabling control programs.
F. Examples of programs for typical control applications.
G. Troubleshooting procedures.

1.11 Training Procedure: Submit 3 copies of proposed operator training procedure.

1.12 Provide a control system input/output summary table or the sequence of operation of the mechanical and electrical systems. The sequence of operation shall be complete and self-explanatory and shall describe the mechanical and electrical equipment response to the building demand for all modes of operation. The control system input/output summary table shall include all digital and analog inputs and outputs required to control and monitor the building environment.

1.13 Documentation: The contractor shall supply 3 complete sets of documentation including, but not limited to:

A. Operating and maintenance manuals.
B. Material descriptions.
C. Special features.
D. Troubleshooting procedures.
E. All training materials.
F. All software material.
G. One complete set of control drawings for each system on mylar.
H. Reproducible "as-built" drawings showing accurate locations of all sensors, controls, conduits, and monitoring equipment.

1.14 The entire installation shall carry a one-year warranty after acceptance of the system by the Owner. Acceptance shall be defined as the time when the Owner has accepted the Project, i.e., when the Owner has issued a Certificate of Completion for the Work (see General Conditions, Section 00700, 1.03M). During the warranty period, any repairs or adjustments made by the Contractor shall be made in the presence of designated members of SPR Maintenance staff.

1.15 The control contractor shall provide technical instruction to operating personnel as necessary and shall also provide assistance during balancing operation to make sure all systems are in proper operating condition. One-year guarantee shall include not less than three inspection trips (Owner to be notified two weeks in advance) during the year. Emergency calls to correct and defects during the guarantee period shall not be counted as inspection trips.

PART 2 - PRODUCTS

2.01 As mentioned in 1.A. above, the Standalone Controller Unit (SCU) for the DDC system shall be Siemens Technology (Landis Division) System 600. SPR will not accept any substitutions.

2.02 For controlled devices such as valves, dampers and actuators following manufacturer's products are acceptable:

A. Siemens Technology (Landis Division)
B. Honeywell.
C. Barber Colman.

2.03 Control Components:

A. All the existing dampers, and valves, and their actuators, shall be reused if they are in good operating condition. All necessary relays, contacts, and interface devices shall be

furnished to make the system fully operable in all operating modes. Temperatures or pressures shall fall in the mid-range of the sensors. The overall system error from sensor to value printout and display on the CRT shall be no greater than $\pm$ 1% of sensor range. All sensors shall be housed in tamper proof enclosures. Sensors and control elements shall operate under the temperature, pressure, humidity, corrosion, and vibration conditions normally encountered in the installed locations.

B. Valve and Damper Actuators:

Quiet-operating geared type. Use valve and damper actuators capable of delivering the torque required for continuous uniform movement of the valves or dampers, and withstand, without damage, continuous stalling. Actuators shall function properly with a 10% + change in line voltage feeding the equipment. Actuator drive pinions and high speed gears may be made of a non-metallic composition to insure quiet operation. Other gears shall be machine cut bronze or steel with face widths of not less than 0.375 inch. Provide actuators with hardened steel shafts running in sleeve bearings or bronze, hardened steel, nylon, or ball bearings. Totally enclose actuators and gear trains in dust proof housings pressed steel or metal casting with rigid conduit connections. Gear trains shall be oil-immersed type. Two-position actuators shall be of the single direction spring return or reversing type. Proportioning actuators shall be capable of stopping at all points in the cycle and starting in either direction from all points. Reversing and proportioning actuators shall have limit switches to limit the lever in either direction unless operator is stall-type.

C. Dampers:

All modulating dampers shall be of the multiple blade type. All damper frames are to be constructed of #13 gauge galvanized sheet metal and shall have flanges for duct mounting. All blade-to-blade linkage on each section shall be concealed within the damper frame. In no case shall the section linkage be exposed to the air stream. Damper blades shall not exceed 6-foot width. All blades are to be corrugated type construction, fabricated from two sheets to #22 gauge galvanized sheet steel, spot welded together. Blades are to be suitable for high velocity performance. Replaceable synthetic elastomer seals to be provided with dampers to be used for outside, return or exhaust air. Elastometer seals are to be installed along the top and bottom of the frames and along each blade edge. Stainless steel end seals are to be provided on all blade ends. Seals shall provide a tight closing, damper non-leakage of less than 1% at 3 inch water gauge static pressure. Bearing shall be oil-impregnated sintered bronze.

D. Three-way Mixing Valves

Provide with threaded or flanged ends and electric motor operators with spring return for fail-safe operation.

PART 3 - EXECUTION

3.01 Scope:

A. Install SCU's in the facility so that it can function as a "stand-alone" system, operable independently or be controlled by the remote CPU.
B. Provide all necessary actuating devices such as dampers and damper controls, relay contractors, solenoid valves, etc., which are not specifically provided under Division 15 or 16.
C. Provide all sensing devices necessary for measurement of temperature, differential pressure, humidity, flow, etc.
D. Arrange with City Light to provide the equipment necessary for energy (KWH) and demand (KW) monitoring.
E. Install all control wiring in conduit, and all piping necessary for installation of sensors and actuators.

3.02 Start-up: The contractor shall check out and make certain that each system is performing properly before he begins the start-up procedure. The start-up procedure shall include Parks Department staff. Each and every piece of equipment and software will be inspected by the Parks department for proper operation before the system is accepted.

3.03 If, during the start-up procedure, the process is delayed more than 3 times because of faulty equipment, incorrect installation, or incorrect software, the contractor will pay the Parks Department an amount equal to the hourly rates plus benefits of (up to) 3 staff people required to stand by during the period of deal.

3.04 Tests: Notify the SPR Job Line (684-7250 between 7:30 A.M. and 3:30 P.M.) at least 48 hours prior to conducting tests of the DDC in operation. Tests shall include:

A. Verification of operation of each actuating device in response to changing signals from the associated sensor.
B. Verification of manual override capability and remote set point adjustment for each sensor.
C. Verification of time controls for solenoid valves.
D. Verification of telecommunication capability for remote monitoring and controlling of system functions.
E. Demonstration of visual display monitor.
F. Verification of alarm functions and the capability of silencing an alarm and disabling any system function for maintenance or repair.

3.05 At the time the system is brought online, the Contractor shall train a minimum of 5 SPR staff in the use of the system. Training shall be for a period of at least 8 hours, and shall include:

A. Operation and programming of SCU and any items interfaced with CPU.
B. Troubleshooting the system including SCU and the controlling devices.
C. Complete instruction on the software program. At the end of the training session, the operator shall be able to:
   1. Program and reprogram the system.
   2. Change set points.
   3. Be able to trouble shoot and "repair" the system.

3.06 Post Installation Requirements:

A. 8-week Check: Contractor shall meet with SPR staff approximately 8 weeks after acceptance of the DDC System, in order to review system operation, and correct any flaws apparent in the program, or the hardware. Allow 8 hours for staff conference.

END OF SECTION