“HVAC&R Technical Requirements for The Commissioning Process”

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Guideline 1-2007

Purpose of this presentation is:

- to assist in understanding the role of supporting technical guidelines,
- examples of additional information for HVAC&R systems, and
- assist with effectively using supporting guidelines
Scope of Guideline 1-2007

- Information on support of the commissioning process for HVAC&R systems with specific emphasis on:
  - HVAC&R systems to fully support The Commissioning Process activities of Guideline 0-2005,
  - verification during each phase of The Commissioning Process,
  - acceptance during each phase,
  - documentation during each phase,
  - Systems Manual specific requirements, and
  - training for operations and maintenance personnel and occupants.
Use With Guideline 0-2005

- Cannot be used alone
- An attempt was made to prevent duplicating procedures and requirements stated in GLD 0-2005
  - Three reasons
    - To allow updates to 0-2005, without conflicts with other technical guidelines
    - To reduce the size of each guideline
    - To allow multiple systems and assemblies to be included in the scope of implementing the CxP, that is, multiple supporting guidelines
Matching Sections and Sub-Sections

- As required by Annex A of GLD 0-2005, all Sections and sub-sections match same sections in GLD 0-2005
Example of Additional Supporting Information

“5.2.1 Commissioning Team Members
In addition to those detailed in ASHRAE Guideline 0-2005 (5.2.1.3), the essential members of the Commissioning Team relative to HVAC&R systems during the Pre-Design Phase include:

   Facilities engineer,
   Owner’s automatic controls and building automation technician,
   Facility IT Network manager or technician
   Owner’s HVAC&R technician,
   Architect,
   HVAC&R design professional,
   Electrical design professional.”
Key Milestones that need to be Identified during the Pre-Design Phase for a Successful HVAC&R

“5.2.4.2 Milestones

During the Pre-Design Phase it is critical to document key commissioning process milestones relative to the HVAC&R systems during Design, Construction, and Occupancy and Operations Phases. These include:

a) Pre-design meeting,
b) Design review (multiple), including the Basis of Design requirements with each design submittal,
c) Design Phase updated Commissioning Plan,
d) Construction pre-bid meeting,
e) Pre-construction meeting,
Key Milestones that need to be Identified during the Pre-Design Phase for a Successful HVAC&R

f) Construction Phase updated Commissioning Plan,
g) Commissioning meetings,
h) Material and equipment submittal (including manufacturer’s operations and maintenance documentation) review, – including control equipment.
i) Coordination drawing submission,
j) Initial Systems Manual submission -- xx days after submittal approval,
k) Submission of automatic control and building automation controls logic diagrams,
l) Submission of automatic control and building automation controls software xx days after submittal acceptance,
m) Training program implementation plan,
Key Milestones that need to be Identified during the Pre-Design Phase for a Successful HVAC&R

n) Construction Checklist completion and tracking,
o) Equipment factory testing,
p) Equipment placement review,
q) Testing procedure development (update Commissioning Plan),
r) Contractor required test verification (duct pressure testing, pipe pressure testing, etc.)
s) Initial automatic controls and building automation system acceptance,
t) Testing, adjusting, and balancing report and verification,
u) Final automatic controls and building automation system acceptance,
v) HVAC&R system testing,
w) Final Systems Manual submission,
Key Milestones that need to be Identified during the Pre-Design Phase for a Successful HVAC&R

x) Operator, maintenance, and occupant training,
y) Turnover of systems/HVAC&R systems acceptance – start of warranties,
z) Draft Commissioning Process Report,
aa) Commissioning Authority site visits during first year of operation,
bb) Operator, maintenance, occupant additional training,
cc) Seasonal testing,
dd) XX-month warranty walk-through and verification,
e) Lessons learned meeting,
ff) Final Commissioning Process Report.”
For HVAC&R Success there are Key Activities in both Pre-Design & Occupancy

“8.2.6.4 As part of the first year site visits, it is also the commissioning team’s role to facilitate the integration of the commissioning process activities into ongoing operations and maintenance procedures. This includes the following key activities:

a) **Maintaining the Owner’s Project Requirements** document to reflect changes in use and operation of the HVAC&R systems and facility.

b) **Maintaining the Basis of Design** to reflect changes in HVAC&R systems and components due to renovations or in response to changes in the Owner’s Project Requirements.

c) **Periodic (seasonal, annual, or bi-annual) evaluation** of achievement of the current Owner’s Project Requirements against previous benchmarks by the use of appropriate tests.

d) **Maintaining the Systems Manual** to reflect changes in the Owner’s Project Requirements, Basis of Design, and systems/assemblies.

e) **On-going training** of operations and maintenance personnel and occupants on current Owner’s Project Requirements and Basis of Design, changes in HVAC&R systems and operation, and on maintaining current Record Drawings.
Information in Annexes

Like Guideline 3-2006 (Exterior Envelopes), the most important information in GLD 1-2007 is specific examples to assist the owner in effectively implementing the CxP.
Following are examples of substantial Annexes (note page numbers will be less in the published version of GLD 1-2007)

- Annex G – CxPlan: 19 pages
- Annex H – Acceptance Plan: 5 pages
- Annex J – Owner’s Project Requirements: 34 pages
- Annex K – Basis of Design: 14 pages
- Annex L – Specifications: 23 pages
- Annex M – Checklists: 33 pages
## 2. Design Checklist for the Mechanical Engineer’s First Design Submittal

### ASHRAE - Guideline 1-200X Example Checklist

**Instructions:**
Step 1: Circle Yes or No and fill in with requested information.
Step 2: Explain all “No” responses at the bottom of the checklist.

<table>
<thead>
<tr>
<th>Item</th>
<th>Task Description</th>
<th>Location of Information: Document, Drawing, or draft Project Manual</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Response</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td><strong>Owner’s Project Requirements</strong></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td><strong>Key Owner’s Project Requirements</strong></td>
<td>Complete</td>
</tr>
<tr>
<td>1</td>
<td>Commissioning Plan Updated, provide date and enclose with this submittal</td>
<td>Yes No</td>
</tr>
<tr>
<td>2</td>
<td>Basis of Design for controls completed</td>
<td>Yes No</td>
</tr>
<tr>
<td>3</td>
<td>Basis of Design for accessibility completed</td>
<td>Yes No</td>
</tr>
<tr>
<td>4</td>
<td>Sustainability and LEED issues coordination addressed</td>
<td>Yes No</td>
</tr>
<tr>
<td>5</td>
<td>Do the general HVAC&amp;R requirements the current OPR requirements? Has justification been document and approved by owner’s Project Manager?</td>
<td>Yes No</td>
</tr>
<tr>
<td></td>
<td>Control format, BACnet requirements complete and documented</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Environmental and sustainability initial design complete</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>B</strong></td>
<td><strong>Owner’s Objectives</strong></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Preliminary mechanical room layout complete</td>
<td>Yes No</td>
</tr>
<tr>
<td>2</td>
<td>Energy analysis meeting goal of 30% less than ASHRAE 90?</td>
<td>Yes No</td>
</tr>
<tr>
<td>3</td>
<td>Single line diagrams developed for controls and systems</td>
<td>Yes No</td>
</tr>
<tr>
<td>4</td>
<td>Report on safety factors and tolerance for facility system operations</td>
<td>Yes No</td>
</tr>
<tr>
<td>5</td>
<td>Have chillers been sized and pre-order to meet occupancy goal</td>
<td>Yes No</td>
</tr>
<tr>
<td>6</td>
<td>Environmental and sustainability initial design complete</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>C</strong></td>
<td><strong>General Owner’s Needs</strong></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Is current HVAC and control systems budget enclosed and within initial budget</td>
<td>Yes No</td>
</tr>
<tr>
<td>2</td>
<td>Mechanical rooms space and location coordinated with shops</td>
<td>Yes No</td>
</tr>
<tr>
<td>3</td>
<td>Has Electrical, Plumbing, Lighting and Communications coordination been completed?</td>
<td>Yes No</td>
</tr>
<tr>
<td>4</td>
<td>Does the initial design meet all Benchmark Established for HVAC&amp;R? Document?</td>
<td>Yes No</td>
</tr>
<tr>
<td>5</td>
<td>Constructability and maintainability analysis completed</td>
<td>Yes No</td>
</tr>
</tbody>
</table>

**Explain all “No” responses at the bottom of the checklist:**

- **Item 1.1:** Commissioning Plan Updated, provide date and enclose with this submittal
  - The Commissioning Plan was not updated.
  - The date of completion was not provided.
  - The Commissioning Plan was not included with the submittal.

- **Item 1.2:** Basis of Design for controls completed
  - The basis of design for controls was not completed.

- **Item 1.3:** Basis of Design for accessibility completed
  - The basis of design for accessibility was not completed.

- **Item 2:** Sustainability and LEED issues coordination addressed
  - Sustainability and LEED issues coordination was not addressed.

- **Item 3:** Do the general HVAC&R requirements the current OPR requirements? Has justification been document and approved by owner’s Project Manager?
  - The general HVAC&R requirements did not meet the current OPR requirements.
  - Justification was not documented and approved by the owner’s Project Manager.

- **Item 4:** Control format, BACnet requirements complete and documented
  - Control format and BACnet requirements were not complete and documented.

- **Item 5:** Environmental and sustainability initial design complete
  - Environmental and sustainability initial design was not completed.

**Explain Failure to meet owner’s objectives:**

- **Item B.1:** Preliminary mechanical room layout complete
  - The preliminary mechanical room layout was not completed.

- **Item B.2:** Energy analysis meeting goal of 30% less than ASHRAE 90?
  - The energy analysis did not meet the goal of 30% less than ASHRAE 90%.

- **Item B.3:** Single line diagrams developed for controls and systems
  - Single line diagrams were not developed for controls and systems.

- **Item B.4:** Report on safety factors and tolerance for facility system operations
  - A report on safety factors and tolerance for facility system operations was not provided.

- **Item B.5:** Have chillers been sized and pre-order to meet occupancy goal
  - Chillers were not sized and pre-ordered to meet the occupancy goal.

- **Item B.6:** Environmental and sustainability initial design complete
  - Environmental and sustainability initial design was not completed.

**Explain Failure to meet general owner’s needs:**

- **Item C.1:** Is current HVAC and control systems budget enclosed and within initial budget
  - The current HVAC and control systems budget was not enclosed and did not meet the initial budget.

- **Item C.2:** Mechanical rooms space and location coordinated with shops
  - Mechanical rooms space and location were not coordinated with shops.

- **Item C.3:** Has Electrical, Plumbing, Lighting and Communications coordination been completed?
  - Electrical, Plumbing, Lighting and Communications coordination was not completed.

- **Item C.4:** Does the initial design meet all Benchmark Established for HVAC&R? Document?
  - The initial design did not meet all benchmarks established for HVAC&R.
  - Documentation was not provided.

- **Item C.5:** Constructability and maintainability analysis completed
  - Constructability and maintainability analysis was not completed.
Annex I, OPR Workshop includes a number of typical questions that can be used related to HVAC&R Systems. Following is one example question included in the annex:

“8. What are your training requirements? This question is for the O&M staff, and sometimes the occupants, to understand what is needed to understand the systems and building. The knowledge base of the expected maintenance crew is key to defining the training requirements defined in the construction and commissioning documents.”
GLD 1-2007 is a “GUIDELINE”

This is a guideline, it is not a standard ‘means’

- It does provide a standard format for implementing the commissioning process.
- Using these guidelines as the basis for implementing the CxP will allow a more uniform and cost effective implementation of the commissioning process.
Continuous Improvement of CxP Guidelines

- Hopefully they will allow a means for input as owners and practitioners develop improved means and methods for delivering a quality-based constructed project.

- Remember, only 15-20 professionals developed these guidelines and there is a limited time and resource for the committee to develop a guideline
Use of CxP Guidelines

- Do not take CxP guidelines as the fixed means and method for implementing the CxP
- If we did not use information from practitioners and owners, we would have a guideline that express the process as practiced in 1980
- Guidelines are essentially out-of-date the day they are published
Use of CxP Guidelines

Use Guidelines to assist you, not cramp a better approach developed by a specific owner