SECTION 15750 - PACKAGED AIR CONDITIONING EQUIPMENT

City of San Diego, CWP Guidelines

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The WORK of this Section includes providing:

1. Self-contained units with electric cooling and either gas-fired, electric, or reverse refrigeration cycle (heat pump) heating, and their related controls.

2. Floor mounted air conditioning units specifically intended for computer room applications.

1.2 RELATED SECTIONS

A. The WORK of the following Sections applies to the WORK of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.

1. Section 03300 Cast-in-Place Structural Concrete
2. Section 11175 Pumps, General
3. Section 15000 Piping Components
4. Section 15050 Vibration Isolation
5. Section 15410 Plumbing Piping
6. Section 15880 Air Distribution Devices and Accessories
7. Section 15950 HVAC Controls and Sequence of Operation
8. Section 15990 Testing, Adjusting and Balancing
9. Section 16040 Electric Motors

1.3 CODES

A. The WORK of this Section shall comply with the current editions of the following codes as adopted by the City of San Diego Municipal Code:

1. Uniform Mechanical Code

1.4 SPECIFICATIONS AND STANDARDS

A. Except as otherwise indicated, the current editions of the following apply to the WORK of this Section:

1. ANSI/NFPA 90A Installation of Air Conditioning and Ventilation Systems

2.	ARI 210	Unitary Air-Conditioning Equipment
3.	ARI 240	Air Source Unitary Heat Pump Equipment
4.	ARI 270	Sound Rating of Outdoor Unitary Equipment
5.	ANSI/ASME	Boilers and Pressure Vessels Code
6.	ANSI/NEMA 250	Enclosures for Electrical Equipment (1000 Volts Maximum)
7.	ASHRAE 52	Air-Cleaning Devices used in General Ventilation for Removing Particulate Matter
8.	FS TT-C-490	Cleaning Method and Pretreatment of Ferrous Surfaces for Organic Coatings
9.	UL	Underwriters Laboratories

1.5 REGULATORY REQUIREMENTS

A. The WORK of this Section shall conform to ANSI/NFPA 90A for the installation of computer room air conditioning units.

1.6 SHOP DRAWINGS AND SAMPLES

A. The following shall be submitted in compliance with Section 01300:

1. Shop drawings showing dimensions, electrical service, duct dimensions, water, drain [and] [refrigeration] rough-in connections.
2. Manufacturer's product data including catalogue cuts.
3. Equipment name, identification number and specification numbers.
4. Calculations of equipment anchorage forces and anchorage details.
5. Samples of colors, [ ] minimum, of computer room air conditioning units.
6. Shipping weights.

1.7 OWNER'S MANUAL

A. The following shall be included in the OWNER'S MANUAL in compliance with Section 01300:

1. Manufacturer's installation instructions.
2. Manufacturer's maintenance and repair procedures.
3. Manufacturer's certification that products comply with the indicated requirements.
4. Certification that products have been factory tested.
5. Certification that the WORK has been field tested, and the WORK complies with the indicated requirements.
6. Control and wiring diagrams.

1.8 SERVICES OF MANUFACTURER

A. **Inspection, Startup, and Field Adjustment**: An authorized representative of the manufacturer shall visit the site and witness the following:

1. Installation of the equipment.
2. Inspection, checking, and adjusting the equipment.
3. Startup and field-testing for proper operation.
4. Performing field adjustments to ensure that the equipment installation and operation comply with the Specifications.

B. **Instruction of OWNER'S Personnel**: The authorized service representative shall also instruct the OWNER'S personnel in the operation and maintenance of the equipment including step-by-step troubleshooting procedures with necessary test equipment for not less than [ ] day.

C. **Local Service**: The manufacturer shall have a local service agency (within 50 miles of the site) which maintains properly trained personnel and adequate spare parts and is able to respond and complete repairs within 24 hours.

1.9 MAINTENANCE SERVICE

A. The WORK of this Section includes maintenance service complying with the following:

1. Complete service and maintenance of packaged units for [1] [ ] year from Date of Substantial Completion.

2. Maintenance service with a 2-month interval as maximum time period between calls and 24-hour emergency service on breakdowns and malfunctions.

3. Maintenance complying with manufacturer's operating and maintenance recommendations, including controls check-out, adjustments and recalibrations.

4. Submittal of copy of service call work order or report, including description of work performed.

1.10 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. **Delivery of Materials**: Units shall be delivered in original, unbroken packages, containers, or bundles bearing the name of the manufacturer.

B. **Storage**: Units shall be carefully stored in a manner that will prevent damage and in an area that is protected from the elements.

PART 2 -- PRODUCTS

2.1 GENERAL

A. **General**: Only units certified as complying with the indicated requirements shall be provided.

B. **Products**: Units shall be new, of current manufacture, and shall be the products of reputable manufacturers specializing in the manufacture of such products.

2.2 SELF-CONTAINED UNITS

A. Self-contained units shall comply with the following:

1. Units shall have [gas burner] [,] [.] [electric heating elements] [,] [.] [and] [electric refrigeration.]

2. Unit shall be self-contained, packaged, factory assembled and prewired, consisting of cabinet and frame, supply fan, [return fan,] [heat exchanger and burner,] [electric heating elements,] controls, air filters[,] [.] [refrigerant cooling coil and compressor, condenser coil and condenser fan.]

B. Units shall be fabricated as follows:

1. Cabinet: [steel] [galvanized steel] with baked enamel finish, access doors or removable access panels with access doors or removable access panels with quick fasteners [screwdriver operated flush cam type.] [locking door handle type with piano hinges.] Structural members shall be minimum 18 gauge, with access doors or removable panels of minimum 20 gauge.

2. Insulation: [1/2] [1] [2] inch thick neoprene coated glass fiber on surfaces where conditioned air is handled.

3. Heat Exchangers: [aluminized] [stainless] steel, of welded construction.

4. Supply [and Return] Fan: forward curved centrifugal type, resiliently mounted with V-belt drive, [adjustable variable pitch motor pulley,] and rubber isolated hinge mounted motor[.] [or direct drive as indicated.]

5. Air Filters: [1 inch thick permanent washable.] [thick glass fiber disposable media in metal frames.] [2 inch thick glass fiber disposable media in metal frames.] [Automatic renewable media with extended surface media filters.]

C. Burners shall comply with the following:

1. Gas Burner: [atmospheric] [induced draft] [forced draft] type burner with adjustable combustion air supply, pressure regulator, gas valves, manual shut-off, intermittent spark, or coil ignition, flame sensing device, and automatic 100 percent shut-off pilot.

2. Gas Burner Safety Controls: ignition, limit time for establishment of flame, opening of gas valve prevented until pilot flame is proven, stop gas flow on ignition failure, energize blower motor, and after air flow with slight delay to allow gas valve to open.

3. High Limit Control: temperature sensor with fixed stop at maximum permissible setting, burner shut off on excessive bonnet temperature and energize burner when temperature drops to lower safe value.

4. Supply Fan Control: temperature sensor sensing bonnet temperatures independent of burner controls, or adjustable time delay relays with switch for continuous fan operation.

D. Evaporator oil, compressor and condenser shall include:

1. Copper [or aluminum] tube aluminum fin coil assembly with galvanized drain pan and connection.

2. Capillary tubes or thermostatic expansion valves for units of 6 tons capacity and less, and thermostatic expansion valves and alternate row circuiting for units 7.5 tons cooling capacity and larger.

3. Hermetic or semi-hermetic compressor, 3600 rev/min maximum, resiliently mounted with positive lubrication, crankcase heater, high and low pressure safety controls, motor overload protection, suction and discharge service valves and gauge ports, and filter drier.

4. Five-minute timed-off circuit designed to delay compressor start.

5. Outdoor thermostat designed to energize compressor above [35] [57] [ ] degrees F ambient.

[6. Step capacity control by [hot gas bypass.] [cycling compressors.] [cycling unloading.] [cycling multi-speed compressors.]

[6. For heat pump units, reversing valve, suction line accumulator, [discharge muffler,] flow control check valve, and solid-state defrost control utilizing thermistors.]

7. Copper [or aluminum] tube aluminum fin coil condenser assembly with subcooling rows.

8. Direct drive propeller fans, resiliently mounted with fan guard, motor overload protection, designed to operate with compressor.

9. [Refrigerant pressure switches] [Outdoor thermostat] to cycle condenser fans.

E. Supply air/return casing shall include:

[1. Dampers: remote controlled outside [and return] air dampers with damper operator and remote rheostat for adjusting outside air quantity.]

[1. Dampers: outside, return, and relief dampers with damper operator and control package to automatically vary outside air quantity; outside air damper shall fail to closed position. [Relief dampers may be gravity balanced.]]

2. Gaskets: tight fitting dampers with edge gaskets[,][.] [maximum leakage 5 percent at 2 inches pressure differential.]

[3. Damper Operator: 24 volt with gear train sealed in oil [,.] [.] with spring return on units 7.5 ton cooling capacity and larger.]]

[3. Damper Operator: pneumatic piston or gear driven type with spring return[.] [and pilot positioner.]

4. Mixed Air Controls: maintain selected supply air temperature and return dampers at minimum position [on call for heating and] [above 57 degrees F ambient.] [above 75 degrees F.] [when ambient air temperature exceeds return air temperature.] [when ambient air enthalpy exceeds return air enthalpy.]

F. Units shall be controlled as follows:

1. General:

Low voltage, adjustable thermostat to control [burner operation,] [heater stages in sequence with delay between stages,] [compressor and condenser fan,] and supply fan to maintain temperature setting.

With system selector switch [(heat-off-cool)] [,] [.] [(off-heat-auto-cool)] [,] [.] [and fan control switch (auto-on).]

With double acting thermostat with minimum [ ] stage heating and [ ] stage cooling.

With single acting thermostat with minimum [ ] stage cooling.

With thermostat located in [room as shown.] [supply air.] [return air.]

Remote mounted fan control switch (on-auto).

Low limit thermostat in supply air to [close outside air damper and] stop supply fan.

Night control energized by central time clock to [maintain lower thermostat setting,] [maintain night thermostat setting,] [lock out refrigeration,] [close outside air damper and open return air damper,] [stop supply air fan,] [set fan control switch to auto position,] for night and unoccupied operation; [with

time delay to maintain outside air damper closed and return air damper open after switching to day and occupied operation.]

Remote readout panels containing signal lights indicating system status, [heating system failure,] [cooling system failure,] and dirty filters; signal light operations; system on-off switch[,] [.] [and cooling system on-off switch.]

Panel including a [manual 12 hour timer to override night control,] [7 day time clock for energizing night control,] [remote damper control,] [low limit manual reset,] [and] [remote thermostat temperature set point.]

2. Single Zone Units:

Electric solid state microcomputer based room thermostat, located as indicated in service area with remote sensor located as indicated.

Room temperature including:

Automatic switching from heating to cooling.
Rate control to minimize overshoot and deviation from set point.
Set-up for four separate temperatures per day.
Instant override of set point for continuous or timed period from one hour to 31 days.
Short cycle protection.
Programming based on weekdays, Saturday and Sunday.
Switch selection feature including display, 12 or 24 hour clock, remote sensor, fan on-auto.

Room thermostat display including:
Time of day.
Actual room temperature.
Programmed temperature.
Programmed time.
Duration of timed override.
Day of week.
System model indication: heating, cooling, auto, off, fan auto, fan on .
Stage (heating or cooling) operation.

Low limit thermostat in supply air to close outside air dampers and stop supply fan.

3. Variable Air Volume Units:

Temperature transmitter located in supply air shall signal electronic logic panel to control mixing dampers and cooling in sequence; mixing section shall operate as first stage of cooling and revert to minimum outside air above approximately [ ] [75] degrees F as determined by enthalpy of return and outdoor air.

Cooling shall be controlled by cycling compressors, cylinder unloading, and hot gas bypass.

Logic shall allow supply air reset under low load or airflow conditions.

Seven-day time clock with spring carry over (or electronic clock with battery backup) shall control unit on occupied/unoccupied schedule; at night, unit shall be off; clock shall be located in remote control panel with status lights.

Two stage morning warm-up thermostat to hold outdoor dampers closed and energize heat until return air temperature reaches setpoint.

Unit shall include bypass dampers, bypassing air from supply fan discharge to return fan inlet to control duct static pressures; operation shall be controlled by sensing current to supply fan motor.

2.3 COMPUTER ROOM AIR CONDITIONING UNITS

A. Computer room air conditioning units shall be:

1. Packaged air-cooled, factory assembled, pre-wired and prepiped unit, consisting of cabinet, fans, filters, humidifier, controls.

2. Constructed with [up-flow] [down]flow] air delivery, in [draw-through] [or] [blow-through] configuration.

B. Cabinet and frame shall be fabricated as follows:

1. Structural Frame: [10] [14] [ ] gauge welded steel suitably braced for rigidity, capable of supporting compressors and other mechanical equipment and fittings [;] [.] [welded tubular steel floor stand with adjustable legs and vibration isolation pads.]

2. Doors and Access Panels: [18] [20] [ ] gauge [galvanized] steel with polyurethane gaskets, clips to allow removal of panels, and concealed fastening devices.

3. Insulation: thermally and acoustically line cabinet interior with one-inch thick acoustic duct liner.

4. Finish of Exterior surfaces: FS TT-C-490 prepared, baked-on textured vinyl enamel; [ ] color[.] [to match computer equipment.] [as selected.]

C. Evaporator fans and motors shall comply with the following:

1. Fans: double inlet, forward curve centrifugal fans, statically and dynamically balanced[,] [on steel shaft with self-aligning [grease] [permanently] lubricated ball bearings, and V-belt drive.] [directly driven.]

2. Motor: [complying with Section 16040] drip proof, permanently lubricated ball bearing motor with built-in current and overload protection.]

3. V-Belt Drive: cast iron or steel sheaves, dynamically balanced,keyed, variable and adjustable pitch motor sheave, minimum of two matched belts, drive rated minimum 2.0 times nameplate rating of motor.

D. Compressors, evaporator coils and condensers shall comply with the following:

1. Compressors shall be [semi-hermetic with suction gas cooled motors, vibration isolators, thermal overloads, oil sight glass, manual reset high pressure switch, pump down low pressure switch, suction line strainer, reversible oil pumps, 1750 rpm] [.] [or,] [hermetic with resilient suspension system, oil strainer, crankcase sight glass, internal motor protection, low pressure switch, manual reset high pressure switch.]

2. Compressors shall be individually serviceable without dismantling other components[.] [or removing unit from service.]

3. Evaporator coils shall be [alternate row] [split face] circuits, direct expansion cooling coils of seamless copper tubes expanded into aluminum fins.

4. Coils shall include [two refrigeration circuits, each with hot gas mufflers, thermal expansion valve with external equalizer, liquid line solenoid valve, liquid line filter-drier, refrigerant sight glass with moisture indicator, service shut-off valves and charging valves[,] [.] [accumulator sized for liquid seal under light load.]

5. Coil assembly shall be mounted in stainless steel drain pan.

[6. Unit shall include air-cooled refrigerant condenser consisting of corrosion resistant cabinet, copper tube aluminum fin coils arranged for two circuits, multiple direct drive propeller fans with [permanently lubricated ball bearing] single phase motors with internal overload protection.]

E. Filters shall comply with the following:

1. Media: pleated, lofted, non-woven, reinforced cotton fabric; supported and bonded to welded wire grid; enclosed in cardboard frame; [2-inch] [4-inch] nominal thickness.

2. Rating: ASHRAE 52; 25-30 percent dust spot efficiency, 90-92 percent weight, 500 ft/min face velocity, 0.30 inch wg initial resistance, 1.0-inch wg recommended final resistance.

F. Heating coils shall comply with the following:

1. Coils shall be enclosed fin electrical elements with minimum of [two] [three] stages.

2. Protection shall be by primary and secondary thermal cutouts, differential air pressure switch, and manual reset overload protection, branch circuit overcurrent protection.

G. Humidifiers shall comply with the following:

[1. Infrared Type: high intensity quartz lamps mounted above stainless steel evaporator pan, serviceable without disconnecting water, drain, or electrical connections; pre-piped and utilizing condensate water from cooling coils with stainless steel or brass float valve mechanism; located in bypass air stream[;][.] [with flush cycle timer and solenoid drain valve.]

[1. Evaporative Pan Type: stainless steel pan and cover, serviceable without disconnecting water, drain, or electrical connections; pre-piped with stainless steel or brass float valve mechanism; electric heating coil and low water cut-off switch; with flush cycle timer and solenoid drain valve.]

H. Electrical panel shall comply with the following:

1. Control Cabinet: NEMA 250; Type [2] [ ] enclosure, UL listed, with piano hinged door, grounding lug, combination magnetic starters with overload relays, circuit breakers and cover interlock, and fusible control circuit transformer.

2. Disconnect Switch: non-automatic molded case circuit breaker with handle accessible with panel closed[.] [and capable of preventing access until switched to "off" position.]

I. Control system shall comply with the following:

1. Electronic Control System:

Type: solid state with start button, stop button, temporary loss of power indicator, manual reset circuit breakers, temperature control, humidity control, and monitor panel.

Monitor Panel: backlighted with no visible indicator lights until operating function is activated; indicators shall include cooling, humidification, loss of air flow, change filters, high temperature, low temperature, high humidity, low humidity, high head pressure (each compressor), and low suction pressure (each compressor).

Temperature and Humidity Control Modules: solid state plug-in with adjustable setpoint, "push-to-test" calibration check button, and built-in visual indicators to indicate mode of operation.

Location: through hinged door in front of unit; isolated from conditioned air stream to allow service while system is operating.

2. Microprocessor Control System

Logic Circuitry: microprocessor shall continuously monitor operation of process cooling system; continuously digitally display room temperature and room relative humidity; sound alarm on system malfunction and simultaneously display problem; when more than one malfunction occurs, flash fault in sequence with room temperature, even when malfunction cleared, and continue to flash fault until reset.

Malfunctions: Power Loss, Loss of Air Flow, Clogged Air Filter, High Room Temperature, Low Room Temperature, High Humidity, Low Humidity, [Smoke/Fire,] Compressor No. 1 - Overload, Compressor No. 1 - Low Pressure, Compressor No. 1 - High Pressure, Compressor No. 2 - Overload, Compressor No. 2 - Low Pressure, Compressor No. 2 - High Pressure, [Water-Under-Floor,] and Supply Fan Overload.

Light Emitting Diodes Display: Control Power On, System On, Humidification, De-humidification taking place, Compressor No. 1 operating, Compressor No. 2 operating, Heat or Reheat operating, Economy Cooling.

With push buttons to STOP process cooling system, START process cooling system, SILENCE audible alarm, push-to-test LED indicators, and display room relative humidity.

$# _____

NTS: The DESIGN CONSULTANT shall obtain a list of 2 years' recommended spare parts from the manufacturers and include the list for each piece of equipment in the Equipment Schedules following this Section.

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2.4 SPARE PARTS AND NAMEPLATES

A. **Spare Parts**: Spare parts listed in the Equipment Schedules shall be furnished to the OWNER by the CONTRACTOR.

B. **Nameplates**: Nameplates of stainless steel engraved or stamped and fastened to the equipment in accessible locations. Nameplates shall contain the manufacturer's name, model, serial number, size, characteristics, and appropriate data describing the machine performance ratings.

2.5 SCHEDULES

A. Self-contained units shall comply with the requirements indicated on the attached Packaged Air Conditioning Unit Schedule.

B. Computer room air conditioning units shall comply with the requirements indicated on the attached Computer Room Air Conditioning Schedule.

2.6 MANUFACTURERS

A. Units shall be manufactured by one of the following (or equal):

1. Carrier
2. McQuay
3. Trane
4. York
5. Lennox

PART 3 -- EXECUTION

3.1 INSTALLATION

A. **General**: Units shall be installed in accordance with the manufacturer's written installation instructions.

3.2 VERIFICATION

A. The WORK of this Section includes verification of the following:

1. That flooring system is ready for unit and opening dimensions are as [indicated on shop drawings.] [instructed by the manufacturer.]

2. That proper power supply is available.

3.3 COMPUTER ROOM AIR CONDITIONING UNITS

A. Installation of computer room air conditioning units shall be coordinated with computer room raised floor Installer.

B. Adequate drainage connections shall be installed for [condensate] [and humidifier] system.

** END OF SECTION **

PACKAGED AIR CONDITIONING UNIT SCHEDULE

	[AC-1]	[AC-2]
Drawing Reference		
Location		
Supply Fan:		
Air Flow, GFM		
External Static Pressure, inch wg		
Fan Motor, hp		
Return Fan:		
Air Flow, CFM		
Air Flow, External Static Pressure, inch wg		
Fan Motor		
Cooling:		
Sensible, BTUH		
Total, BTUH		
Evaporator Coil Entering DB Temp, EF		
Evaporator Coil Entering WB Temp, EF		
Evaporator Coil Leaving DB Temp, EF		
Evaporator Coil Leaving WB Temp, EF		
Condenser Ambient Air Temp, EF		
Energy Efficient Ratio		
Heat:		
Input, BTUH		
Output, BTUH		
Outdoor DB Air Temp, EF		
Outdoor WB Air Temp, EF		
Coefficient of Performance		
Sound Rating Number, db		
Compressor Power Input, KW		
Nominal Capacity, Tons		

COMPUTER ROOM AIR CONDITIONER SCHEDULE

	[CAC-1]	[CAC-2]
Drawing Reference		
Location		
Cooling Capacity:		
Total, BTUH		
Sensible, BTUH		
Evaporator:		
Air Flow, CFM		
Entering Air DB Temp, EF		
Entering Air WB Temp, EF		
Leaving Air DB Temp, EF		
Leaving Air WB Temp, EF		
Evaporator Fan Motors, HP		
Condenser:		
Water Flow, GPM		
Water Temp, EF		
Ambient Air Temp, EF		
Fan Motors, hp		
Reheat:		
Capacity, BTUH		
Water Flow, GPM		
Entering Water Temp, EF		
Leaving Water Temp, EF		
Humidifier:		
Capacity, lbs/hr		
Power Input, KW		
Spare Parts		