



HVAC COMMISSIONING

*Jim Snyder
U. S. Army Corps of Engineers
Fort Sill Resident Office
(580) 581-4115
James.E.Snyder@us.army.mil*

WHY HVAC COMMISSIONING?

- *Improve system performance*
- *Lower operating and maintenance costs*
- *Lower repair costs*
- *User comfort, safety & IAQ*
- *Owner quality verification*
- *Conforms with design intent*

TWO COMMISSIONING PATHS

1. MILCON Transformation

- *ASHRAE Guideline 1, “The HVAC Commissioning Process”*
- *ASHRAE Guideline 1.1 & 0*

2. Traditional MILCON

- *UFGS 230800*

TRANSFORMATION

- *Design-Build contract with standard Request For Proposals (RFP)*
- *Allow A/E more leeway in design*
- *Use standard construction guidelines and codes*
- *Corps of Engineers Unified Guide Specifications not required*
- *Reduce cost and time of construction*

TRANSFORMATION cont'd

- *Standard RFP requires:*
 1. *Test, Adjust and Balance*
 2. *Government Supervised PVT*
 3. *Commissioning*
 4. *Energy Conservation 30% below baseline building based on life cycle cost analysis*

MILCON TRANSFORMATION RFP

All HVAC systems and equipment including controls shall be commissioned in accordance with ASHRAE Guideline 1. The Commissioning Authority as described in Guideline 1 shall be hired by the General Contractor and shall be certified as a Commissioning Authority by AABC, NEBB, or TABB. The Contracting Officer's Representative will act as the Owner's representative in performance of duties spelled out under OWNER in Annex A2 of ASHRAE Guideline 1.

MILCON TRANSFORMATION RFP

Commission all HVAC systems and equipment including controls and all systems requiring commissioning for LEED Fundamental commissioning, in accordance with ASHRAE Guideline 1.1, ASHRAE Guideline 0 and LEED. Do not use the sampling techniques discussed in ASHRAE Guideline 1.1 and 0. Commission 100% of the HVAC controls and equipment. The Contractor shall hire the Commissioning Authority (CA), Certified as a CA by AABC, NEBB, or TABB, as described in Guideline 1.1. The CA will be an independent contractor and not an employee or subcontractor of the Contractor or any other subcontractor on this project, including the design professionals (i.e., the DOR or their firm (s)). The Contracting Officer's Representative will act as the Owner's representative in performance of duties spelled out under OWNER in Annex F of ASHRAE Guideline 0.

WHEN TO IMPLEMENT?

- *ASHRAE Guideline 1 and 0 recommends early in the program phase, and provides general information required in the full commissioning process from program phase to post-acceptance.*
- *Design-build contractor team should identify commissioning authority in their proposal.*

COMMISSIONING GOAL

- *ASHRAE Guideline 1 Goal: A fully functional, fine-tuned HVAC system with complete documentation and an adequately trained operating and maintenance staff.*
- *Guideline 1.1: The Commissioning Process is a quality-oriented process for achieving, verifying, and documenting that the performance of facilities, systems, and assemblies meets defined objectives and criteria.*

Government's GOAL

- *Meet ASHRAE Guideline's 1 goal and no customer comments that we are turning over a building that the HVAC system does not work.*
- *Personal Priorities*
 1. *Occupants are comfortable*
 2. *System operates in most energy efficient manner*
 3. *Cost as low as possible (taxpayer)*

CONSTRUCTION PROBLEMS

- *Commissioning Schedule & Cost*
- *Design deficiencies*
- *Construction deficiencies*
- *Product quality*
- *HVAC controls operation*
- *Energy*

Cx Schedule & Cost

- *From start of TAB to completion of Functional Performance test 6-12 wks*
- *Normally takes significantly longer mainly due to Contractor's not performing start-up testing correctly or not at all*
- *Do not use the Performance Verification and Functional Performance tests to find problems*
- *Cost is usually 3-5% of the Mechanical Contractors bid*

Design Deficiencies

- *COE is no longer doing thorough 100% design reviews of Design-Build Projects*
- *A/E's are not using COE standard designs and are making control sequences of operation extremely complicated*
- *“Fast track” design is causing an enormous increase in design errors on projects. In some cases it has become Build-Design project*
- *Quality Control of the Design Documents has been reduced by A/E firms due to time constraints*

Product Quality

- *Quality Control at factories has decreased with the recession*
- *Motors being wound with little or no QC*
- *One pump manufacturer would not back efficiency ratings on their product sheets*
- *Brand new products out of the box are failing more frequently. Examples: Control valves, freeze stats, and controllers*

HVAC Control operation

- *The most important thing to do is the Performance Verification Test (PVT)*
- *Standard RFP states, “The Contractor shall perform a PVT under Government supervision prior to system acceptance. During the PVT the Contractor shall demonstrate that the system performs as specified, including but not limited to demonstrating that the system is Open and correctly performs the Sequences of Operation”*

HVAC Control operation cont'd

- *The PVT procedure must be a step-by-step procedure with expected outcomes*
- *Do a single point calibration test of all transmitters*
- *Test every sequence of operation on every control system*
- *Prior to start of PVT, controls contractor needs to perform the same test as his start-up test to ensure everything performs per the Contract Documents*

ENERGY

- *RFP requires systems to achieve an energy consumption that is at least 30% below the consumption of a baseline building meeting the minimum requirements of ASHRAE 90.1-2004*
- *RFP requires purchase of Energy Star products*
- *RFP requires building envelope sealing performance to be tested to achieve less than .25 cfm leakage per square foot of envelope at 0.3 “ w.g. pressure*
- *RFP requires infrared thermography be performed on entire building*
- *RFP requires deep dehumidification through DOAU's that provide 24-7 ventilation air with 48 deg. F. dewpoint*

PROGRAM PHASE

- *Contractor proposal should include identification of the commissioning authority and provide a preliminary commissioning plan*

PRELIMINARY COMMISSIONING PLAN

- *Initial Design Intent*
- *Time required for completion*
- *List of inspections to be made*
- *List of systems to be tested*

DESIGN PHASE

- *Document the design intent as it evolves*
- *Continue to develop Commissioning Plan*
- *Develop Commissioning Specification*
- *Prepare Contract Drawings*
- *Coordinate equipment layout*
- *Contractor's that have CA on board during design phase finish projects on time with less design errors*

CONSTRUCTION PHASE

- *Procedures*
 - *Submittal review*
 - *Detailed Commissioning Plan*
 - *Create specific procedures and checklists*
 - *Inspections*
 - *Use the CA as an additional set of eyes to look at HVAC systems which will reduce problems at end of project*

CONSTRUCTION PHASE

- *Commissioning Plan*
 - *Detail schedule of inspections*
 - *Develop schedule for verification and FPT*
 - *Define process for reporting and correcting deficiencies*
 - *Detailed training sessions (training needs to be improved including video taping)*

ACCEPTANCE PHASE

■ *OBJECTIVES*

- *Verify accuracy of TAB report*
- *Verify HVAC control system complies with contract*
- *Provide As-Builts*
- *Complete commissioning Report*
- *Complete systems manual*
- *Turn over building to owner*

ACCEPTANCE PHASE

- *Verification*
 - *Demonstrate the function of the automatic control system and accuracy of TAB report*
- *Functional Performance Testing*
 - *Measured capacities, effectiveness of operation and all control functions*
 - *Documentation should include all performance data for the entire HVAC system for each mode of operation*

ACCEPTANCE PHASE

- *Functional Performance Testing*
 - *Should progress from individual components to the building systems*
 - *Extended tests shall be in accordance with contract documents and commissioning plan*
 - *Simulations may be required*
 - *Performance tests may be done at part load conditions if full load cannot be achieved*

ACCEPTANCE PHASE

- *Documentation*

- *Verification checklist data sheets*
- *Verification report*
- *Certification of readiness*
- *Functional performance test data records*
- *System operation description and final design intent*
- *Commissioning Report*

ACCEPTANCE PHASE

- *Final Acceptance*
 - *Commissioning report*
 - *HVAC system completed in accordance with contract documents and performing in accordance with final design intent document*
 - *Identify any variances*
 - *Used to evaluate system and serve as a future reference document during operation*
 - *May include recommendation for acceptance or rejection of the HVAC system*
 - *Submitted to owner*