GC Led Value of Commissioning
A Wrigley Field Case Study

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Agenda

• Restoration project scope
• Challenges that arose during construction
• Cx issues identified and resolutions
• Qualitative results from the GC
• Other GC led Cx experiences
Wrigley Restoration Project Scope

- “Specialty” design team for Phases 4 and 5
- Extreme pace of construction, made more challenging by Cubs post-season success.
Phase 1-3

- Local design team involved
- Structural and enabling work as well as restroom, office, and concession upgrades to Concourse and Mezzanine levels.

- Bleacher reconstruction
- Plaza Building & Home Team Locker Room construction.
Phase 4

- Scope: Concourse Concessions & Restrooms, Suite and Club levels, construction of 2 new ComEd Vaults
- Timeline: November 2017 – April 2018 (20 Weeks)
- New Remote Specialty Design Team
  - Not local – provided a challenge for day-to-day questions and in-field support
- Beginning of major HVAC equipment installation and integration to campus BAS
Phase 4

• Quickly assembled design drawings presented many challenges
  • Control Sequences Missing/Misleading, Equipment not properly scheduled between Phase 4 and Phase 5.

• Work occurred 24/7

• 1,547 overall construction RFIs submitted in Phase 4. (11 RFIs per day!)

• MEP Construction challenges starting to become more frequent
  • Project was not in line to be formally commissioned.
Phase 4 – Race to the Finish Line

- Entirely new electrical infrastructure.
  - Permanent power was not available until March.
- Mechanical startup was squeezed for time
- Final balancing report was received the day before Opening Day

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Phase 4

- Issues that arose during construction:
  - Powering-on of equipment was not properly prioritized.
  - VFDs were wired to incorrect fans. Not discovered until startup.
  - Any issues with equipment performance not discovered until the last minute.
Phase 4

- Two big issues that arose after Opening Day:
  - Humidity and pressure control in club level
  - General issue with Suites maintaining temperature. Lack of humidity control in suites causing condensation on glass partitions.
- Pepper brought in GBA’s commissioning group to provide technical engineering support
  - GBA performed Cx design review
  - found issues in design and controls sequence
Phase 4 – Initial Site and Contractor Review

• In April, prior to GBA, the 1914 was cold due to bringing in cold air when the space was negative. In the summer, when GBA was hired, the spaces were warm and humid.

• Design team reiterated that their design intent relies on doors remaining closed. Should this have been the assumption in baseball stadium fan areas?

• When games are not on-going, spaces used for batting practice and field maintenance have doors left open.

• 1914 Club doors are continually opened throughout the game, effecting pressure and the ability to maintain temperature and humidity.

• It was clear, after discussions with Johnson Controls, and quick reviews of the drawings and BAS information, that the issues were most likely design related.
Phase 4 – Initial Site and Contractor Review
Phase 4 – Cooling and Humidity Issues

Review of the 1914 Club AHU Cooling Coil:

• EAT: 75F 65WB = 29.9 BTU/lb
• LAT: 53F 53WB = 21.9 BTU/lb
• Airside cooling load = 648,000 BTU/hr
• CHW cooling load = 560,000 BTU/hr

Loads significantly different!
Phase 4 – Cooling and Humidity Issues

Review of the 1914 Club AHU Cooling Coil:

- Submitted and installed coil can’t meet the LAT requirement.
- This results in additional hours that humidity setpoint can’t be met!
- Engineer ran a reselection at more appropriate design conditions, and with a 30% increase in CHW flow the coil could provide 56F leaving.

- New parameters became:
  
  EAT: 82.5F, 69.5WB, LAT: 56F, 113 GPM, 780,000 MBH
  OAT: 91.4F, 74.3 WB, OA increased from 3,900 to 8,300 CFM
Phase 4 – Cooling and Humidity Issues

1914 Club AHU Demand Control Ventilation Sequence of Operations:

H.19. CO2 SENSORS SHALL BE MOUNTED IN THE RETURN AIR SECTION OF THE AHU FOR MONITORING OF CO2 LEVELS.

H.19.1. HIGH OCCUPANCY ROOMS SHALL HAVE SPACE CO2 SENSORS. ON SPACE CO2 LEVEL RISE TO 850 PPM (ADJ.), HAS SHALL OVERRIDE CURRENT OPERATION TO DRIVE ASSOCIATED VAV BOXES TO 100% OPEN. AFTER 15 MINUTE DELAY, 2ND STAGE OF CONTROL SHALL RESET THE POSITION OF THE OA DAMPER IN INCREMENTS OF 10% AIRFLOW UNTIL SPACE CO2 LEVEL IS BELOW SET POINT.

H.19.2. IF ALL SPACE AND RETURN AIR CO2 LEVELS ARE BELOW 500 PPM (ADJ.), THE OA DAMPER SHALL MODULATE DOWN IN 10% INCREMENETS OF AIRFLOW. MINIMUM OA CFM IS LISTED ON THE SCHEDULES.
Phase 4 – Cooling and Humidity Issues

Review of Suite Level VRF System:

• System shall be integrated to BAS.

• Thermostat shall be capable of DRY (dehumidify).
Phase 4 – Cooling and Humidity Issues

Review of Suite Level RTU:

- RTU is specified to be used in a “single zone VAV” configuration.
- This provides continuous dehumidification
- Additional dehumidification mode was also specified

K. DISCHARGE AIR TEMPERATURE:

J. DEHUMIDIFICATION MODE (SUITE LEVEL RTUS):
1. WHEN THE SPACE HUMIDITY RISES ABOVE 80%(ADJ.) AS MEASURED VIA ANY OF THE SPACE HUMIDITY SENSORS, SUPPLY FANS SHALL RAMP DOWN TO MINIMUM AIRFLOW AND ENABLE DX COOLING COIL. VARIABLE SPEED DX COMPRESSORS WILL MODULATE TO MAINTAIN SPACE HUMIDITY.
2. SUPPLY FAN WILL RAMP UP / DOWN TO MAINTAIN SPACE TEMPERATURE SETPOINT. IF THE SPACE IS OVERCOOLED AT MINIMUM FLOW, THE GAS HEATING SECTION WILL BE ENABLED. HEATING SECTION TO MODULATE TO MAINTAIN SPACE TEMPERATURE.
Phase 4 – Cooling and Humidity Issues

Review of Suite Level RTU:

• RTU was approved as a constant volume airflow.
• Cooling will be cycle based on load.
• Dehumidification mode will result in a discharge temperature of 70°F

- **SF-VSC**: Supply Fan with Variable Speed Control.
  - The SF-VSC’s speed will be manually set based upon the SF airflow and/or static pressure value. Select

<table>
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<th>Item and Review Comments</th>
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<td>Note: Items in () Represent Item Tags from Equipment Schedule</td>
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<tr>
<td>Roof Top Units – Phase 4 (RTU 4C-01 and 4C-02)</td>
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  - Coordinate mounting and roof curb with other contractors.
  - Submitted units are heavier than basis of design. Structural engineer to confirm this is acceptable.
  - Contractor to verify that controls sequence can be achieved. Control sequences and points lists will be reviewed with the complete controls will be reviewed with the controls submittal.
  - Electrical
    - Revise RTU 4C-01 fuse size to 45A FRS-R in lieu of 50A.
    - Receptacles were already provided on electrical drawings for units. It is acceptable to use receptacles provided with unit. Utilize circuit as indicated on electrical drawings.

  - HGRH is enabled to operate as necessary based upon the SAT dehumidification set point (70°F, adjustable).
  - When the Z-RH is 2% (adjustable) or more below the Z-RH set point (55%rh, adjustable), compressor #1 turns off and Dehumidification Mode is disabled.
Phase 4 – Pressurization Issues

Review of AHU OA and EA Balance:

• Some AHUs had internal return/exhaust fans and others had external relief fans.
• Relief fans to control to pressure.
• Some spaces had additional relief fans only for smoke control system.

4. PROVIDE MAGNETIC STARTER WITH AUXILIARY CONTACTS AND HOA SWITCH ON ALL THREE PHASE UNITS EXCEPT WHEN SERVED FROM MOTOR CONTROL CENTER.

H.15.2 FOR UNITS WITH EXTERNAL RETURN FANS:
H.15.2.1. THE RELIEF AIR DAMPER SHALL PROVE OPEN.
H.15.2.2. THE RELIEF AIR FANS SHALL MODULATE TO MAINTAIN THE SPACE STATIC PRESSURE OF ±0.05" W.C. WITH RESPECT TO THE OUTSIDE.
H.15.2.3. PROVIDE A MINIMUM OF 1 SENSOR PER FAN. RETURN AND EXHAUST DAMPERS SHALL MODULATE TO MAINTAIN SPACE STATIC PRESSURE.
Phase 4 – Pressurization Issues

Review of AHU OA and EA Balance:

• Found all relief fans ON
• SoO stated that they should control to a positive pressure stpt
• No pressure sensors shown on control drawings or plans
• No VFDs were installed
• OA quantities also needed to be recalculated since they didn’t make-up for the kitchen grease exhaust in Club Level.
Phase 4 – Pressurization Issues

Review of AHU Economizer mode:

• During construction, RFI response directed contractor to blank off the AHU exhaust outlet on units with internal return fans.

EA connection was capped, which put the return fan in series with the supply fan. This caused dead-heading during Econ and wild fan fluctuations.

AHU-1C-01 and 1E-01 were designed with exhaust dampers on top of the units. AHU-1C-01’s damper is completely open during operation which then pressurizes the room it is in. Should this damper be closed/capped? For AHU-1E-01, it’s exhaust damper runs completely open as well. However, it has RF-0E-01 in the same space interlocked with it. Should this damper be closed/capped or left open?

The internal return fans control to negative duct static pressure and the relief fans control to keep the space slightly positive. The exhaust damper shall be blanked off at the unit.
Phase 4 Closeout

• Phase Review
  • Design engineer attendance for “system acceptance”
  • Contractor responsible for system until time of acceptance

• Demonstration and Acceptance
  • 4 demonstration attempts occurred.
  • Not signed off until January of following year

• How to improve Phase 5?
  • Goals: successfully obtain a passing grade on first attempt.
  • Hand over BAS system to Owner for majority of baseball season

3.8 ACCEPTANCE PROCEDURE

A. General: The system installation shall be complete and tested for proper operation prior to acceptance testing for the Owner’s authorized representative.

B. Upon completion of the calibration, Contractor shall startup the system and perform all necessary testing and run diagnostic tests to ensure proper operation. Installer shall be responsible for generating all software and entering all database necessary to perform the sequence of control and specified software routines. An acceptance test in the presence of the Owner’s representative or Architect shall be performed.

1. If more than two of the first 10 devices tested, or more than 10% of the first 20 or more devices tested, fail to operate properly, the test shall be discontinued.
2. Additional testing, after corrections are made, shall be done at the Installer’s expense.

C. A letter shall be submitted to the Architect requesting system acceptance. This letter shall certify all controls are installed and the software programs have been completely exercised for proper equipment operation. Acceptance testing will commence at a mutually agreeable time within ten (10) calendar days of request. When the field test procedures have been demonstrated to the Owner’s representative, the system will be accepted. The warranty period will start at this time.
Phase 5

• Scope: rest of suites and upper deck
• Previous Cx comments not able to be incorporated into new phase design
• Same complications came up along with new ones
Phase 5 – GBA Scope

- GBA was contracted to perform functional testing on Phase 4 equipment after all design team clarifications.
- GBA was then contracted to perform Cx/QC during the Phase 5 construction.
  - 24 site visits to observe MEP installation
  - Attended 12 weekly OAC/MEP meetings
  - Performed functional testing of new:
    - AHUs
    - FCUs
    - Suite VRF system
    - EFs

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<th>Tasks</th>
<th>Hours</th>
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<td>Construction Phase</td>
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<tr>
<td>Review construction documents for project familiarity and Cx document development.</td>
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<td>Construction site visits including site observations, field observation reports, maintaining issues log, commissioning meetings, etc.</td>
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<td>Prepare Cx prefunctional checklists and update Pepper checklists</td>
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<tr>
<td>Prepare the Cx functional test procedures.</td>
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<td>Perform Cx functional testing, including sixteen (16) hours of troubleshooting once testing has been completed.</td>
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<td>Review training documentation and be present for one training session.</td>
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<td>Review O&amp;M materials.</td>
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<td>Develop and issue a final Cx report.</td>
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Phase 5 – Issues Identified

- 202 Issues identified
  - 84 during site visits
  - 118 during functional testing
Phase 5 – Issues Identified

Concession Stand walk-in coolers:

• We were asked to review why the existing concession walk-in coolers CHW loops were not as cold as they were designed.

• Ph 4 didn’t have a detail, Design Team used PH 3 detail for response.

• Ice cream machines were affected!!
Phase 5 – Issues Identified

Club Kitchen AHU Low Temp Trips:

• 100% OA Kitchen make-up air unit would continuously trip on low-temp switch and difficult to restart.

• GBA reviewed trending and performed some simulated tests.

• Initial testing found that supply fan ramped up too fast for a 100% OA unit.
Phase 5 – Issues Identified

Club Kitchen AHU Low Temp Trips:

• AHU could now restart, but extreme hunting was witnessed.
• GBA reviewed 1 min trends and witnessed more tests.
• Min airflow was too low for heating coil causing stratification.
• Unit found to need revision to limit the fighting between PH and CC.
Club Kitchen AHU Low Temp Trips:

- Revised programming so that the PH coil controlled directly to a PH stpt.
- Simulated increased the min airflow and a DAT reset.
- Stratification was reduced and space remained positive.
- *The addition of a coil pump can increase controllability at low loads.

As has been discussed in previous conversations between PCC and ME, there has been issues with AHU 1D-02 tripping off on low limit. The AHU was supplying around 3,000 cfm based on demand from the VAV boxes. The discharge air setpoint was 65F. The following were the procedures taken to troubleshoot this issue:

GBA took temperature readings on the leaving side of the PH coil. There was a large temperature difference between the bottom (around 38F) and the top (around 65F) of the coil. The OA temp was approximately 30F and the PH valve was 15% open at the time of the readings.

GBA and JCI attempted a few different operating scenarios.

With these conditions the PH valve maintained around 20 - 25% open and the temperature gradient across the coil was more even. There was less than 10F difference from top to bottom. The unit did not trip as OA temperatures ranged from around 40F to 60F.

The DAT setpoint was adjusted to 65F. The unit tripped off when the OA-T was around 25-30F.

GBA and JCI adjusted the DA-T setpoint to reset based on OA-T. The DA-T resets from 55F to 70F as the OA-T decreases from 55F to 45F. Since the final adjustments were made, the unit has not tripped on low limit. The unit maintains around 4,300 – 4,500 cfm.

Pressures were taken and the kitchen was positive to both the 1st base club and the 1914 club. The hood exhaust fan was not operating during the test. The pressures were:

1. 1st Base Club - 0.010”
2. 1914 Club - 0.015”
Phase 5 – Issues Identified

Visitor’s Locker Room AHU Run Around Coil:

• Drawings showed an enthalpy wheel, not a run around coil.

• RFI was issued and response was limited to the RFI response.

• GBA reviewed the RFI and provided additional questions and comments that needed attention.
Phase 5 – Issues Identified

Visitor’s Locker Room AHU Run Around Coil:

• Design team described a recirculating loop, with pump, between the two air streams.

• Typical concerns with this type of system:
  • Exhaust airflow control, constant vs. intermittent.
  • Frost on the exhaust air stream
  • Low-temp switch nuisance trips

1. The AHU 4E-01 submittal shows operating characteristics of the exhaust and supply heat recovery coils at design conditions only. However, the unit will have variable supply airflow, and possibly variable return airflow which will affect the air and water/glycol leaving temperatures of coils. Our concern is in the winter if the unit is going to be operated with the locker room in use, with elevated humidity levels due to showers, athletes, etc. This design does not appear to consider frosting of the air-side of the exhaust coil if the water/glycol entering the coil drops enough below the dewpoint of the exhaust air stream. This is typically mitigated by adding a 3-way control valve that allows the warmest water leaving the exhaust coil to blend back with the water entering the coil, resulting in water above the low limit setpoint. Please advise if any provisions are required due to this concern.

2. We have a question regarding the design sequence of operation for the AHU-4E-01 return fan control. Drawings call for the return fan to control to a duct static pressure setpoint. Is the engineers intent for the return duct static pressure to rise and fall as the supply airflow increases and decreases, causing the return fan to “track” the supply?

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1. Recommends monitoring the temperature sensor on the discharge side of the coil on the exhaust and shutting off the pump if the DAT falls below 35-40F (ADJ).

2. The intent is for the airflow to track up and down with the supply fan. The duct static pressure setpoint remains fixed.
Phase 5 – Issues Identified

Dishwasher Exhaust ductwork leakage:

- The dishwasher exhaust ductwork was leaking water. Design team noted that the ductwork wasn’t welded as specified.
- Pepper requested GBA to provide an independent engineering response describing issue.
Phase 5 – Issues Identified

Dishwasher Exhaust ductwork leakage:

- This system/ductwork was originally not shown on the drawings.
- Design team’s ductwork specification described vapor laden duct, while explicitly calling out Showers and Locker Rooms. We commonly see this.
- Design team’s review of submittal noted aluminum, but no mention of spec section or welded seams.

Request

Per drawing FS3-0.3.4 (Phase 5), there are to be (2) vapor exhaust duct collars for a dishwasher. Per drawing M2-0.4 (Phase 4; Bulletin #9), there is a note to provide a dishwasher exhaust fan and ductwork to drain line for kitchen. The fan, ductwork and route are not shown. See attached figures. This ductwork needs to be installed in Phase 4 before walls are completely up. Please provide more information and routing for the Phase 5 dishwasher system in the right field clubhouse level kitchen as it affects Phase 4 installation and coordination.

2.4 DISHWASHER HOOD
A. Material: Stainless steel.
B. Seams: Welded.
C. Drainage:
   1. Provide one-inch gutter on all sides, run duct vertical or pitch toward hood.
   2. Provide ¾” coupling and plug in bottom of gutter.

2.5 VAPOR LADEN DUCT (SHOWER AND LOCKER ROOM EXHAUST)
A. Material: 22-gauge aluminum.
B. Seams: Provide continuous material without seams for bottom and side of duct. Seams permitted at top of ductwork only and sealed watertight.
C. Drainage: Run duct vertical or pitch toward diffuser.
Phase 5 – Issues Identified

Dishwasher Exhaust ductwork leakage:

• GBA reviewed the TAB report and noted that a larger fan/motor was most likely required to ensure proper airflow/velocity.

• We found it reasonable for contractor to interpret the specification as they did.

• System did meet the City of Chicago code, but we provided the SMACNA best practice as the best practice “solution”.

Design Review:
1. Duct sizing: duct sizing (300 CFM – 12x8 duct) is appropriate for the application (500 FPM duct velocity, 0.05" WC, 1/100 ft. pressure drop).
2. Fan sizing: Based on the balancing information, the fan had to be sped up to 2534 RPM (from 2,071) and almost 0.32 BHP (1/3 HP motor).
   a. Based on the current operating conditions, fan motor seems to be undersized due to expected BHP and motor selection horsepower being equal. We would recommend replacing with a 1/2 HP motor, especially considering the fan is now operating in its service factor.
3. Ductwork and joint specification: the specified material and joining methods do not appear to be in violation of Chicago Code.
4. Best practice would be to follow SMACNA and provide stainless steel welded duct, sloped towards the dish washer with drain ports at low points.

Installation Review:
1. It is the opinion of GBA that it was reasonable for the contractor to interpret the vapor laden duct section of the specification to not include the dishwasher ductwork. This is due to the explicit reference to shower and locker room exhaust, and the statement related to pitching towards diffusers (which is not relevant to dishwasher exhaust system). The engineer made note to install aluminum ductwork in their shop drawing review, but made no mention of this specification section or references to no seams.
2. Based on the photos taken Friday, April 5th, it does not appear that the contractor installed the gutter at the dishwasher hood as specified, but further detail from design team may be needed to clarify how this is to be installed at the termination.
3. Based on the need for rebalancing the fan, it appears that there is considerable leakage and that the specified leakage testing did not occur.
4. Based on our on-site inspection, no drain ports were installed at low points, which would have been based on SMACNA best practice, as it appears that low point drains were not specified.

Conclusion:
The contractor installed the dishwasher exhaust system per the design documents, and as additionally directed in the shop drawing review. However, duct leakage, if observed, should be addressed by duct inspection and additional tightening and sealing of joints. Drain ports and piping can be installed at low points, but would not be necessarily be significantly useful if the ductwork is not also tightened and sealed throughout.
Phase 5 – Issues Identified

Hot Chocolate Machine Flue Discharge:

• This was located directly above the main concourse and was a condensing boiler, so condensate dripping is expected.

• Design team found no issue with installation as it met their specifications and met city of Chicago Code.

• GBA agreed it met code but recommended extending the flue to outside of the concourse.
Phase 5 – Issues Identified

Visitors Locker room Laundry EF:

• This dryer exhaust fan has an internal lint filter that will need regular cleaning.

• Fan was installed in a configuration not recommended by manufacturer.

• Manufacturer’s response was that it isn’t recommended, but it care could be taken when opening.

• We recommended to the subcontractor to demonstrate to owner how this would be accessed.
Phase 5 – Additional Issues Identified
Phase 5 – Additional Issues Identified
Phase 5 – Additional Issues Identified

- Phase 5 Issues:
  - CHW TAB had to be performed twice
  - Autodiscover points for Trane units
  - Catalina Club zone control
Cx Results from GC

- Pepper perspective:
  - GBA’s technical reports informed design team to make drawing revisions to correct design issues from Phase 4.
  - Much smoother turnover process after Phase 5.
  - System acceptance occurred in July 2019 (3 months) vs. Phase 4 which took 9 months to complete.
  - All new equipment/systems to the owner – GBA’s expertise improved Pepper’s ability to respond to owner questions and concerns.

SUBJECT: WF Phase 4 Bulletin 49
Description: Revisions to Phase 4 Documents – Mechanical schedules and controls

All drawing revisions contained within this drawing issuance are indicated with description PH4 Bulletin 49 (drawings dated 08/01/2018)

*Note: Some drawings may contain in-progress revisions that will be included in future Bulletins. These items include value engineering scope changes. Only those items clouded on the drawings are being issued for incorporation into the work at this time.

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Other GC Led Cx Projects

Operating Suite AHU Upgrade:

• New AHU to be installed in new mechanical room while existing unit continues to serve. Intent for new unit is to be the primary unit with the existing as a backup through dampers.

• No interruption to scheduled procedures on two OR floors.

• System switchover to occur over a single weekend, 12/29 – 1/1.
Other GC Led Cx Projects

Operating Suite AHU Upgrade:

• GBA performed testing on AHU in a temporary recirculation condition to test AHU sequences during week prior to Christmas 2011.

• The only nights the hospital allowed disruption to the ORs was Christmas and New Years weekend. Switchover was to occur on Jan 2.
Operating Suite AHU Upgrade:

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15. When the return and supply fans are commanded ON but given a speed command of 0%, RF-1 and SF-1 VFD output is 15 Hz while the remaining fan’s VFDs have an output of 60 Hz. JCI to review why command is only given to the first fan. Verify that this issue will be fixed when graphics is on main BAS. Also, is the 15 Hz a value from the manufacturer during startup? A minimum speed requirement may

24. When SF-1 VFD went into fault, the only way to manually get the fault to reset was to cycle power to the AHU. JCI programmed a means to reset the VFD remotely through the BAS, but a manual reset needs to be found. KJWW and Edwards to investigate how to reset faults manually at the VFD without the BAS. Operations need to be trained on the VFDs. JCI checked with the manufacturer and this is the way the drives work, no action to be taken. No additional engineering needs to be aware of this issue. ISSUE CLOSED

25. Electrical conduit coupling above the pressurstats is broke and needs to be replaced.

26. (12/21-24) The bottom chilled water coil is missing a plug on the coil drain pan.

27. (12/21-24) Found ORs 28 and 29 are short on return air flows and both ORs are even though the return fan is trading to the -0.3 setpoint. The return static pressure setpoint was raised to -0.5", and then increased again to -0.7". OR-28 is short on return air flow. TelFlow/Slp 1480, actual Flow/Eo 1392, damper Eo/Cmd 100%. Both ORs were found to be maintaining -0.1" room pressure settings. This is unexpected and found the ORs were not making cmf setpoint, the supply static setpoint was raised to +1.5" and the return static pressure setpoint was raised to -1.0". The setpoints were overridden at the end of the night back to the -0.3" and -1.5" until the ducts are capped in the 7th floor locker room to minimize duct leakage. This will need to be released on 12/27. (12/31) This was released. ISSUE CLOSED

28. (12/21-24) The SA Humidity setpoint was 46 degree dewballs. OR 28 and 29 humidity was found to be running at 11-12%RH respectively with the RA humidity at 22%. The SA humidity setpoint was increased to 98 degree dewballs. The OR humidity increased to 25 and 29/31, the return came up to 26.5%RH with a SA humidity of 48 degree dewballs.

29. (12/21-24) Found ORs are VAV boxes which respond to temperature. The ORs were not meeting supply or return static pressure setpoint. OR 28 max cooling cfm is 2000 and minimum cfm is 1400. OR 29 max cooling cfm is 2000 and minimum cfm is 1400, these values need to be checked and verified with owner.

30. (12/21-25/26) ORs 28 & 29 were maintaining positive pressurization of +0.01".

31. (12/31) The right-pass on the heating coil steam traps need to be installed.

32. (1/12) Need to review the requirement for steam traps leaving the humidifier. While the unit was running we had poor dispersion throughout the humidifier with the 1/2 valve 100% open and the 2¼ valve 9-10% open. Steam was only coming out the first 9" of the dispersion tubes. After shutting down the unit, the steam dispersion improved significantly. We suspect there is a condensate issue with the humidifier after it has been running for a while and the condensate is not draining out properly. We observed significant condensate coming out the humidifier dispersion tubes, all over the floor and all over the condensing coil. Under the current conditions with the steam only coming out the first 9" of the tubes, there is significant carry over into the motors section of the unit. Although the filters are dry, we are concerned about potential wetting of the final filters. About 10 minutes after the restart of the fans, the dispersion tubes started to drip again and steam was only coming out the first 9-10". There is condensate accumulating on the supply fan back draft dampers and housing frame. KJWW TO REVIEW

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Questions?

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