

Construction Industry Misconceptions on Building Enclosure Commissioning

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Introduction

“Additional work” and “added cost” are what many general contractors (GC) think of when they hear “Building enclosure commissioning (BECx).” They see it as an additional process that requires them to fill out forms, attend more meetings, prepare and revise submittals, and the list goes on and on. Not surprisingly then, commissioning has received some resistance among GCs. Unfortunately, many haven’t had the opportunity to work with a Building Enclosure Commissioning Process Provider (BECxP) who is brought in at the right time, for the right reasons and by the right party.

There also is a misperception that commissioning is only about reducing the Owner’s risks and comes with a high price tag – not only to the Owner, but also to the design team and the contractors. This comes from a misunderstanding of the commissioning process, the scope of commissioning, and truly when a commissioning provider should be brought onto the team.

Many BECxP professionals are equally frustrated with what should be a very beneficial and smooth process. They share the anxiety the rest of the design team, the GC and enclosure trades feel when the process is not implemented as designed.

Owners who hire commissioning professionals may not even fully understand this process and may only see these services as an insurance of sorts. These perceptions have been plaguing the construction industry for the last couple of decades and have given

commissioning a bad name despite a measurable improvement in performance outcomes on projects where commissioning (Cx) and BECx were successfully integrated into the project delivery process.

The costs of NOT commissioning

All contractors have experienced the costs of not commissioning: The “we have always done it this way,” attitude and overemphasis on schedule at the expense of craftsmanship and quality often results in call-backs and rework that go straight to the bottom line, reducing margins and depleting contingency funds. A BECxP can be a GC’s saving grace when it comes to finishing a project on schedule, within budget, and with minimal rework and call backs. This only occurs if the process is followed and the commissioner is doing (or allowed to do) his or her job as the collaborator between all members of the design and construction team.

The problem is not simply a “contractor-resistance” problem. The problem with commissioning lies with the general misunderstanding of the process and procedures that should be a benefit to all parties. When done as intended, commissioning is a quality-oriented process incorporated throughout the project from design inception, to schematic design, design development, construction documents, as well as pre-construction, construction, and through post-construction as shown in Figure 1.



Figure 1: BECxP Process

Rationale for standards and training

Before we can have a sensible discussion about BECx process, it is important to understand the history and rationale behind standards development in this space. Over the past several decades, a rapid increase in the advancement of building enclosure technology and the liability associated with failure at that layer of a building has led to a compartmentalization of the design profession. This trend is arguably reflected on the cover sheet of a typical set of construction documents. In the past, the cover sheet produced by an architect would typically contain references to a very small range of consultants, usually limited to the structural and M/E/P practice areas and disciplines. Today, a cover sheet often includes a myriad of consultants, many of whom are directly engaged through some level of delegated design¹ to participate in or otherwise be responsible for the design of the building enclosure. This trend, together with an insufficient level of formal education and training of architects in building science and the physics of building enclosure performance² and parallel decline in the skill levels available from the construction trades³ combined to create a ‘perfect storm’ of sorts that resulted in buildings that failed to meet even the most basic expectation of an Owner of his or her design and construction team: To provide shelter from the environment.

This misalignment of expectations and corresponding demand for the delivery of environmentally conscious, energy-efficient, higher-performing buildings has led directly to a call from the marketplace for enforceable guidelines and standards meant to reassure Owners and investors in real estate in the near-term until more generational changes could be realized in the education and training of the next generation of design and construction professionals. This is the genesis of BECx standards development and the foundation on which training-based certificate and fully accredited personnel certification programs will be built.

Industry standards – Current state

Currently there are only two published documents that fully describe and provide guidance for the Building Enclosure Commissioning process: ASTM E2813, Standard Practice for Building Enclosure Commissioning and its companion document, ASTM E2947, Standard Guide for Building Enclosure

Commissioning. As a Standard Practice, ASTM E2813 was developed in response to the demand in the marketplace for higher performing buildings and the need for a document that would provide mandatory minimum enforceable levels of building enclosure performance and an outline of the core competencies required of the BECx service provider. As a Standard Guide, ASTM E2947 replaced NIBS Guideline 3 in 2014 and provides guidance to the Owner/Developer and its design and construction team regarding the appropriate development of an OPR (Owner’s Project Requirements) and best practices for the successful delivery of the BECx process.

Today, both standards remain the first and only BECx standards developed and published entirely through an independent, consensus-based standards development process and have been selected alongside ASHRAE Standard 202 and the still-developing BECx standard to be balloted and published by the International Standards Organization (ISO) to form the basis of the first fully accredited International Building Enclosure Commissioning Personnel Certification Program. Together, these documents are the only recognized and enforceable standards available to the marketplace that are reviewed, updated and maintained on an annual basis. These two standards are scheduled for direct reference in USGBC LEED v4.1 for New Construction and will form the basis of both the BECx Training-Based Certificate Program currently under development.

After several years of deliberation among ASTM International, NIBS, ASHRAE, the International Code Council (ICC), and stakeholders from across the real estate development, property management, design, construction, legal, and insurance professions, the International Institute of Building Enclosure Consultants (IIBEC) – formerly RCI, Inc. – has stepped forward to lead the re-launch of this program, which will be developed and maintained in full compliance with the requirements of ISO/IEC 17024. Laverne Dalglish of Building Professionals has been contracted by IIBEC to organize and coordinate this effort, while ASTM, ASHRAE, and similarly aligned organizations, both public and private, are providing the subject matter experts necessary to develop the technical content that will underpin and sustain this program.

Misunderstanding the standards

One misconception regarding ASTM E2813 is that the guidance provided in that document for performance testing requires that all of the tests listed in that standard are mandatory to achieve either the ‘Fundamental’ or ‘Enhanced’ levels of BECx outlined in the standard. Nothing could be further from the truth. In reality, the design team, working in close collaboration with the Owner/Developer and BECx provider, must first establish the OPR for a project, after which the appropriate range of mandatory minimum pre-construction laboratory and/or field tests should be selected from the list provided in ASTM E2813, with additional guidance available in ASTM E2947. Using this approach, an appropriate and enforceable level of BECx can be developed and

adapted to suit the performance requirements unique to each project and provide the Owner/Developer and the project team with the added level of quantifiable reassurance they need to achieve, rather than hope for, an environmentally conscious, energy-efficient, high-performance building enclosure. The return on this investment is clear and increasingly evident in the performance metrics now being gathered for buildings designed and built with the benefit of an appropriately developed and successfully integrated Cx and BECx process.⁴

As defined in ASTM E2947, BECx is “architecture or engineering-related technical services or both, performed on behalf of the Owner that implements a quality-focused process for enhancing the delivery of a project by focusing on validation during the design phase and verifying during the construction phase that the performance of building enclosure materials, components, assemblies and systems are designed and installed to meet the Owner’s Project Requirements.”

ASHRAE Guideline 0, The Commissioning Process, provides a sample flow chart for best practices on how to implement commissioning as shown in Figure 2. In this process, the commissioning team is formed following the Pre-Design Phase. The flowchart shows the collaboration between the Owner, design team and the commissioning provider. It also shows what tasks should be completed as part of the construction process. During the Construction Phase, test procedures, construction checklists, and issue logs are created. These tasks affect the contractors directly and present a challenge if the contractor is not familiar with these tasks and expectations.

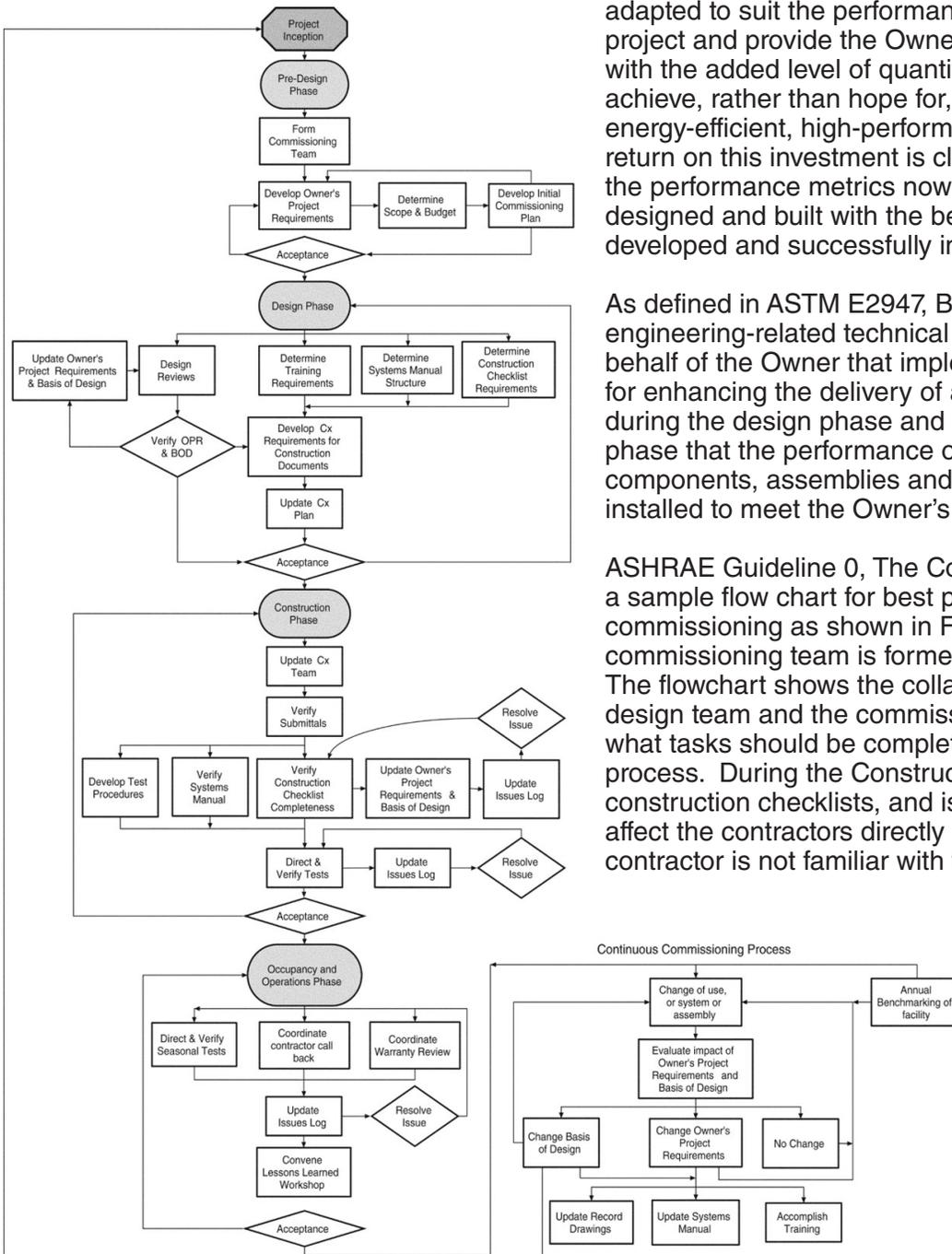


Figure 2: ASHRAE Guideline 0 2013 – The Commissioning Process, Annex B – FIGURE B-1 Commissioning (Cx) process flow chart, (Referenced from NIBS – Whole Building Design Guide, Owner’s Role and Responsibilities in the Design Process, Updated 11-15-2016.)

ANSI/ASHRAE/IES Standard 202, Commissioning Process for Buildings and Systems, states “The Commissioning Process is a quality-focused process for enhancing the delivery of a project. The process focuses upon evaluating and documenting that all of the commissioned systems and assemblies are planned, designed, installed, tested, operated and maintained to meet the Owner’s Project Requirements.” It is very clear that the ultimate goal of commissioning is to construct buildings to meet the project requirements established by the Owner. The commissioner’s scope of work is to be involved throughout this process.

While both the standard and the guidelines give BECxP professionals standard procedures and protocols to be followed, they do not clearly guide or educate the design team, the construction team, or even the Owner as to what their part and involvement is in the commissioning process. These guidelines and standards speak more to the process and expectations of the team member providing the commissioning services. The Owners know that they want a building that meets their project requirements, and most architects realize that the commissioner is yet another resource to the design team, but where does this leave the contractor?

The process of commissioning is not typically taught to contractors or even the system installers of the buildings we are constructing. This creates somewhat of a disconnect for the contractor and an unclear understanding of what commissioning can do for them.

Purpose of BECx

Before we jump into the benefits of commissioning, we have to look at the “why” of commissioning. Commissioning is intended to define the project expectations, focus on quality assurance, quality control, the verification of system performance, and to provide the Owner with training and maintenance guidance. This seems pretty similar to what the design team and contractor provide, right? In essence it is very close. The commissioning process is intended to complement both of these team members by enhancing the quality and reliability of the design and construction of buildings. To do this, the commissioner works hand-in-hand with the design and construction team. The difference is that a commissioner is able to focus on the building enclosure assembly and

environmental dividers, and brings a knowledge base that is founded in building science and scientific performance, analysis, and testing.

With the vast number of products offered and the multitude of assemblies available to the design team and contractors, this is a critical piece of the puzzle. The building enclosure commissioner can offer specialized knowledge about the six sided cube that is the building enclosure, the environmental separators within the structure, and how it relates to and performs within the parameters of the mechanical system.

So, what does all of this mean? In simple terms, the BECx process focuses on product selection, the generation of details that minimize air and water leaks, and it ensures the building is energy-efficient, durable and meets the Owner’s anticipated service life of the building. The process is designed to prove that the systems work as intended by design and overall reduces risks for all parties. This sounds like a great idea, so why isn’t our industry embracing this process to help fix an industry that is somewhat broken and divided?

Behind the industry skepticism

The problem is that true commissioning is rarely done, which has led to the stigma that BECx is not what it’s cut out to be. We often forget the collaboration that must occur and the team effort that is required to construct a building – from inception to completion. In reality, very few projects actually undergo the holistic building enclosure commissioning process as it was designed and intended to be conducted. Thus the nirvana of BECx is not typically accomplished. Our industry has chosen to do “enhanced building enclosure consulting,” or even “quasi-building enclosure commissioning,” and tried to label it as BECx. This creates a broken and divided industry full of skepticism, and typically results in lost faith in the benefits the process can bring to projects. Not all projects need commissioning, but with the construction industry pushing the envelope on schedules, design, and performance, commissioning often should be implemented.

BECx advantages for the contractor

Let’s face it, buildings these days leak! In truth, probably more new buildings leak, than not. Owners and contractors battle these leaks for months and

even years after the building is substantially complete and the Owner takes the keys. Because contractors are often faced with challenging or otherwise unrealistic deadlines, weather conditions, product lead times, not to mention the numerous new products available and specified, they are more in danger of failing than succeeding. Many of these products may not have been installed and used in the past by the “bid winner.”

Not only are contractors dealing with deadlines, but now they are dealing with installations and details that are unfamiliar to them and with unfamiliar construction sequencing, all of which wreaks havoc on their schedules and deadlines. Many of these products are so new that even the design team does not know or clearly understand how to terminate or transition them, leaving it up to the contractors to “figure it out” to the best of their knowledge.

The contractor that is the “winning” bidder, often takes on an uphill battle that results in them designing solutions in the field. Contractors should not be designing, however, many are left to provide transition details that manufacturers do not touch as they do not want to assume the “risk” or liability, thereby introducing the “by others” nonexistent persona. This has brought many contractors to hire building enclosure consultants to assist them and to minimize their risks.

Reducing the burden on architects

This is not to suggest that architects and designers are not doing their job. But the system is broken. Most of the time, Owners are selecting the “lowest fees” for professional services. The architect is selected for a percentage of the budgeted project amount. So, the lower the percentage, the less the Owner pays for that service. The problem is that the Owner fails to see that architects’ fees generally don’t vary much from firm to firm. They don’t realize that the design package is minimized, not the fee the architect receives. Architects allow for a certain amount of hours to provide a set of construction documents as a deliverable. The less the Owner pays, the less that package contains. The result is “thin” specification manuals and construction drawings that do not possess sufficient detailing. They end up with “permit drawings” rather than bidding/construction documents. This reality is why commissioning has become an enticing option for Owners.

One could argue that the Owner could pay the design professionals more so that the documents are more complete; however, the architect is still limited to what he or she can specialize in. Larger firms may have the advantage of a staff member that is well versed and educated in building enclosures, but most smaller architectural firms are challenged with a lack of building enclosure resources at their disposal.

These facts are why commissioning is so critical to the design and construction process. Looking at the construction industry without commissioning, we typically see unsatisfied Owners who are handed leaky buildings that do not perform as expected. The design team is typically challenged with numerous Requests for Information (RFIs), Supplemental Instructions (SIs), Change Orders, and Submittal packages that are not project-specific. Finally, a contractor is left with challenges in the field that end up costing them profits in call-backs, rework and construction insurance claims. The disconnect between the design and construction team is more real than most would like to admit, often resulting in forensic investigations, costly litigations, and construction insurance claims.

The need for education and training

This brings us back to why GCs are not buying into commissioning. Why are they so skeptical of the value and advantages of the process – a process that could be so beneficial to them and could lower their risks? Simply because it is different, and it is a change that they do not understand. We could offer contractors the best design, we could hire the best subcontractors, and the Owner may even hire a BECxP, but if we do not educate the whole construction team (contractors and design professionals) on this process, we are setting them up to fail and are even cutting into their profits.

Education and empowerment of construction companies and the trades who are tasked to deliver leak-free, energy-efficient, and sustainable buildings are the keys to success. A failure to embrace the commissioning process and/or lack of education of the process are the reasons why most construction teams struggle to deliver leak-free, efficient and sustainable buildings.

Conclusion

Building Enclosure Commissioning should be considered at the inception of the project by the Owner and design team selected. If it is deemed that the project would benefit from commissioning, the Owner, designer, and commissioning professional must select construction contractors who understand the process and procedures.

Well-educated contractors who have quality control and quality assurance programs still do not fully understand the benefits of the BECx process. As an industry we need to bring education to our contractors and building enclosure trades. If they are given a clear understanding as to why and how BECx can benefit them, contractors will embrace it.

As noted previously IIBEC, NIBS, and ASTM are currently working together to develop education, training, and certification programs intended to advance our industry and the profession through further support of the BECx process. When the program is developed and implemented, IIBEC will be the only place a professional can become certified as an ISO 17024 accredited BECx. The framework for that effort – which is subject to further refinement and change as subject-matter experts begin to gather to develop this program outlined in Figure 3 – will include the development of ISO-accredited personnel certification for each of the following:

- Certified Building Enclosure Commissioning Provider (CBECxP)
- Certified Building Enclosure Commissioning Technologist (CBECxT)

Currently under consideration is a Certified Building Enclosure Commissioning Specialist (CBECxS) to be implemented as phase two; however, IIBEC, NIBS, and ASTM will remain focused on development of the CBECxP and CBECxT in phase one of this endeavour. The curricula developed for both the training-based certificate and personnel certification programs will be a reflection of the core competencies outlined in ASTM E2813, with the individuals outlined above supported by a team of building enclosure experts as appropriate to

respond effectively to building enclosure material selection, integration and performance requirements that are unique to each project. The position titles referenced here are further described by ASTM E2947 and, together, are collectively referred to in that standard as the BECx “Group” (BECxG).

As an industry we must join forces and collaborate to bring education to the construction teams who are building Owners’ visions. By giving them this education, we can empower them to be successful in the construction of our future structures.

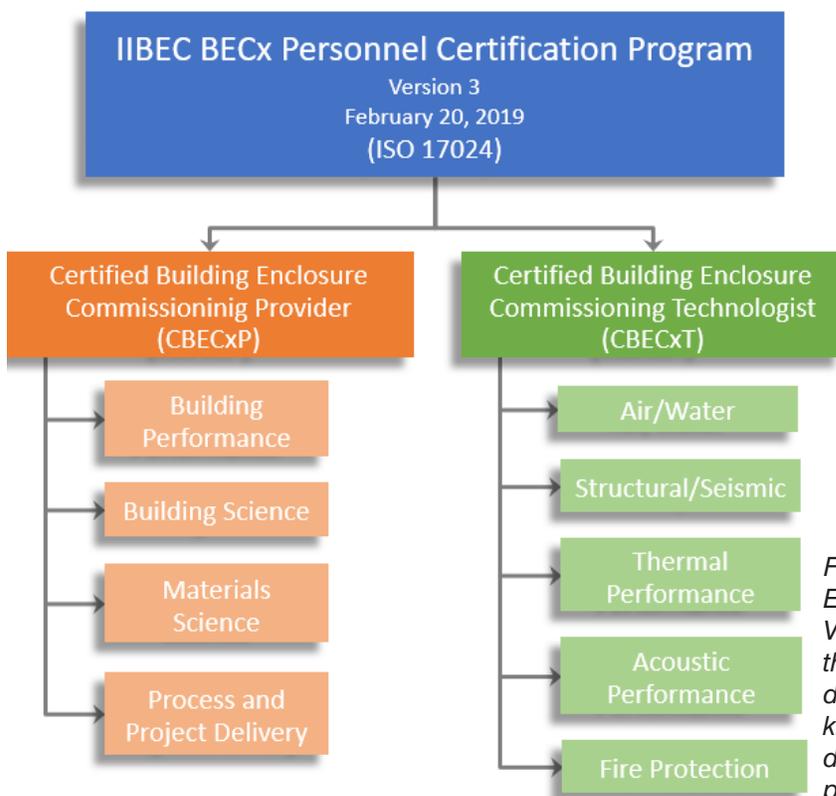


Figure 3: IIBEC, formally RCI, Certified Building Enclosure Commissioning Personnel Chart, Version 3, February 20, 2019. This chart depicts the ISO-accredited personnel certification designations of the CBECxP and CBECxT and the knowledge base exams which each personnel designations will be required to successfully pass as part of the accreditation process.

Endnotes:

¹ [Delegated design legal definition: §3.2.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.2.3, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating coordination and construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the Contractor shall promptly report to the Architect any errors, inconsistencies or omission discovered by or made known to the Contractor as a request for information in such form as the Architect may require. It is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents. A201-2017 General Conditions of the Contract for Construction (electronic). Available at: www.aiacontracts.org/contract-documents/25131-general-conditions-of-the-contract-for-construction

² [... in 1970s an academic discipline of Building Physics was firmly established in Central and Northern Europe. Born as the academic discipline, for many years, the Europeans attempted to separate the industrial knowhow from the academic knowledge. It was quite opposite to North America where (until recently) little or no building physics has been taught at the Universities and the progress in construction achieved by consultants was mainly based on the know-how. In Canada, for years, N.B. Hutcheon tried to introduce building science (physics) to the schools. In his 1973 lecture he said: But the mere existence of building science is not enough. It must be put to use throughout the building industry wherever technical decisions are made about building. It must be introduced appropriately into the education and training of all who are in a position to use it" Bomberg, Mark. (2012). Building science or building physics. *Frontiers of Architectural Research*, December 2012, p.422]

³ ["Eighty Percent of Contractors Report Difficulty Finding Qualified Craft Workers to Hire as Association Calls for Measure to Rebuild Workforce." AGC News, Associated General Contractors of America, 29 August 2018, www.agc.org/news/2018/08/29/eighty-percent-contractors-report-difficulty-finding-qualified-craft-workers-hire]

⁴ ["Benefit of Commissioning for GSA Buildings – Industry sources indicate that on average the operating costs of a commissioned building ranges from 8% to 20% below that of a non-commissioned building." U.S. General Service Administration Public Building Service 'The Building Commissioning Guide' (electronic). Available at: www.gsa.gov/real-estate/design-construction/commissioning/commissioning-program]

Referenced Documents:

ANSI/ASHRAE/IES Standard 202, - Commissioning Process for Buildings and Systems, Foreword

ASHRAE Guideline 0 - The Commissioning Process, Annex B

ASTM E2813 – Standard Practice for Building Enclosure Commissioning

ASTM E2947 - 16a – Standard Guide for Building Enclosure Commissioning

"Agree to Avoid Duplicating Building Enclosure Commissioning Efforts" NIBS, ASTM International, and RCI Issue Joint Statement, July 2018, <https://rci-online.org/nibs-astm-international-rci-issue-joint-statement/>

NIBS Guideline 3 – 2012

NIBS WBDG "OWNER'S ROLE AND RESPONSIBILITIES IN THE COMMISSIONING PROCESS," by the WBDG

Project Management Committee, Updated: 11-15-2016, <https://www.wbdg.org/building-commissioning/Owners-role-and-responsibilities-commissioning-process>

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