

Charting a Course to Energy Independence

Providence, RI
August 9-12, 2009

Existing Building Commissioning
Ed St.Germain - EMR





Existing Building Commissioning



What's the Difference?
Why Do It?
What's the Process?
Well.... Show Me!

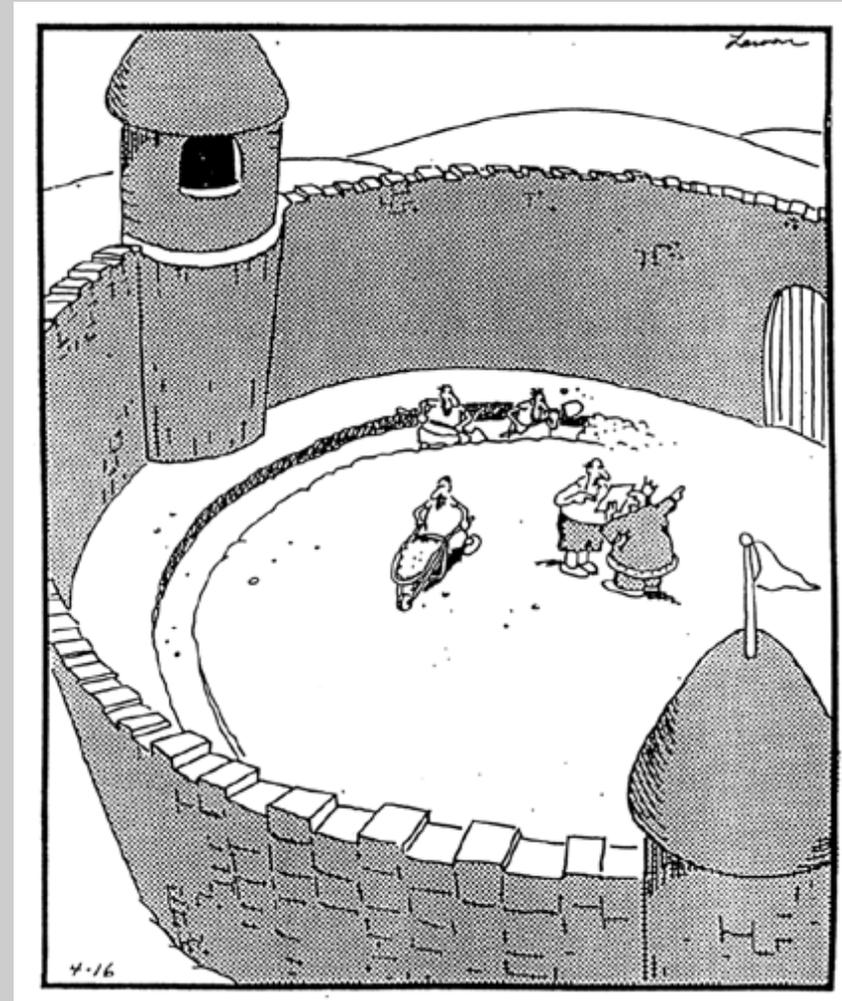


Existing Building Commissioning

What's the Difference?

- **New Building Commissioning**
 - Building systems perform interactively per design intent and Owner's operational needs.

“Suddenly, a heated exchange took place between the king and the moat contractor.”





Existing Building Commissioning

- **Retro-Commissioning**
 - Existing building, never commissioned
 - To improve and optimize building performance
 - Focus on energy-consuming equipment, envelope
- **Recommissioning/Continuous Commissioning**
 - Existing building, previously commissioned
 - To improve efficiency and address new issues
 - Focuses on HVAC&R, electrical, controls, & changes
 - Difference is degree of persistence



Existing Building Commissioning

- Main intent is to improve and optimize how building systems operate... NOT to keep old, inefficient equipment limping along
- Probably NOT appropriate where...
 - Most of the systems are outdated or at the end of their useful lives
 - Major system design problems exist
 - Major equipment malfunctions persist and best remedy is equipment replacement



Existing Building Commissioning

Why Do It? Most Common Reasons:

- Addresses gap between building that does not work and over-burdened M&E staff (i.e., corrects root cause, not symptom)
- Inadequate work environment
- Indoor air quality issues
- Mold
- Energy costs too high compared to others
- Equipment & systems sustaining damage over long term
- Pre-requisite for LEED-EB
- Required by EISA 432 (f)(3)(B)



Existing Building Commissioning

“All involved need to realize that theirs is not a fault-finding mission. Rather, it is to work collectively to optimize and improve the building’s efficiency and working conditions.”

The Process:

Planning Phase

- Identify objectives & scope
- Decide on equipment & systems
- Determine retro-Cx team
- Develop retro-Cx plan
- Collect data





Existing Building Commissioning

Discovery Phase

- Document review
- Personnel interviews
- Site assessment
- Diagnostic monitoring & testing
- Master list of deficiencies & improvements



“Control systems have become so sophisticated that few end users really understand fully how to use them to optimize system performance. Often, they are not programmed or calibrated correctly on the front end, and maintenance professionals bypass them completely to address exigencies.”



Existing Building Commissioning

“It is far easier and less expensive to maintain a building that operates correctly than to maintain one that does not.”

Corrective Phase

- Cost-effective opportunities are selected
- Prioritize:
 - (1) Cost effectiveness
 - (2) Criticality
 - (3) Meeting objectives
- Implement No/Low cost right away





Existing Building Commissioning

Hand-Off Phase

- Monitoring & Verification (sets benchmark)
- Update building documentation
- Provide staff training and documentation on how to sustain proper and/or improved operation.
- Final retro-commissioning report

“Over the span of a few years, it is highly likely that the building systems have been modified. While modifying systems is not a problem in itself, the lack of documentation can be.”



Existing Building Commissioning

Best Practices

- Keep the retro-commissioning scope focused on the facility's mission
- Concentrate only on the essentials
- Collect only important and especially useful information
- Link the retro-Cx to the operating & business objectives (i.e., link to monetary indices through energy savings, improved maintenance, improved productivity, occupant satisfaction)
- Document (!!!!) to support future commissioning efforts



Existing Building Commissioning

DOD Commissary

- Constructed as commissary with warehouse 1979
- Modernized & expanded 1996
- 128,062 gsf
- Appearance attractive, good condition
- Steady increase in energy use 2004 to date





Existing Building Commissioning

Commissary Retro-Cx Procedures

- Site filled out a detailed pre-screening survey
- Store management, engineers, maintenance techs interviewed together and individually
 - Recurring problems
 - Occupant Concerns
 - Indoor Air Quality & Lighting Issues
 - Utility Procedures and Issues
 - Issues of importance to Store Director



Existing Building Commissioning

Results of Interview:

- HVAC hot and cold spots
- Humidity
- Too many self-contained refrigeration units put out too much heat & drip condensate on floor
- Mold problems



Existing Building Commissioning

Commissary Retro-Cx Procedures

- Reviewed maintenance procedures
- Reviewed prior energy audits (one N/A)
- Reviewed energy conservation measures in place
- Reviewed 2 years of energy invoices and developed an energy use profile
- Cx team (including TAB) conducted unit by unit evaluation of mechanical equipment (including forgotten rooftop exhaust fans and others)



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Commissary Retro-Cx Procedures

- Looked at maintenance records specific to unit
- Looked at sequences of operations and controls
- TAB Looked at
 - Motor amps
 - Supply, return, outside air volumes
 - Actual static pressures – total and external
 - Motors, pulleys, shafts, and belts



Existing Building Commissioning

Commissary Retro-Cx Major Findings

1-Major AHU serving front of store runs continuously & near max capacity

- 18% leakage from penetrations and disconnects in ducts
- Significant leaks at joints
- Removed and missing Insulation
- Mold and corrosion
- Improper duct transition creating significant back pressure
- Pneumatic controls are disabled
- Unit is poorly maintained
- Heating coil is improperly designed and misplaced in duct



Existing Building Commissioning

Commissary Retro-Cx Major Findings

2- Major AHU Serving Retail Store De-Humidification

- 15% leakage due to penetrations and disconnects in ducts
- Has digital controls and energy efficient motors but needs VSD and cogged belts
- Emergency disconnect is code violation (hidden, out of sight)
- Unit is poorly maintained
- Air intake grate is severely damaged and allows foreign objects (and body parts) to be sucked into fan unit
- Rear of unit is severely distorted – likely due to extraordinary pressure experience in the past



Existing Building Commissioning

Commissary Retro-Cx Major Findings

3-Major AHU Serving Back of Store

- 17% leakage due to detached, missing, and ripped flex conduit (detached was reattached by inspector)
- Unit is dirty with indications of mold, chemical buildup, and corrosion
- Belts are too loose
- Evident that belt is being “pried on” without loosening motor and properly tensioning (affects alignment and bearings)



Existing Building Commissioning

Commissary Retro-Cx Major Findings

4 – Rooftop Units (RTUs) Serving Mezzanine

- Outside air intakes are blocked off with metal plate – Area served is not getting fresh air
- No dampers to adjust air flows
- VSDs are running at max RPM
- Outlet installations vary from drawings
- Nameplates are painted over and undecipherable
- Belts are loose to point of being ineffective, worn, cracked (on-the-spot belt replacement was made)



Existing Building Commissioning

Commissary Retro-Cx Major Findings

5 – Exhaust Fans

- 12 of 32 EFs (38%) do not work or are abandoned in place
- 3 EFs on drawings never installed & cannot be found
- 1 EF totally missing flex duct connection

(These 16 fans are virtually non-existent)

- Operating fans' inlets are dirty to point of affecting airflow
- New EF needs grease filter and is filthy
- Every rooftop EF nameplate is painted over and undecipherable



Existing Building Commissioning

Commissary Retro-Cx Major Findings

6 – Refrigerator Compressor Rack

- Unit is overcooling – evident from icing of header and piping (Check settings, malfunctioning hot gas bypass, other defect)



1. All refrigeration compressors are R-22 units; R-22 may be inefficient for freezer units.
2. Low temperature rack #2 (shown) and remote condensing unit #8 are overcooling based on icing header and piping – serves frozen foods and the bakery freezer and display case, respectively.



Existing Building Commissioning

Commissary Retro-Cx Major Findings

7 – Rooftop Condensers

- Oversized for their application & short cycling due to low load
- Extremely high wear pattern on two units that cycle ON/OFF constantly (30 sec on/45 sec off)
- Little wear on units that rarely engage
 - (Consider splitting condenser by 3-way valves and install VSD on each condenser rack)
 - (Consider reevaluating refrigeration requirements and rack capacities for consolidation)



Existing Building Commissioning

Commissary Retro-Cx Major Findings

8 – Compressor for Pneumatic Controls

- Immediately identified to store director as a severe safety hazard
- Bad bearing about to fail
- Badly worn belt
- No belt guard



NOTE – Indeed during period of inspection, compressor broke down due to bad bearing, deactivating all pneumatic controls in the store !

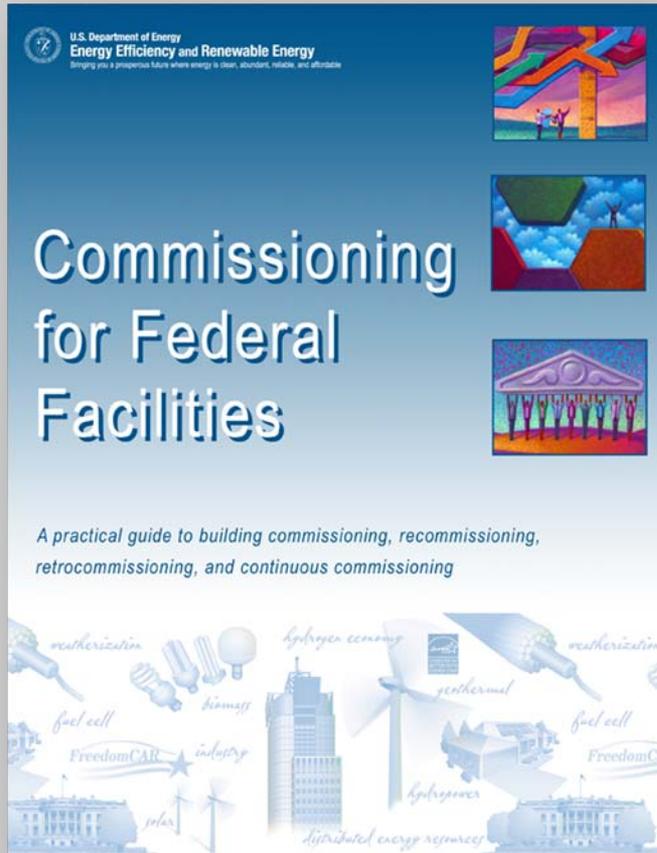


Existing Building Commissioning

	Why?	Who?	When?	How?
Commissioning	Ensure that the building and its systems and equipment operate as designed	Independent CxA hired by the Owner or the project Construction Manager	Once, during new construction or renovation	Verification and functional performance testing
Retrocommissioning	Identify and correct problems and optimize performance	Facility O&M staff or independent CxA	Once, in response to specific problems or to establish a commissioning program	Diagnostic monitoring and functional performance testing
Recommissioning	Ensure that the building, its systems, and equipment continue to operate as designed, or meet current operating needs	Facility O&M staff or independent CxA	Periodically as the building ages, or ongoing as part of the facility O&M program	Functional performance testing
Continuous Commissioning	Identify and correct problems and optimize performance	Facility O&M staff or independent CxA	Ongoing as part of the facility O&M program	Data monitoring and trending

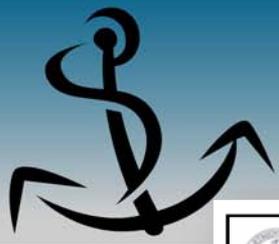


Existing Building Commissioning



Commissioning for Federal Facilities – A Practical Guide to Building Commissioning, Re-Commissioning, Retro-Commissioning, and Continuous Commissioning

<http://www1.eere.energy.gov/femp/information/publications.html#om>



Existing Building Commissioning



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Energy Efficiency and Renewable Energy *Bringing you a prosperous future where energy is clean, abundant, reliable, and affordable*

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Commissioning E-Course

Welcome



The purpose of this guide is to provide you, the Operations and Maintenance (O&M)/Energy manager and practitioner, with useful information about O&M management, technologies, energy efficiency, and cost-reduction approaches. To make this guide useful and to reflect your needs and concerns, the authors met with O&M and Energy managers via Federal Energy Management Program (FEMP) workshops. In addition, the authors conducted extensive literature searches and contacted numerous vendors and industry experts. The information and case studies that appear in this guide resulted from these activities.

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Content Last Updated: 7/31/2009

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