Retrocommissioning: Squeezing the Best from What Exists

Learn what retrocommissioning is, how to apply it to existing buildings and the processes that need to be continued after a project is complete.

BY TOM MEYER

All images courtesy of National Environmental Balancing Bureau.

Commissioning is more than system startup just prior to building occupancy. According to ASHRAE Guideline 0, The Commissioning Process, “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.”

“Performance,” for these purposes, includes all aspects of building performance—reliability, operation and energy costs, comfort, and the like. Building performance is dependent upon four legs of the building stool. Take one leg away and the building will be unstable.

There are different types of commissioning: new construction commissioning, retrocommissioning, ongoing or continuous commissioning, process commissioning, and technical commissioning. New construction commissioning, retrocommissioning, and ongoing or continuous commissioning are determined by when the commissioning is done during the life cycle of the building. Technical and process commissioning describe approaches toward retrocommissioning.

All forms of commissioning share the same goals: to produce a building meeting the unique needs of its owners and occupants; to operate as efficiently as possible, while providing a safe, comfortable work environment; and to be operated and maintained by a well-trained staff or service contractor.

Retrocommissioning, or RCx, is the systematic process by which systems are tested and optimized to perform interactively to meet the current operational needs of the owner. One distinction between commissioning and retrocommissioning is the guiding document. In new construction commissioning, it is the Owner’s Performance Requirements. The OPR lays out the owner’s vision. Retrocommissioning looks at the current functional requirements—simply what the building owner needs for it to do now.

Why is RCx important?
For the last few years, the HVAC business has changed—new construction has waned; existing buildings are used to meet current needs; maintenance and capital improvements have been deferred; and user awareness and demands have changed. What led to this situation and what it means in the long term could fill several bookshelves. Regardless, RCx has taken a more significant role as a result of these circumstances. RCx makes what already exists work better. It helps keep what exists working at the best possible level considering the facilities, equipment use and users.

Some reasons to retrocommission are: user discomfort; accurate “as-builts;” optimization of existing systems; components that read accurately; and identifying change of use from original design.

The RCx professional should not guarantee performance or savings because there is no assurance the building will be maintained or operated properly. For example, if an RCx professional guarantees a 20% drop in energy costs over the next three years (ROI), and the building operators go back to bad habits like deferring maintenance and bypassing controls, it is doubtful the expected energy savings will be realized. Experienced RCx professionals know from experience who will be “blamed” for this failure to realize the expected savings. The good ones are reluctant to make promises they cannot keep because they have no control once the RCx is complete.

RCx professionals are hired to make the building work because it does not work. Most buildings are not working correctly when they are turned over to the owner, and there are many reasons as to why: uncoordinated trades; systems seen
This table illustrates the percentage of buildings in existence that were built during specific time periods. Majority of buildings today were built between 1960 and 1999—a lot of potential for retrocommissioning projects.

### Commercial Buildings

<table>
<thead>
<tr>
<th>Year Built</th>
<th>% of Building Stock Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>1960 to 1999</td>
<td>66%</td>
</tr>
<tr>
<td>2000 to 2003</td>
<td>9%</td>
</tr>
<tr>
<td>2004 to 2010</td>
<td>7%</td>
</tr>
</tbody>
</table>

Taken from DOE 2010 data

as isolated rather than integrated; the building not properly commissioned prior to initial occupancy; or the building not properly maintained since occupancy. Possibly the answer lies deeper. It may be because construction is driven by schedule and costs, not performance.

There is an old saying, “It’s not going to look any better than it does today.” Unfortunately, that rings true for buildings as well. Most building owners do not measure performance, so performance does not improve. Since performance is not measured, operators are not held accountable for their performance.

### The RCx process

Arguably, the most important part of RCx is finding the best RCx provider. The secret: write an appropriate specification to help select the appropriately trained, experienced, educated and credentialed RCx professional. Once goals are identified and the team is selected, onto the RCx process. The

---

Presenting NEO™, the everywhere you need ice machine.

By providing increased levels in performance, intelligence and convenience, Manitowoc's new ice machine offers an all-in-one solution to your undercounter ice cube needs.

Thirsty for more? Talk with Manitowoc® ice.

1-920-682-0161 | ManitowocIce.com/NEO
Retrocommissioning is not a linear process. Although it may seem like once a phase is complete, it need not be repeated again, in reality, RCx is a cyclical process.

phases of an RCx project as listed in the NEBB Procedural Standards for Retro-Commissioning, include: Planning Phase; Investigation Phase; Corrective Action Phase; and Performance Verification Phase.

It is important to understand RCx is not a linear process. It may seem once a phase is complete, the activity or phase need not be repeated again. The nature of RCx is exactly the opposite. There will be times when the discovery of a problem in one area will require the RCx team to return to a previous activity and start the investigative process again.

Initially, the owner and the RCx professional survey the facility to determine the extent and purpose of the project. This survey should always include walking the facility. An experienced RCx professional will find this invaluable pointing out “low-hanging fruit” as they go through the facility. The walk-through also gives the RCx professional a sense of the building.

During the Investigation Phase, among other things, the RCx professional:

- Creates an RCx plan;
- Reviews existing documents;
- Reviews maintenance-management work orders;
- Performs management, operator and occupant interviews;
- Reviews current use and any change of use from design or last commissioning; and
- Performs an ASHRAE Level II energy audit.

This may be a good time to talk about energy audits. First, energy audits are an essential tool of a true retrocommissioning. Unfortunately, some people are selling energy audits incorrectly claiming them as such. ASHRAE describes three levels of energy audits: Level I–Basic Evaluation; Level II–Diagnostic Measurement; and Level III–Advanced Analysis.

NEBB recommends an ASHRAE Level II energy audit as part of a proper retrocommissioning. Defining characteristics of Level II include: a Level I energy audit; a more detailed building survey; breakdown of energy use (including sub-metering); savings and cost analysis of all energy conservation measures (ECM); and identification of ECM requiring elevation to a Level III energy audit.

As issues are discovered, the RCx professional analyzes each issue with associated causes and impacts. The key is to treat the building as a single system composed of many integrated subsystems. With this in mind, the RCx professional analyzes interaction between systems. An issue report is created to include a description of the issue, recommended corrective action, estimated costs, and a general estimated savings, payback and ROI. This is where the low-cost/no-cost corrections are underscored. It is notable the number of simple fixes that significantly improve building performance.

Once the issue report is generated, the owner decides which corrective actions need to be implemented and when. These actions could include a contract for remedial design, procure contractors or equipment, or to perform corrective construction. Significant, although obvious, is a clear understanding that if the owner does not do anything with the list, there is no improvement to the building performance.

Once the actions from the issue report are complete, building owners and users rate building performance and, indirectly, the effectiveness of the retrocommissioning. This “report card” includes comfort and costs. Comfort is extremely difficult to measure. Comfort is like a clean kitchen—no one notices until it is not clean or comfortable. Comfort may be described as “a lack of discomfort.” More measurable are costs—energy costs, maintenance costs and system reliability.

For RCx to be successful, beyond doing the corrective actions, measures must be in place to prevent the same thing from happening again. Building owners, maintenance teams, and users have good and bad habits. Here is a list of habits that impact building performance.

**Bad habits**

- Disable schedule to get the space to temperature in the morning;
- Disable or override setpoint reset to make it colder or hotter;
- Override any automatic setpoint reset;
- Override control point output with manual switch; and
- Allow deferred maintenance items to exist.

**Good habits**

- Find the cause and fix it instead of reacting to the symptom;
- Document any temporary measures taken and change them back as soon as the issue is resolved; and
- Measure performance often.

Measuring performance in building energy consumption can include comparing data to baselines using the building’s past performance or to comparable buildings using Energy Star or Commercial Building Energy Consumption Survey. Having the information is not enough. It has to go where it
HeatMaster®

“The Motor They All Copied”

Why settle for second best? Every HeatMaster motor is built with loads of contractor friendly features that result in fewer call backs and reduced truck stocking cost.

- UL and CSA approved Class F insulation for 70°C maximum ambient conditions provides longer motor life.
- UL approved high temperature thermal overload protectors are used to reduce nuisance trip outs.
- Ultra high torque designs mean that HeatMaster motors will work in even the toughest applications.
- HeatMaster motors are designed for easy installation with extra mounting fasteners and many other contractor friendly features...

Stephen Jones, a wholesaler from Houston, Texas, says: “Go to the head of the class Century! HeatMaster not only reduces wholesaler sku’s it also helps the contractor reduce the inventory investment of each company’s service truck. First to the market with great products, leaders in the HVAC industry with innovative ideas.”

For more information on HeatMaster replacement motors, visit our website and download bulletin #6001D and #6025A at:
www.centuryelectricmotor.com