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Stockton EDD
WO#: 130685

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STUDY

The scope of this report is to recommend long term HVAC (Heating, Ventilating and Air Conditioning) needs, renovations and repairs, to make the building HVAC system more reliable and better functioning. Due to the probability of building sale and relocation, short term recommendations for repairs to keep the building HVAC system functional for another five years are also included.

Stockton EDD office building from southeast

The Stockton EDD office building is a 30,030 square foot building located at 135 West Fremont Street. It was constructed in two parts. The original building was built in 1951 and is located on the southern part of the property. The original building is 19,602 square feet. In 1964 an addition of 10,428 square feet was constructed on the north side of the original building. The building and site are owned by EDD.

Building maintenance is provided by DGS BPM (Department of General Services, Building and Property Management). The stationary engineers are Brian Phillips and Raymond Lopez, both from the nearby Stockton DGS office. Both are relatively new to the site so for building HVAC history the project team

also talked with Jesse Navarro and Gill Charanjit, the previous building engineers.

The California Building Code (CBC) exempts HVAC projects from the requirements to provide accessibility upgrades as part of a project. This is handled specifically in the 2007 CBC, Article 1134B.2.1.4. Projects "which consist only of heating, ventilation, air conditioning, reroofing ...shall not be subject to this code." Paraphrasing, this means if ceiling replacement or new light switches are done as part of this project, then ADA upgrades not addressed in this report will also be required. This is only mentioned, so that the reader is aware, that if the ceilings are replaced ADA upgrades would be required, potentially doubling or more the ceiling cost.

EXISTING:

In 1992 a HVAC renovation replaced the constant volume air handler units with Variable Air Volume (VAV) systems. There are presently two variable air volume air handlers and 27 VAV boxes throughout the facility. Both Air Handlers included VFDs (Variable Frequency Drives) for both the supply and return fans. Additionally, the boiler, pumps, chiller and cooling tower were all replaced with new in 1992.

The original building is conditioned by air handler AH-1. AH-1 is located in the second floor mechanical room. AH-1 has a 20,700 cfm, 30 hp motor for supply fan (SF-1), a 7-1/2 hp motor for return fan (RF-1), a 70 ton cooling coil and 540 MBh heating coil. Sixteen VAV boxes (VAV-1 through VAV-16) provide temperature zones with perimeter VAV box reheat coils for the original building.

The AH-1 supply fan power branch power is fed from the 120/208 volt, three phase, 4 wire, 400 ampere distribution panel 'DP2' with a 175 ampere - 3 pole circuit breaker and a 1-1/2" conduit with (3)#1/0 copper conductors. The return fan motor branch circuit power is fed from 'DP2' with a 50 ampere – 3 pole circuit breaker and a ¾" conduit with (3) #8 cu copper conductors.

The addition is conditioned by AH-2. AH-2 is located in a rooftop mechanical room. AH-2 is 16,000 cfm, 20 hp motor for supply fan SF-2, 5 hp return fan motor for RF-2, a 50 ton cooling coil and 420 MBh heating coil. Eleven VAV boxes (VAV-17 through VAV-27) provide temperature control with perimeter VAV box reheat coils for the building addition.

The AH-2 supply fan power branch power is fed from the 120/208 volt, three phase, 4 wire, 600 ampere distribution panel 'DP' with a 125 ampere - 3 pole circuit breaker and a 1" conduit with (3)#4 copper conductors. The return fan motor branch circuit power is fed from 'DP' with a 30 ampere – 3 pole circuit breaker and a ¾" conduit with (3) #10 cu copper conductors.

A 1.2 MBh natural gas fired boiler provides hot water to coils at both air handlers and the VAV boxes. A 2 hp, 72 gpm pump, HWP-1, circulates the space heating hot water from the boiler to the air handler units and VAV box reheat coils.

HWP-1 and boiler

The pump (HWP-1) is fed from distribution panel 'DP2' with a 20 ampere – 3 pole circuit breaker and a ½" conduit with (3) #12 copper conductors.

A 120 ton chiller provides CHW (Chilled Water) to both air handlers. The chiller rejects heat via a cooling tower, CT-1. A 10 hp, 290 gpm chilled water pump, CHWP-1, circulates the chilled water to the air handlers. A condenser water pump, CWP-1, is a 5 hp, 300 gpm pump that moves water between the chiller and cooling tower. The chiller, cooing tower and pumps are all located outside in a fenced enclosure on the east side of the addition.

120 ton Chiller

Cooling Tower, CT-1

The pump (CHWP-1) is fed from distribution panel 'DP' with a 60 ampere – 3 pole circuit breaker and a ¾" conduit with (3) #8 copper conductors. The second pump (CWP-1) is fed from distribution panel 'DP' with a 30 ampere – 3 pole circuit breaker and a ¾" conduit with (3) #10 copper conductors.

Four exhaust fans ventilate the three restroom areas and the employee kitchen. Three are roof mounted and one (for the front employee restrooms) is located in the second floor mechanical room.

<u>ACM, Asbestos Containing Material</u>:

The drawings for the 1992 Office Alteration project, OPDM 0195, include asbestos abatement drawings. The drawings indicate duct wrap, pipe, fittings, insulation, carpet, floor tile and adhesive were all abated.

No information was available indicating whether or not the ceiling had been tested for ACM or piping insulation above the ceiling. The assumption was made that testing of potentially disturbed surfaces will be required.

FINDINGS

In discussion with the building engineers and onsite staff the overall comfort level in the building is satisfactory. Along with some calculations this confirms the equipment sizing is correct.

AH-1 is in bad shape. Both VFDs for SF-1 and RF-1 have been bypassed. SF-1 VFD caught fire at one point and has not been repaired or replaced. The return air fan, RF-1, is located adjacent/parallel to the air handler, AH-1. The RA (return air) duct wraps around the end of the unit and enters the air handler from the end. The OA (outside air) comes from a doghouse on the roof. The OA duct drops from above going through a damper. Drawings from the 1992 renovation show a 30"x62" OA duct and 30"x62" OA damper. Onsite measurements show a 31"x82" OA connection at AH-1 and a 21"x66" OA damper. The OA damper restricts the OA duct to less than 55% of its cross sectional area. The OA damper free area should equal the duct cross sectional area. When the RA damper is closed and the OA damper is open the OA is a restriction. In this damper arrangement the supply fan sucks the RA duct in. When the RA damper is open and the OA damper is closed, the return fan, RF-1, expands the RA duct out. In other words the return air duct entering AH-1 is expanding and contracting, as the dampers change positions.

AH-1 outside air restriction

AH-1 external duct supports

The return fan, RF-1, became unbalanced a few years ago and the internal inlet shrouds for RF-1 were decimated by the fan blades. Since then the fan has been operating without them resulting in decreased efficiency. Additionally, RF-1 was designed to be hung from the roof, but rests on the ceiling joists as a means of support.

AH-1 VFDs have been bypassed because they are shot. Note the wall discoloration above SF-1 VFD in the photo below.

VFDs for RF-1 and SF-1, resp.

AH-2 is in considerably better shape. The unit runs well. SF-2 VFD is new. RF-2 VFD needs a low voltage transformer and therefore is presently bypassed.

AH-2 piping
Note bucket for leaky CHW valve

Coils, both cooling and heating, in both units are in good shape based on temperature differentials. CHW three-way valves work, but leak on both units. Space heating hot water three-way valves on both units are in good shape.

The chiller, CH-1, has two compressors. One compressor, the south one, was replaced in 2009 with a rebuilt unit. This compressor has 56,936 starts and 8,960 hours or 6-1/3 starts per hour of use. The second compressor had the valves replaced by American Chiller Service three years ago and is presently in good shape. This second refrigeration circuit is low on refrigerant. This compressor has 22,685 starts and 2,112 hours or 10-3/4 starts per hour of use. This is an excessive number of starts per use for both compressors. American Chiller Service visited the site and provided an assessment of the chiller.

The cooling tower, CT-1, overall is in good shape. There are 3 fans and 3 bearings. The center bearing of the three bearings need replacement. One of the three sets of fan blades are missing. The plastic drift eliminators have suffered

sun damage, become brittle and need replacement. ACS Cooling Tower Services visited the site and provided an assessment of the cooling tower.

The boiler was installed in 1992. Overall it seems to be in good shape. The controls work for a while, then quit. The current operational fix is to manually restart the boiler.

Boiler

Reportedly, the VAV boxes are in good operating condition.

The second floor is conditioned by air handler, AH-1. Per drawing M1 of the 1992 renovation the supply ducts to this area were capped. Onsite investigation revealed that air was coming out of the supply diffusers and that there are no return registers in any of the three rooms on the second floor. The only return air register for this area is located in the stairwell. At one point there were returns in the doors but they have been sealed. It is assumed this was the result of a CSFM (California State Fire Marshal) requirement. The Building code allowed returns through doors and hallways in the era the building was built. Since then code updates have deleted this allowance. The net result for these areas of the building is, if the doors are closed, minimal space conditioning occurs.

Second floor door blocked return air

There are two training rooms and one office on the second floor. One training room is at the top of the stairs and has no windows. The other meeting room is located on the south with windows along the full wall length. The office is presently not occupied. There is only one thermostat for the three rooms. It is located in the meeting room at the top of the stairs. The other meeting room has south facing windows without any shade devices. This layout results in the south meeting room getting very hot.

Both air handler unit fans run 24/7. Because the VFDs are bypassed there is no fan control for the units. The heating and cooling still turns on and off for both units. The EMS (Energy Management System) controls computer is located remotely at Building 901, 31 East Channel Street, nearby in Stockton.

Numerous supply diffusers throughout the building have permanent devices in place to block air flow. The restoration of properly functioning VFDs should allow lower air flow and the removal of the devices.

Some of the four exhaust fans are not working resulting in poor odor control.

The electrical connections are adequate and in good condition with no known problems.

RECOMMENDATIONS:

Presently a VAV system is installed but because the VFDs and controls do not work the system does not operate as intended. Regardless of any other work that may or may not be done, repairing the VFDs and controls will provide a dramatic difference in both occupant comfort and energy savings.

Three main estimated costs are shown on the three page estimate, estimated total current costs, estimated total construction cost and total estimated project costs. The estimated total current cost is the current cost of materials and labor alone. The estimated total construction cost is the estimated total current cost with escalation factors to the time of construction and construction contingency funds added. A summary of total estimated project costs is estimated total construction cost plus Architectural and Engineering fees, inspection fees, regulatory review fees, project management fees and contract bidding costs.

Short Term (now to 5 years, in order of importance):

1) Add refrigerant to chiller to number 2 compressor circuit.
2) Replace chilled water 3-way valves.
3) Replace VFDs (disconnect and reconnect any electrical power.)
4) Replace EMS controls (disconnect and reconnect any electrical power).
5) Replace cooling tower fans, fan inlet rings, shaft, bearings, fan sheave, belts, and sheave bushings.
6) Replace cooling tower plastic honeycomb drift eliminators.
7) Replace AH-1 RA and OA dampers.
8) Replace RF-1 inlet shroud.
9) Reconfigure AH-1 RA duct and RF-1 support.
10) Repair/replace boiler controls.
11) Replace four exhaust fans.
12) Add wall returns to two second floor conference rooms and ceiling return to second floor office.

13) Relocate second floor thermostat to south meeting room.
14) Adjust zoning to separate pubic and employee use areas.
15) Air balance HVAC system.

The estimated total project costs for all fifteen items is $663,000.

Long Term

This list is in addition to or in lieu of short term fixes noted above. Any equipment being replaced will be with similar size equipment. Most of the long term fixes will require a full closure of the building as the work being done will cause major disruption to the facility. Median life expectancy of various mechanical equipment per the ASHRAE (American Society of Heating, Refrigeration and Air conditioning Engineers) is 20-25 years for chillers, 20-30 years for AHUs and 20 years for cooling towers.

1) Replace cooling tower.
2) Replace CHW and CW pumps.
3) Replace VFDs.
4) Provide new zoning reusing much of the duct.
5) Replace supply diffusers and return registers. Remove and reinstall lights and repair ceiling as required to perform the work.
6) Clean ducts if being reused.
7) Remove and replace ceiling as required for access to mechanical equipment and appurtenances being replaced.
8) Air balance HVAC system.
9) Replace chiller.
10) Replace both air handlers including removal of unused concrete pads from mechanical rooms.
11) Replace VAV boxes.

Disconnect the power and reconnect to all new equipment with the same existing branch circuit power feeders that are currently feeding the replaced equipment.

The replacement of the control system alone should greatly enhance the life of the chillers because it would stop the wear and tear of the constant starting and stopping that is presently occurring.

The estimated total project cost for all eleven long term items is $1,677,800.