DEPARTMENT OF THE ARMY
CHARLESTON DISTRICT, CORPS OF ENGINEERS
69-A HAGOOD AVENUE
CHARLESTON, SOUTH CAROLINA 29403-5107

CESAS-CT-PC

September 7, 2011

Team Partners:

Subject: Amendment 0001 MATOC Request for Proposal for Task Order Request Number W912HP-11-R-0005-000X, Project MATOC Contract for Energy Conservation Improvements Projects

A. Incorporate the below items into the RFP. Please acknowledge this amendment in your proposal.

The purpose of this amendment is to change RFP Proposal Due date from 12 Sep 2011 to 14 Sep 2011. Additionally the following items will be incorporated.

1. **Section 01 10 00, 2.4.1, Section 5 of 8/16/11 SOW: REPLACE** Entire section 5 with updated pdf. The following changes are made in the revised pdf:
   - New paragraph 5.1.3 was added to require new chillers to be tied into existing CEP 1 controls.
   - Paragraph 5.4.4 now includes the heading "Option 1- ASHRAE 15 Upgrades". Paragraph wording edited for clarity.
   - Paragraph 5.5 now includes "Option 2" in the heading.
   - Paragraph 5.5.1 was edited to clarify the scope of this option.

2. **REPLACE** CLIN schedule with attached.

3. **Section 01 45 00.00 10, Para 3.4.2: DELETE** "The CQC System Manager must be assigned as System Manager and may also act as SSHO in addition to quality control."

Contractor shall comply with Section 01 35 26.00 25, Para 1.5.1.1 which states "The SSHO duties will be the employee's sole, full-time responsibility."

4. If you have any questions or concerns please contact Angela Kelly at Email: angela.kelly@usace.army.mil or Phone: 843-329-8060.

HENRY WIGFALL, JR
Contracting Officer

CONTRACT LINE ITEM SCHEDULE

Item No.	Description	Quantity	Unit	Price	Amount
	BASE PROPOSAL				
0001	**Design Costs**				
0001AA	Install VSD's on all 4 CEP's	1	Job	LS	$_____
0001AB	Replace secondary MTW and CHW pumps at CEPs 1 and 2. Provide VSDs for these pumps.	1	Job	LS	$_____
0001AC	Replace motor control centers (MCCs) at CEPs 1 and 3.	1	Job	LS	$_____
0001AD	Replace 3 existing chillers at CEP 1 with 3 new 1200 ton chillers. Replace 3 associated primary CHW pumps.	1	Job	LS	$_____
				Subtotal Item 0001	**$**_____
0002	**Non-Design Costs**				
0002AA	Install VSD's on all 4 CEP's	1	Job	LS	$_____
0002AB	Replace secondary MTW and CHW pumps at CEPs 1 and 2. Provide VSDs for these pumps.	1	Job	LS	$_____
0002AC	Replace motor control centers (MCCs) at CEPs 1 and 3.	1	Job	LS	$_____
0002AD	Replace 3 existing chillers at CEP 1 with 3 new 1200 ton chillers. Replace 3 associated primary CHW pumps.	1	Job	LS	$_____

**TAB should be included in each bid item for a complete and usable product.

	Subtotal Item 0002	**$**_____
TOTAL BASE PROPOSAL		**$**_____

0003	**Option 1A Design Costs**	1	Job	LS	$_____
	Refrigerant monitoring and alarm, ventilation requirements in case of alarm and interlock to existing boilers in case of alarm. Ref Section 01 10 00, 5.4.4 of SOW				
	Option 1B Non-Design Costs	1	Job	LS	$_____
	Refrigerant monitoring and alarm, ventilation requirements in case of alarm and interlock to existing boilers in case of alarm. Ref Section 01 10 00, 5.4.4 of SOW				
	Subtotal Option 1				$_____
0004	**Option 2A Design Costs**	1	Job	LS	$_____
	Central Energy Plant DDC Control System Ref Section 01 10 00, 5.5 of SOW				
	Option 2B Non-Design Costs	1	Job	LS	$_____
	Central Energy Plant DDC Control System Ref Section 01 10 00, 5.5 of SOW				
	Subtotal Option 2				$_____
0005	**Option 3A Design Costs**	1	Job	LS	$_____
	Building 11000 Automatic Lighting Controls				
	Option 3B Non-Design Costs	1	Job	LS	$_____
	Building 11000 Automatic Lighting Controls				
	Subtotal Option 3				$_____

0006	**Option 4A Design Costs**	1	Job	LS	$_____
	Building 10440 Automatic Lighting Controls				
	Option 4B Non-Design Costs	1	Job	LS	$_____
	Building 10440 Automatic Lighting Controls				
	Subtotal Option 4				$_____
0007	**Option 5A Design Costs**	1	Job	LS	$_____
	Buildings 10402, 10404, 10405, 10406, & 10407 Automatic Lighting Controls				
	Option 5B Non-Design Costs	1	Job	LS	$_____
	Buildings 10402, 10404, 10405, 10406, & 10407 Automatic Lighting Controls				
	Subtotal Option 5				$_____
0008	**Option 6A Design Costs**	1	Job	LS	$_____
	Building 4600 Automatic Lighting Controls				
	Option 6B Non-Design Costs	1	Job	LS	$_____
	Building 4600 Automatic Lighting Controls				
	Subtotal Option 6				$_____
0009	**Option 7A Design Costs**	1	Job	LS	$_____
	Building 5450 Automatic Lighting Controls				
	Option 7B Non-Design Costs	1	Job	LS	$_____
	Building 5450 Automatic Lighting Controls				
	Subtotal Option 7				$_____

0010	**Option 8A Design Costs**	1	Job	LS	$_____
	Building 4295, 4285, 4275, 4265, 4255, 4243, 4235, 4225, 4215, 4205, 3295, 3285, 3276, 3275, 3265, 3235, 3225, 3216, 3215, & 3205 Automatic Lighting Controls				
	Option 8B Non-Design Costs	1	Job	LS	$_____
	Building 4295, 4285, 4275, 4265, 4255, 4243, 4235, 4225, 4215, 4205, 3295, 3285, 3276, 3275, 3265, 3235, 3225, 3216, 3215, & 3205 Automatic Lighting Controls				
	Subtotal Option 8				$_____

TOTAL BASE OFFER (Items 0001-0002) $_____

TOTAL OPTION OFFER (Items 0003-0010) $_____

TOTAL OFFER BASE + OPTIONS (Items 0001-0010) $_____

Contract Duration in Calendar Days ___365___

5. REPLACE CHILLERS IN CEP 1

5.1. Replace (3) chillers and associated primary chilled water pumps, piping and associated equipment. Provide all work required for a completely functional and operational new chiller and pump installation including the following:

5.1.1. Provide engineering services by registered professional engineers including equipment selection for replacement of existing chillers and pumps identified.

5.1.2. Supply all labor, transportation, material, apparatus, tools, and permits necessary to replace three water-cooled chillers and three associated primary chilled water pumps with new high efficiency equipment at CEP #1.

5.1.3. Tie new chillers into existing CEP 1 controls.

5.1.4. Remove and dispose of all unused equipment.

5.1.5. Consideration shall be given to cooling demand of buildings served by CEP 1. Enough chillers must remain on-line to supply cooling demand. Contractor shall perform chiller replacements between the months of December and March as far as practicable.

5.1.6. Provide (3) high efficiency Water-Cooled Chillers per ASHRAE 90.1 minimum efficiencies, Performance Data below and the following requirements. Price each chiller and its associated equipment as a separate line item:

5.1.6.1. Centrifugal Compressors.

5.1.6.2. Chiller shall be charged with refrigerants R-123 or R-134a only.

5.1.6.3. All performance and capacity data shall be in accordance with ARI 550-2003. Manufacturer shall provide copy of computer selection. Chiller shall be ARI Certified and bear the ARI seal.

5.1.6.4. Chiller and factory mounted Starter shall be UL Listed and UL labeled as a complete assembly.

5.1.6.5. New electrical for chillers shall utilize existing disconnects and provide new wiring from the load side of the disconnects to the new unit mounted starters. Utilize existing conduits as appropriate.

5.1.6.6. Chillers shall ship from the factory as a single piece, fully assembled unit requiring no field assembly or mounting of any major components.

5.1.6.7. Free Cooling cycle shall be provided for Chillers #1 and #2 . Capacity shall meet or exceed the performance as detailed below. The chiller shall provide required material (including controls, valves, piping, and additional storage vessels) to allow cooling of chilled water by transferring heat to cold condenser water without operating the compressor. If available, this shall be a factory installed option on the centrifugal chiller. Interlock between free cooling cycle and normal operational cycle shall be provided to prevent compressor start-up or operation during unsafe conditions.

5.1.6.8. If free cooling is not available as a factory-installed option, chiller manufacturer shall provide all necessary design, equipment, controls and piping to provide complete free cooling system utilizing plate frame heat exchanger with same capacity and warranty as specified chiller option.

5.1.6.9. Plate and frame heat exchangers, if used, shall comply with the following requirements:

- Plate and frame water-to-water heat exchangers of the sizes and capacities noted on the schedule shall be provided. Each heat exchanger shall consist of stainless steel heat transfer plates, steel end plates, and a carbon steel carrying bar, of single pass configuration. Units shall be specifically designed for 150 PSIG working pressure (minimum) at 230°F (minimum). Heat exchanger selection shall be optimized by the manufacturer to provide minimum heat transfer surface area requirements under specified capacity and pressure drops.

- Heat exchangers shall be shipped to the site as completely assembled units. Each heat exchanger shall be pressure tested and flushed clean at the factory prior to shipment. All nozzle connections shall be factory sealed prior to shipment to prevent the entrance of foreign matter into the heat exchanger during shipment, storage, and installation.

- Corrugated channel steel plates shall be of type 304 or 316 stainless steel. Channel plate ports shall be double gasketed to prevent cross contamination of hot and cold side fluids. Gaskets shall be of a one-piece design formulated from Nitrile rubber. Plates shall be grooved to accept the gaskets and gasket clips to minimize gasket movement.

- Channel carrying bar shall be of carbon steel, aluminum or stainless steel with zinc yellow chromate finish.

- Fixed frame plates and movable pressure plates shall be corrosion-resistant epoxy painted carbon steel. Flow through the plates shall be of a counter-flow design to maximize the heat transfer capability of the unit.

- Connections 2 inches and smaller shall be carbon steel NPT tappings. Connections 4 inches and larger shall be studded port design to accept ANSI flange connection. Connection ports shall be integral to the frame or pressure plate.

- Unit to be supplied with OSHA approved splash guard, enclosing exterior channel plate and gasketed surfaces. Heat exchanger shall be provided with the scheduled square footage of heat transfer area.

- Unit shall be constructed in accordance with ASME Code Rules and shall have a manufacturer's data report for pressure vessels, form No. U-1. Form U-1 shall be furnished to the engineer for the owner upon request. An authorized inspector, holding a National Board commission, certifying that construction conforms to the latest ASME Code for pressure vessels must sign this form. The ASME "U" symbol should also be stamped on the Heat Exchanger(s). In addition, each unit registered with the National Board of Boiler and Pressure Vessel Inspectors.

- Heat exchanger manufacturer shall be ISO-9001 certified.

5.1.6.10. Motor shall be suction gas cooled, hermetically sealed, two-pole, squirrel cage induction-type.

5.1.6.11. Microprocessor based chiller control panel and digital monitoring and instrumentation package for all temperature, pressures and electrical data. Include digital KW meter.

5.1.6.12. Digital Display of:

- Unit diagnostics with a historical summary of the minimum of the last (20) diagnostics with a date stamp.
- Entering/Leaving water temperatures for both evaporator and condenser.
- Refrigerant temperatures for both evaporator and condenser.
- Refrigerant pressures read from transducers for both evaporator and condenser (not derived from temperatures).
- Compressor discharge temperatures and with high limit cutout.
- Oil pressure, and oil temperature for the oil sump and all chiller bearings for compressor and motor.
- Quantity of three (3) motor winding temperatures sensors, one (1) per phase and with high limit.
- Compressor starts, elapsed run time hours and operating mode.
- Compressor (by phase) running amps, volts and KW.
- Water flow displayed in GPM for both evaporator and condenser.
- Operator Interface shall be factory mounted on the door on the control panel and shall have an LCD touchscreen display for operator input.

5.1.6.13. Factory Mounted & Wired NEMA 1 Medium-Voltage Primary Reactor or Autotransformer Starter by Cutler-Hammer or approved equivalent as determined by the COR. Remote Mounted Starters or Variable Frequency Drives are not permitted. The starter shall be able to operate in temperatures up to 104 degrees F. The isolating switch shall be a non-load break, externally operated manual three pole draw-out, such that in the open position it completely grounds and isolates the starter from the line connectors with a mechanically driven isolating shutter leaving no exposed high voltage. Integral mechanical interlocks shall prevent entry into the high voltage areas while the starter is energized and shall block accidental opening or closing of the isolating switch when the door is open or contactor is closed. The isolating switch handle shall have provision for one padlock. Current limiting power fuses shall be of the self- protecting type with visible fuse condition indicators, and with special time/current characteristics for motor service allowing proper coordination with the contactor and overload protection for maximum motor protection. The power fuses shall be vertically mounted permitting easy inspection and replacement without starter disassembly. The vacuum contactor shall be enhanced SL vacuum contactors designed specifically for use with chiller squirrel cage induction motors. A built-in test circuit shall be included to permit checking of the starter control and pilot circuit with the high voltage de-energized and isolated, with the contactor in its normal position. In the test mode, the control circuit shall be capable of being energized through a polarized plug connector from an external 115 volt supply. Enclosures for the high voltage starters shall be NEMA 1. If the chiller control panel does not incorporate advanced motor protection, the starter shall include an advanced motor protection system incorporating electronic three phase current overloads and current transformers of the proper size, ratio, and burden capacity. This electronic motor protection system shall monitor and protect against the following conditions:

- Three phase current overload protection
- Current overload protection during start-up
- Current phase unbalance
- Current phase loss
- Current phase reversal
- Under and over voltage

5.1.6.14. Distribution fault protection with auto restart consisting of three-phase, current sensing devices that monitor the status of the current. Distribution faults of 1-1/2 electrical cycle duration shall be detected and the compressor motor shall be disconnected within six electrical cycles.

5.1.6.15. Voltage: 4160-3-60 Single Point Power Connection with integral Control Power Transformer. Maximum Over-Current Protection for each starter shall be as scheduled.

5.1.6.16. Provide certified chiller attenuation package for maximum sound level of 90 dBA per ARI Standard 575-87.

5.1.6.17. Chillers shall be factory insulated with ¾" Armaflex II or equal insulation (K=.28).

5.1.6.18. 2-Pipe Evaporator Configuration with Standard Waterbox.

5.1.6.19. 2-Pipe Condenser Configuration with Marine Waterbox. Gantries/Davits/Hinges shall be factory supplied on the ends of the condenser to facilitate water box removal without external rigging.

5.1.6.20. Tubing for Evaporator and Condenser shall have a minimum root-to-root tube wall thickness after fabrication of 0.028". Verification of tube wall thickness will occur during factory certified testing of the Chillers.

5.1.6.21. NEMA 1 Flow Switches for Field Installation on Evaporator & Condenser.

5.1.6.22. Neoprene Isolation Pads for Field Installation.

5.1.6.23. Chiller shall ship with full operating charge of oil & refrigerant. Refrigerant will be loaded into the chillers during factory start-up by manufacturer technician.

5.1.6.24. 10-Year Parts (including Starter), Labor & Refrigerant Warranty by Unit Manufacturer.

5.1.6.25. Start-Up by Factory Certified Technician.

5.2. VERIFICATION OF CHILLER CAPACITY AND EFFICIENCY: A factory certified test for the owner is required for testing and verification of (3) of the Chillers (Free Cooling, Standard Cooling). The equipment will be accepted if the test is conducted in conformance with ARI Standard 550/590-2003 procedures and the standard's tolerances are met. If the equipment fails to perform within proposed tolerances, the manufacturer will be allowed to make necessary revisions to his equipment and retest as required. Chillers shall be tested at 100%, 75%, 50% and 25%. Entering condenser water temperatures are 85°F for 100%, 75°F for 75% and 65°F for 50% and 25%. In the event that these revisions do not achieve submitted performance, the following penalties will be imposed:

5.2.1. CAPACITY TEST: For each ton below the allowable capacity, one thousand dollars per ton will be deducted from the contract price.

Allowable capacity = [(1 - tolerance) x design capacity]

5.2.2. POWER CONSUMPTION PENALTY: All load points and the Power Consumption Penalty (P.C.P.) shall be based upon the tolerances specified above. The P.C.P shall be calculated based upon the following formula: P.C.P. = [Measured KW - (Measured Tons x ALLOWABLE KW/Ton*)] x $2000/KW *Allowable KW/Ton = [(1 + tolerance) x design KW/Ton]

5.2.3. TOTAL PERFORMANCE PENALTY: The total performance penalty will be the sum of CAPACITY PENALTY AND POWER CONSUMPTION PENALTY, times the number of typical chillers, regardless if tested.

5.2.4. Equipment manufacturer shall not invoice for the centrifugal chillers(s) until successful completion of the performance test or acceptance of penalty deduction from the contract.

5.2.5. A factory certified test report of all data shall be submitted to the Contracting Officer prior to completion of the project. The factory certified test report shall be signed by an officer of the manufacturer's company.

5.2.6. Chillers shall be factory performance tested with the proposed refrigerant under full load conditions in an ARI certified test facility. The test procedure shall include both the Chiller and the Starter that will be provided on the project. The manufacturer shall supply a certified test report to confirm performance as specified. Proper ARI certification documents for the test loop shall be made available upon request from the manufacturer for inspection.

5.2.7. The factory test instrumentation shall be per ARI Standard 550/590-2003, and the calibration of all instrumentation shall be traceable to the National Institute of Standards and Technology (formerly NBS).

5.2.8. The performance test shall be run with clean tubes in accordance with ARI 550/590-2003 to include the following:

5.2.8.1. A downward temperature adjustment per ARI 550/590-2003 Section C6.3 shall be made to the design leaving evaporator water temperature to adjust from the design fouling to the clean tube condition.

5.2.8.2. An upward temperature adjustment per ARI550/590-2003 Section C6.3 shall be made to the design entering condenser water temperature to adjust from the design fouling to the clean tube condition.

5.2.8.3. There shall be no exceptions to conducting the performance test with clean tubes and with temperature adjustments above. The manufacturer shall clean tubes, if necessary, prior to test to obtain a test fouling factor of 0.0000 hr. sq. ft. F/BTU.

5.3. Submittal Requirements

5.3.1.35% Submission shall include the following:

5.3.1.1. Detailed written narrative describing the design approach to equipment replacement, special features of proposed design and project sequence/schedule including details on how cooling is to be maintained.

5.3.1.2. Preliminary equipment submittals or cutsheets summarizing proposed equipment.

5.3.2.65% Design Submission shall include required engineering services and equipment/material submittals.

5.3.3.100% Design Submission is required at job completion and shall include any modifications required after 65% review and as-built documentation.

5.3.4.Final Design Submission is required within 60 days of project completion.

5.4. Additional Work Requirements

5.4.1.Perform all work per SCDHEC regulations and section 608 of the most updated version of the "Clean Air Act." Recover the existing refrigerant charge and dispose of refrigerant per section 608.

5.4.2.The chilled water supply and return piping and condenser water supply and return piping shall be rerouted as needed to connect to the new chiller and shall include new thermometers and pressure gauges. New chilled water piping shall be insulated to match existing. New condenser water piping shall be painted to match existing. As far as practicable, the piping shall not obstruct maintenance access to any component.

5.4.3.Provide new double suction horizontal split case pumps for each chiller evaporator (primary) pump (3 pumps total). Pumps shall meet types, sizes, capacities, and characteristics as required to serve new chillers and existing chilled water distribution system. Pumps shall include the following features:

5.4.3.1. The pumps shall be long coupled, base mounted, single stage, double suction, horizontal split case design, in cast iron bronze fitted construction specifically designed and guaranteed

for quiet operation. Suitable standard operations at 225°F (107°C) and 175 psig (12 BAR) working pressure. Working pressures shall not be de-rated at temperatures up to 250°F (121°C). The pump internals shall be capable of being serviced without disturbing the upper casing half and system piping. A bearing housing shall supply support for a pair of heavy-duty regreaseable ball bearings. An inboard single row bearing will absorb thermal expansive forces while an outboard double row bearing will be clamped in place to absorb both radial and thrust loads and keep the rotating element in proper axial alignment. Bearings shall be replaceable without disturbing the system piping, the upper casing half, and shall be regreaseable without removal of the bearings from the bearing housing.

5.4.3.2. The impeller shaft shall be a solid 416 stainless steel shaft.

5.4.3.3. Pump shall be equipped with a pair of internally flushed mechanical seal assemblies in direct contact with the pump shaft. Seal assemblies shall be Type 21 having a stainless steel housing, Buna bellows and seat gasket, stainless steel spring, and be of a carbon-ceramic design with the carbon face rotating against a stationary ceramic face.

5.4.3.4. Impeller shall be of the enclosed double suction type made of bronze, both hydraulically and dynamically balanced to ANSI/HI 1.1-1.5-1994, section 1.4.6.1.3.1, figure 1.106, balance grade G6.3 keyed to the shaft and fixed in the axial position.

5.4.3.5. A flexible type coupling, capable of absorbing torsional vibration, shall be employed between the pump and motor.

5.4.3.6. The coupling shall be shielded by a dual rated ANSI B15.1, Section 8 AND OSHA 1910.219 compliant coupling guard and contain viewing windows for inspection of the coupling.

5.4.3.7. Pump volute shall be of a cast iron (rated for 175 psig Max WP) axially-split design with flanges (175 psig drilled for 125# ANSI companion flanges) and mounting feet integral cast into the bottom half of the casing. Suction and discharge flanges shall be on a common centerline in both the horizontal and vertical planes, and the volute shall include Bronze Casing Wear Rings, priming port, gauge ports at nozzles, and vent and drain ports. The upper half casing shall be capable of being removed without disturbing piping connections or electrical motor connections.

5.4.3.8. Pump seal flushing shall be internal within the pump casing and shall flush the seal at a rate equal to 25% of the total pump flow.

5.4.3.9. Motors shall meet existing horsepower, speed, voltage, and enclosure design. Pump and motors shall be factory aligned, and shall be realigned after installation by the manufacturer's representative. Motors shall be non-overloading at any point on the pump curve and shall meet NEMA specifications and conform to the standards outlined in EPACT 92.

5.4.3.10. Base plate shall be of structural steel or fabricated steel channel with fully enclosed sides and ends, and securely welded cross members. The grouting area shall be fully open. The combined pump and motor base plate shall be sufficiently stiff as to limit the susceptibility of vibration. The minimum base plate stiffness shall conform to ANSI/HI 1.3.4-1997 for Horizontal Baseplate.

5.4.3.11. Base shall be capable of being field grouted. Pump rotation shall be righthand or lefthand as viewed from the pump end. Pump manufacturer shall be ISO-9001 certified. The seismic capability of the pump shall allow it to withstand a horizontal load of 0.5g, excluding piping and/or fasteners used to anchor the pump to mounting pads or to the floor, without adversely affecting pump operation. Each pump shall be factory hydrostatically tested per Hydraulic Institute standards and name-plated before shipment. It shall then be thoroughly cleaned and painted with at least one coat of high-grade paint prior to shipment.

5.4.3.12. Demolish existing, pour new or modify existing equipment pads as needed to accommodate new chillers and pumps.

5.4.3.13. Provide and install new automatic tube brush cleaning system on each chiller condenser including installation of new brush and baskets for each tube, new 4-way reversing valve with pneumatic actuator and control panel including flow switch bypass.

5.4.3.14. Make arrangements for scheduled services and repairs by contacting Directorate of Public Works (DPW), Contract Management Branch (803-751-1069).

5.4.4. **Option 1- ASHRAE 15 Upgrades**: Evaluate CEP 1 for compliance with latest ASHRAE 15 Standard. Provide all required modifications to upgrade central energy plant to meet these guidelines. Among the items included shall be refrigerant monitoring and alarm, ventilation requirements in case of alarm and interlock to existing boilers in case of alarm. These are not all that may be required and existing facility has to be evaluated to determine all required upgrades to meet standard. (price as a separate line item.)

Performance Data – Centrifugal Water-Cooled Chillers

Tags	CH-1,2	CH-3
Capacity (tons)	1200	1200
Unit power (kW)	671.9	671.9
Maximum Efficiency (kW/ton)	0.560	0.560
Maximum NPLV (kW/ton)	0.448	0.448
Full load sound pressure (ARI Condition) (dBA)	89	89
Refrigerant charge (HCFC-123) (lb)	1850	1850
Evap entering temp (F)	56	56
Evap leaving temp (F)	42.00	42.00
Evap flow rate (gpm)	2048, 2520	2048
Evap fluid concentration (%)	0.00	0.00
Max. Evap pressure drop (ft H2O)	16.9'	16.9'
Evap fouling factor (hr-sq ft-deg F/Btu)	0.00010	0.00010
Cond entering temp (F)	85.00	85.00
Cond leaving temp (F)	94.38	94.38
Cond flow rate (gpm)	3600	3600
Cond fluid concentration (%)	0.00	0.00
Max. Cond pressure drop (ft H2O)	22.9	22.9
Cond fouling factor (hr-sq ft-deg F/Btu)	0.00025	.00025
Run load amps (A)	106.7	106.7
Min circuit ampacity (A)	135	135
Max overcurrent protection (A)	230	230

Tags	CH-1,2	CH-3
Nominal Starter Inrush (A)		
Motor locked rotor amps (A)	681	681
Free Cooling Tons @ 45 Entering Cond. Temp.	598	NA
Leaving Evap. Temp. (2047.72520 GPM)	55.3	NA
Entering Evap. Temp.	62.3	NA
Free Cooling Tons @ 45 Entering Cond. Temp.	465	NA
Leaving Evap. Temp. (2047.72520 GPM)	53.1	NA
Entering Evap. Temp.	58.5	NA

Chiller Part Load Information (NPLV= 0.454)

% Load	Capacity	Lvg. Evap.	Ent. Evap.	Evap. GPM	Ent. Cond.	Lvg. Cond.	Cond. GPM	KW	Efficiency
100	1200	42	56	2047.7	85	93.38	3600	106.5	0.56
75	900	42	52.5	2047.7	75	81.85	3600	415	0.461
50	600	42	49	2047.7	65	69.51	3600	250.3	0.417
25	300	42	45.5	2047.7	65	67.34	3600	161.4	0.538

5.5. Option 2: CENTRAL ENERGY PLANT DDC CONTROL SYSTEM (price as a separate line item)

5.5.1. General – If this option is exercised, demolish existing CEP chiller plant control system and provide a new chiller plant control system as follows. The chiller plant control system shall monitor and control the chilled water system including the chiller(s), pump(s), cooling towers, and variable speed drives as appropriate. The control system shall meet LonMark interoperability guidelines. Provide equipment necessary so that monitoring and control can be accomplished by the existing base wide Energy Management and Control System (EMCS) system using LONworks protocol via the existing wireless system.

5.5.2. The chiller plant control system shall have a fully editable user interface set-up via point and click on a standard windows screen. It shall not require special software tools or a building automation system technician to operate.

5.5.3. The chiller plant control system shall include the following features:

- Operator interface
- System Start/Stop
- Chiller and pump sequencing
- Chiller minimum flow by-pass valve control
- System soft start
- Automatic rotation of chillers and pumps
- Failure recovery diagnostics/protection
- Energy optimization routines
- System and chiller status reports
- Demand limiting
- Cooling tower sequencing and control

5.5.4. System Control Configuration Overview – Control of the system components shall be as follows:

5.5.4.1. The chillers shall receive enable/disable signals either through a command via a communication link or via a hardwired binary input.

5.5.4.2. A chiller binary output shall control the operation of the chiller evaporator isolation valve and/or call for pump operation.

5.5.4.3. The pump(s) speed shall be modulated to control the chilled water system supply / return pressure differential to the required setpoint.

5.5.4.4. The system minimum flow by-pass valve shall be a normally open valve.

5.5.4.5. The system minimum flow by-pass valve shall be modulated to the fully open position whenever the system is shutdown to ensure minimum flow and prevent the possibility of water hammer whenever a pump is started.

5.5.4.6. The system minimum flow by-pass valve position shall be modulated to ensure operating chiller(s) flow does not drop below the manufacturer's minimum recommended flow. Control shall be based on flow through the chiller evaporator by measuring pressure drop across the evaporator and calculating evaporator flow from manufacturer's data OR direct measurement using a calibrated flow meter.

5.5.4.7. Flow rate fluctuation through the chiller shall not exceed 30 percent of the design flow rate per minute.

5.5.4.8. A chiller binary output shall control the operation of the chiller condenser isolation valve and/or call for pump operation.

5.5.4.9. During cold start-up the condenser water flow through the chiller shall be modulated per the manufacturer's recommendations to maintain the no less than the minimum condenser/evaporator refrigerant pressure differential.

5.5.5. Operator interface - The chiller plant control system shall include the operator interface elements listed in the following paragraphs. Any additional monitoring and control points necessary for proper control, operation, and monitoring shall be added to the operator interface at the request of the COR.

5.5.5.1. Operational status screen to include:

- Chiller System Status (Off/Soft Start/Normal/Ambient Lockout/Shutdown in Progress)
- Chiller Plant Supply Water Setpoint
- Chilled Water System Supply Water Temperature
- Chilled Water System Return Water Temperature
- Predictive chiller addition / subtraction status messages (i.e. "Next Chiller will be added if the system supply water temp 41.7exceeds 43.5 degrees for 10 minutes.")
- KW/Ton for total plant operation (including all Pumps, Towers and Chillers)
- Individual Chiller Failure Reset (Push Button)
- All Chiller Failure Reset (Push Button)
- System Pump Failure Reset (Push Button)
- Manual Addition of Chiller (Push Button)
- Manual Subtraction of Chiller (Push Button)

- Manual Rotation of Chiller Sequence (Push Button)
- Flow measurement or flow calculation as required by 5.5.4.6 & other subsequent paragraphs
- All pump VFD commands and feedback in either % speed or Hz
- Pump status and start/stop command
- Condenser return water temperature
- Tower VFD start/stop command, status, speed command, and feedback
- Demand limiting schedule & current command/status
- Chilled water supply flow (leaving CEP)
- Outside air dry & wet bulb temperatures
- Display of chiller rotation sequence (lead, lag-1 & lag-2)

5.5.5.2. Screen that allows editing of the following data (to be performed without entering program code editor):

- Supply Water Setpoint
- System Soft Loading Parameters
- Ambient Lockout Parameters
- Chiller Addition Parameters
- Chiller Subtraction Parameters
- Auto Rotation Parameters
- Alarm Handling Setup
- Security Setup

5.5.5.3. Individual Chiller Graphic(s) to include all data listed on the supplementary Chiller System Point List, including:

- Chiller Name
- Chiller Operating Mode
- Chilled Water Setpoint
- Chiller RLA %
- Entering Chiller Water Temperature
- Leaving Chilled Water Temperature
- Evaporator Flow Rate
- Evaporator Flow Status
- Condenser Flow Status
- System Start/Stop - The chilled water system shall start in response to a binary signal from an external source such as the building automation system, with the option to use outside ambient temperature lockout.

5.5.5.4. Upon the start of the chilled water system the chiller plant control system shall automatically start Trend Log Reports including hourly logging of system of the following points:

- Outside Air Dry Bulb
- Outside Air Wet Bulb
- System Chilled Water Setpoint
- System Chilled Water Supply Temperature
- System Chilled Water Return Temperature
- System Condenser Water Supply Temperature
- System Condenser Water Return Temperature
- System Chilled Water Supply Flow
- Operating Status of each chiller
- Operating Status of system pumps
- KW/Ton for total plant operation (including all Pumps, Towers and Chillers)

5.5.5.5. Sequencing - The chiller plant control system will start and stop the chilled water pumps and chillers based upon system load.

5.5.5.6. When the chilled water system is enabled the chiller plant control system shall:

- Send an Enable signal to the lead chiller.
- Upon receiving the enable signal the chiller shall enable the chiller evaporator isolation valve.
- The isolation valve shall be controlled to 100% open.
- When the isolation valve is confirmed to be 100% open, the chiller plant control system shall start the lead chilled water pump in the sequence.
- The chilled water pump shall be controlled to maintain the design pressure setpoint for the system.
- Upon confirmation of evaporator water flow the chiller shall enable the chiller condenser isolation valve and call for the lead condenser pump operation.
- Upon confirmation of condenser water flow the chiller shall continue its pre-start sequence and start its compressor(s).
- The chiller plant control system shall initiate the start of the next system chilled water pump when the pressure setpoint is not met for 5 minutes. The active pumps shall run at the same speed.
- The chiller plant control system shall initiate the shutdown of the next system chilled water pump whenever excess pump capacity exists for 5 minutes as determined by the pump speed, the system pressure, and the number of pumps running.

- The chiller plant control system shall initiate the start of the next chiller in the sequence whenever the chilled water load, as determined by the system supply water temperature, is not met for 17 minutes.
- The chiller plant control system will unload operating chillers to an operator editable current limit prior to starting a lag chiller. Lag chillers shall start in a similar manner to the lead chiller start sequence.
- The chiller plant control system shall initiate the shut down of the next chiller in the sequence whenever excess chilled water capacity exists, as determined by percent run load amps, for 20 minutes.
- Upon sensing a chiller failure the chiller plant control system shall shut down the failed chiller immediately and initiate the start of the next chiller in the rotation sequence.
- The chiller plant control system shall control individual chiller setpoints to maintain the system supply water temperature at setpoint.
- The design system chilled water setpoint shall be 42 degrees F and editable by the operator.

5.5.5.7. Chiller Minimum Flow By-Pass Valve Control

5.5.5.7.1. The Chiller Minimum Flow By-Pass line and valve shall be sized to allow for the manufacturer's recommended minimum flow, with all load control valves closed, for the chiller with the largest minimum flow rate in the system.

5.5.5.7.2. The "Chiller Minimum Flow By-Pass Valve" shall be a normally open valve.

5.5.5.7.3. The "Chiller Minimum Flow By-Pass Valve" shall be modulated to the fully open position when the system is shutdown. This shall be done to prevent water hammer when a pump is started and to allow for minimum flow in the event the chiller calls for pump operation.

5.5.5.7.4. Following the confirmed start of the lead chiller and whenever system is enabled, the chiller plant controls system shall modulate the "Chiller Minimum Flow By-Pass Valve" such that the chilled water flow through any operating chiller(s) shall not drop below the manufacturer's recommended minimum flow.

5.5.5.7.5. The chiller minimum flow shall be determined based on the pressure drop across the chiller evaporator barrel using a high accuracy pressure differential sensor. The differential pressure setpoint shall be determined based on the manufacturer's chiller pressure drop rating curves.

5.5.5.8. System Soft Start - The chiller plant control system will initiate a "soft start" mode whenever the system chilled water temperature exceeds the specified chilled water system

setpoint by 20 degrees F at system start-up. The chiller plant control application will add cooling capacity during soft start mode only if return water temperature is not declining at a rate of at least .5 degrees F per minute. This prevents the unnecessary operation of chillers and limits system electrical demand during chilled water loop pull down.

5.5.5.9. Automatic rotation of chillers and pumps.

5.5.5.9.1. Chiller rotation shall be initiated based on an operator entered day interval or by the cycling of a binary point. The method of sequence shall be operator selectable.

5.5.5.9.2. Chiller cycling caused by normal system load fluctuations shall cause the chillers to change rotation sequence or at the operator's option chillers may be forced into the new rotation sequence at the time of sequence change.

5.5.5.10. Diagnostics/Protection - the Building Automation System shall be able to alarm from all sensed points and diagnostic alarms monitored by the chiller controller.

5.5.5.11. Chiller Status Report - Provide an operating status report for each chiller. The report(s) shall provide the present for the following information to provide the operator with critical chiller operating data:

- Compressor On/Off Status
- Compressor Starts/Run Hours
- Compressor Phase 1/2/3 Percent RLA - separate for each compressor
- Compressor Current Draw - RLA Percent
- Active Chiller Diagnostics or Alarms
- Leaving Chilled Water Temperature
- Entering Chilled Water Temperature
- Evaporator Flow Rate
- Condenser Water Entering/Leaving Temperatures
- Chilled Water Setpoint
- Refrigerant Temperature Evaporator/Condenser - Separate for each circuit
- Operating Mode
- Chiller Model and Serial Number
- Outside Air Dry Bulb
- Outside Air Wet Bulb

5.5.5.12. Demand Limiting - As part of the demand limiting scheme on the building, the chiller plant control system shall be able to monitor and reduce peak power demand through the limiting of chiller current draw.

5.5.5.13. Free Cooling operation - when the outside air ambient conditions are adequate the chiller plant control system will automatically configure valves and cooling tower operation to supply chilled water without the mechanical operation of centrifugal chillers.

5.5.5.14. Cooling Tower Leaving Water Setpoint Optimization

5.5.5.14.1. The chiller plant control system shall calculate the optimal tower setpoint at any chiller(s) load and ambient wet bulb. The chiller plant control system shall provide as an output a leaving tower water temperature setpoint.

5.5.5.14.2. Optimal performance is defined as the lowest total kW input consumed by both chiller(s) plus cooling tower(s) while maintaining chilled water setpoint.

5.5.5.14.3. At all times the tower leaving setpoint shall be limited within the high and low values specific to the chiller(s) being supplied as specified by the chiller manufacturer.

5.5.5.14.4. The chiller plant control system shall include a chiller/cooling tower optimization routine. As a minimum, the following chiller and tower characteristics shall be used in the optimization routine:

- Chiller type (per chiller)
- Chiller full load efficiency (kW/ton)
- Chiller part load performance (kW/ton) (efficiencies from 100-10% in 10% increments)
- Chiller condenser water flow rate
- Tower type (per tower)
- Tower approach temperature
- Tower range
- Actual instantaneous chiller tons

The chiller plant control system shall scan the chiller(s) load and ambient WB temperature every 15 minutes. Using these inputs and both the chiller and cooling tower characteristics noted above, the chiller/cooling tower optimization routine shall calculate the optimal chiller plus tower performance.

5.5.5.15. Cooling tower sequencing and control- The Building Automation System shall monitor the refrigerant pressure in each chiller's evaporator and condenser. The Building Automation System shall control the chiller condenser pump VSD OR cooling tower bypass

valve OR chiller condenser bypass valve OR chiller condenser throttling valve to maintain no less than the minimum pressure differential specified by the chiller manufacturer.

5.5.5.15.1. Cooling Tower Fan Control- When a chiller is operating and the cooling tower basin temperature rises to 2 degrees F above the current tower leaving water leaving water setpoint, the cooling tower lead tower fan shall be turned on at minimum speed and the control loop shall be enabled.

5.5.5.15.2. The cooling tower fan speed shall be modulated to maintain the desired cooling tower leaving water temperature.

5.5.5.15.3. When the operating fan(s) are operating at 50 percent speed an additional fan shall be enabled and controlled at the same speed as the operating fans until all active cooling tower cell fans are enabled.

5.5.5.15.4. When operating fans are running at minimum speed and the tower supply water temperature is 5 degrees F below the current tower leaving water leaving water setpoint, the most lag tower fan shall be turned off.

5.5.5.15.5. Cooling tower fans shall have 5 minute minimum on and off time delays.

5.5.6. Control Execution- All Control wiring shall be in Conduit. All Control devices (Sensors, Valves, Flow Meters, etc.) required to meet the specified requirements and sequence of operation must be included.

5.5.7. Training- Provide a minimum of 16 hours of training on the new equipment and control systems for Government Personnel. Provide training materials for not less than 10 personnel.