Commissioning Plan
For
1900 Sixteenth Street at the Millennium Bridge
In Denver, Colorado

PROJECT 007-131

Prepared for Fred Shultz:

Trammell Crow Company
1225 17th Street 3050
Denver, Co 80202

Prepared by Susan Marshall:

Architectural Energy Corporation
2540 Frontier Avenue, Suite 201
Boulder, Colorado 80301

May 2009

1900 Sixteenth Street at the Millennium Bridge
Commissioning Plan

Table of Contents

1. Overview

1.1 Abbreviations and Definitions

The following are common abbreviations used in this document.

A/E	Architect and design engineers	FPT	Functional performance test
CXA	Commissioning Agent	GC	General contractor
CC	Controls contractor	MC	Mechanical contractor
CX	Commissioning	PF	Pre-functional checklist
EM	Energy manager	Subs	Subcontractors to General
CX Plan	Commissioning Plan document	TAB	Test and balance contractor
EC	Electrical contractor	Staff	Maintenance Staff
MM	Maintenance Manager		

Where the term “contractors” is used in the CX Plan, it refers to the GC and/or Subs as appropriate.

1.2 Purpose of the Commissioning Plan (CX Plan)

The purpose of the CX Plan is to provide direction for the commissioning process during construction, providing resolution for issues such as scheduling, roles and responsibilities, lines of communication and reporting, approvals, and coordination.

1.3 Commissioning Goals and Objectives

Commissioning is a systematic process of ensuring that the building systems perform according to the design intent and the owner’s operational requirements. All equipment and systems should be installed according to manufacturer’s recommendations, the best practices and standards of the industry, and the Contract Documents.

Commissioning will include documenting the design intent, followed by activities in the construction, acceptance, and warranty phases of the project. The participation of the contractors in commissioning activities will follow the requirements defined in the specifications. The three main goals of the commissioning process are:

1. Facilitate the final acceptance of the project at the earliest possible date.
2. Facilitate the transfer of the project to the owner’s maintenance staff.
3. Ensure that the comfort systems meet the requirements of the occupants.

Commissioning is also intended to achieve the following specific objectives:

- Document that equipment is installed and started per manufacturer’s recommendations.
- Document that equipment and systems receive complete operational checkout by installing contractors.

- Document system performance with thorough functional performance testing and monitoring.
- Verify the completeness of operations and maintenance materials.
- Ensure that the owner's operating personnel are adequately trained on the operation and maintenance of building equipment.

1.4 LEED Rating and Commissioning

The commissioning effort for this project will also include meeting all of the USGBC LEED commissioning requirements:

The LEED section on "Energy and Atmosphere" has a prerequisite of "Fundamental Building Systems Commissioning." In addition, the LEED rating system has a credit available for "Enhanced Commissioning." The LEED prerequisite commissioning requirement addresses the fundamental commissioning process, with specific reference to the following:

1. Engage a Commissioning Authority.
2. Develop Design Intent and Basis of Design documentation.
3. Include commissioning requirements in the construction documents.
4. Develop and utilize a Commissioning Plan.
5. Verify installation, functional performance, training and documentation.
6. Complete a Commissioning Report.

The LEED Enhanced commissioning credit requirement addresses commissioning activities during the design and post-occupancy phases, with specific reference to the following:

1. Conduct a focused review of the design prior to the Construction Documents Phase.
2. Conduct a selective review of contractor submittals of commissioned equipment.
3. Develop a system and energy management manual (Re-Commissioning Manual).
4. Verify that the requirements for training operating personnel and building occupants are completed.
5. Have a contract in place for a near-warranty end or post occupancy review.

Architectural Energy Corporation's preliminary commissioning plan assumes that these best practices commissioning activities will be performed as an integral part of the scope of commissioning services this project.

1.5 Commissioning Scope

The systems to be commissioned include:

- ☐ HVAC components and equipment
  - HVAC systems: interaction of cooling, heating, and comfort delivery systems.
  - Building Automation System (BAS): control hardware and software, sequence of operations, integration of factory controls with BAS
  - Chillers
  - Cooling Towers
  - Boilers
  - Pumps
  - VAV Terminal Boxes
  - Fan Powered Terminal Boxes
  - Heat Pumps
  - Split A/C Units
  - Fans
  - Glycol make-up
  - Electric Heaters
- ☐ Lighting Controls
- ☐ Domestic Hot Water Systems

Refer to Appendix A for a table listing the specific equipment. All general references to equipment in this document refer only to equipment that is to be commissioned.

2. General Building Information

Project Name	1900 Sixteenth St. at the Millennium Bridge
Project Address	1900 Sixteenth St. Denver, CO
Building Type	Mixed Use
Square Footage	409,571 SF
Building Description	18-Story
Owner	Commons 19 LLC

3. Commissioning Team Information

Function	Name/Address	Contact Info
Owner's Representative	Trammell Crow Company 1225 17th Street 3050 Denver, Co 80202	**PM – Fred Shultz** Tel: 303-628-7444 Email: FSchultz@trammellcrow.com
Design Build General Contractor	Saunders PO Box 3908 Englewood, CO 80155	**Project Manager – Jim Steimel** Tel: 303-951-7962 Email: j.steimel@saundersci.com **Superintendent – Tony Street** Tel: 303-598-6051 Email: t.street@saundersci.com **Project Engineer – Alyssa Rossnagel** Tel: 303-951-7965 Email: a.rossnagel@saundersci.com
Commissioning Agent	Architectural Energy Corporation 2540 Frontier Avenue, Suite 201 Boulder, CO 80301	**Susan Marshall** Tel: 303-444-4149 x467 Mobile: 303-668-4029 Fax: 303-444-4304 Email: smarshall@archenergy.com
Architect	Tryba Architects 1620 Logan St. Denver,CO 80203	**Construction – George Feathers** Tel: 720-947-5417 Email: gfeathers@TrybaArchitects.com

Function	Name/Address	Contact Info
Mechanical, Plumbing, Electrical Engineer	Hodji & Associates 1825 Lawrence St#200 Denver, CO 80202	**Mechanical Engineer – Dimitri Passas** Tel: 303-293-3800 Email: dpassas@hadjiengr.com
Mechanical Plumbing Contractor	Trautman and Shreve 4406 Race St. Denver, CO 80216	**Project Manager – John Berger** Tel: 303-295-1414 Email: jberger@trautman-shreve.com **Superintendent –** Tel: Email: **Project Engineer –** Tel: Email:
TAB	JPG Engineering 1833 Mountain View Road Sedalia CO 80135	**TAB Technician – Jock Griffith** Tel: 303 870-5700 office Mobile: 303 688-9044 Email: jpgengineering@qwest.net
Controls Contractor	Honeywell 345 Inverness Dr South #240 Englewood, CO 80112	**Programmer - Stephan von Kalben** Tel: 719-237-0654 Email: Stephan.vonKalben@Honeywell.com
Electrical Contractor	Dyna Electric 345 Sheridan Blvd Lakewood CO 80226	**Project Manager – Martin St Peter** Tel: 303 205-5561 Mobile: 303 961-7573 Email: martin_stpeter@emcorgroup.com

4. Roles and Responsibilities

4.1 General Management Plan

The CXA coordinates the commissioning activities and will report to Lee Real Estate Development. The CXA's responsibilities, along with the designation of the CX Team, are detailed in the Separate Scope of Commissioning Work. The CX process will require the coordinated effort of all members of the CX Team in order to meet the objectives of the Contract Documents.

4.2 General Descriptions of Roles of the CX Team

General descriptions of the commissioning roles are as follows:

CXA: Coordinates the CX process, writes and reviews testing plans, directs and documents performance testing.

MM: Coordinates maintenance staff participation in commissioning activities.

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

Subs: Demonstrate correct system performance.

Staff: Participate in commissioning tasks and performance testing, review O&M documentation, and attend training.

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

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

Owner: Responsible for final approval of the CX work.

4.3 Specifications and Commissioning

Commissioning language in the specifications and in the Separate Scope of Commissioning Work details the scope of commissioning for this project. The following lists the sections of the specifications that include commissioning related language with a brief description.

Section 01770 - Project Closeout
Section 01781 - Project Record Documents
Section 01810 - General Commissioning Requirements
Section 15010 - Basic Mechanical Requirements
Section 15995 - Commissioning of Mechanical Systems

4.4 General Management Plan and 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 through the GC and Owner.
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 GC and Owner
For scheduling functional tests or training:	The CXA provides input and coordination of testing and training. Scheduling is done through the GC.
For scheduling commissioning meetings:	The CXA selects the date and schedules through the GC and Owner.
For making a request for significant changes:	The CXA has no authority to issue change orders.
For making minor changes in specified sequences of operations:	All changes in sequences of operations required must be approved by the A/E. The CXA may recommend changes in sequences of operation to correct operational deficiencies and/or to improve efficiency or control.
Subcontractors disagreeing with requests or interpretations by the CXA shall:	Resolve issues at the lowest level possible. First with the CXA, then with the GC and Owner. Some issues may require A/E input.

4.5 Commissioning Team Responsibilities

The responsibilities of various parties in the commissioning process are provided in this section.

4.5.1 Commissioning Agent (CXA)

The CXA is not responsible for design concept, design criteria, code compliance, general construction scheduling, cost estimating, or construction management. The CXA may assist with problem-solving deficiencies, but ultimately that responsibility resides with the GC and the A/E team. The primary role of the CXA is to develop and coordinate the execution of a testing plan to verify and document that systems are functioning in accordance with the design intent and the Construction Documents.

Construction and Acceptance Phase

- Coordinates and directs all commissioning activities. Work with the GC and Owner to ensure that commissioning activities are scheduled.

- Maintain an up-to-date CX Plan.
- Plan and conduct the commissioning scoping meeting.
- Request and review additional information required to perform commissioning tasks, including O&M materials, contractor start-up and checkout procedures, and sequences of operation.
- Review Contractor submittals applicable to commissioned systems.
- Develop start-up and checkout plans with Subs. Write and distribute pre-functional checklists.
- Perform site visits, as necessary, to observe component and system installations. Attend construction job-site meetings, as necessary, to monitor construction and commissioning progress.
- Review completed pre-functional checklist and start-up reports.
- Assist with coordination of start-up requirements with TAB requirements.
- Write functional performance test procedures for equipment and systems.
- Coordinate, witness, and document functional performance tests completed by installing contractors. Coordinate retesting as necessary until satisfactory performance is verified.
- Maintain a master deficiency and resolution record. Provide the GC and Owner with written progress reports and test results with recommended actions.
- Review the training proposed by the contractors for the Owner's operating personnel.
- Review the O&M manuals.
- Prepare a final commissioning report.

4.5.2 Design Team (A/E)

Construction and Acceptance Phase

- Attend commissioning scoping meeting and additional meetings, as necessary.
- Provide design intent and sequence of operation documentation as required by the CXA.
- Assist in resolution of system deficiencies identified during commissioning.
- Review and approve the operations and maintenance manuals.
- Optional: Review equipment start-up and pre-functional checklists. Review functional performance test plans. Witness performance testing.

Warranty Period

- Assist in resolution of system deficiencies identified during warranty period commissioning.

4.5.3 Owner

Construction and Acceptance Phase

- Arrange for facility operating and maintenance personnel to participate in commissioning activities and training sessions.
- Provide final approval for the completion of the commissioning work.

Warranty Period

- Work with GC and CXA to facilitate seasonal and deferred testing and to address deficiency issues.

4.5.4 General Contractor (GC)

Construction and Acceptance Phase

- Facilitate the coordination of the commissioning work by the CXA.
- Attend commissioning scoping meeting and additional meetings, as necessary.
- Furnish copies of construction documents, addenda, change orders and approved submittals and shop drawings related to commissioned equipment to the CXA.
- Ensure that Subs execute their commissioning responsibilities according to the Specifications, CX Plan and Separate Scope of Commissioning Work.
- Coordinate the training of owner personnel.
- Prepare O&M manuals, according to the Specifications, including updating original sequences of operation to as-built conditions.

Warranty Period

- Ensure that Subs execute required seasonal or deferred functional performance testing.
- Ensure that Subs correct deficiencies and make necessary adjustments to O&M manuals and as-built drawings for issues identified during the warranty period.

4.5.5 Mechanical, Electrical, Controls and TAB Contractors

Construction and Acceptance Phases

- Attend commissioning scoping meeting and additional meetings, as necessary.
- Provide additional requested documentation, prior to normal O&M manual submittals, to the CXA for development of start-up and functional testing procedures.
- Assist in clarification of operation and control of commissioned equipment where the specifications control drawings or equipment documentation is not sufficient for writing detailed testing procedures.
- Develop a start-up and checkout plan for all commissioned equipment based on manufacturer's recommendations and pre-functional checklists from the CXA. Submit to CXA for review and approval prior to startup.

- During the startup and checkout process, execute the mechanical-related portions of the pre-functional checklists for all commissioned equipment. Perform and clearly document all completed startup and system operational checkout procedures.
- Resolve A/E punch list items before functional testing. Air and water TAB shall be completed with discrepancies and problems resolved before functional testing.
- Perform functional performance testing, under the direction of the CXA, for commissioned equipment.
- Resolve equipment or system deficiencies and retest as required to verify modified performance.
- Prepare O&M manuals according to the Specifications, including updating original sequences of operation to as-built conditions.
- Provide training of the Owner's operating personnel as specified.
- Coordinate with equipment manufacturers to determine requirements to maintain the validity of warranties.

Warranty Period

- Execute seasonal or deferred functional performance testing, as necessary.
- Correct deficiencies and make necessary adjustments to O&M manuals and as-built drawings for issues identified during the warranty period.

4.5.6 Controls Contractor

The commissioning responsibilities of the controls contractor, during construction and acceptance phases are:

1. Sequences of Operation Submittals.

   The temperature controls submittals shall include complete and detailed sequences of operation for each piece of equipment, regardless of the completeness and clarity of the sequences in the specifications. They shall include:

   a. A narrative description of the system, describing its purpose, components and function.

   b. Interactions and interlocks with other systems.

   c. Delineation of control interactions between packaged controls and the building automation system, including a listing of monitored points, controlled points, and adjustable points.

   d. Written sequences of control for packaged controlled equipment.

   e. Sequences of control for all modes of operation (Start-up, Warm-up, Cool-down, Normal occupied, Unoccupied, Emergency Shutdown, etc.).

   f. Capacity control sequences and equipment staging.

g. Temperature and pressure control sequences (setbacks, resets, etc.).

h. Sequences for all control strategies (economizer control, optimum start/stop, optimization, demand limiting, etc.).

i. Effects of power or equipment failure with all standby component functions.

j. Sequences for alarms and emergency shutdowns.

k. Seasonal operational requirements.

2. Control Drawings Submittal

a. The control drawings shall have a key to all abbreviations.

b. The control drawings shall contain graphic schematic depictions of the systems and each component.

c. The schematics will include the system and component layout of all equipment that the control system monitors, enables or controls, even if the equipment is primarily controlled by packaged or integral controls.

d. Provide a full points list with at least the following included for each point:

1) Controlled system
2) Point abbreviation
3) Point description
4) Point type (digital/analog, input/output)
5) Display unit
6) Control point or setpoint (Yes / No)
7) Monitoring point (Yes / No)
8) Intermediate point (Yes / No)
9) Calculated point (Yes / No)

3. An as-built version of the control drawings and sequences of operation shall be included in the final controls O&M manual submittal.
4. The controls contractor shall prepare a written plan indicating in a step-by-step manner, the procedures that will be followed to test, checkout and adjust the control system prior to functional performance testing.
5. Provide a signed and dated certification to the CXA and GC upon completion of the control system checkout.

4.5.7 Equipment Suppliers

- Provide requested submittal data, including detailed start-up procedures and specific responsibilities of the Owner to keep warranties in effect.

- Provide information requested by CXA regarding equipment sequence of operation and testing procedures.
- Assist in equipment testing per agreements with contractors.

5. Commissioning Process

This section sequentially details the commissioning process by commissioning task or activity.

5.1 Prepare Commissioning Plan

The Commissioning Plan describes the implementation of the commissioning process and provides a framework for integration of commissioning activities into the construction and acceptance process. The Commissioning Plan also provides an agenda for organizing and focusing the commissioning scoping meeting. The Commissioning Plan expands to incorporate more information as the design, construction, and acceptance and warranty phases of the facility are completed. The Commissioning Plan will be updated during the construction and warranty phases.

The Commissioning Plan will include, at a minimum, the following information:

- A brief overview of the commissioning process.
- A list of all commissioned features and systems.
- Identification of the commissioning team and its responsibilities.
- A description of the management, communication, and reporting of the commissioning process.
- An outline of the commissioning scope, including: development of the owner's project requirements, review of the basis of design, schematic design, construction documents and submittals, construction phase verification, functional performance test development and implementation, and ten-month warranty review.
- A list of the expected work products.
- A list of key commissioning milestones.

5.2 Documentation of Design Intent and Basis of Design

A clear design intent is critical to the commissioning process. Design Intent defines the benchmark for system performance. The Design Intent Report is a detailed explanation of the information developed for the owner’s program, focused on those systems included in the scope of work for commissioning. It will clearly define the functional and indoor environmental quality requirements.

The Basis of Design Report details the design teams response to the performance criteria in owner’s program and design intent. It will include the heating, ventilation, and air-conditioning requirements for each occupancy type, with references to applicable codes

and standards, and other design criteria used as the "basis of design" for other building systems to be commissioned.

5.3 Design Review at 100% Design Development

The 100% design development review seeks to identify building system design issues and potential operation and maintenance issues that should be addresses during the Construction Documents Phase of the project. At this point in the design phase, the building system designs have been refined and many decisions crucial to overall building performance operation and maintenance have been made. This review is designed to ensure that the design team has achieved the major design goals (intent) relative to functionality, energy performance, maintainability and indoor environmental quality.

5.4 Develop Commissioning Specifications

The commissioning specifications prepared by the Design Team will be reviewed by AEC for completeness. Any recommended changes to the commissioning specifications will be reviewed and approved by the Design Team prior to inclusion in the construction specifications. The commissioning specifications describe the scope and requirements for commissioning, as well as the roles and responsibilities of the general contractor, installing subcontractors, owner personnel, Design Team, and the AEC Commissioning Team.

5.5 Submittal Review

The contractor's standard submittals will be reviewed to ensure that the equipment or system provided will meet the specifications and design intent, as they relate to environmentally responsive characteristics. The reviews performed by AEC will be sent to the design team to be incorporated into their standard review forms, prior to being sent to the contractors.

5.6 Commissioning Scoping Meeting

The scoping meeting brings together all members of the design, construction, and operations team that will be involved in the commissioning process. The coordination of commissioning activities to coincide with the completion of mechanical systems is discussed. Each building system to be commissioned is addressed, including commissioning requirements, and completion and start-up schedules for each area. During the scoping meeting, all parties agree on the scope of work, tasks, schedules, deliverables, and responsibilities for implementation of the Cx Plan.

5.7 Commissioning Kickoff Meeting

A commissioning kickoff meeting will be held on the jobsite and will be run by the GC and AEC. This meeting will include all applicable sub-contractors that are involved in the commissioning process. AEC and the Developer will be present to answer questions and help in the discussion as needed. During this meeting, the GC will advise the contractors of their roles in this process, and will explain what tasks and milestones have been added to the “standard” construction process as a result of the developer including commissioning

in their scope. The GC will direct the contractors to the Cx specification and will clear up any questions that may arise as a result of the specification. It is expected that the GC will be prepared and will be familiar with the commissioning specification and its requirements, and will be able to clearly explain what the contractors need to do to participate. Prior to this kickoff meeting, AEC will be available to the GC to aid in their understanding of the commissioning requirements.

This meeting will be scheduled by the Developer, GC and CxA and should occur prior to the installation of piping and ductwork

5.8 Commissioning Plan (Cx Plan)

AEC 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 timeline is fine-tuned as construction progresses. The GC is requested to update AEC regularly with construction schedules, and to include pre-functional checkout and functional performance testing in the master schedule.

5.9 Submittals Review

The GC will provide AEC with a set of equipment and system submittals. AEC will review the submittals for completeness and check that the submitted equipment meets the design requirements and design intent. This equipment data includes installation and start-up procedures, O&M data, performance data and temperature control drawings. The GC, Subs, or A/E notify AEC 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.

AEC review comments will get forwarded to the design engineer of record for that particular system. The design engineer then determines which comments are to be forwarded to the GC and contractor and also determines if the review comment requires re-submittal or not.

5.10 Jobsite Observations

Onsite observations are conducted as needed to verify compliance with manufacturer's installation and start-up instructions and recommendations, compliance with the design intent, and meeting the requirements for efficient operation and maintenance. Testing and balancing (TAB) observation will verify TAB methods and procedures on both air-side and water-side systems. Commissioning will also include verification of the TAB as a prerequisite to substantial completion. The verification procedure will spot check (10% sampling rate) air and water flow rates at locations selected by the commissioning engineer. For this activity, The TAB contractor will complete the measurements and provide the same instrument that was used when the original data was collected. Construction observation is not for the express purpose of ensuring compliance with codes and standards.

Refer to Appendix B for an example of a Jobsite Observation Report.

5.11 Pre-functional Checklists

Pre-Functional Inspection Checklists are developed and completed for all mechanical equipment being commissioned. The checklist captures equipment nameplate and characteristics data, and confirms the as-built status of the equipment or system. The checklists ensure that the systems are complete and operational and document the installation of components and completion of systems.

The checklists are prepared by AEC from manufacturer's data, drawings and specifications to include the required installation, checkout, and start up procedures. The installing Subs date and initial the checklists as the construction and start-up is completed. AEC reviews and verifies the completed checklists before scheduling the functional performance testing.

Pre-Functional checklists will be created for all systems to be commissioned. They are to completed by the installing contractors prior to functional performance testing. The GC will aid in supervising this process by managing the pre-functional checklist books, either by keeping them in their trailer, or by giving them to the appropriate contractor for completing. The GC will at least bi-weekly fax a copy of the summary sheet "functional performance readiness checklist" to AEC to keep AEC informed of pre-functional checkout progress. This aids in scheduling of the functional performance tests.

Refer to Appendix C for an example of a Pre-Functional Checklist.

5.12 Functional Performance Testing

Functional performance testing verifies the intended operation of individual components and system interactions under various conditions and modes of operation. The systems are run through all of the sequences of operation and the response of components is verified. Testing proceeds from components to subsystems to systems, and finally to interlocks and connections between systems.

AEC prepares functional performance test plans so that the complete sequence of operations is included. AEC obtains all documentation, including an updated points list, control sequences, and setpoints. If necessary, AEC may request clarifications from contractors and the design team regarding sequences and operation. Prior to execution, AEC provides a copy of the primary equipment tests to the installing Subs and GC who can review the tests for feasibility, safety, warranty and equipment protection.

AEC schedules functional tests through the GC and Subs. Under the supervision of AEC, the installing Subs performs the hardware and/or software manipulations required for the testing. Owner maintenance staff may also be present in order to assist in system observations. AEC witnesses and records the results of functional performance testing.

Refer to Appendix D for an example of a Functional Performance Test

5.13 Short-Term Diagnostic Testing

Short-term diagnostic testing, using data acquisition equipment or building automation system trends to record system operation over a two to three week period, may be used to investigate the dynamic interactions between components in the building system.

The monitoring occurs after occupancy to evaluate the building systems' performance under natural occupancy and ambient load conditions. The objectives of the monitoring are to evaluate scheduling, the interaction between heating and cooling, and the effectiveness of the system in meeting the comfort requirements of the occupants.

Either the building automation system or AEC Microdataloggers or both will be used to take data on selected systems. This occurs after occupancy, and any further deficiencies identified from this testing will be reported to the team for correction.

5.14 Deficiency Report and Resolution Record

AEC and its commissioning sub-contractors will make periodic site visits to witness equipment and system installations. Each site visit will have a specific agenda and will be coordinated with the GC site supervisor. AEC attends selected planning and job-site meetings in order to remain informed on construction progress and to update parties involved in commissioning. The GC provides AEC with information regarding substitutions or change orders that may affect commissioned equipment or the commissioning schedule.

All deficiencies found from site visits and functional performance testing will be documented in a Deficiency Report. The report will include all details of the components or systems found to be non-compliant with the parameters of the functional performance test plans and design documents. The deficiency report will become part of the punch list. The report will detail the adjustments or alterations required to correct the system operation, and identify the responsible party. The deficiency report will be continuously updated. AEC schedules any required re-testing through the GC. Decisions regarding deficiencies and corrections are made at as low a level as possible, preferably between AEC, sub-contractor and the GC.

Refer to Appendix E for an example of a Deficiency Log

5.15 Operations and Maintenance Training

Manuals: The operation and maintenance manuals prepared by the contractors for the owner's maintenance personnel are reviewed for completeness. The contractors are encouraged to submit O&M manuals at the earliest possible date. Materials may be added, or requested from the contractors, to stress and enhance the importance of system interactions, troubleshooting, and long-term preventative maintenance and operation.

Training: Effective maintenance personnel training is critical to the long term performance of the new building. AEC will assist the owner and GC in organizing the training sessions by identifying the appropriate staff for each session and creating an overall training plan.

For each training session, the contractors provide a detailed agenda for each piece of equipment or system for which training is required. The agenda describes the training scope, duration, and methods, along with the name and qualifications of the trainers. AEC will develop a plan for including in the training session contractors / trainers from different disciplines, when appropriate. The trainer documents each training session (duration, general subjects covered, and attendees). AEC may witness any of the training sessions, but will not be present for all training.

5.16 Final Commissioning Report and LEED Documentation

Final Commissioning Report: A final Commissioning Report will be compiled which summarizes all of the tasks, findings, and documentation of the commissioning process. The report will address the actual performance of the building systems in reference to the design documents. All test reports by various sub-contractors, manufacturers and controlling authorities will be incorporated into the final report.

The commissioning report includes:

- An evaluation of the operating condition of the systems at the time of functional test completion,
- Deficiencies that were discovered and the measures taken to correct them,
- Functional test procedures and results,
- Reports that document all commissioning field activities as they progressed, and
- A description and estimated schedule of required deferred testing.

LEED Documentation: LEED documentation will be compiled. Documentation will address the LEED section on “Energy and Atmosphere” prerequisite of “Fundamental Building Systems Commissioning” and the LEED section on “Best Practice Commissioning.”

5.17 Systems Manual

A Re-Commissioning Manual will be prepared which includes all information required to effectively maintain the building at optimal performance. The Re-Commissioning Manual will include, at a minimum, the following information:

- Final version of the Owner's project requirements and basis of design.
- As-built sequences of operations for all equipment as provided by the design professionals and contractors, including time-of-day schedules and schedule frequency, and detailed point listings with ranges and initial setpoints.
- Ongoing operation instructions for all energy- and water-saving features and strategies.
- Functional performance test results, blank test forms, and recommended schedule for ongoing benchmarking.
- Seasonal operational guidelines.
- Recommendations for re-calibration frequency of sensors and actuators by type and use.
- Single line diagrams of each commissioned system.
- Troubleshooting table for ongoing achievement of the owner's project requirements.

- Guidelines for continuous maintenance of the owner's project requirements (operational requirements) and basis of design (basis of operation).

5.18 Post Occupancy Review

Deferred Testing includes: Unforeseen Deferred Tests, Seasonal Testing, and End-of-Warranty Review.

Seasonal variation in operations or control strategies may require additional testing during peak cooling and heating seasons to verify system performance. During the warranty period, seasonal testing and other deferred testing is completed as required to fully test all sequences of operation. AEC coordinates this activity. Tests are executed and deficiencies corrected by the appropriate Subs, witnessed by facilities staff and AEC. All final adjustments to the O&M manuals and as-builts due to the testing are made.

AEC will request input from the owner's operations staff and occupants about the performance of the building systems. AEC also supports the GC's troubleshooting process during the warranty period. The GC's warranty team will first try and resolve the issues before requesting assistance from AEC.

6. Schedule

6.1 General Issues

The following sequential priorities are followed:

1. The scheduling of commissioning activities will be coordinated to coincide with the completion of HVAC systems. Commissioning activities that address the interaction between systems will occur upon completion of all HVAC related construction.
2. Equipment is not "temporarily" started (for heating or cooling), until pre-start checklist items and all manufacturers' pre-start procedures are completed and moisture, dust and other environmental and building integrity issues have been addressed.
3. Functional performance testing does not begin until pre-functional, start-up and TAB is completed for a given system.
4. The controls system and equipment it controls are not functionally tested until all points have been calibrated and pre-functional checklists are completed.

Appendix A: Mechanical Equipment Scoping Table

CX Status Report
20-Jun-08

Equipment Information				*Start-up / Testing status*					*O&M - Training*	
EQUIPMENT TAG	AREA SERVED	LOCATION	EQUIPMENT TYPE	START-UP	TAB	INITIAL TESTING	RE-TESTING	COMPLETE	O&M MANUALS	TRAINING
Built-Up AHU										
SF-1	Supply Fan	Penthouse	Vane Axial Pitch							
SF-2	Supply Fan	Penthouse	Vane Axial Pitch							
SF-3	Supply Fan	Penthouse	Vane Axial Pitch							
SF-4	Supply Fan	Penthouse	Vane Axial Pitch							
RF-1	Return Fan	Penthouse	Vane Axial Pitch							
RF-2	Return Fan	Penthouse	Vane Axial Pitch							
RF-3	Return Fan	Penthouse	Vane Axial Pitch							
RF-4	Return Fan	Penthouse	Vane Axial Pitch							
CC-1 thru CC-6	Cooling Coil	Penthouse	6-Row Coil							
CC-7 thru CC-12	Cooling Coil	Penthouse	6-Row Coil							
HC-1 thru HC-6	Heating Coil	Penthouse	1-Row Coil							
HC-7 thru HC-12	Heating Coil	Penthouse	1-Row Coil							
AM-1	Air Flow Monitoring Station	Penthouse	4 Inlet							
VAV and FPB										
VAV-1	2 thru 17 Flr Elevator Lobby	Ceiling	Cooling only							
VAVR-1	2 thru 17 Flr Restrooms	Ceiling	Cooling and heating							
FPB-3	2 thru 17 Flr Shell Space (4 per flr)	Ceiling	Parallel - electric heat							
SFPB-1	1st Flr Lobby (4)	2nd flr ceiling	Series - electric heat							
Hot Water System										
B-1	AHU Heating Water	Penthouse	Forced Draft							
B-2	AHU Heating Water	Penthouse	Forced Draft							
B-3	AHU Heating Water	Penthouse	Forced Draft							
B-4	1st Flr Tower 1 Hot Water	1st Flr Tower 1	Condensing							
BP-1	Boiler Pump	Penthouse	Base - End Suction							
BP-2	Boiler Pump	Penthouse	Base - End Suction							
BP-3	Boiler Pump	Penthouse	Base - End Suction							
BP-4	Building Hot Water	Penthouse	Base - End Suction							
BP-5	Building Hot Water	Penthouse	Base - End Suction							
BP-6	1st Flr Tower 1 Hot Water	1st Flr Tower 1	Base - End Suction							
GF-1	AHU Heating Water	Penthouse	Packaged							
Stairway and Hoistway Pressurization Fans										
SPF-1	West Stairway	Ground Level	Tubular Inline Cent.							
SPF-2	East Stairway	Ground Level	Tubular Inline Cent.							

Equipment Information				*Start-up / Testing status*					*O&M - Training*	
EQUIPMENT TAG	**AREA SERVED**	**LOCATION**	**EQUIPMENT TYPE**	**START-UP**	**TAB**	**INITIAL TESTING**	**RE-TESTING**	**COMPLETE**	**O&M MANUALS**	**TRAINING**
SPF-3	West Stairway	Penthouse	Tubular Inline Cent.							
SPF-4	East Stairway	Penthouse	Tubular Inline Cent.							
HPF-5	West High Rise Service Hoistway	Ground Level	Mixed Flow Inline							
HPF-6	East High Rise Elevator	Ground Level	Tubular Inline Cent.							
HPF-7	West Low Rise Elevator	Ground Level	Mixed Flow Inline							
HPF-8	East Low Rise Elevator	Ground Level	Mixed Flow Inline							
HPF-9	West High Rise Service Hoistway	Penthouse	Mixed Flow Inline							
HPF-10	East High Rise Elevator	Penthouse	Mixed Flow Inline							
Fans										
EF-1	Toilets	Penthouse Roof	Mixed Flow Upblast							
EF-2	Electric Rooms	Typical Flrs	Cabinet Fan							
EF-3	Eng Toilet	Penthouse								
EF-4	Mech Rm purge	Penthouse Roof	Roof Centrifugal							
EF-5	Ground Flr restrooms	Ground Flr	Inline Centrifugal							
EF-6	Ground Flr storage / loading	Ground Flr	Inline Centrifugal							
TF-7	Parking Level storage	Parking level	Inline Centrifugal							
EF-8	Parking Level Pump Room	Parking level	Cabinet Fan							
EF-9	Boiler Room	Penthouse Roof	Roof Centrifugal							
GEF-1	Garage Exhaust	Parking Level P1	Propeller							
GEF-2	Garage Exhaust	Parking Level P1	Propeller							
GEF-3	Garage Exhaust	Parking Level P1	Propeller							
GEF-4	Garage Exhaust	Parking Level P1	Propeller							
GEF-5	Garage Exhaust	Parking Level P1	Propeller							
GEF-6	Garage Exhaust	Parking Level P1	Propeller							
GSF-1	Garage Ventilation	Parking Level P1	Propeller							
GSF-2	Garage Ventilation	Parking Level P1	Propeller							
GSF-3	Garage Ventilation	Parking Level P1	Propeller							
GSF-4	Garage Ventilation	Parking Level P1	Propeller							
GSF-5	Garage Ventilation	Parking Level P1	Propeller							
GSF-6	Garage Ventilation	Parking Level P1	Propeller							
Electric Heaters - Cabinet, Unit and Baseboard										
ECUH-1	Parking Level P1 and Ground Flr Tower 1	same	Electric heater							
ECUH-2	Parking Level P1 and Ground Flr Tower 1	same	Electric heater							
EUH-1	Parking Level P1 and Ground Flr Tower 1	same	Electric heater							
BBH-1	Parking Level P1 and Ground Flr Tower 1	same	Electric heater							
BBH-2	Parking Level P1 and Ground Flr Tower 1	same	Electric heater							
BBH-3	Parking Level P1 and Ground Flr Tower 1	same	Electric heater							

Equipment Information				*Start-up / Testing status*					*O&M - Training*	
EQUIPMENT TAG	**AREA SERVED**	**LOCATION**	**EQUIPMENT TYPE**	**START-UP**	**TAB**	**INITIAL TESTING**	**RE-TESTING**	**COMPLETE**	**O&M MANUALS**	**TRAINING**
Chiller Water System										
CH-1	Chilled Water System	Penthouse	Centrifugal Chiller							
CH-2	Chilled Water System	Penthouse	Centrifugal Chiller							
CT-1	Condenser Water	Penthouse	2 Cell Induced Draft							
CDWP-1	Condenser Water	Penthouse	Base -Double Suction							
CDWP-2	Condenser Water	Penthouse	Base -Double Suction							
CDWP-3	Condenser Water	Penthouse	Base -Double Suction							
CDWP-4	Condenser Water	Penthouse	Base -Double Suction							
ACDWP-1	Auxilliary Condenser Water	Penthouse	Inline							
ACDWP-2	Auxilliary Condenser Water	Penthouse	Inline							
CHWP-1	Chilled Water	Penthouse	Base -Double Suction							
CHWP-2	Chilled Water	Penthouse	Base -Double Suction							
GF-1	Chilled Water System	Penthouse	Packaged							
SDF-1	Condenser Water	Penthouse	Sand Filter							
HX-1	Free Cooling	Penthouse	Plate & Frame							
HX-2	Tenant Loop	Penthouse	Plate & Frame							
RM-1	Refrigerant Monitoring	Penthouse	Gas monitor system							
Misc										
EHC-1	Service / Loading area	Ground Flr	Duct mntd electric coil							
HP-1	Mechanical Access	12th Flr	Heat Pump							
HP-2	Main Electric	Parking Lvl P1	Heat Pump							
AC-1	?	?	Split DX							
AC-2A and AC-2B	Mechanical	Penthouse	Split DX							
AC-3	?	?	Split DX							
Plumbing Equipment										
DWBP-1	Domestic water booster pump	Water Entry	Packaged-VFD							
ECH-1	Drinking fountains	above ceiling	Air cooled							
EWH-1	Restroom	Ground Flr	6 gallon							
EWH-2	Restrooms (typ-5)	Flrs 3,8,11,14,17	19 gallon							
IWH-1	Trash/Mech Rm	Ground Flr	Instantaneous							
SP-1,2	Sump Pump sand/oil sewage ejector	Parking P1	Packaged							
SP-3,4	Sump pump dewatering drainage	Parking P1	Packaged							

Appendix B: Jobsite Observation Report (Example)

MEMORANDUM
ARCHITECTURAL ENERGY
C O R P O R A T I O N

To: (General Contractor, Mechanical Contractor, Controls Contractor, TAB Contractor, Electrical Contractor)

From: Tom Hickey (AEC)

cc: (Design Team)

Date: Date of report

Subject: Jobsite Observation

General condition and progress of construction:

1. Observation:

   Action Item:

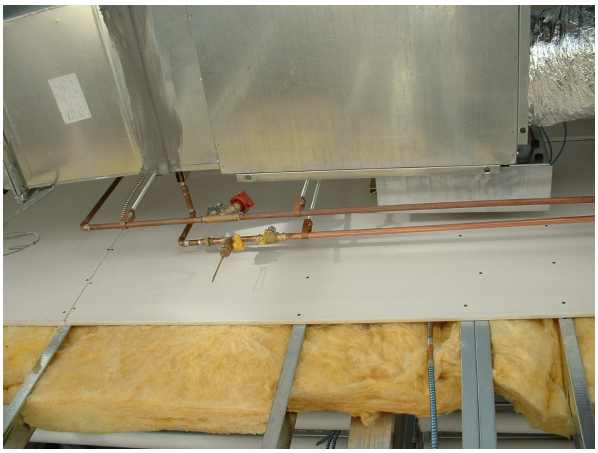

Figure X - Description

Tom Hickey, LEED AP

Commissioning Engineer

Corporate Office
2540 Frontier Avenue, Suite 201
Boulder, Colorado 80301 USA
Tel: (303) 444-4149 ■ Fax: (303) 444-4304
www.archenergy.com

San Francisco Office
142 Minna Street
San Francisco, California 94105 USA
Tel: (415) 957-1977 ■ Fax: (415) 957-1381
www.archenergy.com

Appendix C: Pre-Functional Checklist (Example)

Pre-functional Test Verification Form: Mechanical

Facility Name: Fitzsimons Facility Support Building

Equipment Name	*Location*	*Area Served*	*Drawing No*	*Manufacturer*	*Model No*
SA-01-001	Storage 116B	Dispatch 110, Police Training	M-101	York	XTI-42X57

General: To be filled out by installing contractor, and kept onsite during project. The checklist will be completed and turned in prior to Functional Performance Testing.

Instruction: Fill in Unit Information as as listed below, then check the appropriate box as as items are verified and deemed acceptable. Add comments if needed and explain any exceptions taken.

Installation Checks	***Contractor***			
	Yes	***No***	***N/A***	***Comment***
Electrical power complete (main, branch circuit breakers, etc.)	☐	☐	☐	
Permanent labels attached and documented (valves, AHU sections, drive set, etc.)	☐	☐	☐	
AHU sections, fan, coil, condensate ptrap and pan (installed per IOM manual) are clean, free of damage, drive set is aligned, belt tight, and all packing materials are removed.	☐	☐	☐	
Access doors installed and operable	☐	☐	☐	
Maintenance access OK (for filter changes, coil removal, etc.)	☐	☐	☐	
Duct system complete and pressure tested (test documented and attached) as required, joints sealed per specification and best practices	☐	☐	☐	
Correct valve types installed properly, system hydronic piping complete and pressure tested (test documented and attached) as required	☐	☐	☐	
Clearances per manufacturer's guidelines (outside air intake clearance from contaminants, service clearances, etc.)	☐	☐	☐	
Suspension Checked. Unit must be secure and level	☐	☐	☐	
Power disconnects installed, wired, and labeled	☐	☐	☐	
Control wiring and set up complete (see control pre-functional checklist)	☐	☐	☐	
System controls and/or layout (return duct sealed if necessary, etc.) set up to run initially with 100% outside air, 0% return air for flush out period per flushout plan.	☐	☐	☐	
VFD installed, labeled, wired, tested for proper phase balance, programmed (skip frequencies determined and programmed, etc.), document attached indicating VFD tested and started per VFD manufacturer's procedures.	☐	☐	☐	
Manufacturer's installation manual followed for installation and startup procedures	☐	☐	☐	
Copy of Filled out Manufacturer's procedures attached	☐	☐	☐	
Test Adjust and Balance Complete, with deficiencies corrected	☐	☐	☐	
Equipment signed as complete on CX FPT Readiness checklist (mechanical entry)	☐	☐	☐	

Notes _____

_____

_____

*****By signing, I have verified that the above equipment is installed per the manufacturer's instructions, and the design documents, and is ready for final testing by the commissioning agent.***

Signature** ***Date***

Mechanical Contractor _____ _____

General Contractor _____ _____

Pre-functional Test Verification Form: Control

Facility Name: Fitzsimons Facility Support Building

Equipment Name	*Location*	*Area Served*	*Drawing No*	*Manufacturer*	*Model No*
SA-01-001	Storage 116B	Dispatch 110, Police Training	M-101	York	XTI-42X57

General: To be filled out by installing contractor, and kept onsite during project. The checklist will be completed and turned in prior to Functional Performance Testing.

Instruction: Fill in Unit Information as as listed below, then check the appropriate box as as items are verified and deemed acceptable. Add comments if needed and explain any exceptions taken.

Installation Checks	***Contractor***			
	Yes	***No***	***N/A***	***Comment***
Safety interlocks wired and tested per design (smoke, freeze, etc.)	☐	☐	☐	
Correct valve types installed for actuators	☐	☐	☐	
Start/stop wiring complete with proper fail position for all actuators	☐	☐	☐	
Sensor wiring is complete with sensors in proper position to accurately measure the value in question	☐	☐	☐	
Copy of completed point to point checkout attached	☐	☐	☐	
DDC parameter setpoints per specification	☐	☐	☐	
Sequences of operation tested and a written copy of as-built sequences is on site	☐	☐	☐	
Actuators open and close off completely, leak-by inspection is complete on all valves and dampers and any leakage corrected	☐	☐	☐	
Sensors calibrated, calibration sheets attached and/or cal. equipment referenced	☐	☐	☐	
DDC control panel labeled and control as-built drawings are on site (preferably in or near the panel)	☐	☐	☐	
Graphics complete and installed	☐	☐	☐	
Trends enabled	☐	☐	☐	
Equipment signed as complete on CX FPT Readiness checklist (control entry)	☐	☐	☐	

Notes _____

_____

_____

*****By signing, I have verified that the above equipment is installed per the manufacturer's instructions, and the design documents, and is ready for final testing by the commissioning agent.***

Signature** ***Date***

Control Contractor _____ _____

General Contractor _____ _____

Appendix D: Functional Performance Test (Example)

Functional Performance Testing Procedure

System:	RTU - DX/Gas-Fired VFD with Relief Fan	
Title:	Rooftop unit serving underfloor system with Fan powered boxes(w/reheat) for perimeter zones	
Eqipment Tag:	RTU-2.01	
Participants:	**Name**	**Organization**
Date:		
_____		
Comments:	The second floor temperature is reading higher than it should be.	
Sequence:	Packaged Trane Intellipack with manufacturer provided control panel. BMS enables and disables unit for cooling or heating as specified by the space temperature sensor. DAT is reset to maintain Space setpoint and overriden to maintain a minimum space humidity setpoint and still mantain space setpoint. DAT setpoint is 65F. Supply fan is provided with a VFD for modulation to maintain underfloor space pressure to 0.05". Releif Fan is provided with a VFD for modulation to maintain space pressure setpoint of 0.05". A CO2 sensor mounted I nthe return ductwork modulates the O.A. damper to maintain a space CO2 level of 1000PPM.	

System:	RTU - DX/Gas-Fired VFD with Relief Fan	
Title:	Rooftop unit serving underfloor system with Fan powered boxes(w/reheat) for perimeter zones	
Eqipment Tag:	RTU-2.01	
Equipment Schedule		**RTU-2.01**
DAY	**DESIGN**	**ACTUAL**
Monday		8:30am-10pm
Tuesday		8:30am-10pm
Wednesday		8:30am-10pm
Thursday		8:30am-10pm
Friday		8:30am-7pm
Saturday		8:30am-7pm
Sunday		12pm-6pm
Holiday		

Functional Performance Testing Procedure

DDC Parameters	RTU-2.01
Record values for current setpoints, control parameters, limits, delays, lockouts,etc.and note any deviation from design.	
Parameter	**Value programmed in BAS**
Underfloor SP setpoint	0.05"
Space SP setpoint	0.04"
Area Space T setpoint	74 clg/71 htg
DAT setpoint	cascade reset from 60-75 (every 5 minutes)
CO2	1000PPM
Economizer Enable	63

Verify that sensor is installed and in an appropriate location. If calibration is in question, use a reference temperature or humidity sensor to test the following sensors. Place the reference sensor as close as possible to the tested sensor.

Sensor Location Checks		RTU-2.01
Sensor	**Actual Location**	**Notes**
CO2	**Return duct**	
SPP-1	**Underfloor**	
SPP-2	**Space**	
SD-1	**Return Plenum**	Smoke detector
FZ	**Cooling Coil**	Freezstat
DAT	**Discharge ductwork**	
H	**Humidistat**	

Actuator Stroke Checks			RTU-2.01	
Override each actuator from fully closed to fully open. Remove power and note fail position. Note excessive linkage slop and inadequate sealing.				
Component	**Fully Open**	**Fully Closed**	**Fail Position**	**Notes**

Status Check		RTU-2.01
Override control to each piece of equipment, note response.		
Component	**Responds?**	**Notes**

Functional Performance Test

System:	RTU - DX/Gas-Fired VFD with Relief Fan
Title:	Rooftop unit serving underfloor system with Fan powered boxes(w/reheat) for perimeter zones
Tag:	RTU-2.01

Pass	Fail	Event #	Description of Event Testing	Expected Results	Remarks
Occupied - Unoccupied - Morning Warm-up					
x x x		1A	***Enable Occupied Mode***	OA Damper goes to minimum position Supply Fan ramps up to maintain underfloor SP setpoint of (0.05") Cooling or Heating energizes to maintain DAT of 65.	when box fans are running the flr pressure can only get to about 0.01 with vfd's at 99%
X X X		1B	***Enable Un-Occupied Mode***	OA Damper closes Supply Fan shuts down Space Temp is reset to unoccupied setpoint	Unoccupied Htg setpoint=60 and clg=85
X X X		1C	***Enable Night Setback Mode***	OA Damper closes Space Temp is reset to night setback setpoint Supply Fan cycles on upon drop in night setback space temp	Unit goes into night setback mode from unoccupied mode when space temp drops below unoccupied setpoint
x x x		1D	***Enable Morning Warm-up***	OA damper closed, Cooling locked out Supply Fan shall ramp up to SP setting Heat shall energize fully to maintain 95 DAT until all spaces have reached the occupied setpoint. Once achieved unit goes into occupied mode.	
Pressure Control					
x		2A	***Overide underfloor static pressure sensor to 0.02"***	Supply fan VFD increases speed to achieve 0.05"SP setpoint	
x		2B	***Override underfloor static pressure sensor to 0.07"***	Supply fan VFD decreases speed to achieve 0.05"SP setpoint	
	x	2C	***Override all Fan boxes to energize***	Supply fan VFD maintains 0.05"SP setpoint	when box fans are running the flr pressure can only get to about 0.01 with vfd's at 99%
x		2D	***Override space static pressure sensor to 0.07" and then 0.03"***	Relief fan VFD shall modulate to maintain 0.05 setpoint.	space pressure has a 0.04 deadband

Functional Performance Test

System:	RTU - DX/Gas-Fired VFD with Relief Fan
Title:	Rooftop unit serving underfloor system with Fan powered boxes(w/reheat) for perimeter zones
Tag:	RTU-2.01

Pass	Fail	Event #	Description of Event Testing	Expected Results	Remarks
Temperature Control					
x		3A	***Override discharge air sensor to 70 degrees***	Compressors energize in stages to maintain setpoint	deadband at RTU was reset to 4 degrees. This is the unit's minimum cooling deadband.
x		3B	***Override discharge air sensor to 60 degrees***	Heater combustion blower starts on high speed. Pilot flame is lit, gas valve modulates to maintain setpoint.	
x		3C	***Override space temperature sensor to 78 degrees***	DAT resets thru PID loop to achieve space temp.	
x		3D	***Override space temperature sensor to 68 degrees***	DAT resets thru PID loop to achieve space temp.	
x		3E	***Override space humidistat sensor to 65%***	Humidity is maintained by overriding DAT reset to highest possible temperature	Reset DAT to 57 if RH gets to 60%
x		3F	***Override Outdoor air sensor to 63 degrees***	VCM module increases OA CFM for economizer operation. Consequently, space pressure increases and the relief fan ramps up.	Economizer is set at unit to be 65 degrees. If discharge gets below 55 it will go to minimum.
CO2 Control					
x		4A	***Override CO2 sensor to over 1000PPM***	VCM module increases OA CFM to lower CO2 levels.	min OA flow is 3000
Alarms					
x		5A	***Override DAT to 40 degrese***	Supply fan and releif fan denergize and the O.A. Damper closes	
x		5B	***Overide high static to 2.0"***	unit shuts down	

Appendix E: Deficiency Log (Example)

Issues Log

Facility Name: Northfield at Stapleton

Wednesday, January 10, 2007

No.	*Equipment*	*Description*	*Date Identified*	*Action Required*	*Expected Date Resolution*	*Responsibility*	*Notes*
37	J: EF-2	Fan does not turn on when T'stat is adjusted.	8/24/2006	Verify fan has power and is tied to the T'stat. Resolve any issues that arise.		MC	11/29/06: T'stat was bad. It has been replaced. AEC to verify.
33	M: EF-1	Backdraft damper does not open completely.	8/24/2006	Adjust damper so that it opens 100% when fan is enabled.		MC	11/29/06: Southwest states this has been corrected. AEC to verify.
32	M: RTU-1	During heating Mode the OA damper closes 100%. The OA damper must be balanced to 1400CFM during heating mode as stated in the schedule of the design documents.	8/24/2006	The unit must be provided with potentiometer to accomplish this design intent. Southwest to order and install necessary parts and balance OA CFM as designed. In Unoccupied mode and morning warm-up unit should be in full recirc.		MC	11/29/06: Potentiometer is installed. Southwest and MSI are coordinating with Manufacturer to accomplish 100% Recirc during unocc and morning warmup. Min OA damper position to be set by TAB. 1/2/07: Unit has been wired by MSI for Unocc mode, so that the OA damper closes during this event. TAB has set OA damper. AEC to Verify.
28	K: EF-3	Electric Room damper is open when fan is off.	8/24/2006	OA Damper is to be closed when exh fan is off.		MC	11/29/06: Southwest states this has been corrected. AEC to verify.
27	K: EF-2	T'stat or fan is wired backwards. With fan on, when temperature is set lower, the fan turns off.	8/24/2006	Re-wire so that the t'stat controls the fan on a rise in space temperature.		MC	11/29/06: T'stat was wired fo heating. Fixed, AEC to verify.
24	K: RTU-2	CO2 sensor is not installed.	8/24/2006	Install CO2 sensor and wire according to Spec-Aire wiring diagram. Start-up personnel to verify it's correct operation.		MC	11/29/06: Part has been ordered. Trane to install sensor and wire to unit. Unit preforms sequence thru packaged controls. AEC to verify when complete.