Technical Commissioning Delivers a Functional Building

There are two basic approaches to the work of Building Commissioning:

1 Technical Approach ✓

Commissioning Agent (along with Cx technicians from the Cx firm) conducts all commission work on-site.

2 Process Approach ✗

Commissiong Agent MAY witness checks and tests or may just compile results. Contractors are responsible for performing commissioning checks and tests of their own work.

At Cooper Commissioning, we strongly recommend the technical commissioning approach over the process approach. To understand why, one does have to get into the details a bit!

COST:

It may be the case that the fee you see for a process approach is lower than a technical approach. However, if the process Cx approach is taken, several other contractors will need to increase their fees to account for the Cx burden placed on them.

✓ **Technical Approach** – Cx Agent performs all Cx work. Contractors only address deficiencies, at no additional cost to the Owner.

✗ **Process Approach** – all involved contractors must account for time to complete the Cx work. This results in 4 to 6 contractors (MEP, TAB, TC, Cx) charging the Owner for Cx time, making the real cost of the process approach much higher than only the Cx Provider's fee. In addition, a process approach misses issues that will need to be addressed later, further increasing its true cost.

Abbreviations used:
Cx = Commissioning
MEP: Mechanical, Electrical, Plumbing
CCx = Our firm, Cooper Commissioning
TAB: Testing, Adjusting, and Balancing

Technical ✓ Cx Approach as done by Cooper Commissioning	Process ✗ Cx Approach – does it offer the same service?
Independent 3rd -party Cx Agent with no affiliation to any other firm in the construction industry.	Possibly – many Design and Engineering firms have their own Cx division.
Experienced Cx Agent. At CCx our Owner and your Cx Agent is Andy Cooper with 18 years full-time Cx experience.	Possibly – if part of a design or engineering firm we find it is often a single employee whose role isn't solely Cx work.
Cx Agent/Specialist Writes all Prefunctional Checks, Functional Tests, & Integrated Tests. These are customized to each individual project with additional information gathered from contractors and the design team as needed.	Typically, yes - The writing of project specific prefunctional checks, functional tests, and integrated tests still largely remains under the Cx Agent's scope. However, if the Cx Provider is a part-time division within another company, they may lack experience in writing these documents and may defer a portion of this to the division contractors.
Cx Agent spends significant time on the job site during all phases of construction for observations, trouble-shooting, checks, tests, and re-tests.	No – [1]The Cx Agent will not spend as much time on-site under a process approach. They may spot-check completed commissioning check sheets from the Contractors. Sampling/spot checking rates can vary widely.
Cx Checks, Tests, and Re-tests can be performed efficiently because only the Cx Agent (and their in-house technicians(s)) need to be onsite for testing.	Possibly – [2]Depending on whether the Cx Agent is present for all testing is dependent on the Cx Agent's discretion. If the Cx Agent is not present for testing, that often leads to a situation where contractors test their equipment individually and a coordinated testing of equipment interactions and integrations is not performed. Between coordinating schedules and siloed testing, significant issues can potentially go unnoticed.
Cx Agent/Specialist performs all Prefunctional Checks.	No – this is left to the contractors.
Cx Agent performs all Functional Tests.	Possibly – see above[1,2]
Cx Agent performs all Integrated Tests.	Possibly – see above[1,2]
Cx Agent re-tests deficiencies to ensure they are corrected.	Possibly – Again, depending on how much involvement the Cx Agent has will vary between what is specified and the Cx Provider.
Cx Agent tracks issues to resolution so that the Owner has few if any issues to address after Cx is complete. Cx Agent communicated with contractors(s) responsible to see issues are resolved.	Possibly – often a report is produced, including an outstanding issues log, and it is up to the Owner/facilities staff to track issues to resolution.
Contractors are required to correct Cx-identified deficiencies at no additional cost to Owner.	Possibly – depending on the how the specifications are written, the Owner may be billed for time.

Easy Fixes: Common Items Requiring Contractor Remediation with Retesting by CCx

Selected checks/tests	Examples of issues routinely discovered by CCx
Prefunctional Checks:	
Physical condition of equipment.	Incorrect mounting, vibration control not installed, inadequate service clearance, damaged equipment/filters.
Installation of adjacent piping and ductwork.	Insufficient insulation, incorrect valves/dampers installed, missing valves/dampers/testing ports, inadequate clearance for TAB.
Visual check of control devices.	Wiring not complete, control device mounted in a way that will impede function (incorrect location or orientation).
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Functional Verifications:	
BAS Graphic Accuracy	Missing graphics, missing points, thermostats mis-mapped.
Sensor Accuracy	Missing sensors, inaccurate/malfunctioning sensors.
Valve and Damper Function	Valves/dampers that won't open/close completely, valves/dampers wired backwards.
Integrated Functional Testing:	
Alarms and Safeties	Alarms not generated as required in sequences, alarms not pushed through to main screen and/or not logged.
Enable/Disable (based on): OAT, Schedule, Sensor Input, and/or Occupancy	Manual overrides affecting system performance, equipment fails to follow schedule/mode as programmed. Trending not set up to record data as required.
Temperature and Humidity Control	False loading (hot or cold) resulting in overly cooled or heated spaces, dehumidification modes not activating, units not modulating as required in sequences.
Fan Speed Control	Unit not following sequences as required (sensor or programming issue), supply and exhaust fans not coordinated as required.
Building and Zone Pressure Control	Building/zone/room severely over/under pressurized due to sensor or programming issues.
Energy Recovery	Building/zone/room severely over/under pressurized due to sensor or programming issues.
Space CO2 controly	Units not responding to increased CO2 levels due to sensor or programming issues.

Not-So-Easy Fixes: Complex Problems Requiring Input from Multiple Parties.

General Case:

Complex Issue Identified (usually during our functional testing). Often there is some disagreement among the contractors about who is responsible for addressing an issue.

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Andy communicates individually with all involved contractors, Design Team, and Owner to determine if convening a meeting with all parties and/or further testing with relevant contractors on-site is needed.

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Andy convenes and facilitates meeting(s) to gather input from all parties and record the decision-making process. This can involve the design team approving changes with Andy reminding the design team that any reduction in equipment, monitoring, or performance should come with an appropriate cost-reduction for the Owner.

This step can also involve additional testing to identify defective manufacturing. Manufacturers aren't keen to replace defective equipment without detailed documentation of rigorous testing that completely eliminates any other source of system problems.

Possible ***consequences of not fully addressing complicated issues*** during construction, acceptance, and warranty phases:

- Owner and Occupant frustration.
- Cost to repeatedly call contractors back to the site if past warranty period.
- Damage, potentially major, to the newly finished building.
- New spaces and/or equipment being entirely unusable.

Recent Example:

Our functional testing identified the supply and return piping to an AHU were backwards due to a mix-up when tying into existing mains. In addition, a number of inputs for the BAS were missing due to sensors not being installed (and related controls programming missing).

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Andy spoke with the Architect, Engineer, and the Owner and it was decided an in-person meeting was the best route to address these issues.

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During this meeting, the following decisions were made:

1. The piping would be drained down during the next appropriate weather conditions; the piping would be fixed to match design, at no additional cost to the Owner.
2. The representatives of the contractors and design team felt that fewer sensory inputs would not significantly affect the function of the building. However, Andy suggested to the group that the Owner was paying for all of those inputs, and so if they were not going to be installed perhaps a reduction in the fee was appropriate? It was then decided that all inputs would be installed per the original design.

What if this hadn't been addressed at this time?

- It is unlikely the issues with the reversed piping would have been identified at all. All other contractors involved had already done their own final checks. Without our thorough functional testing, identifying this root cause of building issues would be almost impossible.
- In every season, this would have wasted significant energy.
  It is unlikely the sensors and related programing would have ever been installed. This may have resulted in a system that was difficult to monitor and control.