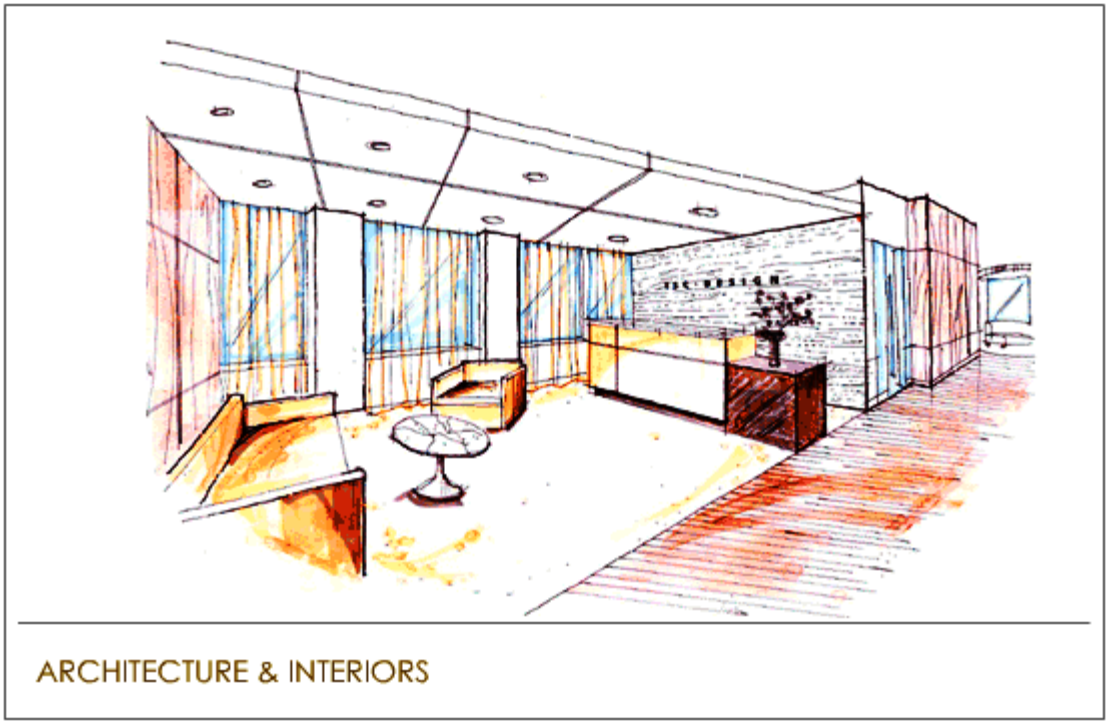
Commissioning Report

TSC Design



275 7TH Avenue
New York City, NY 10001

OLA Job No: NTSC0001.00

O'DEA
LYNCH
ABBATTISTA
CONSULTING ENGINEERS

November 13, 2008

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TSC Design

November 13, 2008

SECTION 1.0 EXECUTIVE SUMMARY

1.1 Executive Summary

At the time of the submission of this report to the owner and to LEED the majority of issues identified were still open. OLA received assurance from TSC design that these open issues are intended to be rectified and the outstanding issues were clear to the owner.

The TSC design project consists of the 19th floor of a 24 story building, which is approximately 12,500 square feet of primarily office space. The building is located on 275 Seventh Avenue, New York. TSC design has set out to bring an awareness level for sustainability to a higher level by using the LEED Green Building Rating System has as a benchmark for this project. TSC will submit to achieve the LEED Silver level certification. This report will be submitted as one of the supporting documents for the commissioning portion of the LEED certification. See appendix I for a copy of the LEED letter template.

This report contains the information pertaining to the fundamental commissioning credit. Commissioning is a detailed set of tests and processes that are completed to help verify that the building energy systems and the system components perform in accordance with the daily operational requirements of the building owner and the design intent.

The following systems were commissioned during the project:

- The air conditioning units and associated condensing units
- Sampling of VAV boxes
- The controls associated with each air conditioning unit
- Sampling of the lighting system
- The domestic hot water system

Some major issues identified by the commissioning team identified described below:

1. During the functional testing of the air conditioning units, and the associated components, the units were found to be active through a 24 hour period. The unit controls were not programmed to de-activate the units during un-occupied hours.

2. The enthalpy sensors, which will modulate the unit into an economizer cycle (free cooling), were found to be installed within the mixed air section of each unit. The enthalpy sensor location will not enable the economizer cycle while installed in the mixed air section of the unit, since the economizer cycle is based on outside air temperature and humidity.

3. Air conditioner 3 original design intent illustrated a variable air volume system through the use of VAV boxes and a variable frequency drive. The testing identified that the unit was found to be manipulated to behave as a constant volume system. VAV boxes have been manually shut down in the full open position and the unit variable frequency drive was not ramping up or down. The energy savings accompanying a variable air volume system has been deleted by operating this system as a constant volume system.

4. The outside air dampers were found to be closed during normal operations. The only times that the dampers would modulate open are; when the unit goes into an economizer mode, or when the CO2 sensor set point was breeched. The design intent is to have the outside air damper modulate to a minimum outside air position and modulate per the CO2 level.

5. The thermostat associated with air conditioning unit 4 was found to be located in an occupied space that is not supplied by air conditioning unit 4. This thermostat location will not provide the unit with accurate temperature or CO_2 read outs. The sensor location should be re-located since this sensor will maintain the unoccupied and occupied temperatures.

A full list of issues and resolutions can be found in appendix G of this report. A detailed description of each functional test can be found in the checklists associated with the units pertaining to this project (located in appendix D).

This report also contains the clearly documented owner's project requirements and basis of design for the energy related systems, documented design review comments submitted by the commissioning authority, design drawings which incorporate the commissioning requirements, the commissioning plan that was developed and utilized throughout the life of the project, associated reports pertaining to the installation and functionality of the installed systems and an outstanding issues report.

SECTION 2.0 BASIS OF DESIGN

2.1 Basis of Design

The Basis of Design is developed by the design professionals. The Basis of Design document includes how each of the owner's project requirements has been met. (I.e. Primary design assumptions such as occupancy, space and process requirements, applicable codes, policies, standards and load and climate assumptions that influence design decisions.)

BASIS OF DESIGN DOCUMENT

FOR

T S C • D E S I G N

275 7TH AVENUE

NEW YORK, NY

DECEMBER 12, 2007

Engineers | Consultants

110 William Street, New York, NY 10038
Phone: (212) 791 8300, Fax: (212) 791 8301

Basis of Design

1. Selection of System Components

HVAC	The existing HVAC system is composed of four (4) variable speed split units mounted on the setback roof in front of tenant space. All air handling units are connected to a air-cooled condensing unit of suitable capacity. Three of these split units are connected to a ducted air distribution system with VAV's modulating airflow in response to space temperature. The fourth air handling unit supplies air to a perimeter zone comprising of open office area. When outside air temperature falls below a certain temperature, the air handling units shall utilize 100% outside air to cool the interior space. This airside economizer cycle shall utilize a power exhaust fan, which will exhaust the space return air to the exterior. During winter, all air handling units recycle a percentage of space air, and use electric reheat coils to temper outside air used for ventilation purposes. The quantity of ventilation air shall be determined by a signal from suitably placed CO2 sensors. There is a control lockout provided which prevents the simultaneous operation of the electric coils and the compressors of the condensing units. Heating for the space is provided by cast iron steam radiators connected to the building 2-pipe steam system.
Domestic Hot Water	Domestic Hot Water is provided by the base building.
Computer Room	The IT room has air supply from the base AC unit, and an exhaust fan for extraction of heat.
Kitchen Exhaust	Exhaust will be provided for the Kitchen based on the predicted use with a floor population of 45 and ASHRAE standards.
Copy Room Exhaust	Copy rooms shall be provided with an exhaust consistent with ASHRAE standards.
Diffusers	Diffusers will be selected based on space requirements. Areas with open ceilings shall be served by sidewall registers, while areas with gypboard ceiling shall be served by linear diffusers.

2. Codes and Standards

ASHRAE standards, NY City Building Code, NFPA standards and referenced LEED standards will be used where applicable. Where two standards have separate requirements for a space the more stringent will be followed.

3. Fire and Life Safety

All Fire and Life Safety systems will comply with the NY City building code and best practices.

Space Program for 19th Floor (List):
3 partners
73 Design Staff
4 Admin. staff
2 Conference Rooms (seats 10 each with 2 credenzas)
1 Pantry
1 Accounting Room
1 IT Room
2 Copy Rooms- 8 Printers
1 Library
1 Janitor's Closet
1 Gym
2 Bathrooms with ADA accessibility and showers

All lighting will be installed with non-dimming ballasts. Lighting should be florescent wherever practical.

HVAC systems should be designed with the assumption that the perimeter induction units are properly controlled, are in good repair, and are sufficient to cool all exterior offices.

HVAC Assumptions are as follows:

No skin load or exterior office load due to perimeter fan coil units.

Cooling load methodology	CLTD-CLF
Occupancy	100 sq/ft per person in open office
Lighting Load	1.5 W/sq ft.
Cooling Setpoint	75 degrees
Heating Setpoint	70 degrees
People sensible/latent heat generation	255 Btuh/255 Btuh
Server Equipment	1200 W/room
Supply air temperature	55 degrees
Design system peak cooling load	117 MBtuh
Number of occupants at peak load	62 Persons

Cooling & heating load design program	TRACE 700
Ductwork sizing program	TRANE Ductulator

4. Room Specific Design Conditions

Conference Rooms	Conference Rooms shall be provided with floor to ceiling walls to minimize noise within the space. Each conference room shall be served by an individual VAV.
Personal Offices	Personal Offices shall be provided with lighting centered over the workspace. Perimeter offices will be designed to minimize indoor noise.
Restrooms	Restrooms will have all fixtures replaced with new, low-flow fixtures. Restrooms shall be exhausted to the building toilet exhaust shaft.

5. LEED Design

Prior to and throughout the course of design, TSC Design and the MEP engineer will coordinate to discuss and decide which LEED points the project will pursue. When the points that the design will pursue are finalized, the requirements of each of the LEED points will become part of the Basis of Design. All relevant codes and standards to those points will also become part of the Basis of Design. If it is determined during the design phase that other LEED points not previously discussed are low/no cost options the project team will be made aware of this.

SECTION 3.0 Owners Project Requirements

3.1 Owners Project Requirements

The Owner's Project Requirements (OPR) is a document created by the commissioning authority. The OPR was utilized through throughout the commissioning process to provide focus on the key success criteria. This document also addresses the ideas, objectives and criteria that the owner considered important.

Owner's Project Requirement's
Design Phase

TSC DESIGN
275 Seventh Avenue, N.Y., N.Y. 10010

Owner and User Requirements

The primary purpose of TSC Design is to proactively support the need to bring an awareness level for sustainability to a higher level. As TSC Design continues to grow, it acknowledges the need to adapt to better improve the business and the industry by promoting environmentally responsible design and operations. TSC Design has set out to use the LEED™ Green Building Rating System as a benchmark; and ultimately achieve a LEED™ Silver level certification.

General Project Information:

Project Name: TSC Design
Owner: CB Richard Ellis
Occupants: TSC Design
Net square footage: 12,500
Primary purpose is for office space
9th Floor of a 24 story building
Construction Budget: approx. $1.2M
Construction Schedule: Construction start date: 1st week of Oct.; targeted move in date mid December 2007.
The project will have an electrical sub meter to monitor energy usage
Flexibility changes in occupancy type, number of occupants or user activity.
50 occupants; anticipate 10% growth

Quality of materials:

Building Life: 10 year lease

Warranty Requirements: 12 Months parts and labor and 5 years on compressors and other major equipment.

General Building Standards:

Local Laws of the City of New York for the Year 2004

Environmental and Sustainability Goals

The TSC Design project will be designed to achieve the LEED™ Silver level of sustainability under the U.S. Green Building Council's Leadership in Energy and Environmental Design™ (LEED™) green building rating system version 2.0.

Environmental Goals Narrative:

TSC Design has designed an office space with the environmental impact in mind.

TSC Design minimized its contribution to landfills during construction by diverting construction waste through on-site separation program.

During construction, smoking and other potentially harmful elements were prohibited on the job site. Products procured, such as carpet and furniture, are required to exceed VOC emission regulations.

In addition, TSC has incorporated the use of Energy Star rated equipment, efficient lighting, heating and cooling to consume less energy than required by local codes.

TSC encourages the use of alternative transportation such as the use of mass transit and bicycles. Bike racks and shower facilities were provided for those that would take the opportunity to use their bikes as alternative transportation.

Sustainability Goals Narrative:

TSC Design intends to educate the rest of the team with sustainable concepts which may be applied outside of the office setting.

TSC Design will conserve energy by seeking continuous reductions in its consumption of energy.

TSC Design will increase the use of recycled-content products; and in addition increase the recycling and conservation of materials.

Energy Efficiency Goals

The TSC Design project will perform 25% better than current ASHRAE 90.1-2004 lighting requirements. The owner will track electric bills through the first year of operation to verify that energy consumption is managed. This will be for electrical bills, and the Commissioning Authority will provide a spreadsheet for tracking. Perimeter heating will be off the existing buildings steam system.

Indoor Environmental Quality Requirements

Space Name or Type: Office Space (19th Floor).
Intended Use: Office Space for Design Architects.
Anticipated Occupancy: 50

Anticipated Occupancy Schedule: Typically 8 am to 6 pm with some personnel staying later or coming in on weekends.
Seasonal Use: All year.
Space Environmental Requirements:

Space Temp: 70 winter 74 summer
Space Humidity: 60% max.
Air Quality:

Ventilation: Shall meet NYC Code, ASHRAE 62.1 2004 and will have partial CO2 control, as well as operable windows.
Filtration: to meet LEED requirements. May target the MERV-13.

Acoustical Requirements: N/A
Lighting Levels: to meet IESNA requirements.

Desired user ability to adjust system controls:

Temperature: VAV control Zones
Humidity: No Humidifiers (some dehumidification with the Cooling coils).
Lighting: Task Lighting for each occupant.

Desired specific type of lighting: Occupancy Sensors are provided.
Open office workstations: task lighting - local control at user desk.
Overhead general space lighting have zoned local controls.
Enclosed offices, rooms, etc,: local control of room lights.

Accommodations for after hour use: After hour override has been provided for all zones.

Commissioned Systems:

A. The following systems are intended to be commissioned.

AC Units (AHU's and Condensing Units)
VAV Boxes
Control System
Lighting System
Domestic Hot Water

1. Priorities (Assign numerical priority, with 1 being the highest. Do not assign the same number to more than one item)

__1___ First cost
__5___ Quality
__2__ Operating cost
__3__ Energy efficiency
__4___ Reliability
__8___ Simplicity
__7___ Ease of equipment and system maintenance
_____ Other

2. Redundancy: No requirements
3. Flexibility: As best possible based on Cost
4. Special requirements: N/A
5. Energy efficiency: ASHRAE 90.1 2004 exceed lighting requirements by 25%
6. Operator preferences (manufacturers, system types, fuel source, etc) – Lutron Lighting System.
7. Other

Operations and Maintenance:

The building owner will maintain the lighting systems
The mechanical contractor will maintain the HVAC systems

Training requirements:

- Intermediate level technical information of the systems performed by the equipment suppliers and installing contractors

Occupant orientation for the following individuals:

- Wey Lee (from TSC)
- Building Operator (under management)
- CxA to Witness

SECTION 4.0 Project Overview

4.1 Project Overview

The TSC design project consisted of 12,500 square feet of primarily office space. The space will house fifty (50) occupants with a 10% anticipated growth projection. The construction budget pertaining to this project consisted of 1.2 million dollars. The project began construction within the first week of October 2007. The project was occupied by the users on/or around December 2008. A copy of the HVAC system layout can be found at the end of this section.

The following firms were involved with this project:

Firm	Team Member	Contact Information
TSC Design Associates, Inc. 275 7th Avenue, 19th Floor New York, NY 10001 *(Owner)*	Wey Lee & Jennifer Hirsch	Wey Lee [Wey.Lee@tscdesign.com] Jennifer Hirsch [Jennifer.Hirsch@tscdesign.com] T 212.213.4595
WB Engineers 110 William St New York, NY 10038 *(MEP Engineer)*	Shantanu Mukherjee & Ed Moore	Shantanu Mukherjee [smukherjee@wbengineering.com] Ed Moore [emoore@wbengineering.com] T 646.778.5653
OLA Consulting Engineers 50 Broadway Hawthorne, NY 10532 *(Commissioning Authority)*	Jim Dolan, Paul Scholler & Dan Norval	Jim Dolan – CxA PM [jdolan@olace.com] T 914-919-3106 Paul Scholler – CxA [pscholler@olace.com] T 914-919-3148 Dan Norval – CxA [Dnorval@olace.com] T 914-919-3122
NCI Construction 1983 Marcus Ave, Suite 108 Lake Success, NY 11042 *(Construction Manager)*	Andrew DiMarco	T 516.358.7681x12

The commissioning portion of this project was divided into three (3) phases. These were Design Review Phase, Construction Phase and Acceptance Phase. Activities for these phases are outlined as follows.

4.2 Design Review Phase

One of the first tasks performed by the commissioning team was to review the design documents (plans and specifications). These documents were reviewed once during design period. The review identified a total of forty-one (41) items needing additional

clarification and/or correction. Some examples of the comments were as follows:

- M1.01 It is not clear if the economizer powered exhaust fan will be variable speed. If it does not have a VFD, negative space pressure may result when the supply fan is running at reduced speed, but the system is also in economizer mode.
- M1.01/M6.01 What is the minimum airflow allowed by the manufacturer of AC-1, 2, 3, 4. The supply fan VFD minimum setting should be such that the airflow is not reduced below that required by the AC-unit manufacturer, or that required by the electric heating coil.
- M1.01/3.01 Refrigerant line sizes are not provided for AC-1, 2, 3, 4.
- M1.01 Toilet exhaust fan TX-19-1: listed airflow is 600 cfm, however the sum of the connected exhaust registers is 650 cfm.
- M1.01 Provide an EER rating of the AC unit/Condensing unit combination for compliance with ASHRAE 90.1.
- 5.03.6 M6.01 The Demand Controlled Ventilation strategy as written is not sufficient to adequately describe the intended sequence. What are the Minimum Outdoor Air CO2 level setpoints, and/or the corresponding indoor CO2 level setpoints? What is the reset schedule of OA with respect to CO2. Is OA to be measured by a flow station, or inferred by space CO2? Where are the CO2 sensors to be located? What is the sequence for overriding DCV during economizer conditions?
- 5.03.7 M6.01 It appears a single CO2 sensor per air handler has been specified. This appears to be in conflict with ASHRAE 62.1-2004 which requires systems serving multiple zones to address IAQ of all the ventilation zones separately. (AC-1, AC-3, AC-4, appear to serve multiple zones).
- 7.01 From the 09-26-07 LEED-CI Scorecard it appears that the space contains an electricity sub meter. There is a substantial amount of electric heating coils on this project. Have other options been explored such as using more steam heating coils were the steam would already have been included in the cost of the rent for the space?
- 7.02 With the steam radiation being controlled by local Danfoss valves there appears to be a very high potential of simultaneous heating and cooling which could substantially increase energy usage. We recommend installing controls to prevent the AHUs from switch to the cooling or economizer mode when the steam heat is active.

The comments listed herein identified areas of the project design that require further attention. These comments were offered to help ensure that the design intent of the project was reached and for successful completion of construction documents and ultimately commissioning of the systems within the project. A complete report containing all of the comments pertaining to the design review can be found in appendix A.

4.3 Construction Phase

Commissioning Plan – Construction Phase

The commissioning team felt that it was important to develop a precise plan that would guide the team through the entire process. With this in mind, the “Commissioning Plan – Construction Phase” document was developed. This plan outlined specific requirements for each member of the design and construction team. Some of the broad areas outlined in this plan were as follows:

- Provided direction for the development of commissioning activities during the latter part of the design phase.

- Provided direction for the commissioning process during the construction phase of the project.
- Provided additional direction and support to items not fully detailed during the design phase of the project.
- Provided scheduling of all commissioning activities.
- Developed lines of reporting regarding approvals and coordination for the project.
- Outlined equipment to be commissioned.
- Provided contacts, numbers and addresses for each member of the design and construction team.
- Provided flow diagrams outlining Functional testing requirements.
- Listed commissioning related requirements for each team member for this project.

Appendix B contains the Commissioning Plan for this project.

Job Site Observations

There were a total of two (2) formal job site observations made by the commissioning team. During these site visits, construction issues that could affect the systems that would be commissioned were reviewed and comments were given to the design / construction team. Some examples of items noted during job site observations are as follows:

- A good portion of the ductwork has been installed. Most of the VAV boxes have been installed. The air handling units and condensing units are not on site.
- Ductwork on AC-3 and AC-4 is significantly different than what is show on the drawings. OLA has not received any shop drawings on the ductwork for review. It was noted that in previous discussions with the owner, that the shop drawing approval cycle was omitted based on the agreement that the contractor would install the mechanicals as per the contract documents. There appears to be discrepancies.
- OLA has not received shop drawings for any of the equipment being installed. This information is vital to the commissioning process and for verification of all equipment being commissioned.
- Duct insulation is missing on top of ducts in many locations where the ducts pass under beams. Insulation is required to prevent condensation and potential mold issues. Contractor to correct.
- The filters associated with AC-1 need to be replaced.
- The filters associated with AC-2 need to be replaced.
- The filters associated with AC-3 need to be replaced.
- The filters associated with AC-4 need to be replaced.

The items listed above and shown in the “Commissioning Site Visit Report” tab of this report would not have been identified if these job observations had not been performed. Appendix C contains the construction site visit reports.

4.4 Acceptance Phase

Functional Testing

The acceptance phase encompassed the functional testing of the systems. Functional testing was completed on September 19, 2008, using the functional checklists outlined in the commissioning plan. The functional tests are developed by the commissioning authority to verify that the building systems and components are functioning as specified and that proper installation was completed. These tests were completed by the design engineer firm and were overseen by the commissioning authority. Some issues that were found during the testing are listed below:

- AC-1: The OA enthalpy sensor is located within the return air flow. The sensor should be relocated to the OA inlet hood.
- AC-2: The OA enthalpy sensor is located within the return air flow. The sensor should be relocated to the OA inlet hood.
- AC-3: The OA enthalpy sensor is located within the return air flow. The sensor should be relocated to the OA inlet hood.
- AC-4: The OA enthalpy sensor is located within the return air flow. The sensor should be relocated to the OA inlet hood.
- AC-2: There are multiple diffusers supply either above or below 10% of the design CFM value. The balancer should re-adjust the dampers so that these values are within the 10% design range. Please refer to the balancing verification checklist for clarification on what diffusers are out of the 10% range.
- The airflow associated with the VAV which serves the conference room 19.013 was found to be over the design value. The volume dampers were modulated to lessen the airflow to achieve the design value.
- The airflow associated with the VAV that serves the reception area was found to be over the design value. The volume dampers were modulated to lessen the airflow to achieve the design value.
- The space temperature sensor associated with AC-4 is not located in the space that which the unit serves. The unit cannot modulate properly due to the location of the sensor. Contractor needs to relocate the sensor to a space that the unit serves in-order to obtain accurate readings.
- The CO2 sensor associated with AC-4 is not located in the space that which the unit serves. The unit cannot modulate properly due to the location of the sensor. Contractor needs to relocate the sensor to a space that the unit serves in-order to obtain accurate readings.

The results of the functional test were recorded in the checklists and are provided for reference in appendix D.

Balancing Verification

Part of the responsibility of the commissioning authority within this project was to spot check the air distribution systems balancing. The commissioning authority worked along side the design engineer in-order to accomplish this task. Some issues found during the balancing verification are listed below:

- AC-2: There are multiple diffusers supply either above or below 10% of the design CFM value. The balancer should re-adjust the dampers so that these values are within the 10% design range. Please refer to the balancing verification checklist for clarification on what diffusers are out of the 10% range.
- The airflow associated with the VAV which serves the conference room 19.013 was found to be over the design value. The volume dampers were modulated to lessen the airflow to achieve the design value.
- The airflow associated with the VAV that serves the reception area was found to be over the design value. The volume dampers were modulated to lessen the airflow to achieve the design value.
- There is no volume damper associated with the diffuser located in storage room 19.038. Contractor to correct.
- Only one diffuser has been installed within the telecom room. Drawing M-3.01 illustrates two exhaust diffusers to be installed.

The OLA balancing verification report can be found in appendix E. Located in appendix F is the complete balancing report pertaining to this project.

Commissioning Issue's Log

The commissioning authority recorded all issues found during the construction site visits and through the performed of the functional testing within an issues log. The intent of commissioning issues log was for each responsible party to review their respective items and provide the appropriate response within the comment box. All items within the log remained open until there completion has been verified. The complete log can be found in appendix G of this report. All log of all outstanding items can be found in appendix H.

Commissioning Conclusion

As with most projects, the TSC Design project was not without problems. There were many challenges that were addressed by the design, construction and commissioning teams. Many of the items noted during the commissioning process would have been overlooked or ignored by the contractor and design team if these issues had not been brought to the forefront in a timely manner. The commissioning process helped the owner become more aware of the issues on the project and their potential for problems during the life of the building if they were not addressed. The client should be commended for their untiring effort regarding energy conservation and building sustainability, of which commissioning proves to be a vital tool for ensuring that client owned buildings are operating according to design and the owner's requirements.

APPENDIX A

Design Review Report

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TSC OFFICE

275 7TH AVENUE
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COMMISSIONING DESIGN REVIEW
Based on 09/26/07 Drawings

PRESENTED BY:

O'DEA, LYNCH, ABBATTISTA
CONSULTING ENGINEERS, PC
50 BROADWAY
HAWTHORNE, NY 10532
OLA Project Number: NTSC0001.00

October 12, 2007

1.0 INTRODUCTION

The design review presented in this document is based on Addendum #1, Revised as Noted drawings dated September 26, 2007. The design review focused primarily on the Mechanical, Electrical and Plumbing (referred to commonly as MEP) design elements of the project, as well as energy design intent. In some instances the Civil and Architectural disciplines were looked at as they related to MEP issues.

The comments listed herein identify areas of the project design that require further attention. These comments are offered to ensure that the design intent of the project is reached and for successful completion of construction documents and ultimately commissioning of the projects systems.

2.0 GENERAL COMMENTS

The following general comments/questions are offered and suggested to be incorporated into and/or submitted the next submission:

2.01 A0.2 HVAC Notes: Suggest coordinating mechanical notes with mechanical drawings for construction coordination and pricing.

2.02 A0.2 Note DM-23: Suggest making specific reference to “LEED-CI” requirements.

2.03 A0.2 Reflected Ceiling Notes: Suggest coordinating mechanical notes with mechanical drawings for construction coordination and pricing.

2.04 A0.2 Reflected Ceiling Notes: Suggest coordinating electrical notes with electrical drawings for construction coordination and pricing.

2.05 A0.2 Reflected Ceiling Notes: Suggest coordinating fire protection notes with fire protection drawings for construction coordination and pricing.

2.06 A0.2 Reflected Ceiling Notes: Suggest coordinating mechanical notes with mechanical drawings for construction coordination and pricing.

2.07 A0.3 Telephone and Electrical Notes: Suggest coordinating electrical notes with electrical drawings for construction coordination and pricing.

2.08 A-1 Radiator General Scope Note: Confirm that specified finish will not impede heat transfer ability of radiators.

2.09 A-1 Box note 3: Suggest providing a specification of the “insulated glass” requirements of the greenhouse. In particular, specify U-values and SC of new glazing.

2.10 A-1 Box note 6: This note is called out at the patio, but does not address what the scope of work is at the patio.

2.11 A-1 Box note 9: Structural drawings were not included in the drawing set.

2.12 A-3 Equipment Schedule: If LEED-CI credit EA Credit 1.4 is being pursued confirm that the required percentage of equipment is Energy Start eligible.

2.13 A-3 Equipment Schedule: Suggest referencing mechanical drawings for hot water heater specifications.

3.0 PLUMBING COMMENTS

The following plumbing comments are offered and suggested to be incorporated into the next submission:

3.01 P-3.01 Connect to existing comment refers to drawing P-5.01. This drawing was not included in the drawing set.
3.02 P-3.01 Confirm the purpose of electric heat trace cable. Is this being used in lieu of a domestic hot water recirculation line?

4.0 MECHANICAL COMMENTS

The following mechanical comments are offered and suggested to be incorporated into the next submission:

4.01 M1.01 It is not clear if the economizer powered exhaust fan will be variable speed. If it does not have a VFD, negative space pressure may result when the supply fan is running at reduced speed, but the system is also in economizer mode.
4.02 M1.01/M6.01 What is the minimum airflow allowed by the manufacturer of AC-1, 2, 3, 4. The supply fan VFD minimum setting should be such that the airflow is not reduced below that required by the AC-unit manufacturer, or that required by the electric heating coil.
4.03 M1.01/3.01 Refrigerant line sizes are not provided for AC-1, 2, 3, 4.
4.04 M1.01 Toilet exhaust fan TX-19-1: listed airflow is 600 cfm, however the sum of the connected exhaust registers is 650 cfm.
4.05 M1.01 Provide an EER rating of the AC unit/Condensing unit combination for compliance with ASHRAE 90.1.
4.06 M1.01 Provide cooling coil leaving air dry bulb and leaving air wet bulb temperatures.
4.07 M1.01 Provide heating coil entering air and leaving air temperatures.
4.08 M1.01 AC- unit filters: ASHRAE 62.1-2004 requires filters be specified as “MERV 6 minimum” when tested in accordance with ASHRAE 52.2. The specification of “30% efficient” filters may or may not meet this requirement. Suggest filters be specified by their MERV rating. If LEED-CI IAQ credit 5 is being pursued filters will have to have a MERV rating of 13 and fans etc. will have to be sized to handle the increased static pressure.

5.0 CONTROLS COMMENTS

The following controls comments are offered and suggested to be incorporated into the next submission:

5.01 M2.02 15900 Automatic Temperature Controls: This appears to be a base specification for an automatic temperature control system but there are no points indicated on drawing M6.01 that require an automatic temperature control system. Please clarify.
5.02 M6.01 It appears that the mechanical equipment will not be controlled by a central building automation system. A building automation system would improve the level of control of the system, reduce the time to

trouble shoot issues and would help optimize the indoor air quality and energy usage of the systems. Without a central BMS system the components will be operating on their own without knowing how the associated components are operating. Although DCV will reduce energy usage substantially we do not recommend DCV without the use of a building automation system.

5.03 M6.01 Control action of the VAV boxes has not been completely specified. (i.e. on call for cooling, VAV box to modulate open…. Call for heating, VAV boxes to open? Close? go to minimum?). Will VAV controls include both occupied and unoccupied space temperature set points.

5.03.1 M6.01 It is not clear from the sequence how the AC-unit should be indexed to heating or cooling mode. (By schedule, zone demand?). Without a building automation system occupancy schedules will have to be programmed and modified at each individual AC-unit and VAV box.

5.03.2 M6.01 AC-unit sequence should indicate if the fan should run for ventilation during the occupied hours/mode? What are the occupied hours? What is the sequence during unoccupied hours? (i,e, Fan Off, cooling available/ unavailable?). What are the damper positions for each mode of operation?

5.03.3 M6.01 The RTU sequence appears to not address the multiple zone nature of units AC-1, 3, and 4. What is the supply air set point that should be maintained at the cooling coil by the condensing unit?

5.03.4 M6.01 What is the supply air setpoint after the electric heating coil when the AC-unit is in heating mode?

5.03.5 M6.01 What are the setpoints for economizer operation? It is not clear if this is intended to be a dry-bulb setpoint or enthalpy setpoint?

5.03.6 M6.01 The Demand Controlled Ventilation strategy as written is not sufficient to adequately describe the intended sequence. What are the Minimum Outdoor Air CO2 level setpoints, and/or the corresponding indoor CO2 level setpoints? What is the reset schedule of OA with respect to CO2. Is OA to be measured by a flow station, or inferred by space CO2? Where are the CO2 sensors to be located? What is the sequence for overriding DCV during economizer conditions?

5.03.7 M6.01 It appears a single CO2 sensor per air handler has been specified. This appears to be in conflict with ASHRAE 62.1-2004 which requires systems serving multiple zones to address IAQ of all the ventilation zones separately. (AC-1, AC-3, AC-4, appear to serve multiple zones).

5.03.8 M6.01 With AC-2 serving a single zone what is controlling the supply air fan VFD?

6.0 LIGHTING COMMENTS

The following electrical comments are offered and suggested to be incorporated into the next submission:

6.01 E-0.01 Light Fixture Schedule – Type A fixture is listed as 9W CFL. This fixture is listed as 13W on drawing A-2. Please confirm wattage.

6.02 E-0.01 Light Fixture Schedule – Type V fixture is listed as 1-54WT5HO. This fixture is listed as 1-24WT5HO on drawing A-2. Please confirm wattage.

6.03 E-0.01 Light Fixture Schedule – Input watts per fixture does not match total lamp wattage. Was ballast factor accounted for? Please confirm.

7.0 ENERGY COMMENTS

The following electrical comments are offered and suggested to be incorporated into the next submission:

7.01 From the 09-26-07 LEED-CI Scorecard it appears that the space contains an electricity sub meter. There is a substantial amount of electric heating coils on this project. Have other options been explored such as using more steam heating coils were the steam would already have been included in the cost of the rent for the space?

7.02 With the steam radiation being controlled by local Danfoss valves there appears to be a very high potential of simultaneous heating and cooling which could substantially increase energy usage. We recommend installing controls to prevent the AHUs from switch to the cooling or economizer mode when the steam heat is active.

7.03 It appears that the lighting power density has been fairly well optimized at a little over .5 watts per ft^2. Have calculations been made to see the percentage below ASHRAE 90.1 2004?

7.04 Please list efficiency requirements of all equipment on the drawings. This will be needed to confirm that equipment meets ASHRAE 90.1 2004. This could also limit equipment substitutions during construction.

CC
Client name – TSC Design
Project PM – Jim Dolan
CxA – Daniel Norval
File

APPENDIX B

Commissioning Plan

TSC OFFICE

Commissioning (Cx) Plan
LEED CI

275 7TH Avenue
New York City, NY 10001

PROJECT NO.: NTSC0001.00

November 12, 2007

Table of Contents

Commissioning Plan—Construction Phase

1. General Building Information

Project:	TSC Office Renovation
Location:	New York, NY
Building Type:	Office Space
Square Footage:	12,500
Number of stories:	19th floor of multi-story building
Const. Period:	2007

Plan Approved: _____ _____ _____

Signature Title Date

2. Overview

2.1 Abbreviations and Definitions

The following are common abbreviations used in this document.

A/E	Architect and design engineers (Design Team)	FT	Functional performance test
CxA	Commissioning authority	GC	General contractor
CC	Controls contractor	MC	Mechanical contractor
CM	Construction Manager	PC	Prefunctional checklist
Cx	Commissioning	PM	Project manager
Cx Plan	Commissioning Plan document	Subs	Subcontractors to General
EC	Electrical contractor	TAB	Test and balance contractor

2.3 Commissioning Scope

Commissioning is a systematic process of ensuring that all building systems perform interactively according to the design intent and the owner's operational needs. This is achieved by beginning in the design phase, documenting the design intent and continuing through construction, acceptance and the warranty period with actual verification of performance.

Commissioning during the construction of this project is intended to achieve the following specific objectives:

According to the Contract Documents:

- Ensure that applicable equipment and systems are installed properly and receive adequate operational checkout by installing contractors.
- Verify and document proper performance of equipment and systems.
- Ensure that O&M documentation left on site is complete.
- Ensure that the Owner's operating personnel are adequately trained.

2.4 Commissioned Systems

The following equipment/ systems will be commissioned in this project. All general references to equipment in this document refer only to equipment that is to be commissioned.

HVAC System (and all integral equipment controls)

X Perimeter Radiation System
X Air Handling Units
X Condensing Units
X Testing, Adjusting and Balancing work (review of TAB report only)
X Mechanical Control System

Plumbing System (and all integral equipment controls)

X Domestic hot water heater(s)
X Domestic hot water system

Lighting System (and all integral equipment controls)

X Lighting system
X Lighting controls system

3. Construction/Cx Team Data

Landlord: ..... CB Richard Ellis

Architect / Tenant: ..... TSC Design Associates, Inc.
60 Madison Avenue, Suite 1001
New York, NY 10010
Contact: Wey Lee/ Jennifer Hirsch
Email: wey.lee@tscdesign.com
Jennifer.hirsch@tscdesign.com
Phone: (212) 213-4595
Fax: (212) 213-8237

Construction Manager: ..... NCI Construction
Marcus Avenue, Suite 108
Lake Success, NY 11042
Contact: Andrew DiMarco
Phone: 516.358.7681x12

MEP Design Engineer: ..... WB Engineers Consultants PLLC
110 Williams St.
New York, NY 10038
Contact: Edward Moore
Email: emoore@wbengineering.com
Phone: (646) 778-5653
Fax: (212) 791-8301

Commissioning Authority: ..... O'Dea Lynch Abbattista Consulting Engineers, P.C.
50 Broadway
Hawthorne, NY 10532
Contact: James Dolan/ Paul Scholler/Daniel Norval
Email: jdolan@olace.com
pscholler@olace.com
dnorval@olace.com
Phone: (914) 747-2800
Fax: (914) 747-0453

LEED Consultant: ..... YRG New York
217 Grand Street, Suite 802
New York, NY 10013
Contact: Liza Trafton
Email: ltrafton@yrgconsultants.com
Phone: (917) 677-8023

Mch / Plumb Contractor: ..... Con Air
246 Broadway
Garden City Park, N.Y. 11040
Contact: Russ Brodsky
Phone: (516) 294.8860

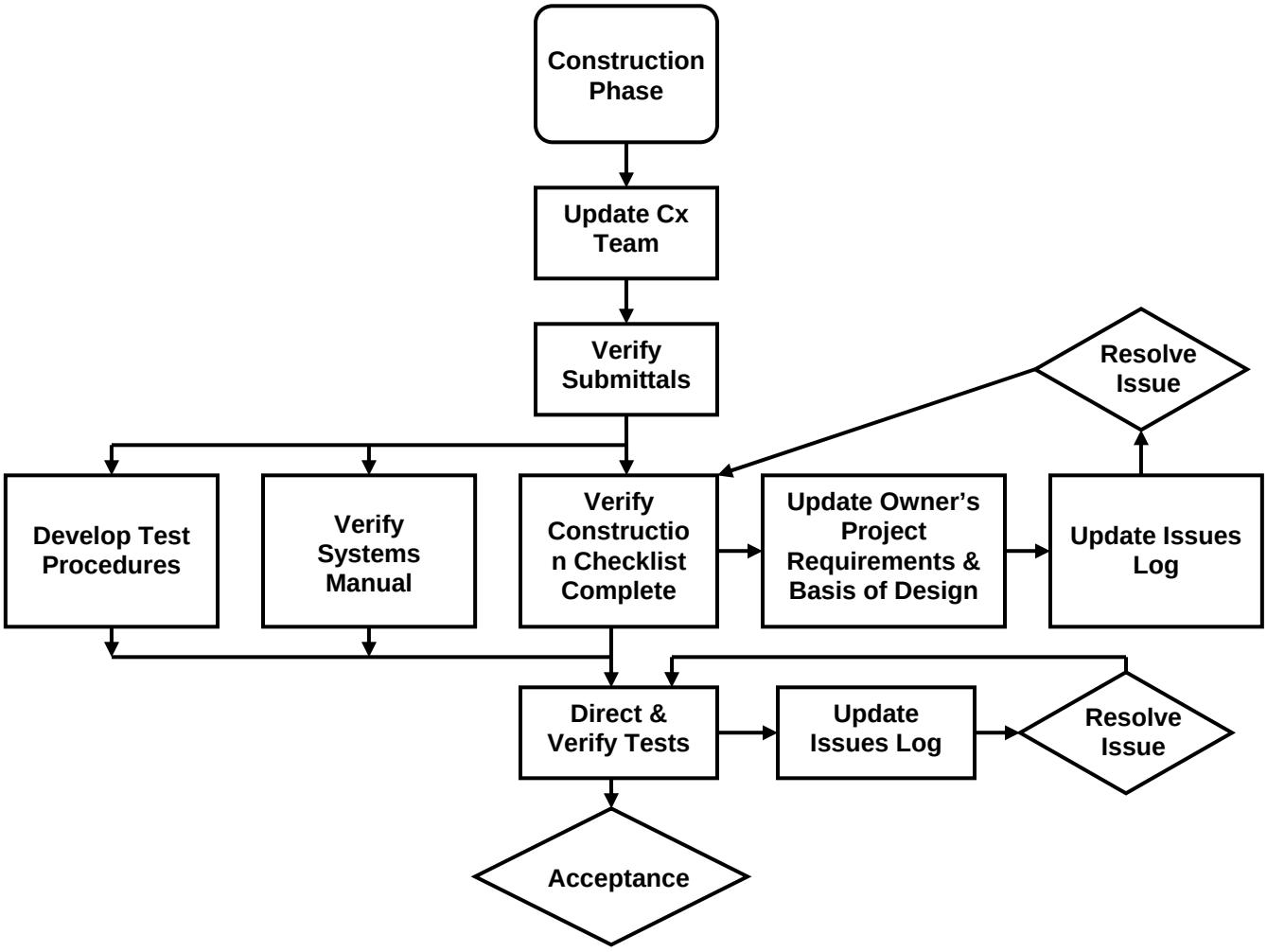
Balancing Contractor: ..... Balancing Service Inc
233 East Shore Road
Great Neck, NY 11023
Phone: (718) 786-6818
Fax: (718) 786-3813

Electrical Contractor: ..... D&D Electric Contracting Corp.

13 East 37th Street, Suite #701
New York, NY 10016
Phone: 718.401.4533

4. Roles and Responsibilities

4.1 Construction Phase Commissioning Team Flow Chart



4.2 Team Members

The members of the commissioning team consist of the CxA, Owner, assigned members of the CM, GC, A/E (particularly the mechanical engineer), the mechanical contractor (MC), electrical contractor (EC), TAB representative, controls contractor, any other installing subcontractors or suppliers of equipment. The owner's building or plant operator/ engineer is also a member of the commissioning team.

4.3 General Management Plan

The CxA was hired by the Owner directly. In general, the CxA coordinates the commissioning activities and reports to the Owner and informs A/E through the CM. The Specifications will take precedence over this Cx Plan. All members work together to fulfill their contracted responsibilities and meet the objectives of the Contract Documents. Refer to the management protocols section below.

4.4 General Descriptions of Roles

General descriptions of the commissioning roles are as follows:

Document	Input By	Provided By	Reviewed/ Approved By	Used By	Notes
Owner's Project Requirements Update	Owner, Operations, A/E	CxA or A/E	Owner	CxA, A/E, Contractors	
Basis of Design Update	A/E	A/E	CxA, Owner	A/E, CxA	
Commissioning Plan Update	CxA, A/E, Owner, Contractors	CxA	CxA, A/E, Owner, Contractors	CxA, A/E, Owner, Contractors	
Submittal Review Comments	CxA	A/E	A/E	Contractors	
System Coordination Plans	Contractors, A/E	Contractors	CxA, A/E	Contractors, CxA	
Inspection Checklists	CxA, Contractors, A/E	CxA	CxA, A/E	Contractors	
Inspection Reports	Contractors	CxA	CxA, Owner	Contractors	
Test Procedures	CxA, Contractors, A/E	CxA	CxA, A/E	Contractors	
Test Data Reports	Contractors	CxA	CxA, Owner	Contractors	
Commissioning Meeting Agendas and Minutes	CxA	CxA	All	All	
Training Plans	CxA, Operations, A/E, Contractors	CxA or Contractors	Owner, CxA	Operations, Users, Contractors	
Systems Manual	A/E, CxA, Operations, Contractors	Contractors	Owner, CxA	Operations, Users	
Issues Log	CxA	CxA	N/A	A/E, CxA, Contractors	
Issues Report	CxA	CxA	Owner, A/E	A/E, Owner, Contractors	
Preliminary Construction Commissioning Process Report	CxA	CxA	Owner	Owner	Prior to Occupancy
Final Construction Phase Commissioning Report	CxA	CxA	Owner	Owner	Close of Construction Phase

CxA: Coordinates the Cx process, writes tests, oversees and documents performance tests

CM: Facilitates the Cx process. Approves test plans and signs-off on performance, if the CxA was not hired by the CM.

GC: Facilitates the Cx process, ensures that Subs perform their responsibilities and integrates Cx into the construction process and schedule

Subs: Demonstrate proper system performance

A/E: Perform construction observation, approve O&M manuals and assist in resolving problems

PM: Facilitates and supports the Cx process and gives final approval of the Cx work

Mfr.: The equipment manufacturers and vendors provide documentation to facilitate the commissioning work and perform contracted startup

5. Commissioning Process

5.1 Commissioning Scoping Meeting

A commissioning scoping meeting is planned and conducted by the CxA. In attendance are the respective representatives of the CM, CA, PM, A/E and the mechanical, electrical, controls, and TAB subs. At the meeting commissioning parties are introduced and the commissioning process reviewed, management and reporting lines determined. The flow of documents, how much submittal data the CxA will receive, etc. are also being discussed. The Cx Plan is reviewed, process questions are addressed, lines of reporting and communications determined and the work products list discussed. Also covered are the general list of each party's responsibilities, who is responsible to develop the startup plan for each piece of equipment and the proposed commissioning schedule. The outcome of the meeting is increased understanding by all parties of the commissioning process and their respective responsibilities. The meeting provides the CxA additional information needed to finalize the *Cx Plan*, including the commissioning schedule.

Prior to this meeting the CxA is given, by the GC, all drawings and specifications and the construction schedule by trade. The CxA keeps notes from the meeting and distributes them to each team member.

5.2 Final Commissioning Plan--Construction Phase

The CxA finalizes the draft *Cx Plan* using the information gathered from the scoping meeting. The initial commissioning schedule is also developed along with a detailed timeline. The commissioning plan is approved by the CM and final Cx plan is issued.

5.3 Site Observation

The CxA, and CM if applicable, makes periodic visits to the site, as necessary, to witness equipment and system installations.

5.4 Miscellaneous Meetings

Meetings between various commissioning tea parties will be scheduled by the CxA, through the CM, as required.

5.5 Miscellaneous Management Protocols

The following protocols will be used on this project.

Issue	**Protocol**
For requests for information (RFI) or formal documentation requests:	The CxA goes first: ___ direct to Sub or A/E, x through the CM
For minor or verbal information and clarifications:	The CxA goes direct to the informed party.
For notifying contractors of deficiencies:	The CxA documents deficiencies through the CM, but may discuss deficiency issues with contractors prior to notifying the CM.
For scheduling functional tests or training:	X The CxA may provide input for and do some coordination of training and testing, but does not do any scheduling.

For scheduling commissioning meetings:	The CxA selects the date and schedules through the: _x_CM, ___GC. ___The CxA schedules and notifies attendees directly.
For making a request for significant changes:	The CxA has no authority to issue change orders.
For making small changes in specified sequences of operations:	_X_ The CxA may make small sequences of operations changes to improve efficiency or control or to correct deficiencies, through the responsible contractor, but shall document the change and provide all changes of specified sequences to the CM and A/E. ___The CxA may <u>not</u> make changes to specified sequences without approval from the A/E.
Subcontractors disagreeing with requests or interpretations by the CxA shall:	Try and resolve with the CxA first. Then work through GC who will work with CxA directly or through the CM to resolve the situation.
CM Contact	_____

5.6 Progress Reporting and Logs

At the beginning of construction, the CxA provides the CM with monthly commissioning progress reports. Thirty (30) days prior to the startup of the first piece of major equipment, the frequency of progress reports is increased to twice per month, until startup is completed. Thirty (30) days before functional testing of equipment begins, weekly progress reports are required until functional testing and all non-conformance issues are resolved. The CM may adjust the reporting frequency as needed. The progress reports contain: an update of the schedule with list of requested schedule changes and new items added to the schedule, a list of new and outstanding deficiencies, a description of commissioning progress corresponding to the plan, etc. The CxA keeps a log of all commissioning-related issues that require current or future attention. The CxA provides a form for tracking the status of documentation and testing for each piece of equipment and system (e.g., installer, party responsible for startup, approval dates for checklist and testing forms, their completion, training, O&M documentation review, etc.).

The CxA regularly communicates with all members of the commissioning team, keeping them apprised of commissioning progress and scheduling issues through memos, progress reports, etc.

The CxA will keep all commissioning materials in an organized notebook.

5.7 Initial Submittals and Documentation

5.7.1 Standard Submittals

The CxA provides all Subs responsible for commissioned equipment with commissioning documentation requirements for their respective equipment and systems through the CM. This data request typically coincides with the normal A/E submittal process. At minimum, this equipment data includes installation and start-up procedures, O&M data, performance data and control drawings. The CxA reviews and approves submissions relative to commissioning issues expressed in the contract documents, not for general contract compliance (which is the A/E's

responsibility), unless specifically directed by the owner to do so. CxA provides documentation request and tracking forms for representative equipment and acts as the tracking mechanism for documentation. This also can also be used as the checkoff sheet for part of the final O&M documentation review. CxA recommendations are provided to the A/E, owner or CM as directed.

5.7.2 Special Submittals, Notifications and Clarifications

The Subs, GC or A/E notify the CxA of any new design intent or operating parameter changes, added control strategies and sequences of operation, or other change orders that may affect commissioned systems. The controls contractor provides the CxA a full points list with details requested by the CxA. Thirty (30) days prior to performing owner-contracted tests, the Subs provide the CxA full details of the procedures. As the phases of the TAB are completed, the draft TAB report is provided to the CxA with full explanations of approach, methods, results, data table legends, etc. The final TAB report is provided to the CxA upon completion.

These submittals to the CxA do not constitute compliance for submittals for the O&M manuals. Documentation requirements for the O&M manuals are discussed within the Cx Plan.

The CxA may request additional design narrative from the A/E and from the controls contractor depending on how complete the documentation was which was provided with the bid documents. The CxA may submit written RFIs to contractors through the CM or address them directly for clarifications, as needed.

5.8.1 Start-up Plan

The CxA assists the commissioning team members responsible for startup in developing detailed start-up plans for all equipment. The parties responsible for each part of startup and initial checkout are identified on the prefunctional checklists.

A. The following procedures will be used for this project: (the CxA is responsible for the plan development):

1. The CxA adapts and enhances, if necessary, the representative prefunctional checklists (PC) and procedures from the lists in the associated specification sections, and develops original lists, as necessary.
2. The CxA obtains manufacturer installation, startup and checkout data, including actual field checkout sheets used by the field technicians from the contractor (through an RFI).
3. The CxA copies all pages with important instructional data and procedures from the startup and checkout manuals not covered in manufacturer field checkout sheets and adds a signature line in the column by each procedure.
4. The copied pages from (2), along with the prefunctional checklist provided by the CxA and the manufacturer field checkout sheets become the “Startup and Checkout Plan.”
5. For systems that may not have adequate manufacturer startup and checkout procedures, particularly for components being integrated with other equipment, the Sub should provide the added necessary detail and documenting format to the CxA for approval, prior to execution.
6. The CxA transmits the full Startup Plan to the GC, who designates which trade or contractor is responsible to fill out each line item (mark in the “Contr” column) on the Prefunctional Checklist from the CxA. The GC then transmits the full start-up plan to the Subs for their review and use. (This usually means that the Prefunctional

Checklist, alone, will go to more than one Sub, while the full plan will go to the primary installing contractor.)

5.8.2 Execution of Checklists and Startup

Prior to startup, the Subs and vendors schedule startup and initial checkout with the CM, GC and CxA. The startup and initial checkout are directed and executed by the Sub or vendor. The CxA, and CM if necessary, observe, at minimum, the procedures for each piece of primary equipment, unless there are multiple units, when a sampling strategy is used. For components of equipment, (e.g., VAV boxes), the CxA observes a sampling of the prefunctional and start-up procedures.

To document the process of startup and checkout, the site technician performing the line item task initials and dates each paragraph of procedures in the "Startup Plan" and checks off items on the prefunctional and manufacturer field checkout sheets, as they are completed. Only individuals having direct knowledge of a line item being completed shall check or initial the forms.

The Subs and vendors execute the checklists and tests and submit a signed copy of the completed start-up and prefunctional tests and checklists to the CxA. Further details are found in the Cx Specification Sections. The CxA may review prefunctional checklists in progress, as necessary. On smaller equipment or projects, the checklists (which all contain more than one trade's responsibility), may be passed around to the Subs to fill out. For larger projects, each trade may need a full form and the CxA will consolidate them later.

5.8.3 Sampling Strategy for CA Observation of Prefunctional Checkout and Startup

The following table provides a tentative list of the equipment and how much of the prefunctional checkout and startup work will be witnessed by the commissioning authority.

Equipment or System	Fraction To Be Observed by CA
AHUs	50% two (2)
Duct System	50% two (2)
Perimeter Radiation System	100%
TAB work	Observe 2 hours of TAB
DHW System	100%
HVAC Controls	100%
Lighting Controls	100%

5.8.4 Deficiencies and Non-Conformance

The Subs clearly list any outstanding items of the initial start-up and prefunctional procedures that were not completed successfully at the bottom of the procedures form or on an attached sheet. The procedures form and deficiencies are provided to the CxA within two days of test completion. The CxA works with the Subs and vendors to correct and retest deficiencies or uncompleted items, involving the CM and others as necessary. The installing Subs or vendors correct all areas that are deficient or incomplete according to the checklists and tests. The CxA recommends approval of the startup and initial checkout of each system to the CM. Further details are found in the Cx Specification Sections.

5.8.5 TAB

The TAB contractor submits the outline of the TAB plan and approach to the CxA and the controls contractor eight weeks prior to starting the TAB. Included in the approach, is an explanation of the intended use of the building control system. The CxA reviews the plan and approach for understanding and coordination issues and may comment, but does not "approve." The controls contractor reviews the feasibility of using the building control system for assistance in the TAB work. The TAB submits weekly written reports of discrepancies, contract interpretation requests and lists of completed tests to the CxA and CM. This facilitates quicker resolution of problems and will result in a more complete TAB before functional testing begins. A checklist form for reviewing the TAB plan is provided as one of the prefunctional checklists in Cx Specification Sections.

5.8.6 Controls Checkout Plan

The controls contractor develops and submits a written step-by-step plan to the CxA which describes the process they intend to follow in checking out the control system and the forms on which they will document the process. The controls contractor will also meet with the TAB contractor prior to the start of TAB and review the TAB plan to determine the capabilities of the control system for use in TAB. The controls contractor will provide the TAB with any necessary unique instruments for setting terminal unit boxes and instruct TAB in their use (handheld control system interface for use around the building during TAB, etc.). The controls contractor shall also provide a technician qualified to operate the controls to assist the TAB contractor in performing TAB.

All CxA-required controls prefunctional checklists, calibrations, start-up and selected functional tests of the system shall be completed and approved by the CxA prior to TAB. The controls contractor shall execute the tests and trend logs assigned to them in the project specifications and remain on site for assistance for mechanical system functional tests as specified in the same sections.

5.9 Development of Functional Test and Verification Procedures

5.9.1 Overview

Functional testing is the dynamic testing of systems (rather than just components) under full operation (e.g., the chiller pump is tested interactively with the chiller functions to see if the pump ramps up and down to maintain the differential pressure setpoint). Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, fire alarm, power failure, etc. The systems are run through all of the control system's sequences of operation and components are verified to be responding as the sequences state. The commissioning authority develops the functional test procedures in a sequential written form, coordinates, oversees and documents the actual testing, which is usually performed by the installing contractor or vendor.

5.9.2 Scope of Testing

The specification testing requirements sections provide specific functional testing scope for each piece of commissioned equipment. A detailed description of the functional and prefunctional testing procedures and process is found in the Cx specifications.

5.9.3 Development Process

Before test procedures are written, the CxA obtains all requested documentation and a current list of change orders affecting equipment or systems, including an updated points list, control sequences and setpoints. The CxA develops specific test procedures to verify proper operation

of each piece of equipment and system, using the testing requirements in the specifications. The CxA obtains clarification, as needed, from contractors and the A/E regarding sequences and operation to develop these tests. Prior to execution, the CxA provides a copy of the primary equipment tests to the installing Sub (via the CM) who reviews the tests for feasibility, safety, warranty, and equipment protection. Blank copies of the procedures are input into the O&M manuals for later use by operations staff.

Functional testing and verification may be achieved by manual testing (persons manipulate the equipment and observe performance) or by monitoring the performance and analyzing the results using the control system's trend log capabilities or by stand-alone dataloggers. The CxA follows the Specifications when given and uses judgement where needed to determine which method is most appropriate. According to the Specifications, not all pieces of identical equipment receive in-depth testing. The CxA reviews owner-contracted, factory or required owner acceptance tests and determines what further testing may be required to comply with the Specifications. The CxA reviews and approves documentation format of these tests prior to execution, but does not develop the procedures or document their execution, unless so requested by the CM.

5.10 Execution of Functional Testing Procedures

5.10.1 Overview and Process

The CxA schedules functional tests through the CM, GC and affected Subs. For any given system, prior to performing functional testing, the CxA waits until the prefunctional checklist has been submitted with the necessary signatures, confirming that the system is ready for functional testing. The CA oversees, witnesses, and documents the functional testing of all equipment and systems according to the Specifications and the Cx Plan. The Subs execute the tests. The control system is tested before it is used to verify performance of other components or systems. The air balancing and water balancing is completed and debugged before functional testing of air-related or water-related equipment or systems. Testing proceeds from components to subsystems to systems and finally to interlocks and connections between systems. Refer to Section 6 for details on functional testing scope.

5.10.2 Deficiencies and Retesting

The CA documents the results of the test. Corrections of minor deficiencies identified are made during the tests at the discretion of the CxA. The CxA records the results of the test on the procedure. Subs correct deficiencies, notify the CxA. The CxA schedules retesting through the CM. Decisions regarding deficiencies and corrections are made at as low a level as possible, preferrably between CxA or CM and the Sub. For areas in dispute, final authority, besides the Owner's, resides with the A/E. The CxA recommends acceptance of each test to the CM. The CM gives final approval on each test.

5.10.3 Facility Staff Participation

The Owner's facilities operating staff are encouraged to attend and participate in the testing process.

5.10.4 Sampling

Multiple identical pieces of non-life-safety or otherwise non-critical equipment may be functionally tested using a sampling strategy. The Specifications specify the sampling strategies that are used on this project.

5.11 O&M Manuals and Warranties

5.11.1 Standard O&M Manuals

The CxA reviews the O&M manuals, documentation and redline as-builts for systems that were commissioned to verify compliance with the Specifications. The CxA recommends approval and acceptance of these sections of the O&M manuals to the CM. The CxA also reviews each equipment warranty and verifies that all requirements to keep the warranty valid are clearly stated.

5.11.2 Commissioning Record

The CxA will compile, organize and index the following commissioning data by equipment into labeled, indexed and tabbed, three-ring binders and deliver it to the GC, to be included with the O&M manuals. The correspondence, meeting minutes and progress reports, miscellaneous notes, etc. kept in the Commissioning Record Book during construction will not be retained into this record and the O&M manuals. The format of the manual follows:

General

- Commissioning Plan
- Final Commissioning Report
- Issues Log
- Progress Record

Equipment Specific

- System Type (chiller system, packaged unit, boiler system, etc.)
- Design narrative and criteria, sequences, approvals for Equipment 1
- Start-up plan and report, approvals, corrections, blank prefunctional checklists
- Separator Sheets—for each equipment type (fans, pumps, chiller, etc.)
- Functional tests (completed), trending and analysis, approvals and corrections, training plan, record and approvals, blank functional test forms and a recommended recommissioning schedule.

5.12.1 Special Training and Orientation

The following checked orientation and trainings will be completed by the CxA and A/E according to the specifications:

- **Re-commissioning**

  The commissioning authority will provide instruction on the use of blank functional test forms for periodic re-commissioning of equipment and systems, per the specification.

- **Architect**

  The architect will provide a general overview of the space, its use, special features, etc.

- **Mechanical Design Engineer**

  The mechanical designer will provide an overview of the major systems and equipment in the facility, including for each system: the design intent, why the system was chosen, an overview of its operation, and interactions with other systems, any special areas to be aware of, issues regarding future expansion and remodeling, etc.

- **Electrical Design Engineer**

  The electrical designer will provide an overview of the major electrical systems and equipment in the facility, particularly the lighting control systems, fire alarm, security and emergency power, focusing on the design intent, why the system was chosen, an

overview of its operation, and interactions with other systems, any special areas to be aware of, issues regarding future expansion and remodeling, etc.

6 Summary Report

A final summary report by the CxA will be provided to the CM or PM. The report shall include an executive summary, list of participants and roles, brief space description, overview of commissioning and testing scope and a general description of testing and verification methods. For each piece of commissioned equipment, the report should contain the disposition of the commissioning authority regarding the adequacy of the equipment, documentation and training meeting the contract documents in the following areas: 1) Equipment meeting the equipment specifications, 2) Equipment installation, 3) Functional performance and efficiency, 4) Equipment documentation and design intent. All outstanding non-compliance items shall be specifically listed. Recommendations for improvement to equipment or operations, future actions, commissioning process changes, etc. shall also be listed. Each non-compliance issue shall be referenced to the specific functional test, inspection, trend log, etc. where the deficiency is documented. The functional performance and efficiency section for each piece of equipment shall include a brief description of the verification method used (manual testing, BAS trend logs, data loggers, etc.) and include observations and conclusions from the testing.

Appendices shall contain acquired sequence documentation, logs, meeting minutes, progress reports, deficiency lists, site visit reports, findings, unresolved issues, communications, etc. Functional tests and monitoring data and analysis will be provided.

7. Schedule

7.1 General Issues

The following sequential priorities are followed:

1. Functional testing is not begun until TAB is completed, for a given system (this does not preclude a phased approach).
2. The controls system and equipment it controls are not functionally tested until all points have been calibrated and pre-functional testing completed.
3. TAB is not performed until the controls system has been sufficiently functionally tested and approved by the CxA for TAB work.
4. TAB is not performed until the envelope is completely enclosed and ceiling complete, unless the return are is ducted.

7.2 Project Schedule

The initial commissioning schedule is summarized in Table 7-1.

Table 7-1. Initial Commissioning Schedule Summary

Task / Activity		Estimated Start Date	Estimated End Date
Initial scoping meeting and final plan		11-12-07	11-30-07
Submittals obtained and reviewed		TBD	TBD
Begin construction site visits/inspections		TBD	TBD
Startup and initial checkout plans		TBD	TBD
Startup and initial checkout executed		TBD	TBD
TAB	Water	TBD	TBD
	Air	TBD	TBD
Functional performance tests		TBD	TBD
Final commissioning report		TBD	TBD

APPENDIX C

Construction Site Visit Reports

O'DEA
LYNCH
ABBATTISTA
CONSULTING ENGINEERS

OLA Cx
50 Broadway
Hawthorne, NY 10532
Tel: 914-747-2800
Fax: 914-747-0453
www.olace.com

COMMISSIONING SITE VISIT REPORT #1

PROJECT:	TSC
PROJECT NO.:	NTSC0001.00
DATE OF OBSERVATION:	11-29-07
OBSERVERS:	Dan Norval, Ernie Lawas
CONTRACTORS:	NCI Construction

The project's mechanical and control installation was reviewed on the date above for commissioning purposes. Work is progressing on the interior walls. Please note that work was in progress at time of site visit and the following comments were noted:

A. Mechanical Installation:

1. A good portion of the ductwork has been installed. Most of the VAV boxes have been installed. The air handling units and condensing units are not on site.

2. Ductwork on AC-3 and AC-4 is significantly different than what is show on the drawings. OLA has not received any shop drawings on the ductwork for review. It was noted that in previous discussions with the owner, that the shop drawing approval cycle was omitted based on the agreement that the contractor would install the mechanicals as per the contract documents. There appears to be discrepancies.

3. OLA has not received shop drawings for any of the equipment being installed. This information is vital to the commissioning process and for verification of all equipment being commissioned.

4. Duct insulation is missing on top of ducts in many locations where the ducts pass under beams. (see referenced photo 1). Insulation is required to prevent condensation and potential mold issues. Contractor to correct.

Photo 1: Un-insulated top of duct

5. All of the linear diffusers that were accessible were found without duct insulation on the boot collars. Insulation is required to prevent condensation and potential mold issues. Contractor to correct. (see referenced photo 2).

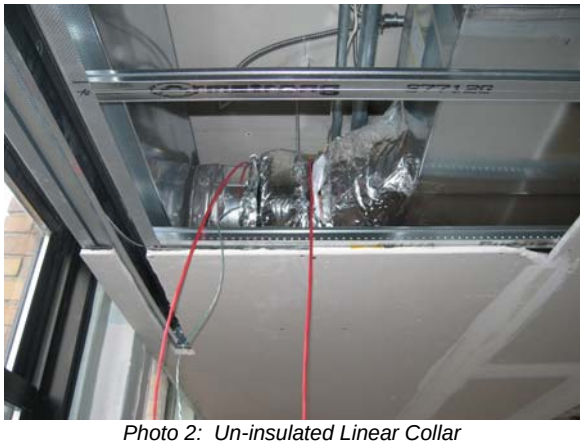


Photo 2: Un-insulated Linear Collar

6. As of the date of this site visit, the ACs have not been received on site nor has any of the new dunnage or roof support equipment yet been installed.

7. There appears to be a VAV box installed with out access to the control panel. See attached photo. (see referenced photo 3).

Photo 3: Inaccessible VAV Controls

8. It appears that a portion of the control wiring has been roughed in. This information is vital to the commissioning process and for verification of all controls being commissioned.

B. Electrical:

1. Rough in of the lighting systems is in progress.

C. Plumbing:

1. The electric hot water heater is not on site.

D. General:

1. It was observed that at least one of the walls was installed in a different location than indicated on the plans. Have any of the architectural changes been coordinated with the mechanical design engineer for HVAC zoning and air distribution requirements?

2. Many of the duct openings have not been properly protected from construction debris (see referenced photo 4). This could affect indoor air quality. With much of the ductwork being lined protecting the ductwork is important. From the latest LEED Scorecard it appears that IEQ Credit 3.1 has been targeted. Has the IAQ management plan been implemented? If so it does not appear that the current construction practices meet SMACNA guidelines.

Photo 4: Unprotected duct opening

3. We will plan our next site visit once all of the major mechanical equipment is on site.

4. Please let us know if there are any questions regarding this commissioning site report.

CC
Client name – TSC Design
Contractors name – NCI Construction
Project PM – Jim Dolan
CxA – Daniel Norval/ Ernie Lawas
File

O'DEA
LYNCH
ABBATTISTA
CONSULTING ENGINEERS

OLA Cx
50 Broadway
Hawthorne, NY 10532
Tel: 914-747-2800
Fax: 914-747-0453
www.olace.com

COMMISSIONING SITE VISIT REPORT #2

PROJECT:	TSC
PROJECT NO.:	NTSC0001.00
DATE OF OBSERVATION:	9/18/08
OBSERVERS:	Paul Scholler – OLA Edward Moore – WB Engineers

The project's mechanical and control installation was reviewed on the date above for commissioning purposes. Work is progressing on the interior walls. Please note that work was in progress at time of site visit and the following comments were noted:

A. General:

1. The functional testing of AC-1 was performed.
2. The functional testing of AC-2 was performed.
3. The functional testing of AC-3 was not performed. WB informed OLA that the unit was problematic and was not ready for commissioning. WB informed OLA the fan speed is limited due to motor loading of a new fan that was installed during construction. The resulting static pressure will be a maximum at this new speed of 52 Hz. A measured static pressure of 0.88" is being produced by the unit. The unit is either not producing enough air within the system or the not able reduce the supply air temperature to design condition. As a result the VAV boxes serving the marketing and accounting offices are starved of cooling, causing high temperatures within these offices. All VAVs have been locked in a

full open position and the associated diffusers have been comfort balanced to supply a constant CFM so that more air can be pushed to the starved areas.

4. The functional testing of AC-4 was performed.
5. The VAV's which serve rooms: 19.002, 19.006, 19.007, 19.008, 19.009, 19.010, 19.013 and the tenant space were functionally tested.
6. The functional testing of EF 19.2 was performed.

A more in depth over view of the functional testing procedures can be found in the functional test sheets, which will be included in the final report.

7. The following issues were identified during the testing:
    - The thermostat located in the reception area is not reading correctly. The actual temperature within the room was recorded to be 75 F; the thermostat was reading a temperature of 68 F.
    - The filters associated with AC-1 need to be replaced.
    - The filters associated with AC-2 need to be replaced.
    - The filters associated with AC-3 need to be replaced.
    - The filters associated with AC-4 need to be replaced.
    - AC-1 is not permanently labeled.
    - AC-2 is not permanently labeled.
    - AC-3 is not permanently labeled.
    - AC-4 is not permanently labeled.
    - AC-1: The refrigeration lines need to be supported.
    - AC-2: The refrigeration lines need to be supported.
    - AC-3: The refrigeration lines need to be supported.
    - AC-4: The refrigeration lines need to be supported.
    - AC-1: The refrigeration lines have not been completely insulated.

- AC-2: The refrigeration lines have not been completely insulated.
- AC-3: The refrigeration lines have not been completely insulated.
- AC-4: The refrigeration lines have not been completely insulated.
- AC-1: The OA enthalpy sensor is located within the return air flow. The sensor should be relocated to the OA inlet hood.
- AC-2: The OA enthalpy sensor is located within the return air flow. The sensor should be relocated to the OA inlet hood.
- AC-3: The OA enthalpy sensor is located within the return air flow. The sensor should be relocated to the OA inlet hood.
- AC-4: The OA enthalpy sensor is located within the return air flow. The sensor should be relocated to the OA inlet hood.
- AC-2: There are multiple diffusers supply either above or below 10% of the design CFM value. The balancer should re-adjust the dampers so that these values are within the 10% design range. Please refer to the balancing verification checklist for clarification on what diffusers are out of the 10% range.
- The airflow associated with the VAV which serves the conference room 19.013 was found to be over the design value. The volume dampers were modulated to lessen the airflow to achieve the design value.
- The airflow associated with the VAV that serves the reception area was found to be over the design value. The volume dampers were modulated to lessen the airflow to achieve the design value.
- The space temperature sensor associated with AC-4 is not located in the space that which the unit serves. The unit cannot modulate properly due

to the location of the sensor. Contractor needs to relocate the sensor to a space that the unit serves in-order to obtain accurate readings.

- The CO2 sensor associated with AC-4 is not located in the space that which the unit serves. The unit cannot modulate properly due to the location of the sensor. Contractor needs to relocate the sensor to a space that the unit serves in-order to obtain accurate readings.
- The AC units (AC 1-4) do not have the capabilities of shutting down at night. The units are running 24/7 even when the setpoints are reached.
- There is no volume damper associated with the diffuser located in storage room 19.038. Contractor to correct.
- None of the AC Units will be able to achieve an economizer mode due to the location of the sensors. The system is not operating per the design intent.
- Only one diffuser has been installed within the telecom room. Drawing M-3.01 illustrates two exhaust diffusers to be installed.
- The OA dampers associated with AC 1 and 4 only modulate open if the unit goes into economizer mode.

CC
Client name – TSC Design
Project PM – Jim Dolan
CxA – Paul Scholler / Daniel Norval
File

APPENDIX D

Commissioning Checklists

TSC
275 7TH AVENUE, NEW YORK, NY
9/18/08

Air Handling Unit(s)
AC-1

FUNCTIONAL PERFORMANCE TEST – RECORD SHEET

A. Documentation Requirements

Prior to the functional performance test and verification process, the Commissioning Agent requires the following documentation:

1. Air and Water Balancing Report
2. Operations and Maintenance Data
3. Verification of Warranty Periods on Equipment
4. Verify Owner Training is Complete

B. System Components

Prior to the functional performance and verification process, the Commissioning Agent shall verify all major system components, capacities, configurations and support functions are consistent with the design or documentation received. The following shall be verified:

1. AC-1 Identification	
a) Supply Fan Identification	United Coolair Corporation
• Model Number	E10G3AS15
• Serial Number	0712070
a) Economizer fan Identification	American Coolair Corporation
• Model Number	CST-D-8
b) Condensing Unit Identification	McQuay International
• Model Number	ACZ010AC712-ER11
• Serial Number	STNU080200002
2. AC-1 Unit Voltage	
a) Supply Fan Volts/HP	208/5.0
b) Condensing Unit Voltage	208
3. AC-1 Full Load Amps – Nameplate	
b) Supply Fan Full Load Amps – Nameplate	13.5
c) Condensing Unit Full Load Amps	58

4. Verify outside duct insulation consist of insulation board covered by 2" thick ASJ Board or equal and a weave glass reinforcing cloth embedded between two wet coats of sealant. (Dwg M4.02 Outdoor Duct system)	Compliance: Non-compliance:	x
Remarks:		
5. Verify supply fan rotation, lubrication and belt alignment.	Compliance: Non-compliance:	x
Remarks:		
6. Verify power exhaust fan rotation, lubrication and belt alignment.	Compliance: Non-compliance:	x
Remarks:		
7. Verify construction start-up filters were removed and replaced with new filters.	Compliance: Non-compliance:	 x
Remarks: ***Unit filters need to be replaced.***		
8. Verify unit is installed with ample clearance for maintenance and repair of all components.	Compliance: Non-compliance:	x
Remarks:		
9. Verify supply fan, return fan and condensing unit are labeled.	Compliance: Non-compliance:	 x
Remarks: ***Unit is not labeled.***		
10. Verify installation of variable speed drives (both supply and exhaust fan with by-pass).	Compliance: Non-compliance:	x

Remarks:

11. Verify fans have been statically and dynamically balanced.

Compliance: x
Non-compliance:

Remarks:

12. Verify refrigeration lines have been supported properly on roof.

Compliance:
Non-compliance: x

Remarks: ***The refrigeration lines need to be supported.***

13. Verify refrigeration lines have been insulated properly on roof.

Compliance:
Non-compliance: x

Remarks: ***The refrigeration lines have not been completely insulated.***

14. Verify outdoor air intake has been anchored properly and is at an appropriate clearance off the roof.

Compliance: x
Non-compliance:

Remarks:

15. Verify condenser disconnect switch has been installed.

Compliance: x
Non-compliance:

Remarks:

16. Verify static pressure sensor has been installed within supply duct.

Compliance: x
Non-compliance:

Remarks:

17. Verify installation of CO2 sensor.

Compliance: x

Non-compliance: _____

Remarks:

C. Functional Performance Tests

1. Verify operation of CO2 sensor.

   Compliance: x
   Non-compliance: _____

   Remarks:

2. Verify operation and placement of the outside air enthalpy sensor.

   Compliance: _____
   Non-compliance: x

   Remarks: ***The OA enthalpy sensor is located within the return air flow. The sensor should be relocated to the OA inlet hood.***

Verify during an un-occupied mode that all dampers are closed; fans and condensers are not running.

Compliance: _____
Non-compliance: x

Remarks: ***OLA was not provided with a trained representative that was able to modulate the unit into the different operating modes. OLA was unable to test this sequence requirement do to the lack of the trained personnel.***

3. Verify during start-up that the outside air damper shall modulate closed until the space design setpoint is reached. Power exhaust fan off. (Dwg M6.01 Control Point Schedule)

Compliance: _____
Non-compliance: x

Remarks: ***OLA was not provided with a trained representative that was able to modulate the unit into the different operating modes. OLA was unable to test this sequence requirement do to the lack of the trained personnel.***

4. Verify during an occupied cooling mode that the OA damper modulates to minimum position, return air damper modulates open and the compressor(s) shall

   Compliance: x
   Non-compliance: _____

be energized. Power Exhaust fan off. (Dwg M6.01 Control Point Schedule)

Remarks: ***During the occupied mode the OA damper is closed. If the CO2 sensor ppm setpoint is breeched the OA damper will modulate open.***

5. Verify during a rise in temperature above setpoint that the unit goes into an occupied cooling mode and one compressor is energized until setpoint is reached. Power exhaust fan off. (Dwg M6.01 Control Point Schedule)

   Compliance: x
   Non-compliance: ____

   Remarks:

6. Verify during an additional rise in return temperature above setpoint while the unit is in an occupied cooling mode that the second compressor is energized until setpoint is reached. Power exhaust fan off. (Dwg M6.01 Control Point Schedule)

   Compliance: ____
   Non-compliance: x

   Remarks: ***OLA was not provided with a trained representative that was able to modulate the unit into the different operating modes. OLA was unable to test this sequence requirement do to the lack of the trained personnel.***

7. Record the O.A. temperature setpoint for lockout of compressors.

   Compliance: ____
   Non-compliance: x

   Remarks: ***OLA was not provided with a trained representative that was able to modulate the unit into the different operating modes. OLA was unable to test this sequence requirement do to the lack of the trained personnel.***

8. Verify during a drop in temperature below setpoint that the unit goes into an occupied heating mode and the electric heater is activated until setpoint is reached. Power exhaust fan off. (Dwg M6.01 Control Point Schedule)

   Compliance: x
   Non-compliance: ____

   Remarks:

9. Verify the positive lockout between the compressors and the electric heater. Power exhaust fan off. (Dwg M6.01 Control Point Schedule)

   Compliance: ____
   Non-compliance: x

Remarks: ***OLA was not provided with a trained representative that was able to modulate the unit into the different operating modes. OLA was unable to test this sequence requirement do to the lack of the trained personnel.***

10. Verify during a rise in the CO2 level that the OA damper modulates open until CO2 drops below setpoint. Power exhaust fan off. (Dwg M6.01 Control Point Schedule)

    Compliance: x
    Non-compliance:

    Remarks:

11. Verify when the ambient temperature drops below a specified point that the unit goes into economizer mode. The OA damper shall modulate 100% open and the return damper shall modulate 100% closed. The power exhaust fan shall be energized to exhaust space return air. The power exhaust fan shall be interlocked with the supply fan VFD.

    Compliance: x
    Non-compliance:

    Remarks: ***The unit will modulate into a economizer mode, however the enthalpy sensor is located in the return airflow. The enthalpy sensor needs to be relocated to the OA hood.***

12. Verify cooling is locked out during the heating mode.

    Compliance:
    Non-compliance: x

    Remarks: ***OLA was not provided with a trained representative that was able to modulate the unit into the different operating modes. OLA was unable to test this sequence requirement do to the lack of the trained personnel.***

13. Verify fan failure alarm. Verify fan stops and O.A. damper closes.

    Compliance: x
    Non-compliance:

    Remarks:

14. Verify drain pan alarm. Verify that all modes of operation are locked out until reason of overflow is located and corrected.

    Compliance:
    Non-compliance: x

Remarks: ***OLA was not provided with a trained representative that was able to modulate the unit into the different operating modes. OLA was unable to test this sequence requirement do to the lack of the trained personnel.***

15. Verify dirty filter DP alarm and record setting.

Compliance: _____
Non-compliance: x

Remarks: ***OLA was not provided with a trained representative that was able to modulate the unit into the different operating modes. OLA was unable to test this sequence requirement do to the lack of the trained personnel.***

16. Verify unit discharge high pressure limit alarm feature is installed. Record setting and verify alarm.

Compliance: _____
Non-compliance: x

Remarks: ***OLA was not provided with a trained representative that was able to modulate the unit into the different operating modes. OLA was unable to test this sequence requirement do to the lack of the trained personnel.***

17. Verify operation of duct smoke detector. Unit shall shutdown and all dampers shall modulate closed.

Compliance: _____
Non-compliance: x

Remarks: ***OLA was not provided with a trained representative that was able to modulate the unit into the different operating modes. OLA was unable to test this sequence requirement do to the lack of the trained personnel.***

Notes:
1.

TSC
275 7TH AVENUE, NEW YORK, NY
9/18/08

Air Handling Unit(s)
AC-2

FUNCTIONAL PERFORMANCE TEST – RECORD SHEET

A. Documentation Requirements

Prior to the functional performance test and verification process, the Commissioning Agent requires the following documentation:

1. Air and Water Balancing Report
2. Operations and Maintenance Data
3. Verification of Warranty Periods on Equipment
4. Verify Owner Training is Complete

B. System Components

Prior to the functional performance and verification process, the Commissioning Agent shall verify all major system components, capacities, configurations and support functions are consistent with the design or documentation received. The following shall be verified:

1. AC-2 Identification	
a) Supply Fan Identification	United Coolair Corporation
• Model Number	E12G3AS15
• Serial Number	0712072
a) Economizer fan Identification	American Coolair Corporation
• Model Number	CST-D-8
b) Condensing Unit Identification	McQuay International
• Model Number	ACZ013AC712-ER11
• Serial Number	STNU080100196
2. AC-2 Unit Voltage	
a) Supply Fan Volts/HP	208/7.5
b) Economizer fan Voltage	
c) Condensing Unit Voltage	208
3. AC-2 Full Load Amps – Nameplate	
b) Supply Fan Full Load Amps – Nameplate	20
c) Economizer fan Full Load Amps – Nameplate	
d) Condensing Unit Full Load Amps	58

4. Verify outside duct insulation consist of insulation board covered by 2" thick ASJ Board or equal and a weave glass reinforcing cloth embedded between two wet coats of sealant. (Dwg M4.02 Outdoor Duct system)	Compliance: Non-compliance:	x
Remarks:		
5. Verify supply fan rotation, lubrication and belt alignment.	Compliance: Non-compliance:	x
Remarks:		
6. Verify power exhaust fan rotation, lubrication and belt alignment.	Compliance: Non-compliance:	x
Remarks:		
7. Verify construction start-up filters were removed and replaced with new filters.	Compliance: Non-compliance:	 x
Remarks: ***Unit filters need to be replaced.***		
8. Verify unit is installed with ample clearance for maintenance and repair of all components.	Compliance: Non-compliance:	x
Remarks:		
9. Verify supply fan, return fan and condensing unit are labeled.	Compliance: Non-compliance:	 x
Remarks: ***Unit is not labeled.***		
10. Verify installation of variable speed drives (both supply and exhaust fan with by-pass).	Compliance: Non-compliance:	x

Remarks:

11. Verify fans have been statically and dynamically balanced.

Compliance: x
Non-compliance:

Remarks:

12. Verify refrigeration lines have been supported properly on roof.

Compliance:
Non-compliance: x

Remarks: ***The refrigeration lines need to be supported.***

13. Verify refrigeration lines have been insulated properly on roof.

Compliance:
Non-compliance: x

Remarks: ***The refrigeration lines have not been completely insulated.***

14. Verify outdoor air intake has been anchored properly and is at an appropriate clearance off the roof.

Compliance: x
Non-compliance:

Remarks:

15. Verify condenser disconnect switch has been installed.

Compliance: x
Non-compliance:

Remarks:

16. Verify static pressure sensor has been installed within supply duct.

Compliance: x
Non-compliance:

Remarks:

17. Verify installation of CO2 sensor.

Compliance: x

Non-compliance: _____

Remarks:

C. Functional Performance Tests

1. Verify operation of CO2 sensor. — Compliance: x; Non-compliance: _____

Remarks:

2. Verify operation and placement of the outside air enthalpy sensor. — Compliance: _____; Non-compliance: x

Remarks: ***The OA enthalpy sensor is located within the return air flow. The sensor should be relocated to the OA inlet hood.***

Verify during an un-occupied mode that all dampers are closed; fans and condensers are not running. — Compliance: _____; Non-compliance: x

Remarks: ***OLA was not provided with a trained representative that was able to modulate the unit into the different operating modes. OLA was unable to test this sequence requirement do to the lack of the trained personnel.***

3. Verify during start-up that the outside air damper shall modulate closed until the space design setpoint is reached. Power exhaust fan off. (Dwg M6.01 Control Point Schedule) — Compliance: _____; Non-compliance: x

Remarks: ***OLA was not provided with a trained representative that was able to modulate the unit into the different operating modes. OLA was unable to test this sequence requirement do to the lack of the trained personnel.***

4. Verify during an occupied cooling mode that the OA damper modulates to minimum position, return air damper modulates open and the compressor(s) shall — Compliance: x; Non-compliance: _____

be energized. Power Exhaust fan off. (Dwg M6.01 Control Point Schedule)

Remarks: ***During the occupied mode the OA damper is closed. If the CO2 sensor ppm setpoint is breeched the OA damper will modulate open.***

5. Verify during a rise in temperature above setpoint that the unit goes into an occupied cooling mode and one compressor is energized until setpoint is reached. Power exhaust fan off. (Dwg M6.01 Control Point Schedule)

   Compliance: x
   Non-compliance: ____

   Remarks:

6. Verify during an additional rise in return temperature above setpoint while the unit is in an occupied cooling mode that the second compressor is energized until setpoint is reached. Power exhaust fan off. (Dwg M6.01 Control Point Schedule)

   Compliance: ____
   Non-compliance: x

   Remarks: ***OLA was not provided with a trained representative that was able to modulate the unit into the different operating modes. OLA was unable to test this sequence requirement do to the lack of the trained personnel.***

7. Record the O.A. temperature setpoint for lockout of compressors.

   Compliance: ____
   Non-compliance: x

   Remarks: ***OLA was not provided with a trained representative that was able to modulate the unit into the different operating modes. OLA was unable to test this sequence requirement do to the lack of the trained personnel.***

8. Verify during a drop in temperature below setpoint that the unit goes into an occupied heating mode and the electric heater is activated until setpoint is reached. Power exhaust fan off. (Dwg M6.01 Control Point Schedule)

   Compliance: x
   Non-compliance: ____

   Remarks:

9. Verify the positive lockout between the compressors and the electric heater. Power exhaust fan off. (Dwg M6.01 Control Point Schedule)

   Compliance: ____
   Non-compliance: x

Remarks: ***OLA was not provided with a trained representative that was able to modulate the unit into the different operating modes. OLA was unable to test this sequence requirement do to the lack of the trained personnel.***

10. Verify during a rise in the CO2 level that the OA damper modulates open until CO2 drops below setpoint. Power exhaust fan off. (Dwg M6.01 Control Point Schedule)

    Compliance: x
    Non-compliance: ____

    Remarks:

11. Verify when the ambient temperature drops below a specified point that the unit goes into economizer mode. The OA damper shall modulate 100% open and the return damper shall modulate 100% closed. The power exhaust fan shall be energized to exhaust space return air. The power exhaust fan shall be interlocked with the supply fan VFD.

    Compliance: x
    Non-compliance: ____

    Remarks: ***The unit will modulate into a economizer mode, however the enthalpy sensor is located in the return airflow. The enthalpy sensor needs to be relocated to the OA hood.***

12. Verify cooling is locked out during the heating mode.

    Compliance: ____
    Non-compliance: x

    Remarks: ***OLA was not provided with a trained representative that was able to modulate the unit into the different operating modes. OLA was unable to test this sequence requirement do to the lack of the trained personnel.***

13. Verify fan failure alarm. Verify fan stops and O.A. damper closes.

    Compliance: x
    Non-compliance: ____

    Remarks:

14. Verify drain pan alarm. Verify that all modes of operation are locked out until reason of overflow is located and corrected.

    Compliance: ____
    Non-compliance: x

Remarks: ***OLA was not provided with a trained representative that was able to modulate the unit into the different operating modes. OLA was unable to test this sequence requirement do to the lack of the trained personnel.***

15. Verify dirty filter DP alarm and record setting.

Compliance: _____
Non-compliance: x

Remarks: ***OLA was not provided with a trained representative that was able to modulate the unit into the different operating modes. OLA was unable to test this sequence requirement do to the lack of the trained personnel.***

16. Verify unit discharge high pressure limit alarm feature is installed. Record setting and verify alarm.

Compliance: _____
Non-compliance: x

Remarks: ***OLA was not provided with a trained representative that was able to modulate the unit into the different operating modes. OLA was unable to test this sequence requirement do to the lack of the trained personnel.***

17. Verify operation of duct smoke detector. Unit shall shutdown and all dampers shall modulate closed.

Compliance: _____
Non-compliance: x

Remarks: ***OLA was not provided with a trained representative that was able to modulate the unit into the different operating modes. OLA was unable to test this sequence requirement do to the lack of the trained personnel.***

Notes:
1.

TSC
275 7TH AVENUE, NEW YORK, NY
9/18/08

Air Handling Unit(s)
AC-3

FUNCTIONAL PERFORMANCE TEST – RECORD SHEET

A. Documentation Requirements

Prior to the functional performance test and verification process, the Commissioning Agent requires the following documentation:

1. Air and Water Balancing Report
2. Operations and Maintenance Data
3. Verification of Warranty Periods on Equipment
4. Verify Owner Training is Complete

B. System Components

Prior to the functional performance and verification process, the Commissioning Agent shall verify all major system components, capacities, configurations and support functions are consistent with the design or documentation received. The following shall be verified:

1. AC-3 Identification	
a) Supply Fan Identification	United Coolair Corporation
• Model Number	E10G3AS15
• Serial Number	0712069
a) Economizer fan Identification	American Coolair Corporation
• Model Number	CST-D-8
b) Condensing Unit Identification	McQuay International
• Model Number	ACZ010AC712-ER11
• Serial Number	STNU080200003
2. AC-3 Unit Voltage	
a) Supply Fan Volts/HP	208/5.0
b) Economizer fan Voltage	
c) Condensing Unit Voltage	208
3. AC-3 Full Load Amps – Nameplate	
b) Supply Fan Full Load Amps – Nameplate	13.5
c) Economizer fan Full Load Amps – Nameplate	
d) Condensing Unit Full Load Amps	58

4. Verify outside duct insulation consist of insulation board covered by 2" thick ASJ Board or equal and a weave glass reinforcing cloth embedded between two wet coats of sealant. (Dwg M4.02 Outdoor Duct system)	Compliance: Non-compliance:	x
Remarks:		
5. Verify supply fan rotation, lubrication and belt alignment.	Compliance: Non-compliance:	x
Remarks:		
6. Verify power exhaust fan rotation, lubrication and belt alignment.	Compliance: Non-compliance:	x
Remarks:		
7. Verify construction start-up filters were removed and replaced with new filters.	Compliance: Non-compliance:	 x
Remarks: ***Unit filters need to be replaced.***		
8. Verify unit is installed with ample clearance for maintenance and repair of all components.	Compliance: Non-compliance:	x
Remarks:		
9. Verify supply fan, return fan and condensing unit are labeled.	Compliance: Non-compliance:	 x
Remarks: ***Unit is not labeled.***		
10. Verify installation of variable speed drives (both supply and exhaust fan with by-pass).	Compliance: Non-compliance:	x

Remarks:

11. Verify fans have been statically and dynamically balanced.

Compliance: x
Non-compliance:

Remarks:

12. Verify refrigeration lines have been supported properly on roof.

Compliance:
Non-compliance: x

Remarks: ***The refrigeration lines need to be supported.***

13. Verify refrigeration lines have been insulated properly on roof.

Compliance:
Non-compliance: x

Remarks: ***The refrigeration lines have not been completely insulated.***

14. Verify outdoor air intake has been anchored properly and is at an appropriate clearance off the roof.

Compliance: x
Non-compliance:

Remarks:

15. Verify condenser disconnect switch has been installed.

Compliance: x
Non-compliance:

Remarks:

16. Verify static pressure sensor has been installed within supply duct.

Compliance: x
Non-compliance:

Remarks:

17. Verify installation of CO2 sensor.

Compliance: x

Non-compliance: _____

Remarks:

C. Functional Performance Tests

1. Verify operation of CO2 sensor.

   Compliance: x
   Non-compliance: _____

   Remarks:

2. Verify operation and placement of the outside air enthalpy sensor.

   Compliance: _____
   Non-compliance: x

   Remarks: ***The OA enthalpy sensor is located within the return air flow. The sensor should be relocated to the OA inlet hood.***

Verify during an un-occupied mode that all dampers are closed; fans and condensers are not running.

Compliance: _____
Non-compliance: x

Remarks: ***OLA was not provided with a trained representative that was able to modulate the unit into the different operating modes. OLA was unable to test this sequence requirement do to the lack of the trained personnel.***

3. Verify during start-up that the outside air damper shall modulate closed until the space design setpoint is reached. Power exhaust fan off. (Dwg M6.01 Control Point Schedule)

Compliance: _____
Non-compliance: x

Remarks: ***OLA was not provided with a trained representative that was able to modulate the unit into the different operating modes. OLA was unable to test this sequence requirement do to the lack of the trained personnel.***

4. Verify during an occupied cooling mode that the OA damper modulates to minimum position, return air damper modulates open and the compressor(s) shall

   Compliance: x
   Non-compliance: _____

be energized. Power Exhaust fan off. (Dwg M6.01 Control Point Schedule)

Remarks: ***During the occupied mode the OA damper is closed. If the CO2 sensor ppm setpoint is breeched the OA damper will modulate open.***

5. Verify during a rise in temperature above setpoint that the unit goes into an occupied cooling mode and one compressor is energized until setpoint is reached. Power exhaust fan off. (Dwg M6.01 Control Point Schedule)

   Compliance: x
   Non-compliance: ____

   Remarks:

6. Verify during an additional rise in return temperature above setpoint while the unit is in an occupied cooling mode that the second compressor is energized until setpoint is reached. Power exhaust fan off. (Dwg M6.01 Control Point Schedule)

   Compliance: ____
   Non-compliance: x

   Remarks: ***OLA was not provided with a trained representative that was able to modulate the unit into the different operating modes. OLA was unable to test this sequence requirement do to the lack of the trained personnel.***

7. Record the O.A. temperature setpoint for lockout of compressors.

   Compliance: ____
   Non-compliance: x

   Remarks: ***OLA was not provided with a trained representative that was able to modulate the unit into the different operating modes. OLA was unable to test this sequence requirement do to the lack of the trained personnel.***

8. Verify during a drop in temperature below setpoint that the unit goes into an occupied heating mode and the electric heater is activated until setpoint is reached. Power exhaust fan off. (Dwg M6.01 Control Point Schedule)

   Compliance: x
   Non-compliance: ____

   Remarks:

9. Verify the positive lockout between the compressors and the electric heater. Power exhaust fan off. (Dwg M6.01 Control Point Schedule)

   Compliance: ____
   Non-compliance: x

Remarks: ***OLA was not provided with a trained representative that was able to modulate the unit into the different operating modes. OLA was unable to test this sequence requirement do to the lack of the trained personnel.***

10. Verify during a rise in the CO2 level that the OA damper modulates open until CO2 drops below setpoint. Power exhaust fan off. (Dwg M6.01 Control Point Schedule)

    Compliance: x
    Non-compliance: ____

    Remarks:

11. Verify when the ambient temperature drops below a specified point that the unit goes into economizer mode. The OA damper shall modulate 100% open and the return damper shall modulate 100% closed. The power exhaust fan shall be energized to exhaust space return air. The power exhaust fan shall be interlocked with the supply fan VFD.

    Compliance: x
    Non-compliance: ____

    Remarks: ***The unit will modulate into a economizer mode, however the enthalpy sensor is located in the return airflow. The enthalpy sensor needs to be relocated to the OA hood.***

12. Verify cooling is locked out during the heating mode.

    Compliance: ____
    Non-compliance: x

    Remarks: ***OLA was not provided with a trained representative that was able to modulate the unit into the different operating modes. OLA was unable to test this sequence requirement do to the lack of the trained personnel.***

13. Verify fan failure alarm. Verify fan stops and O.A. damper closes.

    Compliance: x
    Non-compliance: ____

    Remarks:

14. Verify drain pan alarm. Verify that all modes of operation are locked out until reason of overflow is located and corrected.

    Compliance: ____
    Non-compliance: x

Remarks: ***OLA was not provided with a trained representative that was able to modulate the unit into the different operating modes. OLA was unable to test this sequence requirement do to the lack of the trained personnel.***

15. Verify dirty filter DP alarm and record setting.

Compliance: _____
Non-compliance: x

Remarks: ***OLA was not provided with a trained representative that was able to modulate the unit into the different operating modes. OLA was unable to test this sequence requirement do to the lack of the trained personnel.***

16. Verify unit discharge high pressure limit alarm feature is installed. Record setting and verify alarm.

Compliance: _____
Non-compliance: x

Remarks: ***OLA was not provided with a trained representative that was able to modulate the unit into the different operating modes. OLA was unable to test this sequence requirement do to the lack of the trained personnel.***

17. Verify operation of duct smoke detector. Unit shall shutdown and all dampers shall modulate closed.

Compliance: _____
Non-compliance: x

Remarks: ***OLA was not provided with a trained representative that was able to modulate the unit into the different operating modes. OLA was unable to test this sequence requirement do to the lack of the trained personnel.***

Notes:
1.

TSC
275 7TH AVENUE, NEW YORK, NY
9/18/08

Air Handling Unit(s)
AC-4

FUNCTIONAL PERFORMANCE TEST – RECORD SHEET

A. Documentation Requirements

Prior to the functional performance test and verification process, the Commissioning Agent requires the following documentation:

1. Air and Water Balancing Report
2. Operations and Maintenance Data
3. Verification of Warranty Periods on Equipment
4. Verify Owner Training is Complete

B. System Components

Prior to the functional performance and verification process, the Commissioning Agent shall verify all major system components, capacities, configurations and support functions are consistent with the design or documentation received. The following shall be verified:

1. AC-4 Identification	
a) Supply Fan Identification	United Coolair Corporation
• Model Number	E12G3AS15
• Serial Number	0712071
a) Economizer fan Identification	American Coolair Corporation
• Model Number	CST-D-8
b) Condensing Unit Identification	McQuay International
• Model Number	ACZ013AC712-ER11
• Serial Number	STNU080100198
2. AC-4 Unit Voltage	
a) Supply Fan Volts/HP	208/7.5
b) Economizer fan Voltage	
c) Condensing Unit Voltage	208
3. AC-4 Full Load Amps – Nameplate	
b) Supply Fan Full Load Amps – Nameplate	20
c) Economizer fan Full Load Amps – Nameplate	
d) Condensing Unit Full Load Amps	58

4. Verify outside duct insulation consist of insulation board covered by 2" thick ASJ Board or equal and a weave glass reinforcing cloth embedded between two wet coats of sealant. (Dwg M4.02 Outdoor Duct system)	Compliance: Non-compliance:	x
Remarks:		
5. Verify supply fan rotation, lubrication and belt alignment.	Compliance: Non-compliance:	x
Remarks:		
6. Verify power exhaust fan rotation, lubrication and belt alignment.	Compliance: Non-compliance:	x
Remarks:		
7. Verify construction start-up filters were removed and replaced with new filters.	Compliance: Non-compliance:	 x
Remarks: ***Unit filters need to be replaced.***		
8. Verify unit is installed with ample clearance for maintenance and repair of all components.	Compliance: Non-compliance:	x
Remarks:		
9. Verify supply fan, return fan and condensing unit are labeled.	Compliance: Non-compliance:	 x
Remarks: ***Unit is not labeled.***		
10. Verify installation of variable speed drives (both supply and exhaust fan with by-pass).	Compliance: Non-compliance:	x

Remarks:

11. Verify fans have been statically and dynamically balanced.

Compliance: x
Non-compliance:

Remarks:

12. Verify refrigeration lines have been supported properly on roof.

Compliance:
Non-compliance: x

Remarks: ***The refrigeration lines need to be supported.***

13. Verify refrigeration lines have been insulated properly on roof.

Compliance:
Non-compliance: x

Remarks: ***The refrigeration lines have not been completely insulated.***

14. Verify outdoor air intake has been anchored properly and is at an appropriate clearance off the roof.

Compliance: x
Non-compliance:

Remarks:

15. Verify condenser disconnect switch has been installed.

Compliance: x
Non-compliance:

Remarks:

16. Verify static pressure sensor has been installed within supply duct.

Compliance: x
Non-compliance:

Remarks:

17. Verify installation of CO2 sensor.

Compliance: x

Non-compliance: _____

Remarks:

C. Functional Performance Tests

1. Verify operation of CO2 sensor.

Compliance: x
Non-compliance: _____

Remarks:

2. Verify operation and placement of the outside air enthalpy sensor.

Compliance: _____
Non-compliance: x

Remarks: ***The OA enthalpy sensor is located within the return air flow. The sensor should be relocated to the OA inlet hood.***

Verify during an un-occupied mode that all dampers are closed; fans and condensers are not running.

Compliance: _____
Non-compliance: x

Remarks: ***OLA was not provided with a trained representative that was able to modulate the unit into the different operating modes. OLA was unable to test this sequence requirement do to the lack of the trained personnel.***

3. Verify during start-up that the outside air damper shall modulate closed until the space design setpoint is reached. Power exhaust fan off. (Dwg M6.01 Control Point Schedule)

Compliance: _____
Non-compliance: x

Remarks: ***OLA was not provided with a trained representative that was able to modulate the unit into the different operating modes. OLA was unable to test this sequence requirement do to the lack of the trained personnel.***

4. Verify during an occupied cooling mode that the OA damper modulates to minimum position, return air damper modulates open and the compressor(s) shall

Compliance: x
Non-compliance: _____

be energized. Power Exhaust fan off. (Dwg M6.01 Control Point Schedule)

Remarks: ***During the occupied mode the OA damper is closed. If the CO2 sensor ppm setpoint is breeched the OA damper will modulate open.***

5. Verify during a rise in temperature above setpoint that the unit goes into an occupied cooling mode and one compressor is energized until setpoint is reached. Power exhaust fan off. (Dwg M6.01 Control Point Schedule)

   Compliance: x
   Non-compliance: ____

   Remarks:

6. Verify during an additional rise in return temperature above setpoint while the unit is in an occupied cooling mode that the second compressor is energized until setpoint is reached. Power exhaust fan off. (Dwg M6.01 Control Point Schedule)

   Compliance: ____
   Non-compliance: x

   Remarks: ***OLA was not provided with a trained representative that was able to modulate the unit into the different operating modes. OLA was unable to test this sequence requirement do to the lack of the trained personnel.***

7. Record the O.A. temperature setpoint for lockout of compressors.

   Compliance: ____
   Non-compliance: x

   Remarks: ***OLA was not provided with a trained representative that was able to modulate the unit into the different operating modes. OLA was unable to test this sequence requirement do to the lack of the trained personnel.***

8. Verify during a drop in temperature below setpoint that the unit goes into an occupied heating mode and the electric heater is activated until setpoint is reached. Power exhaust fan off. (Dwg M6.01 Control Point Schedule)

   Compliance: x
   Non-compliance: ____

   Remarks:

9. Verify the positive lockout between the compressors and the electric heater. Power exhaust fan off. (Dwg M6.01 Control Point Schedule)

   Compliance: ____
   Non-compliance: x

Remarks: ***OLA was not provided with a trained representative that was able to modulate the unit into the different operating modes. OLA was unable to test this sequence requirement do to the lack of the trained personnel.***

10. Verify during a rise in the CO2 level that the OA damper modulates open until CO2 drops below setpoint. Power exhaust fan off. (Dwg M6.01 Control Point Schedule)

    Compliance: x
    Non-compliance: ____

    Remarks:

11. Verify when the ambient temperature drops below a specified point that the unit goes into economizer mode. The OA damper shall modulate 100% open and the return damper shall modulate 100% closed. The power exhaust fan shall be energized to exhaust space return air. The power exhaust fan shall be interlocked with the supply fan VFD.

    Compliance: x
    Non-compliance: ____

    Remarks: ***The unit will modulate into a economizer mode, however the enthalpy sensor is located in the return airflow. The enthalpy sensor needs to be relocated to the OA hood.***

12. Verify cooling is locked out during the heating mode.

    Compliance: ____
    Non-compliance: x

    Remarks: ***OLA was not provided with a trained representative that was able to modulate the unit into the different operating modes. OLA was unable to test this sequence requirement do to the lack of the trained personnel.***

13. Verify fan failure alarm. Verify fan stops and O.A. damper closes.

    Compliance: x
    Non-compliance: ____

    Remarks:

14. Verify drain pan alarm. Verify that all modes of operation are locked out until reason of overflow is located and corrected.

    Compliance: ____
    Non-compliance: x

Remarks: ***OLA was not provided with a trained representative that was able to modulate the unit into the different operating modes. OLA was unable to test this sequence requirement do to the lack of the trained personnel.***

15. Verify dirty filter DP alarm and record setting.

Compliance: _____
Non-compliance: x

Remarks: ***OLA was not provided with a trained representative that was able to modulate the unit into the different operating modes. OLA was unable to test this sequence requirement do to the lack of the trained personnel.***

16. Verify unit discharge high pressure limit alarm feature is installed. Record setting and verify alarm.

Compliance: _____
Non-compliance: x

Remarks: ***OLA was not provided with a trained representative that was able to modulate the unit into the different operating modes. OLA was unable to test this sequence requirement do to the lack of the trained personnel.***

17. Verify operation of duct smoke detector. Unit shall shutdown and all dampers shall modulate closed.

Compliance: _____
Non-compliance: x

Remarks: ***OLA was not provided with a trained representative that was able to modulate the unit into the different operating modes. OLA was unable to test this sequence requirement do to the lack of the trained personnel.***

Notes:
1.

TSC
275 7TH AVENUE, NEW YORK, NY
9/18/08

VAV Boxes
VAV-G
(Serve: Tenant Space)
FUNCTIONAL PERFORMANCE TEST – RECORD SHEET

A. Documentation Requirements

Prior to the functional performance test and verification process, the Commissioning Agent requires the following documentation:

1. Air and Water Balancing Report
2. Operations and Maintenance Data
3. Verification of Warranty Periods on Equipment
4. Verify Owner Training is Complete

B. System Components

Prior to the functional performance and verification process, the Commissioning Agent shall verify all major system components, capacities, configurations and support functions are consistent with the design or documentation received. The following shall be verified:

1. Verify proper connection of primary duct to inlet of VAV.

   Compliance: x
   Non-compliance: _____

   Remarks:

2. Verify access to all necessary components.

   Compliance: x
   Non-compliance: _____

   Remarks:

3. Verify unit is supported with straps or threaded rod supports.(installation manual)

   Compliance: x
   Non-compliance: _____

   Remarks:

4. Verify that there are 3 to 5 inlet duct diameters of straight duct at the terminal inlet. (installation manual)

   Compliance: x
   Non-compliance: ____

   Remarks:

5. Verify unit is labeled.

   Compliance: x
   Non-compliance: ____

   Remarks:

C. Functional Performance Tests

1. Verify unit modulates open during a call for cooling.

   Compliance: x
   Non-compliance: ____

   Remarks: ***Thermostat was set to 55°F in-order to verify operation.***

2. Verify unit modulates closed upon satisfaction of cooling setpoint.

   Compliance: x
   Non-compliance: ____

   Remarks: ***Thermostat setpoint was used to verify operation.***

3. Verify calibration of thermostat.

   Compliance: x
   Non-compliance: ____

   Remarks: ***Thermostat was verified to be reading correctly.***

Notes:
1.

TSC
275 7TH AVENUE, NEW YORK, NY
9/18/08

VAV Boxes
VAV-D
(Location: Conference Room 19.013)
FUNCTIONAL PERFORMANCE TEST – RECORD SHEET

A. Documentation Requirements

Prior to the functional performance test and verification process, the Commissioning Agent requires the following documentation:

1. Air and Water Balancing Report
2. Operations and Maintenance Data
3. Verification of Warranty Periods on Equipment
4. Verify Owner Training is Complete

B. System Components

Prior to the functional performance and verification process, the Commissioning Agent shall verify all major system components, capacities, configurations and support functions are consistent with the design or documentation received. The following shall be verified:

1. Verify proper connection of primary duct to inlet of VAV.

   Compliance: x
   Non-compliance: _____

   Remarks:

2. Verify access to all necessary components.

   Compliance: x
   Non-compliance: _____

   Remarks:

3. Verify unit is supported with straps or threaded rod supports.(installation manual)

   Compliance: x
   Non-compliance: _____

   Remarks:

4. Verify that there are 3 to 5 inlet duct diameters of straight duct at the terminal inlet. (installation manual)

   Compliance: x
   Non-compliance: ____

   Remarks:

5. Verify unit is labeled.

   Compliance: x
   Non-compliance: ____

   Remarks:

C. Functional Performance Tests

1. Verify unit modulates open during a call for cooling.

   Compliance: x
   Non-compliance: ____

   Remarks: ***Thermostat was set to 55°F in-order to verify operation.***

2. Verify unit modulates closed upon satisfaction of cooling setpoint.

   Compliance: x
   Non-compliance: ____

   Remarks: ***Thermostat setpoint was used to verify operation.***

3. Verify calibration of thermostat.

   Compliance: x
   Non-compliance: ____

   Remarks: ***Thermostat was verified to be reading correctly.***

Notes:
1.

TSC
275 7TH AVENUE, NEW YORK, NY
9/18/08

VAV Boxes
VAV-C
(Serve: Employee Lounge 19.006)
FUNCTIONAL PERFORMANCE TEST – RECORD SHEET

A. Documentation Requirements

Prior to the functional performance test and verification process, the Commissioning Agent requires the following documentation:

1. Air and Water Balancing Report
2. Operations and Maintenance Data
3. Verification of Warranty Periods on Equipment
4. Verify Owner Training is Complete

B. System Components

Prior to the functional performance and verification process, the Commissioning Agent shall verify all major system components, capacities, configurations and support functions are consistent with the design or documentation received. The following shall be verified:

1. Verify proper connection of primary duct to inlet of VAV.

   Compliance: x
   Non-compliance: _____

   Remarks:

2. Verify access to all necessary components.

   Compliance: x
   Non-compliance: _____

   Remarks:

3. Verify unit is supported with straps or threaded rod supports.(installation manual)

   Compliance: x
   Non-compliance: _____

   Remarks:

4. Verify that there are 3 to 5 inlet duct diameters of straight duct at the terminal inlet. (installation manual)

   Compliance: x
   Non-compliance: ____

   Remarks:

5. Verify unit is labeled.

   Compliance: x
   Non-compliance: ____

   Remarks:

C. Functional Performance Tests

1. Verify unit modulates open during a call for cooling.

   Compliance: x
   Non-compliance: ____

   Remarks: ***Thermostat was set to 55°F in-order to verify operation.***

2. Verify unit modulates closed upon satisfaction of cooling setpoint.

   Compliance: x
   Non-compliance: ____

   Remarks: ***Thermostat setpoint was used to verify operation.***

3. Verify calibration of thermostat.

   Compliance: x
   Non-compliance: ____

   Remarks: ***Thermostat was verified to be reading correctly.***

Notes:
1.

TSC
275 7TH AVENUE, NEW YORK, NY
9/18/08

VAV Boxes
VAV-D
(Serve: Offices 19 - .009, .010, .012)
FUNCTIONAL PERFORMANCE TEST – RECORD SHEET

A. Documentation Requirements

Prior to the functional performance test and verification process, the Commissioning Agent requires the following documentation:

1. Air and Water Balancing Report
2. Operations and Maintenance Data
3. Verification of Warranty Periods on Equipment
4. Verify Owner Training is Complete

B. System Components

Prior to the functional performance and verification process, the Commissioning Agent shall verify all major system components, capacities, configurations and support functions are consistent with the design or documentation received. The following shall be verified:

1. Verify proper connection of primary duct to inlet of VAV.

   Compliance: x
   Non-compliance: _____

   Remarks:

2. Verify access to all necessary components.

   Compliance: x
   Non-compliance: _____

   Remarks:

3. Verify unit is supported with straps or threaded rod supports.(installation manual)

   Compliance: x
   Non-compliance: _____

   Remarks:

4. Verify that there are 3 to 5 inlet duct diameters of straight duct at the terminal inlet. (installation manual)

   Compliance: x
   Non-compliance: ____

   Remarks:

5. Verify unit is labeled.

   Compliance: x
   Non-compliance: ____

   Remarks:

C. Functional Performance Tests

1. Verify unit modulates open during a call for cooling.

   Compliance: x
   Non-compliance: ____

   Remarks: ***Thermostat was set to 55°F in-order to verify operation.***

2. Verify unit modulates closed upon satisfaction of cooling setpoint.

   Compliance: x
   Non-compliance: ____

   Remarks: ***Thermostat setpoint was used to verify operation.***

3. Verify calibration of thermostat.

   Compliance: X
   Non-compliance: ____

   Remarks: ***Thermostat was verified to be reading correctly.***

Notes:
1.

TSC
275 7TH AVENUE, NEW YORK, NY
9/18/08

VAV Boxes
VAV-D
(Serve: Reception 19.002 & Women's Rm)
FUNCTIONAL PERFORMANCE TEST – RECORD SHEET

A. Documentation Requirements

Prior to the functional performance test and verification process, the Commissioning Agent requires the following documentation:

1. Air and Water Balancing Report
2. Operations and Maintenance Data
3. Verification of Warranty Periods on Equipment
4. Verify Owner Training is Complete

B. System Components

Prior to the functional performance and verification process, the Commissioning Agent shall verify all major system components, capacities, configurations and support functions are consistent with the design or documentation received. The following shall be verified:

1. Verify proper connection of primary duct to inlet of VAV.

   Compliance: x
   Non-compliance: _____

   Remarks:

2. Verify access to all necessary components.

   Compliance: x
   Non-compliance: _____

   Remarks:

3. Verify unit is supported with straps or threaded rod supports.(installation manual)

   Compliance: x
   Non-compliance: _____

   Remarks:

4. Verify that there are 3 to 5 inlet duct diameters of straight duct at the terminal inlet. (installation manual)

   Compliance: x
   Non-compliance: ____

   Remarks:

5. Verify unit is labeled.

   Compliance: x
   Non-compliance: ____

   Remarks:

C. Functional Performance Tests

1. Verify unit modulates open during a call for cooling.

   Compliance: x
   Non-compliance: ____

   Remarks: ***Thermostat was set to 55°F in-order to verify operation.***

2. Verify unit modulates closed upon satisfaction of cooling setpoint.

   Compliance: x
   Non-compliance: ____

   Remarks: ***Thermostat setpoint was used to verify operation.***

3. Verify calibration of thermostat.

   Compliance: ____
   Non-compliance: x

   Remarks: ***Thermostat was verified to be reading incorrectly. Thermostat reading 68°F, actual Temperature 74°F***

Notes:
1.

TSC
275 7TH AVENUE, NEW YORK, NY
9/18/08

VAV Boxes
VAV-C
(Serve: Meeting 19.007 & Office 19.008)
FUNCTIONAL PERFORMANCE TEST – RECORD SHEET

A. Documentation Requirements

Prior to the functional performance test and verification process, the Commissioning Agent requires the following documentation:

1. Air and Water Balancing Report
2. Operations and Maintenance Data
3. Verification of Warranty Periods on Equipment
4. Verify Owner Training is Complete

B. System Components

Prior to the functional performance and verification process, the Commissioning Agent shall verify all major system components, capacities, configurations and support functions are consistent with the design or documentation received. The following shall be verified:

1. Verify proper connection of primary duct to inlet of VAV.

   Compliance: x
   Non-compliance: _____

   Remarks:

2. Verify access to all necessary components.

   Compliance: x
   Non-compliance: _____

   Remarks:

3. Verify unit is supported with straps or threaded rod supports.(installation manual)

   Compliance: x
   Non-compliance: _____

   Remarks:

4. Verify that there are 3 to 5 inlet duct diameters of straight duct at the terminal inlet. (installation manual)

   Compliance: x
   Non-compliance: ____

   Remarks:

5. Verify unit is labeled.

   Compliance: x
   Non-compliance: ____

   Remarks:

C. Functional Performance Tests

1. Verify unit modulates open during a call for cooling.

   Compliance: x
   Non-compliance: ____

   Remarks: ***Thermostat was set to 55°F in-order to verify operation.***

2. Verify unit modulates closed upon satisfaction of cooling setpoint.

   Compliance: x
   Non-compliance: ____

   Remarks: ***Thermostat setpoint was used to verify operation.***

3. Verify calibration of thermostat.

   Compliance: x
   Non-compliance: ____

   Remarks: ***Thermostat was verified to be reading correctly.***

Notes:
1.

TSC
275 7TH AVENUE, NEW YORK, NY
9/18/08

In-Line Exhaust Fan(s)
EF-19-2
(Telecom Room)

FUNCTIONAL PERFORMANCE TEST – RECORD SHEET

A. Documentation Requirements

Prior to the functional performance test and verification process, the Commissioning Agent requires the following documentation:

1. Air and Water Balancing Report
2. Operations and Maintenance Data
3. Verification of Warranty Periods on Equipment
4. Verify Owner Training is Complete

B. System Components

Prior to the functional performance and verification process, the Commissioning Agent shall verify all major system components, capacities, configurations and support functions are consistent with the design or documentation received. The following shall be verified:

1. Verify unit is installed with ample clearance for maintenance and repair of all components.

   Compliance: x
   Non-compliance: _____

   Remarks:

2. Verify ductwork sealant.

   Compliance: x
   Non-compliance: _____

   Remarks:

3. Verify installation of damper on the recirculating side of ductwork.

   Compliance: _____
   Non-compliance: x

Remarks: ***Only one diffuser installed***

4. Verify unit is labeled.

Compliance: X
Non-compliance:

Remarks:

5. Verify installation of vibration isolators.

Compliance: x
Non-compliance:

Remarks:

6. Verify installation of ductwork flex connectors.

Compliance: x
Non-compliance:

Remarks:

C. Functional Performance Tests

1. Verify unit activates during a rise in space temperature above setpoint.

Compliance: x
Non-compliance:

Remarks:

2. Verify unit de-activates during a drop in space temperature below setpoint.

Compliance: x
Non-compliance:

Remarks:

Notes:
1.

In-Line Exhaust Fans

APPENDIX E

Air Balancing Verification Report

BALANCING VERIFICATION CHECKLIST

*****RECORD WHAT MODE THE SYSTEM WAS IN DURING THE BALANCING AND BALANCING VERIFICATION**

**VERIFICATION PERFORMED ON September 18th 2008

	Air Flow				
Equipment	**Diffuser Number**	**Design (Air Flow [CFM])**	**BSI Report (Air Flow [CFM])**	**OLA Verification (Air Flow [CFM])**	**Percent Dscrepiency OLA vs. BSI [%]**
AC-1					
AC-1:VAV-D(900)	1	450	440	-	-
	2	450	450	-	-
AC-1:VAV-G(2600)	3	350	355	345	-3%
	4	450	350	345	-1%
	5	350	350	335	-4%
	6	350	355	345	-3%
	7	350	335	310	-7%
	8	300	240	195	-19%
	9	250	310	310	0%
	10	200	210	200	-5%
AC-1:VAV-D(800)	11	400	410	-	-
	12	150	160	-	-
	13	50	55	-	-
	14	200	205	-	-

BALANCING VERIFICATION CHECKLIST

*****RECORD WHAT MODE THE SYSTEM WAS IN DURING THE BALANCING AND BALANCING VERIFICATION**

**VERIFICATION PERFORMED ON September 18th 2008

	Air Flow				
Equipment	**Diffuser Number**	**Design (Air Flow [CFM])**	**BSI Report (Air Flow [CFM])**	**OLA Verification (Air Flow [CFM])**	**Percent Dscrepiency OLA vs. BSI [%]**
AC-2					
	1	130	130	94	-28%
	2	350	350	180	-49%
	3	175	175	150	-14%
	4	170	170	88	-48%
	5	160	160	170	6%
	6	155	155	92	-41%
	7	150	150	135	-10%
	8	135	135	88	-35%
	9	155	155	140	-10%
	10	140	140	145	4%
	11	130	125	100	-20%
	12	135	130	125	-4%
	13	180	170	200	18%
	14	185	190	185	-3%
	15	185	195	225	15%
	16	150	155	200	29%
	17	150	155	125	-19%
	18	150	155	290	87%
	19	150	155	165	6%
	20	150	145	105	-28%
	21	150	155	220	42%
	22	150	160	130	-19%
	23	150	160	95	-41%
	24	150	155	350	126%
	25	150	160	220	38%
	26	180	190	105	-45%
	27	150	155	235	52%
	28	150	150	85	-43%

BALANCING VERIFICATION CHECKLIST

***RECORD WHAT MODE THE SYSTEM WAS IN DURING THE BALANCING AND BALANCING VERIFICATION

**VERIFICATION PERFORMED ON September 18th 2008

	Air Flow				
Equipment	**Diffuser Number**	**Design (Air Flow [CFM])**	**BSI Report (Air Flow [CFM])**	**OLA Verification (Air Flow [CFM])**	**Percent Dscrepiency OLA vs. BSI [%]**
AC-3					
AC-3:VAV-G(2100)	1	150	155	-	-
	2	150	155	-	-
	3	150	155	-	-
	4	150	155	-	-
	5	150	155	-	-
	6	150	160	-	-
	7	150	150	-	-
	8	150	150	-	-
	9	150	160	-	-
	10	150	160	-	-
	11	150	155	-	-
	12	150	155	-	-
	13	150	160	-	-
	14	150	150	-	-
AC-3:VAV-D(750)	15	200	205	-	-
	16	200	195	-	-
	17	100	95	-	-
	18	250	330	-	-
AC-3:VAV-D(875)	19	150	150	-	-
	20	150	155	-	-
	21	150	150	-	-
	22	275	265	-	-
	23	150	150	-	-
AC-3:VAV-D(525)	24	175	180	-	-
	25	150	150	-	-
	26	200	190	-	-

BALANCING VERIFICATION CHECKLIST

*****RECORD WHAT MODE THE SYSTEM WAS IN DURING THE BALANCING AND BALANCING VERIFICATION**

**VERIFICATION PERFORMED ON September 18th 2008

	Air Flow				
Equipment	**Diffuser Number**	**Design (Air Flow [CFM])**	**BSI Report (Air Flow [CFM])**	**OLA Verification (Air Flow [CFM])**	**Percent Dscrepiency OLA vs. BSI [%]**
AC-4					
AC-4:VAV-D(400)	1	85	80	80	0%
	2	85	90	80	-11%
	3	85	90	80	-11%
	3A	150	155	150	-3%
AC-4:VAV-C(450)	4	200	205	180	-12%
	5	250	255	250	-2%
AC-4:VAV-D(850)	6	125	130	125	-4%
	7	125	125	125	0%
	8	125	130	125	-4%
	9	125	125	125	0%
	9A	200	190	200	5%
	9B	100	100	108	8%
	9C	50	55	50	-9%
AC-4:VAV-D(1400)	10	750	735	-	-
	10A	250	380	-	-
	10B	200	360	-	-
	10C	300	deleted	-	-
AC-4:VAV-C(500)	11	250	240	240	0%
	12	250	245	240	-2%
AC-4:VAV-D(800)	13	250	245	235	-4%
	14	250	255	235	-8%
	15	300	290	318	10%

APPENDIX F

Air Balancing Report

BSI
BALANCING SERVICE INC

Ventilation Test Report

TSC Design
275 7th Avenue
New York, NY

Engineer:

WB Engineering
110 Wiliams Street
New York, NY

Prepared For:

Conair
246 Broadway
Garden City Park, NY 11040

233 East Shore Road • # 202 • Great Neck • NY • 11023
LI Phone 516·609·2663
Fax 516·671·6422
NYC Phone 718·786·6818
Fax 718·786·3813

BSI
BALANCING SERVICE INC

SYMBOLS

Supply

Return

Exhaust

NI	Device not installed
DEL	Deleted,device removed from contract but shown on drawing
RAW	Diffuser or register is not installed
NA	Device is not accessible
FO	Damper set for 100% open position
FC	Damper in full closed position
WMS	Wire mesh screen installed at opening
TP	Test point for traverse or static pressure
CD	Ceiling diffuser
CR	Ceiling register
LD	Linear diffuser
LT	Light troffer
VAV	Variable air volume box
CAV	Constant air volume box
NW	Device not working
No TStat	Thermostat not installed\
Exist	Existing CD,CR, Fan, etc.

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Fax 718•786•3813

BSI
BALANCING SERVICE INC

INSTRUMENTATION

1. TSI Balometer 8371 (Measures C.F.M. directly)
   Application: Supply and Return Outlets Readings

2. Alnor Balometer AV -18 (Measures C.F.M. directly)
   Application: Supply and Return Outlet Readings

3. Alnor Balometer 6000P
   Application: Supply and Return Outlets Readings

4. Mannix Thermo Digital Anemometer DCFM8901
   Application: Low Velocity Testing

5. TSI Digital Air Velocity Meter 475-1AV #8340
   Application: Velocity Testing

6. Dwyer Incline Manometer and Pitot Tube
   Application: Suction and Discharge Static Pressures and Duct. Total Air Pressure Readings

7. Dwyer Digital Manometer and Pitot Tube
   Application: Suction and Discharge Static Pressure Readings

8. Amprobe RS-3
   Application: Amperage and Voltage Readings on Fan Motors

9. Digital Photo Tachometer
   Application: RPM Readings

10. SW Tachometer
    Application: Measure Fan RPM

11. Bell & Gosett flow Meter
    Application: Water Flow GPM

12. Panametrics PT 878 Ultrasonic Flow Meter

13. McGill Air Flow Duct Leakage test rig

14. Shortridge Air Data Multimeter Adm-87

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Fax 718•786•3813

BSI
Testing & Air Balancing

233 East Shore Road, #202, Great Neck, NY 11023
516-484-3903 *FAX: 516-671-6422*

PROJECT: TSC Design **DATE:** 5-09-08

ADDRESS: 275 7th Avenue 19th Floor New York, NY **TEST BY:** LM/JH

SYSTEM: AC-1 **PAGE:** 1 OF 2

UNIT DATA

SYSTEM	AC-1
LOCATION	Roof
MANUFACTURER	United Cool Air
MODEL #	E10G3A515
FAN TYPE	Split
FAN SHEAVE	9 3/4"
MOTOR SHEAVE	4"
VARIABLE / FIXED	Variable
DIRECT DRIVE	2 Belt

MOTOR DATA

MAKE	Marathon
HP	5
RPM	3450
RATED VOLTS	208/230/460
RATED AMPS	13.5/12.4/6.2
SER FACTOR	1.15
PHASE	3
FRAME	56HZ

DATA

	L1	**L2**	**L3**
ACTUAL AMPS	12.2	12.4	12.4
ACTUAL VOLTS	208		
RATED RPM	-		
ACTUAL RPM	1101		

AIR FLOW CFM

RATED	4,300	
ACTUAL	4,225	
STATIC PRESSURE	--------	**DISCHARGE**
STATIC PRESSURE	--------	**SUCTION**

S.P. setting .57 w.c.

DRAWING	AREA / REMARKS	#	SIZE	REQ. VELOCITY	REQ. CFM	ACTUAL VELOCITY	ACTUAL CFM
	VAV-D 900/270	1	2410		450		440
	Min 3.8 Max 10.7	2	2414		450		450
	VAV-3-(2600/860)	3	2410		350		355
	Min 2.3 Max 8.9	4	2410		450		350
		5	2410		350		350
		6	2410		350		355
		7	2410		350		335
		8	2410		300		240
	No V/D	9	2410		250		310

BSI

VENTILATION TEST REPORT
AIR OUTLETS

PROJECT: TSC Design DATE: 5-09-08

SYSTEM: AC-1 TEST BY: LM/JH

DRAWING #	AREA SERVED / REMARKS	OPENING		K FACTOR	REQ. VELOCITY	REQ. CFM	ACTUAL VELOCITY	ACTUAL CFM
		#	SIZE					
		10	2410			200		210
	VAV-D 800/240	11	2410			400		410
	Min 1.6 Max 5.3	12	1206			150		160
		13	1206			50		55
		14	Linear			200		205

BSI
Testing & Air Balancing

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PROJECT: TSC Design **DATE:** 5-08-08

ADDRESS: 275 7th Avenue 19th Floor New York, NY **TEST BY:** LM/JH

SYSTEM: AC-2 **PAGE:** 1 OF 2

UNIT DATA

SYSTEM	AC-2
LOCATION	Roof
MANUFACTURER	United Cool Air
MODEL #	E12G3A515
FAN TYPE	Split
FAN SHEAVE	9 3/4"
MOTOR SHEAVE	4"
VARIABLE / FIXED	Variable
DIRECT DRIVE	2 Belt

MOTOR DATA

MAKE	Marathon
HP	7.5
RPM	3460
RATED VOLTS	230/460
RATED AMPS	17.6/8.8
SER FACTOR	1.15
PHASE	3
FRAME	184T

DATA

	L1	**L2**	**L3**
ACTUAL AMPS	14.1	14.0	14.1
ACTUAL VOLTS	208		
RATED RPM	-		
ACTUAL RPM	1165		

AIR FLOW CFM

RATED	4,495	
ACTUAL	4,580	
STATIC PRESSURE	--------	**DISCHARGE**
STATIC PRESSURE	--------	**SUCTION**

DRAWING	AREA / REMARKS	#	SIZE	REQ. VELOCITY	REQ. CFM	ACTUAL VELOCITY	ACTUAL CFM
		1	Linear		125		130
		2	16 x 6		360		350
		3	12 x 6		170		175
		4	Linear		165		170
		5	12 x 6		165		160
		6	Linear		150		155
		7	12 x 6		150		150
		8	Linear		130		135
		9	12 x 6		150		155
		10	12 x 6		135		140

BSI

VENTILATION TEST REPORT
AIR OUTLETS

PROJECT: TSC Design **DATE:** 5-05-08

SYSTEM: AC-2 **TEST BY:** LM/JH

DRAWING #	AREA SERVED / REMARKS	OPENING #	OPENING SIZE	K FACTOR	REQ. VELOCITY	REQ. CFM	ACTUAL VELOCITY	ACTUAL CFM
		11	Linear			130		125
		12	12 x 6			135		130
		13	12 x 6			180		170
		14	Linear			185		190
		15	12 x 6			185		195
		16	12 x 6			150		155
		17	Linear			150		155
		18	12 x 6			150		155
		19	12 x 6			150		155
		20	Linear			150		145
		21	12 x 6			150		155
		22	12 x 6			150		160
		23	Linear			150		160
		24	12 x 6			150		155
		25	12 x 6			150		160
		26	Linear			180		190
		27	12 x 6			150		155
		28	Linear			150		150

BSI
Testing & Air Balancing

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516-484-3903 *FAX: 516-671-6422*

PROJECT: TSC Design **DATE:** 5-12-08

ADDRESS: 275 7th Avenue 19th Floor New York, NY **TEST BY:** LM/JH

SYSTEM: AC-3 **PAGE:** 1 OF 2

UNIT DATA

SYSTEM	AC-3
LOCATION	Roof
MANUFACTURER	United Cool Air
MODEL #	E10G3A515
FAN TYPE	Split
FAN SHEAVE	9 3/4"
MOTOR SHEAVE	4"
VARIABLE / FIXED	Variable
DIRECT DRIVE	2 Belt

MOTOR DATA

MAKE	Marathon
HP	5
RPM	3450
RATED VOLTS	208/230/460
RATED AMPS	13.5/12.4/6.2
SER FACTOR	1.15
PHASE	3
FRAME	56HZ

DATA

	L1	**L2**	**L3**
ACTUAL AMPS	13.2	13.4	13.4
ACTUAL VOLTS	208		
RATED RPM	-		
ACTUAL RPM	1231		

AIR FLOW CFM

RATED	4,250	
ACTUAL	4,390	
STATIC PRESSURE	--------	**DISCHARGE**
STATIC PRESSURE	--------	**SUCTION**

S.P. setting .57 w.c.

DRAWING	AREA / REMARKS	#	SIZE	REQ. VELOCITY	REQ. CFM	ACTUAL VELOCITY	ACTUAL CFM
	VAV-1 2100/630	1	12 x 6		150		155
	Min 2.5 Max 8.6	2	12 x 6		150		155
		3	12 x 6		150		155
		4	12 x 6		150		155
		5	12 x 6		150		155
		6	12 x 6		150		160
		7	12 x 6		150		150
		8	12 x 6		150		150
		9	12 x 6		150		160
		10	12 x 6		150		160

BSI

VENTILATION TEST REPORT
AIR OUTLETS

PROJECT: TSC Design **DATE:** 5-12-08

SYSTEM: AC-3 **TEST BY:** LM/JH

DRAWING #	AREA SERVED / REMARKS	OPENING #	OPENING SIZE	K FACTOR	REQ. VELOCITY	REQ. CFM	ACTUAL VELOCITY	ACTUAL CFM
		11	12 x 6			150		155
		12	12 x 6			150		155
		13	12 x 6			150		160
		14	12 x 6			150		150
	VAV-D 750/225	15	2408			200		205
	Min 3.5 Max 10.4	16	2408			200		195
		17	2408			100		95
	Comfort Balanced-Computer Rm	18	2408			250		330
	VAV-6 875/263	19	2406			150		150
	Min 3.5 Max 10.7	20	2408			150		155
		21	2408			150		150
		22	2410			275		265
		23	2408			150		150
	VAV-7 525/158	24	2408			175		180
	Min 1.5 Max 7.6	25	2408			150		150
		26	2406			200		190

BSI
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516-484-3903 *FAX: 516-671-6422*

PROJECT: TSC Design **DATE:** 5-08-08

ADDRESS: 275 7th Avenue 19th Floor New York, NY **TEST BY:** LM/JH

SYSTEM: AC-4 **PAGE:** 1 OF 2

UNIT DATA

SYSTEM	AC-4
LOCATION	Roof
MANUFACTURER	United Cool Air
MODEL #	E12G3A515
FAN TYPE	Split
FAN SHEAVE	9 3/4"
MOTOR SHEAVE	4"
VARIABLE / FIXED	Variable
DIRECT DRIVE	2 Belt

MOTOR DATA

MAKE	Marathon
HP	71/2
RPM	3460
RATED VOLTS	230/460
RATED AMPS	17.6/8.8
SER FACTOR	1.15
PHASE	3
FRAME	184T

DATA

	L1	**L2**	**L3**
ACTUAL AMPS	14.4	14.1	14.1
ACTUAL VOLTS	208		
RATED RPM	-		
ACTUAL RPM	1178		

AIR FLOW CFM

RATED	4,205	
ACTUAL	4,480	
STATIC PRESSURE	--------	**DISCHARGE**
STATIC PRESSURE	--------	**SUCTION**

S.P. setting .78 w.c.

DRAWING	AREA / REMARKS	#	SIZE	REQ. VELOCITY	REQ. CFM	ACTUAL VELOCITY	ACTUAL CFM
	VAV-8 400/120	1	Linear		85		80
	Min 1.6 Max 5.1	2	Linear		85		90
		3	Linear		85		90
		3A	12 x 6		150		155
	VAV-9 450/135	4	12 x 6		200		205
	Min 2.8 Max 7.4	5	12 x 6		250		255

BSI

VENTILATION TEST REPORT
AIR OUTLETS

PROJECT: TSC Design **DATE:** 5-08-08

SYSTEM: AC-4 **TEST BY:** LM/JH

DRAWING #	AREA SERVED / REMARKS	OPENING #	OPENING SIZE	K FACTOR	REQ. VELOCITY	REQ. CFM	ACTUAL VELOCITY	ACTUAL CFM
	VAV-10 850/255	6	125			125		130
	Min 1.8 Max 6.7	7	Linear			125		125
		8	Linear			125		130
		9	Linear			125		125
		9A	Linear			200		190
		9B	1206			100		100
		9C	6 x 6			50		55
	VAV-11 1500/450	10	Linear			750		735
	Min 2.0 Max 6.7	10A	12 x 6			250		380
		10B	12 x 6			200		360
	DELETED	10C	-			300		-
	VAV-12 500/150	11	2408			250		240
	Min 1.7 Max 6.5	12	2408			250		245
	VAV 13 800/240	13	2408			250		245
	Min 2.7 Max 10.7	14	2408			250		255
		15	2408			300		290

BSI
Testing & Air Balancing

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516-484-3903 *FAX: 516-671-6422*

PROJECT: TSC Design **DATE:** 5-12-08

ADDRESS: 275 7th Avenue 19th Floor New York, NY **TEST BY:** LM/JH

SYSTEM: TX-19-1 **PAGE:** 1 OF 1

UNIT DATA

SYSTEM	TX-19-1
LOCATION	Men Hung Ceiling
MANUFACTURER	Broan
MODEL #	L300
FAN TYPE	Inline
FAN SHEAVE	D/D
MOTOR SHEAVE	D/D
VARIABLE / FIXED	D/D
DIRECT DRIVE	D/D

MOTOR DATA

MAKE	Broan-Nutone
HP	-
RPM	D/D
RATED VOLTS	120
RATED AMPS	2.6
SER FACTOR	-
PHASE	1
FRAME	-

DATA

	L1	L2	L3
ACTUAL AMPS	2.5		
ACTUAL VOLTS	115		
RATED RPM	D/D		
ACTUAL RPM	D/D		

AIR FLOW CFM

RATED	425	
ACTUAL	395	
STATIC PRESSURE	--------	**DISCHARGE**
STATIC PRESSURE	--------	**SUCTION**

DRAWING	AREA / REMARKS	#	SIZE	REQ. VELOCITY	REQ. CFM	ACTUAL VELOCITY	ACTUAL CFM
		1	Raw		50		75
		2	6 x 6		75		70
		3	11 x 11		200		170
		4	11 x 11		100		80

BSI
Testing & Air Balancing

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516-484-3903 *FAX: 516-671-6422*

PROJECT: TSC Design **DATE:** 5-12-08

ADDRESS: 275 7th Avenue 19th Floor New York, NY **TEST BY:** LM/JH

SYSTEM: TX-19-2 **PAGE:** 1 OF 1

UNIT DATA

SYSTEM	TX-19-2
LOCATION	Women Hung Ceiling
MANUFACTURER	Broan
MODEL #	L300L
FAN TYPE	Inline
FAN SHEAVE	D/D
MOTOR SHEAVE	D/D
VARIABLE / FIXED	D/D
DIRECT DRIVE	D/D

MOTOR DATA

MAKE	Broan-Nutone
HP	-
RPM	D/D
RATED VOLTS	112
RATED AMPS	2.6
SER FACTOR	-
PHASE	1
FRAME	-

DATA

	L1	**L2**	**L3**
ACTUAL AMPS	2.5		
ACTUAL VOLTS	115		
RATED RPM	D/D		
ACTUAL RPM	D/D		

AIR FLOW CFM

RATED	225	
ACTUAL	225	
STATIC PRESSURE	--------	**DISCHARGE**
STATIC PRESSURE	--------	**SUCTION**

DRAWING	AREA / REMARKS	#	SIZE	REQ. VELOCITY	REQ. CFM	ACTUAL VELOCITY	ACTUAL CFM
		1	6 x 6		75		80
		2	11 x 11		150		145

BSI
Testing & Air Balancing

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516-484-3903 *FAX: 516-671-6422*

PROJECT: TSC Design **DATE:** 5-12-08

ADDRESS: 275 7th Avenue 19th Floor New York, NY **TEST BY:** LM/JH

SYSTEM: EF-19-1 **PAGE:** 1 OF 1

UNIT DATA

SYSTEM	EF-19-1
LOCATION	IT Hung Ceiling
MANUFACTURER	Broan
MODEL #	-
FAN TYPE	Inline
FAN SHEAVE	D/D
MOTOR SHEAVE	D/D
VARIABLE / FIXED	D/D
DIRECT DRIVE	D/D

MOTOR DATA

MAKE	Broan-Nutone
HP	-
RPM	D/D
RATED VOLTS	120
RATED AMPS	2.6
SER FACTOR	-
PHASE	1
FRAME	-

DATA

	L1	**L2**	**L3**
ACTUAL AMPS	2.5		
ACTUAL VOLTS	115		
RATED RPM	D/D		
ACTUAL RPM	D/D		

AIR FLOW CFM

RATED	250	
ACTUAL	260	
STATIC PRESSURE	--------	**DISCHARGE**
STATIC PRESSURE	--------	**SUCTION**

DRAWING	AREA / REMARKS	#	SIZE	REQ. VELOCITY	REQ. CFM	ACTUAL VELOCITY	ACTUAL CFM
		1	11 x 11		250		260

BSI
Testing & Air Balancing

233 East Shore Road, #202, Great Neck, NY 11023
516-484-3903 *FAX: 516-671-6422*

PROJECT: TSC Design **DATE:** 5-12-08

ADDRESS: 275 7th Avenue 19th Floor New York, NY **TEST BY:** LM/JH

SYSTEM: EF-19-2 **PAGE:** 1 OF 1

UNIT DATA

SYSTEM	EF-19-2
LOCATION	Copy Rm Hung Ceiling
MANUFACTURER	Broan
MODEL #	L700L
FAN TYPE	Inline
FAN SHEAVE	D/D
MOTOR SHEAVE	D/D
VARIABLE / FIXED	D/D
DIRECT DRIVE	D/D

MOTOR DATA

MAKE	Broan-Nutone
HP	-
RPM	D/D
RATED VOLTS	120
RATED AMPS	2.9
SER FACTOR	-
PHASE	1
FRAME	-

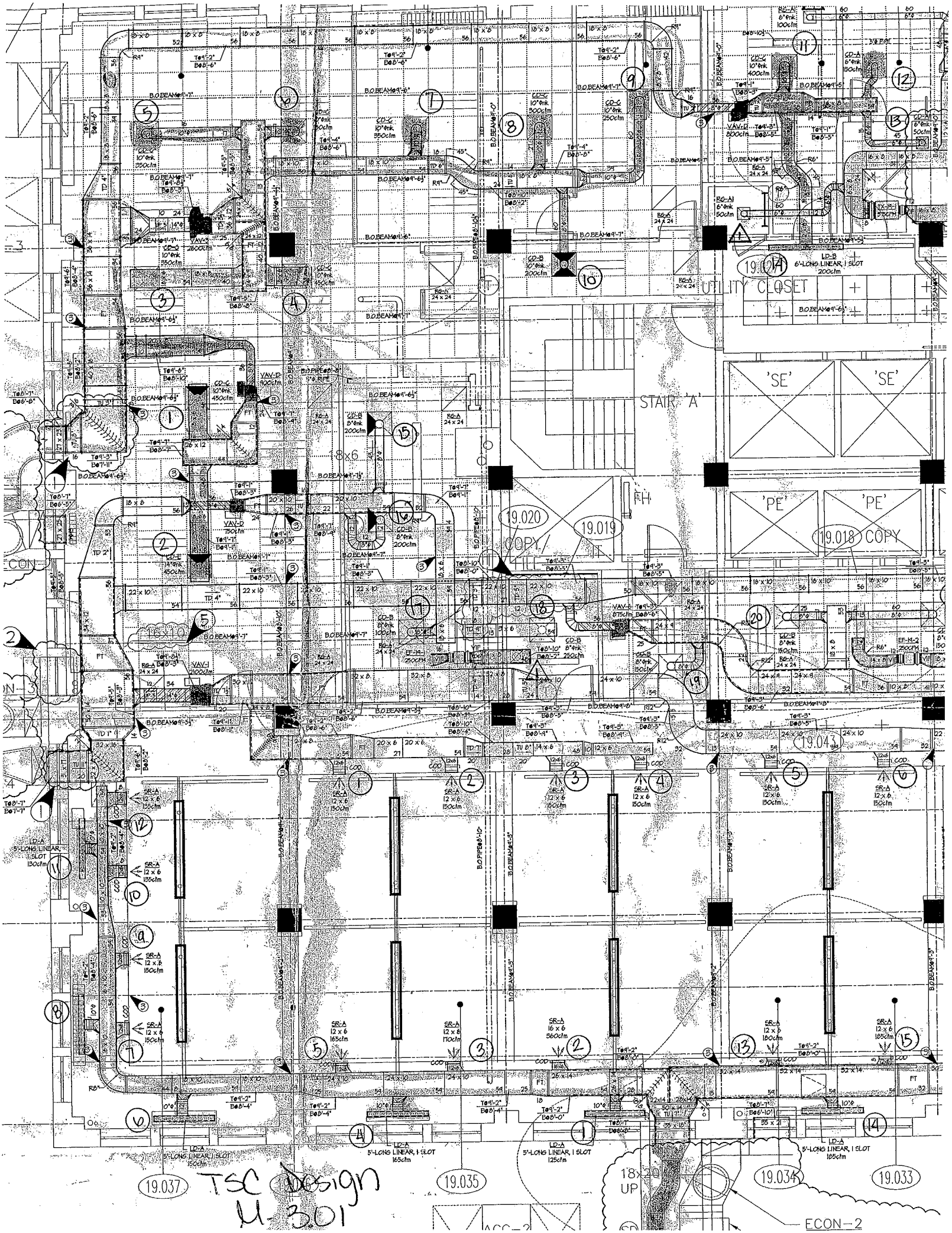
DATA

	L1	L2	L3
ACTUAL AMPS	2.9		
ACTUAL VOLTS	115		
RATED RPM	D/D		
ACTUAL RPM	D/D		

AIR FLOW CFM

RATED	250	
ACTUAL	250	
STATIC PRESSURE	--------	**DISCHARGE**
STATIC PRESSURE	--------	**SUCTION**

DRAWING	AREA / REMARKS	#	SIZE	REQ. VELOCITY	REQ. CFM	ACTUAL VELOCITY	ACTUAL CFM
		1	24 x 24		250		250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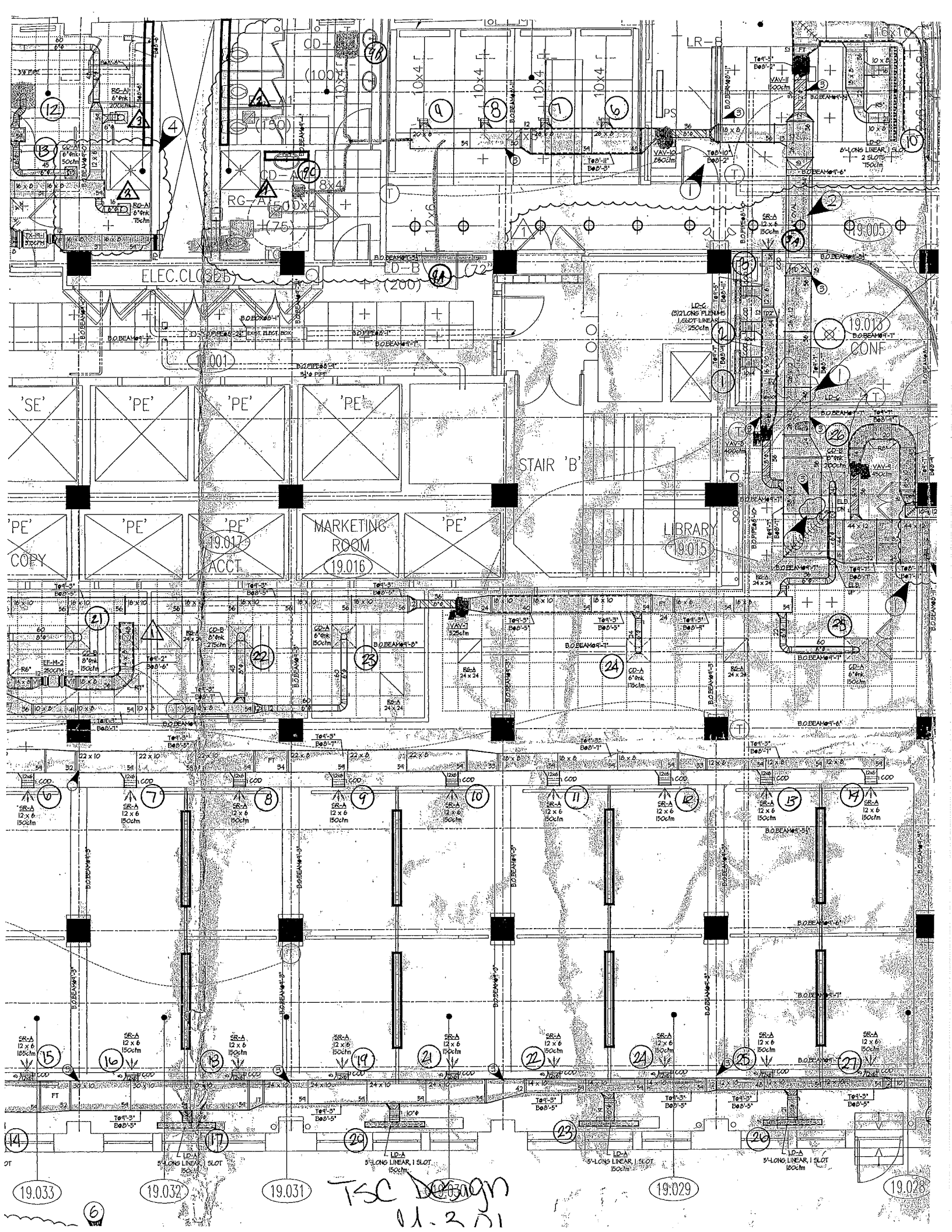
TSC Design
M-301
ECON-2
8x6
16x10
18x20 UP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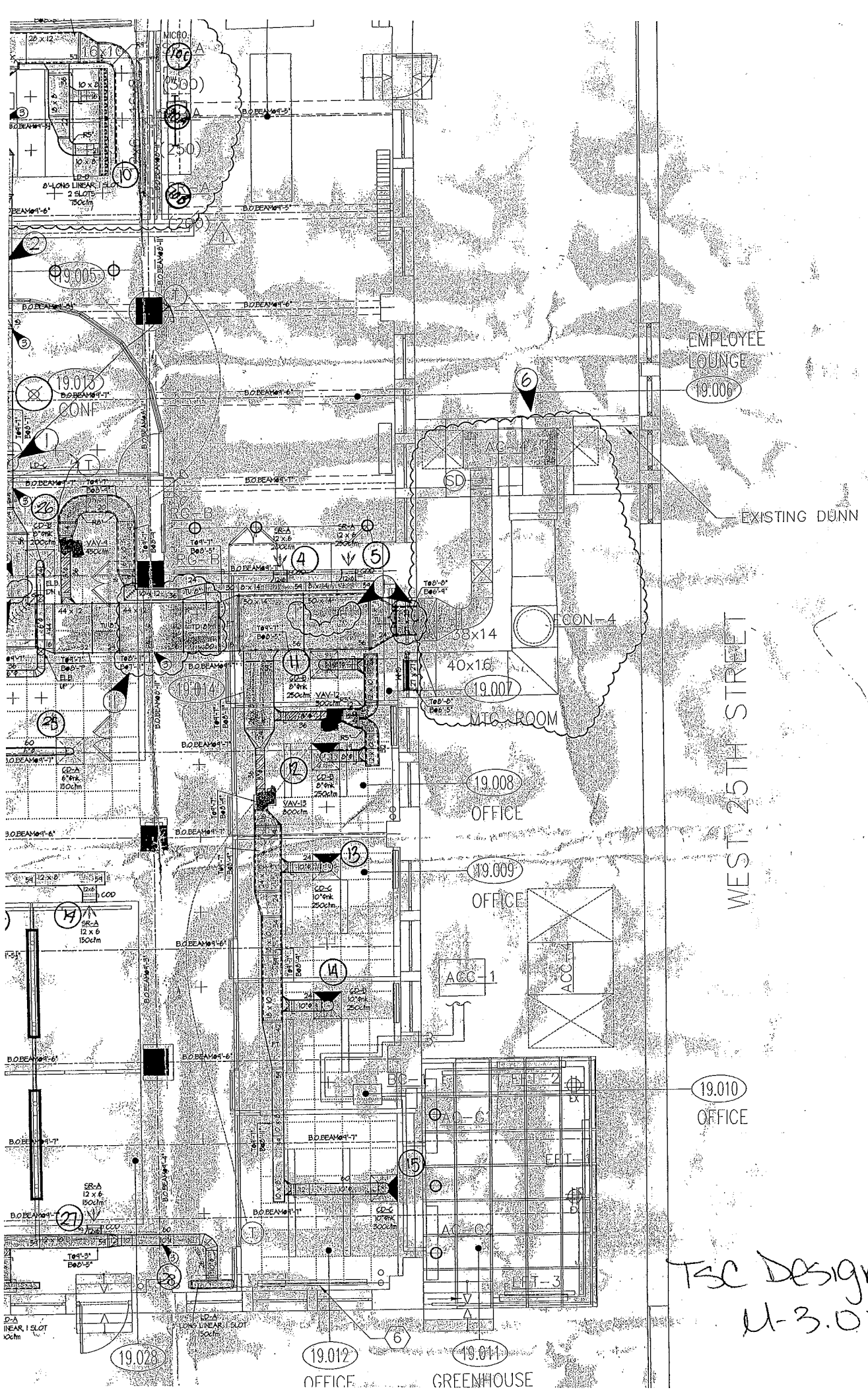
LIBRARY
19.015
CONF
19.013
19.005
19.001
'SE'
'PE'
19.033
19.032
19.031
19.030
19.029
19.028
T&C Design
11-3-01



TSC Design
M-3.01

BSI
Testing & Air Balancing

233 East Shore Road, #202, Great Neck, NY 11023
516-484-3903 *FAX: 516-671-6422*

PROJECT: TSC Design **DATE:** 5-12-08

ADDRESS: 275 7th Avenue 19th Floor New York, NY **TEST BY:** LM/JH

SYSTEM: PE-1 **PAGE:** 1 OF 1

UNIT DATA

SYSTEM	PE-1
LOCATION	Roof
MANUFACTURER	American Cool Air
MODEL #	CRBCA20ND2083
FAN TYPE	Centrifugal
FAN SHEAVE	5"
MOTOR SHEAVE	4"
VARIABLE / FIXED	Variable
DIRECT DRIVE	1 Belt

MOTOR DATA

MAKE	Marathon
HP	2
RPM	1735
RATED VOLTS	208/230/460
RATED AMPS	6.2/5.8/2.9
SER FACTOR	1.15
PHASE	3
FRAME	145T

DATA

	L1	**L2**	**L3**
ACTUAL AMPS	4.5	4.5	4.4
ACTUAL VOLTS	208		
RATED RPM	1070		
ACTUAL RPM	1109		

AIR FLOW CFM

RATED	4,500	
ACTUAL	4,210	
STATIC PRESSURE	--------	**DISCHARGE**
STATIC PRESSURE	--------	**SUCTION**

DRAWING	AREA / REMARKS	#	SIZE	REQ. VELOCITY	REQ. CFM	ACTUAL VELOCITY	ACTUAL CFM

BSI
Testing & Air Balancing

233 East Shore Road, #202, Great Neck, NY 11023
516-484-3903 *FAX: 516-671-6422*

PROJECT: TSC Design **DATE:** 5-12-08

ADDRESS: 275 7th Avenue 19th Floor New York, NY **TEST BY:** LM/JH

SYSTEM: PE-2 **PAGE:** 1 OF 1

UNIT DATA

SYSTEM	PE-2
LOCATION	Roof
MANUFACTURER	American Cool Air
MODEL #	CRBCA20ND2083
FAN TYPE	Centrifugal
FAN SHEAVE	5"
MOTOR SHEAVE	4"
VARIABLE / FIXED	Variable
DIRECT DRIVE	1 Belt

MOTOR DATA

MAKE	Marathon
HP	2
RPM	1735
RATED VOLTS	208/230/460
RATED AMPS	6.2/5.8/2.9
SER FACTOR	1.15
PHASE	3
FRAME	145T

DATA

	L1	**L2**	**L3**
ACTUAL AMPS	4.3	4.4	4.4
ACTUAL VOLTS	208		
RATED RPM	1070		
ACTUAL RPM	1112		

AIR FLOW CFM

RATED	4,500	
ACTUAL	4,305	
STATIC PRESSURE	--------	**DISCHARGE**
STATIC PRESSURE	--------	**SUCTION**

DRAWING	**AREA / REMARKS**	**#**	**SIZE**	**REQ. VELOCITY**	**REQ. CFM**	**ACTUAL VELOCITY**	**ACTUAL CFM**

BSI
Testing & Air Balancing

233 East Shore Road, #202, Great Neck, NY 11023
516-484-3903 *FAX: 516-671-6422*

PROJECT: TSC Design **DATE:** 5-12-08

ADDRESS: 275 7th Avenue 19th Floor New York, NY **TEST BY:** LM/JH

SYSTEM: PE-3 **PAGE:** 1 OF 1

UNIT DATA

SYSTEM	PE-3
LOCATION	Roof
MANUFACTURER	American Cool Air
MODEL #	CRBCA20ND2083
FAN TYPE	Centrifugal
FAN SHEAVE	5"
MOTOR SHEAVE	4"
VARIABLE / FIXED	Variable
DIRECT DRIVE	1 Belt

MOTOR DATA

MAKE	Marathon
HP	2
RPM	1735
RATED VOLTS	208/230/460
RATED AMPS	6.2/5.8/2.9
SER FACTOR	1.15
PHASE	3
FRAME	145T

DATA

	L1	**L2**	**L3**
ACTUAL AMPS	4.2	4.4	4.4
ACTUAL VOLTS	208		
RATED RPM	1070		
ACTUAL RPM	1101		

AIR FLOW CFM

RATED	4,500	
ACTUAL	4,320	
STATIC PRESSURE	--------	**DISCHARGE**
STATIC PRESSURE	--------	**SUCTION**

DRAWING	AREA / REMARKS	#	SIZE	REQ. VELOCITY	REQ. CFM	ACTUAL VELOCITY	ACTUAL CFM

BSI
Testing & Air Balancing

233 East Shore Road, #202, Great Neck, NY 11023
516-484-3903 *FAX: 516-671-6422*

PROJECT: TSC Design **DATE:** 5-12-08

ADDRESS: 275 7th Avenue 19th Floor New York, NY **TEST BY:** LM/JH

SYSTEM: PE-4 **PAGE:** 1 OF 1

UNIT DATA

SYSTEM	PE-4
LOCATION	Roof
MANUFACTURER	American Cool Air
MODEL #	CRBCA20ND2083
FAN TYPE	Centrifugal
FAN SHEAVE	5"
MOTOR SHEAVE	4"
VARIABLE / FIXED	Variable
DIRECT DRIVE	1 Belt

MOTOR DATA

MAKE	Marathon
HP	2
RPM	1735
RATED VOLTS	208/230/460
RATED AMPS	6.2/5.8/2.9
SER FACTOR	1.15
PHASE	3
FRAME	145T

DATA

	L1	**L2**	**L3**
ACTUAL AMPS	4.8	4.9	4.9
ACTUAL VOLTS	208		
RATED RPM	1070		
ACTUAL RPM	1134		

AIR FLOW CFM

RATED	4,500	
ACTUAL	4,390	
STATIC PRESSURE	--------	**DISCHARGE**
STATIC PRESSURE	--------	**SUCTION**

DRAWING	AREA / REMARKS	#	SIZE	REQ. VELOCITY	REQ. CFM	ACTUAL VELOCITY	ACTUAL CFM

APPENDIX G

Commissioning Issues Log

OLA Consulting Engineers
Commissioning Notice #1 09/22/08

50 Broadway

Hawthorne, NY 10532

Tel: (914) 747-2800
Fax: (860) 242-0236
www.olace.com

Notification of Items Requiring Correction

Date: Monday, September 22, 2008

Present: CxA name - Paul Scholler
MEP Design Engineer - WB Engineers
Mechanical Contractor - Comfort Controls
Balancing Contractor - BSI
Owner - TSC

Project Name:	TSC Design
Project Number:	NTSC0001.00
33	**Open Items**
2	**Closed Items**
0	**Items Pending Verification**
0	**Items Out of Contract Scope**
35	**Total Items**

Construction Manager is asked to distribute this commissioning notice to all parties for their review and comment. Once the corrections have been made, the commissioning notice shall be returned to OLA indicating all corrections are complete or exceptions have been taken. OLA will verify their completion of all outstanding items.

Action Code: OLA – OLA Consulting Engineers, MC - Mechanical Contractor, BC - Balancing Contractor, MEP - MEP Engineers, TSC - Owner

No.	Tag	Item Description	Posted On	Responsibility	Status	Comment
1	VAV-D	The thermostat located in the reception area is not reading correctly. The actual temperature within the room was recorded to be 75 F, the thermostat was reading a temperature of 68 F.	9/18/2008	MC	open	
2	AC-1	The filters associated with AC-1 need to be replaced.	9/18/2008	MC	open	
3	AC-2	The filters associated with AC-2 need to be replaced.	9/18/2008	MC	open	
4	AC-3	The filters associated with AC-3 need to be replaced.	9/18/2008	MC	open	
5	AC-4	The filters associated with AC-4 need to be replaced.	9/18/2008	MC	open	
6	AC-1	The unit is not permanently labeled.	9/18/2008	MC	open	
7	AC-2	The unit is not permanently labeled.	9/18/2008	MC	open	
8	AC-3	The unit is not permanently labeled.	9/18/2008	MC	open	
9	AC-4	The unit is not permanently labeled.	9/18/2008	MC	open	
10	AC-1	The refrigeration lines need to be supported.	9/18/2008	MC	open	
11	AC-2	The refrigeration lines need to be supported.	9/18/2008	MC	open	
12	AC-3	The refrigeration lines need to be supported.	9/18/2008	MC	open	
13	AC-4	The refrigeration lines need to be supported.	9/18/2008	MC	open	
14	AC-1	The refrigeration lines have not been completely insulated.	9/18/2008	MC	open	

No.	Tag	Item Description	Posted On	Responsibility	Status	Comment
15	AC-2	The refrigeration lines have not been completely insulated.	9/18/2008	MC	open	
16	AC-3	The refrigeration lines have not been completely insulated.	9/18/2008	MC	open	
17	AC-4	The refrigeration lines have not been completely insulated.	9/18/2008	MC	open	
18	AC-1	The OA enthalpy sensor is located within the return air flow. The sensor should be relocated to the OA inlet hood.	9/18/2008	MC	open	
19	AC-2	The OA enthalpy sensor is located within the return air flow. The sensor should be relocated to the OA inlet hood.	9/18/2008	MC	open	
20	AC-3	The OA enthalpy sensor is located within the return air flow. The sensor should be relocated to the OA inlet hood.	9/18/2008	MC	open	
21	AC-4	The OA enthalpy sensor is located within the return air flow. The sensor should be relocated to the OA inlet hood.	9/18/2008	MC	open	
22	AC-2 Balancing	There are multiple diffusers supply either above or below 10% of the design CFM value. The balancer should re-adjust the dampers so that these values are within the 10% design range. Please refer to the balancing verification checklist for clarification on what diffusers are out of the 10% range.	9/19/2008	BC	open	
23	VAV-8	The airflow associated with the VAV which serves the conference room 19.013 was found to be over the design value. The value dampers were modulated to lessen the airflow to achieve the design value.	9/19/2008	BC	closed	
24	VAV-D (850)	The airflow associated with the VAV that serves the reception area was found to be over the design value. The value dampers were modulated to lessen the airflow to achieve the design value.	9/19/2008	BC	closed	
25	AC-4	The space temperature sensor associated with AC-4 is not located in the space that which the unit serves. The unit cannot modulate properly due to the location of the sensor. Contractor needs to relocate the sensor to a space that the unit serves in-order to obtain accurate readings.	9/19/2008	MC	open	
26	AC-4	The CO2 sensor associated with AC-4 is not located in the space that which the unit serves. The unit cannot modulate properly due to the location of the sensor. Contractor needs to relocate the sensor to a space that the unit serves in-order to obtain accurate readings.	9/19/2008	MC	open	
27	AC Units	The AC units (AC 1-4) do not have the capabilities of shutting down at night. The units are running 24/7 even when the setpoints are reached.	9/19/2008	MC	open	
28	Volume Damper	There is no volume damper associated with the diffuser located in storage room 19.038. Contractor to correct.	9/19/2008	MC	open	

No.	Tag	Item Description	Posted On	Responsibility	Status	Comment
29	AC-3	The fan speed is limited due to motor loading of a new fan that was installed during construction. The resulting static pressure will be maximum at this new speed. A measured static pressure of 0.88" is being produced by the unit. The unit is not producing enough air within the system. As a result of the lack of air the VAV boxes serving the marketing and accounting offices are starved, causing high temperatures within these offices. All VAV have been locked in a full open position and the associated diffusers have been comfort balanced to supply a constant CFM so that more air can be pushed to the starved areas. The right size motor and fan should be installed so that this system can perform as per the design intent.	9/19/2008	MC	open	
30	AC Units	None of the AC Units will be able to achieve an economizer mode due to the location of the sensors. The system is not operating per the design intent.	9/19/2008	MC	open	
31	EF 19-2	Only one diffuser has been installed within the telecom room. Drawing M-3.01 illustrates two exhaust diffusers to be installed.	9/19/2008	MC	open	
32	Balancing Report	The balancing report indicates that AC-3 is producing 4390 CFM which is above the design CFM of 4250. However, there seems to be a lack of airflow to the VAVs associated with the unit.	9/19/2008	WB/BC	open	
33	Balancing Report	The balancing report does not include any suction or discharge pressures for any of the AC units.	9/19/2008	BC	open	
34	OA Dampers	The OA dampers associated with AC 1 and 4 will only open when the unit modulates to an economizer mode. The minimum ventilation requirements are not being met.	9/19/2008	MC	open	
35	Balancing Report	The balancing report does not include minimum OA flow rates for AC 1 & 4.	9/19/2008	BC	open	

APPENDIX H

Outstanding/Open Commissioning Issues Log

OLA Consulting Engineers
Commissioning Notice #1 09/22/08

50 Broadway

Hawthorne, NY 10532

Tel: (914) 747-2800
Fax: (860) 242-0236
www.olace.com

Notification of Items Requiring Correction

Date: Monday, September 22, 2008

Present: CxA name - Paul Scholler
MEP Design Engineer - WB Engineers
Mechanical Contractor - Comfort Controls
Balancing Contractor - BSI
Owner - TSC

Project Name:	TSC Design
Project Number:	NTSC0001.00
33	**Open Items**
2	**Closed Items**
0	**Items Pending Verification**
0	**Items Out of Contract Scope**
35	**Total Items**

Construction Manager is asked to distribute this commissioning notice to all parties for their review and comment. Once the corrections have been made, the commissioning notice shall be returned to OLA indicating all corrections are complete or exceptions have been taken. OLA will verify their completion of all outstanding items.

Action Code: OLA – OLA Consulting Engineers, MC - Mechanical Contractor, BC - Balancing Contractor, MEP - MEP Engineers, TSC - Owner

No.	Tag	Item Description	Posted On	Responsibility	Status	Comment
1	VAV-D	The thermostat located in the reception area is not reading correctly. The actual temperature within the room was recorded to be 75 F, the thermostat was reading a temperature of 68 F.	9/18/2008	MC	open	
2	AC-1	The filters associated with AC-1 need to be replaced.	9/18/2008	MC	open	
3	AC-2	The filters associated with AC-2 need to be replaced.	9/18/2008	MC	open	
4	AC-3	The filters associated with AC-3 need to be replaced.	9/18/2008	MC	open	
5	AC-4	The filters associated with AC-4 need to be replaced.	9/18/2008	MC	open	
6	AC-1	The unit is not permanently labeled.	9/18/2008	MC	open	
7	AC-2	The unit is not permanently labeled.	9/18/2008	MC	open	
8	AC-3	The unit is not permanently labeled.	9/18/2008	MC	open	
9	AC-4	The unit is not permanently labeled.	9/18/2008	MC	open	
10	AC-1	The refrigeration lines need to be supported.	9/18/2008	MC	open	
11	AC-2	The refrigeration lines need to be supported.	9/18/2008	MC	open	
12	AC-3	The refrigeration lines need to be supported.	9/18/2008	MC	open	
13	AC-4	The refrigeration lines need to be supported.	9/18/2008	MC	open	
14	AC-1	The refrigeration lines have not been completely insulated.	9/18/2008	MC	open	

No.	Tag	Item Description	Posted On	Responsibility	Status	Comment
15	AC-2	The refrigeration lines have not been completely insulated.	9/18/2008	MC	open	
16	AC-3	The refrigeration lines have not been completely insulated.	9/18/2008	MC	open	
17	AC-4	The refrigeration lines have not been completely insulated.	9/18/2008	MC	open	
18	AC-1	The OA enthalpy sensor is located within the return air flow. The sensor should be relocated to the OA inlet hood.	9/18/2008	MC	open	
19	AC-2	The OA enthalpy sensor is located within the return air flow. The sensor should be relocated to the OA inlet hood.	9/18/2008	MC	open	
20	AC-3	The OA enthalpy sensor is located within the return air flow. The sensor should be relocated to the OA inlet hood.	9/18/2008	MC	open	
21	AC-4	The OA enthalpy sensor is located within the return air flow. The sensor should be relocated to the OA inlet hood.	9/18/2008	MC	open	
22	AC-2 Balancing	There are multiple diffusers supply either above or below 10% of the design CFM value. The balancer should re-adjust the dampers so that these values are within the 10% design range. Please refer to the balancing verification checklist for clarification on what diffusers are out of the 10% range.	9/19/2008	BC	open	
25	AC-4	The space temperature sensor associated with AC-4 is not located in the space that which the unit serves. The unit cannot modulate properly due to the location of the sensor. Contractor needs to relocate the sensor to a space that the unit serves in-order to obtain accurate readings.	9/19/2008	MC	open	
26	AC-4	The CO2 sensor associated with AC-4 is not located in the space that which the unit serves. The unit cannot modulate properly due to the location of the sensor. Contractor needs to relocate the sensor to a space that the unit serves in-order to obtain accurate readings.	9/19/2008	MC	open	
27	AC Units	The AC units (AC 1-4) do not have the capabilities of shutting down at night. The units are running 24/7 even when the setpoints are reached.	9/19/2008	MC	open	
28	Volume Damper	There is no volume damper associated with the diffuser located in storage room 19.038. Contractor to correct.	9/19/2008	MC	open	
29	AC-3	The fan speed is limited due to motor loading of a new fan that was installed during construction. The resulting static pressure will be maximum at this new speed. A measured static pressure of 0.88" is being produced by the unit. The unit is not producing enough air within the system. As a result of the lack of air the VAV boxes serving the marketing and accounting offices are starved, causing high temperatures within these offices. All VAV have been locked in a full open position and the associated diffusers have been comfort balanced to supply a constant CFM so that more air can be pushed to the starved areas. The right size motor and fan should be installed so that this system can perform as per the design intent.	9/19/2008	MC	open	
30	AC Units	None of the AC Units will be able to achieve an economizer mode due to the location of the sensors. The system is not operating per the design intent.	9/19/2008	MC	open	

No.	Tag	Item Description	Posted On	Responsibility	Status	Comment
31	EF 19-2	Only one diffuser has been installed within the telecom room. Drawing M-3.01 illustrates two exhaust diffusers to be installed.	9/19/2008	MC	open	
32	Balancing Report	The balancing report indicates that AC-3 is producing 4390 CFM which is above the design CFM of 4250. However, there seems to be a lack of airflow to the VAVs associated with the unit.	9/19/2008	WB/BC	open	
33	Balancing Report	The balancing report does not include any suction or discharge pressures for any of the AC units.	9/19/2008	BC	open	
34	OA Dampers	The OA dampers associated with AC 1 and 4 will only open when the unit modulates to an economizer mode. The minimum ventilation requirements are not being met.	9/19/2008	MC	open	
35	Balancing Report	The balancing report does not include minimum OA flow rates for AC 1 & 4.	9/19/2008	BC	open	

APPENDIX I

TSC Letter of Open Issues Resolution

T S C • D E S I G N

275 Seventh Avenue, 19th Floor New York, NY 10001 T 212.213.4595 F 212.213.8237 www.tscdesign.com

11.11.2008

Jim Dolan
OLA Consulting Engineers
50 Broadway
Hawthorne, NY 10532
914.747.2800

Dear Jim,

As a follow up to completing TSC Design's Commissioning Report, we are aware of the following outstanding items from the Commissioning Notice and intend to resolve them in accordance with your findings as soon as possible:

A. 27

B. 34

C. 29, 32

D. 18 – 21, 30,1

E. 25 – 26

F. 2-5

G. Remaining Items

Please let us know if you have any additional questions.

Regards,

Wey Lee

Chief Operating Officer

APPENDIX J

LEED Template

(Responsible Party)

I, Paul Scholler , declare to USGBC that the following commissioning requirements for the project's energy related systems have been successfully executed or will be provided under existing contract(s).

The energy-related systems to be included in the commissioning process activities include as a minimum: heating, ventilating, air conditioning and refrigeration (HVAC&R) systems (mechanical and passive) and associated controls; lighting controls, including day lighting; domestic hot water systems; renewable energy systems (PV, wind, solar, etc.).

Completed	Under Contract	
☒		Designate an individual as the Commissioning Authority to lead the commissioning process activities. This individual should not be directly responsible for project design or construction management.
☒		Clearly document the owner's project requirements and the basis of design for the project's energy-related systems. Updates to these documents shall be made during design and construction by the design team.
☒		Develop and incorporate commissioning requirements into the construction documents.
☒		Develop and utilize a commissioning plan.
◉	○	Verify that the installation and performance of energy consuming systems meet the owner's project requirements and basis of design.
◉	○	Complete a commissioning report inclusive of all components as outlined in Table 6 in the LEED-CI v2.0 Reference Guide.

I have provided the following supplementary documentation to support the declaration:

☒ A narrative and diagrams indicating how the HVAC system works, what portions are shared with other tenants in the building, what was included in the project scope of work, and if improvements were made in conjunction with the project by others to any common building systems supplying the tenant area.

☒ An excerpt or executive summary of the commissioning report or a copy of the commissioning plan and contract.

Project Name: TSC Office

Prerequisite: EA Prerequisite 1: Fundamental Commissioning Prerequisite Documented: Yes

READY TO SAVE THIS TEMPLATE TO LEED-ONLINE? Please enter your first name, last name and today's date below, followed by your LEED-Online Username and Password associated with the Project listed above to confirm submission of this template.

Paul	Scholler	2008-11-13	pscholler@olace.com	*******
First Name	Last Name	Date	Username (Email Address)	Password

SAVE TEMPLATE TO LEED-ONLINE PRINT TEMPLATE

APPENDIX K

NYSERDA Building Commissioning Certification

NYSERDA

New Construction Program

NCP7593
(Provide 4 Digit Number)

BUILDING COMMISSIONING CERTIFICATION

Applicant: TSC DESIGN **Building Address: 275 SEVENTH AVENUE 19TH FLOOR NEW YORK, NEW YORK**

Commissioning (Cx) Provider Information:

Name of Cx Company: OLA Consulting Engineers

Name of Cx Authority Person: Jim Dolan, P.E., LEED AP

Address: 50 Broadway

City, State, Zip: Hawthorne, New York, 10532

Telephone Number: (914) 747 – 2800

Commissioning Process Employed: (check all that apply)

6 NYCRR Part 638.8, New York State Green Building Tax Credit:	☐
ASHRAE Guideline 0-2005, 1-200X or 3-2005, "The Commissioning Process":	☐
Leadership in Energy and Environmental Design (LEED®-NC 2.2) EA Prerequisite 1:	■
Leadership in Energy and Environmental Design (LEED®-NC 2.2) EA Credit 3:	☐
Portland Energy Conservation Incorporated (PECI), Model Commissioning Plan:	☐
Other (please attach detailed explanation):	☐

Prerequisite Commissioning Activities: (note dates of completion)

	Complete	Date
Incorporated Commissioning Requirements into construction documents:	■	7/02/07
Developed and utilized a Commissioning plan:	■	11/12/07
Verified pre-functional performance of Commissioned systems:	■	9/18/08
Verified functional performance of Commissioned systems:	■	9/18/08
Completed Commissioning Report:	■	10/6/08

Additional Commissioning Activities: (note dates of completion)

	Complete	Date
Completed review of Owner's Project Requirements (OPR):	■	10/6/08
Completed review of Basis of Design (BOD):	■	10/6/08
Conducted design review prior to completion of construction documents phase	■	10/12/07
Conducted opposite season testing:	☐	_____
Set date for end of Warranty Operation Review.	☐	_____

Please Return Building Commissioning Certification with an original signature (copies are not acceptable) to:
New Construction Program – Project Coordinator, NYSERDA, 17 Columbia Circle, Albany, NY 12203

NCP7593
(Provide 4 Digit Number)

1) Commissioning Record:

Please provide a location and address where project Commissioning record can be reviewed if necessary.

TSC DESIGN

275 SEVENTH AVENUE 19TH FLOOR

NEW YORK, NEW YORK 10001

2) Systems Commissioned: (required)

(List equipment/systems for which NYSERDA has provided a capital incentive offer through the New Construction Program and indicate whether they have been Commissioned. Refer to Section 8, of the Technical Assistance Study in support of New Construction Program for a list of equipment.)

The following equipment/systems have been commissioned: (please refer to the attached NYSERDA: Buildings Portal – NCP Pre-Qualified Measure Recommendation Report for complete description of the NYSERDA codes listed below.)

I. Four (4) DEC-1
II. Two (2) HVAC (Air Source >135,000 – 240,000)
III. Two (2) HVAC (Air Source >65,000 – 135,000)
IV. Seventeen (17) OC-2
V. Two (2) VSD (5 – 20 HP)
VI. Two (2) VSD (5 – 20 HP)

3) Other Systems Commissioned: (optional)

List equipment/systems Commissioned without a NYSERDA Incentive Offer.

I. One (1) General Exhaust Fan
II. Six (6) Variable Air Volume (VAV) Units without Re-heat
III. One (1) Domestic Water System
IV. One (1) Perimeter Radiation System

4) Commissioning Deficiencies (required):

List any uncorrected system/equipment deficiencies on equipment listed in Section (2) that may have an impact on equipment performance.

1. The thermostat located in the reception area is not reading correctly. The actual temperature within the room was recorded to be 75 F, the thermostat was reading a temperature of 68 F.
2. The filters associated with all AC units need to be replaced.
3. The OA enthalpy sensor is located within the return air flow. The sensor should be relocated to the OA inlet hood. This is consistent for all AC units.

4. AC-2: There are multiple diffusers supply either above or below 10% of the design CFM value. The balancer should re-adjust the dampers so that these values are within the 10% design range. Please refer to the balancing verification checklist for clarification on what diffusers are out of the 10% range.
5. The space temperature sensor associated with AC-4 is not located in the space that which the unit serves. The unit cannot modulate properly due to the location of the sensor. Contractor needs to relocate the sensor to a space that the unit serves in-order to obtain accurate readings.
6. The AC units (AC 1-4) do not have the capabilities of shutting down at night. The units are running 24/7 even when the setpoints are reached.
7. The fan speed is limited due to motor loading of a new fan that was installed during construction. The resulting static pressure will be maximum at this new speed. A measured static pressure of 0.88" is being produced by the unit. The unit is not producing enough air within the system. As a result of the lack of air the VAV boxes serving the marketing and accounting offices are starved, causing high temperatures within these offices. All VAV have been locked in a full open position and the associated diffusers have been comfort balanced to supply a constant CFM so that more air can be pushed to the starved areas. The right size motor and fan should be installed so that this system can perform as per the design intent.
8. None of the AC Units will be able to achieve an economizer mode due to the location of the sensors. The system is not operating per the design intent.
9. The OA dampers associated with AC 1-4 will only open when the unit modulates to an economizer mode. The minimum ventilation requirements are not being met.

*****PLEASE REFER TO THE COMMISSIONING REPORT FOR THE COMPLETE OPEN ISSUES LIST.**

*****PLEASE REFER TO THE ATTACHED DOCUMENT OR THE COMMISSIONING REPORT FOR THE TSC LETTER OF OPEN ISSUES RESOLUTION PLAN.**

5) Narrative: (optional)
Attach narrative description of the systems that were Commissioned and the results of the Commissioning process.

The following systems were commissioned during the project:

- The air conditioning units and associated condensing units
- Sampling of VAV boxes
- The controls associated with each air conditioning unit
- Sampling of the lighting system
- The domestic hot water system

Some major issues identified by the commissioning team identified described below:

1. During the functional testing of the air conditioning units, and the associated components, the units were found to be active through a 24 hour period. The unit controls were not programmed to de-activate the units during un-occupied hours.

2. The enthalpy sensors, which will modulate the unit into an economizer cycle (free cooling), were found to be installed within the mixed air section of each unit. The enthalpy sensor location will not enable the economizer cycle while installed in the mixed air section of the unit, since the economizer cycle is based on outside air temperature and humidity.
3. Air conditioner 3 original design intent illustrated a variable air volume system through the use of VAV boxes and a variable frequency drive. The testing identified that the unit was found to be manipulated to behave as a constant volume system. VAV boxes have been manually shut down in the full open position and the unit variable frequency drive was not ramping up or down. The energy savings accompanying a variable air volume system has been deleted by operating this system as a constant volume system.
4. The outside air dampers were found to be closed during normal operations. The only times that the dampers would modulate open are; when the unit goes into an economizer mode, or when the CO2 sensor set point was breeched. The design intent is to have the outside air damper modulate to a minimum outside air position and modulate per the CO2 level.
5. The thermostat associated with air conditioning unit 4 was found to be located in an occupied space that is not supplied by air conditioning unit 4. This thermostat location will not provide the unit with accurate temperature or CO_2 read outs. The sensor location should be re-located since this sensor will maintain the unoccupied and occupied temperatures.

NYSERDA

New Construction Program

NCP7593

(Provide 4 Digit Number)

COMMISSIONING CERTIFICATION: (to be completed by the Commissioning Authority)

The undersigned project Commissioning Authority certifies that to the best of the Authority's knowledge, information and belief, the Commissioning work required by the New York State Energy Research and Development Authority has been completed in accordance with accepted industry practices and that all Commissioned systems are functioning as intended by the owner and as designed by the design team.

Commissioning Authority Firm: OLA Consulting Engineers

Commissioning Authority Person: James F. Dolan, P.E., LEED AP Date: November 11, 2009

NOTARIZATION:

Subscribed and sworn to before me on this day of _____, 200

Notary Public _____

My Commission Expires:

APPLICANT CERTIFICATION: (to be completed by NCP Applicant)

I, _____from, _____
(NCP Applicant) (Applicant Company)

verify that the information provided above is accurate, to the best of my knowledge.

Print Name & Title: _____

Authorized Signature: _____ Date: _____

For NYSERDA Use Only:

Received: _____ **Date:** _____

Approved: _____ **Date:** _____

Please Return Building Commissioning Certification with an original signature (copies are not acceptable) to:
New Construction Program – Project Coordinator, NYSERDA, 17 Columbia Circle, Albany, NY 12203

T S C • D E S I G N

275 Seventh Avenue, 19th Floor New York, NY 10001 T 212.213.4595 F 212.213.8237 www.tscdesign.com

11.11.2008

Jim Dolan
OLA Consulting Engineers
50 Broadway
Hawthorne, NY 10532
914.747.2800

Dear Jim,

As a follow up to completing TSC Design's Commissioning Report, we are aware of the following outstanding items from the Commissioning Notice and intend to resolve them in accordance with your findings as soon as possible:

A. 27

B. 34

C. 29, 32

D. 18 – 21, 30,1

E. 25 – 26

F. 2-5

G. Remaining Items

Please let us know if you have any additional questions.

Regards,

Wey Lee

Chief Operating Officer

Buildings Portal - NCP Pre-Qualified Measure Recommendation Report

NCP7593

Project Information

NCP #	NCP7593	Site Inspector	
PON	1155	Inspection Date	
OPC Firm	SAIC	Applicant Name	TSC Design
OPC	Cohen, David	Applicant Federal ID #	133881153
Building Name	275 Seventh Avenue, 19th Floor	Application Received	07/20/2007

Measure Information

NYSERDA Code	Measure Description	Qualifying Criteria	OPC Remarks	Per Unit Incentive	Quantity Approved	Incentive Offer $ Amount
DEC-1	Differential Enthalpy Economizer Control System	Differential Enthalpy Economizer control; solid state, Honeywell W7210A1001	Equipment meets program requirements; 4 x $150 = $600	$0.00	4	$600.00
HEFLEBG-2	High efficiency pendant or wall-mounted indirect fluorescent fixture (4ft - 2-lamp T5)	Pendant indirect, 2 lamp, 8 ', T5 fixture efficiency 90.2%; Mark Lighting PLA-228T5-EB	Equipment meets program requirements; 17 units x 2 (4' units)x $20/per 4'=$680 17 units x $20 = $340	$0.00	34	$680.00
HEFLEBG-2	High efficiency pendant or wall-mounted indirect fluorescent fixture (4ft - 2-lamp T5)	Pendant indirect, 1 lamp, T5, 4', EB, fixture efficiency 82.8%; Mark Lighting QSI-128T5-EB	Equipment meets program requirements; 2 units x $20/fixture = $80	$0.00	2	$40.00
HEFLG-4	High efficiency low glare recessed or surface mounted fluorescent fixture (4ft - 2-lamp T8)	2 lamp, 4', EB, must meet IES criteria for low glare candelas, Mark Lighting PLSL 2T5HO-EB	Equipment does not meet program requirements; does not meet IES criteria, Applied for 72 units x $15/fixture = $1,080; incentive $0	$0.00	0	$0.00
HEFLG-4	High efficiency low glare recessed or surface mounted fluorescent fixture (4ft - 2-lamp T8)	1 lamp, T5, must meet IES criteria for low glare candelas & required fixture efficiency 60%; Mark Lighting SL2C 124-T5HO EB	Equipment does not meet program requirements; does not meet IES criteria and the fixture efficiency is 47.7%, applied for 11 units x $15/fixture = $165	$0.00	0	$0.00
HEFLG-4	High efficiency low glare recessed or surface mounted fluorescent fixture (4ft - 2-lamp T8)	1 lamp, T5, Low glare recessed, required fixture efficiency 60%, Lithonia SL6-4-128T5 EB	Equipment does not meet fixture requirements; 57% fixture efficiency; applied for 10 units x $15/fixture = $150; $0 incentive	$0.00	0	$0.00
HEFLG-4	High efficiency low glare recessed or surface mounted fluorescent fixture (4ft - 2-lamp T8)	2 lamp, low-glare recessed, must meet IES criteria for low glare candelas, Mark Lighting 2RLDS 22 240BX	Equipment does not meet program requirements; applied for 34 units x $15/fixture = $510; incentive $0	$0.00	0	$0.00

HVAC(Air Source >135,000-240,000)	Air-Source Unitary or Split System HVAC > 11.25 to 20 tons - AC or HP (Tier 2)	13 ton, Air Source, 11.4 EER, MCQuay ACZ013	Equipment meets program requirements;2 Units x 13 Tons x $90/ton = $2,340	$0.00	2	$2,340.00
HVAC(Air Source >65,000-135,000)	Air-Source Unitary or Split System HVAC > 5.4 to 11.25 tons - AC or HP (Tier 2)	10 ton, Air source, 11.4 EER McQuay, ACZ-010	Equipment meets program requirements; 10 Tons x 2 units x $90/ton = $1800	$0.00	2	$1,800.00
OC-2	Occupancy Sensors (T8 fluorescent fixtures - On/Off Control)	Ceiling mounted PIR & ultrasonic, no "on" override, WattStopper DT-300	Equipment meets program requirements; 17 units x $20/sensor = $340	$0.00	17	$340.00
VSD (5-20 HP)	Variable Speed Drive - Average HP and end-use application for the NC program for historical installations based on program typical information (from the OPC Database). Average motor size is 10 HP, installed in HVAC fan applications.	5 HP Supply fan VSD, AC- 1 & 3; Yaskawa E7	Equipment meets program requirements; 5 HP x 2 units x $20/hp = $200	$0.00	2	$200.00
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					Total Incentive	$6,300.00

APPENDIX L

NYSERDA Buildings Portal - NCP Pre-Qualified Measure Recommendation Report

Buildings Portal - NCP Pre-Qualified Measure Recommendation Report

NCP7593

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