

(This annex is not a mandatory part of the referring ASHRAE SSPC 300 standard or guideline. It is merely informative and does not contain requirements necessary for conformance to the standard or guideline.)

(The following informative annex is provided to illustrate, explain, or support the ASHRAE SSPC 300 commissioning process. The information presented herein represents consensus good practice but does not contain mandatory commissioning process provisions. This informative annex supports more than one ASHRAE SSPC 300 commissioning standard or guideline and is not intended to serve as a standalone document. See the referring ASHRAE SSPC 300 standard or guideline for mandatory commissioning process requirements and guidance.)

ASHRAE SSPC 300 INFORMATIVE ANNEX 06—BASIS OF DESIGN

06.1 Introduction

The Basis of Design (BoD) records the major thought processes and assumptions behind design decisions made to meet the Owner's Project Requirements (OPR).

The OPR is intended to capture “what” the owners needs and expects from a project. The construction documents detail “how” the OPR will be physically achieved. The BoD captures important information linking the “what” and the “how.”

The BoD documentation is distinct from the construction documents, is seldom included in drawings and specifications, and is generally not needed to meet the contractor's obligations. However, the BoD documentation is exceptionally valuable to the CxP Team when evaluating the ability of a design and its components to meet the OPR.

The objective of specifically documenting BoD information is to provide the parties involved with a project, at each phase in the process, an understanding of the underlying thinking that led to the selection of specific components, assemblies, systems, and system integrations. A design narrative that provides an overview of assemblies and systems in verbal format is usually an integral element of the BoD.

The BoD is typically developed incrementally as work on a project moves from Predesign, to Design, and into the Construction Phase. Changes to the BoD that often occur as a design evolves must be documented.

The BoD should be reviewed and updated as part of each design submission during development of the design; after issue of supplementary instructions during the construction process; prior to occupancy; and after completion of acceptance testing.

06.2 Sample BoD Requirements to be Contained in the Owner's Project Requirements

06.2.1 Introduction. The BoD is a written document that should detail the Design Team's approach to the OPR. The BoD serves several purposes:

- a. To illustrate to the entire team, in nontechnical terms, what systems are being provided. The narrative portion of the BoD should be written to be understandable by stakeholders, such as the Owner or tenants.
- b. To demonstrate the ways in which the design meets the OPR. Specific instances of OPR requirements should be included in the BoD, with acknowledgement that they are met, and with a description of how this is accomplished. For example, if “N+1” redundancy is described in the OPR, the BoD response might be “to satisfy the N+1 redundancy requirement in Section XYZ of the OPR, three CHW pumps will be provided, two of which are sized to meet the design flow.”
- c. To allow a technical reviewer, such as the Cx Provider (CxP), insight into particular elements of the design, the BoD should include details of how particular calculations were made, and (upon request) the calculations themselves. An example might be an experienced reviewer questioning the validity of a life-cycle cost analysis by noting that certain results in the energy model appear to run counter to typical values, indicating possible errors. In that case, the modeling approach should be described in the BoD (what program or method was used) and should be available and accessible to the CxP, and the actual model itself should be provided to the reviewer to allow the verification of calculation/model inputs.
- d. Where a design/build approach is used rather than a design/bid/build approach, the design rules the contractor should use/may be part of the OPR. Instead of the engineer of record showing in the BoD

what types of duct sizing they will use (typical in a design/bid/build approach), it may be that the Owner (with technical assistance from the CxP) outlines OPR criteria to be used in design (e.g., “Duct velocities in shafts shall not exceed 3000 fpm [15 m/s].”)

06.2.2 Basis of Design Development Process

- a. The OPR should provide a list of required information and the format for the BoD to the Design Team prior to the start of design.
- b. The Design Team should gather and organize information during the creation of the design.
- c. The Design Team should submit the BoD to the Owner and the CxP for review and comment with each design document submittal.
- d. The BoD should be updated by the Design Team to provide increasing levels of detail as the design evolves to reflect changes to design criteria and systems during the subsequent phases of the project and the reason for those changes.
- e. The Design Team should work with the Owner and the CxP to resolve review comments.
- f. The BoD should include signature blocks and require acceptance by the Owner and the CxP.

06.2.3 Basis of Design Content. The content of the BoD will vary from project to project and system to system, but in general, it should address the following:

- a. Specific codes, standards, and guidelines considered during the design of the facility and designer interpretations of such requirements.
- b. Information regarding ambient conditions (climatic, geologic, structural, existing construction) used during design.
- c. Assumptions regarding usage of the facility.
- d. Expectations regarding system operation and maintenance.
- e. Performance criteria that the system was designed to meet linked to the OPR.
- f. Specific design methods, techniques, software used in design.
- g. A narrative statement of design that describes how the designer intends to meet the OPR.
- h. A narrative statement of operation that details how the facility is expected to operate under various situations, such as normal operation, extreme event, emergency, etc.
- i. A listing of specific manufacturer makes and models used as the basis for drawings and specifications.

The following, more specific BoD contents will be edited for each project based on discussions between the Owner, CxP, or other parties. Ideally, the requirements for the BoD, third-party Cx, sustainable rating certifications, measurement and verification, energy modeling, and other nontraditional design elements are identified prior to receiving proposals for services from the Design Team.

06.2.3.1 HVAC

a. Schematic Design

1. Occupancy schedule (time and number of people)
2. Climatic design criteria
3. Indoor design criteria, including tolerances (allowable temperature and humidity ranges)
4. Design diversity per system
5. Redundancies
6. Applicable building codes
7. Additional design requirements (LEED and energy goals, other special requirements)
8. Sustainable code requirements
9. Design narrative, including description of how each sustainable design requirement is met
10. Controls system narrative
11. Renewable energy systems narrative
12. (Optional) Design narrative (system options described in sufficient detail for energy modeling)

13. (Optional) Ventilation calculations for each above system option

b. **Design Development**

1. Preliminary energy modeling report
2. Ventilation optimization narrative
3. ASHRAE Standard 62.1 calculations
4. Heating and cooling loads calculations (input and output files)
5. Equipment cut sheets (equipment around which the design is based)
6. Control schematics, database, points list, sequences, alarm conditions, and operator interface elements

c. **Construction Documents.** Any modifications to the design development BoD

06.2.3.2 Lighting

a. **Schematic Design**

1. Design power capacity, W/ft^2 (W/m^2)
2. Design illumination levels, foot-candle (lux)
3. Lighting performance goals and standards
4. Lighting and lighting control narrative
5. Anticipated lighting power density (LPD) for each space type

b. **Design Development**

1. Lighting calculations
1. Power load calculations
2. Lighting control zoning diagrams
3. Lighting system control information distributed to potential suppliers
4. (Optional) Short-circuit study

c. **Construction Documents (CD).** Ensure lighting controls CDs include the following:

1. Finalized specification language
2. Dimension locations of ceiling-mounted sensors
3. Controls initial calibration criteria
4. Definition of the timing of final calibration (for daylight controls) after partitions/furniture in place
5. Definition of initial scheduling or time clock requirements
6. Identification of interface coordination requirements
7. Definition of any other programming, such as scenes, overrides, or special events

06.2.3.3 Other Systems. Develop similar scope BoD requirements for other systems as required by the OPR.

06.2.4 Format and Organization. The format and organization of the BoD includes the detail design response to the OPR requirements as follows:

- a. Major sections should include **<edit as appropriate for each project>** Envelope Systems, Interior Systems, Electrical and Lighting Systems, HVAC Systems, Renewable Energy Systems, and Plumbing and Service Hot-Water (SHW) Systems. Within each major section should be subsections labeled for each required design submittal (“Schematic Design,” “Design Development,” etc.)
- b. An updated BoD should be submitted with each design submittal. Updates should include descriptions of changes to the design since the previous submittal, the reasons for those changes, and additional detailed information that becomes available as the design progresses. Design submittals for this project include **<edit as appropriate for each project>** Schematic Design Phase, Design Development Phase, and 50%, 95%, and 100% contract documents.
- c. The BoD should reflect the progression of the design within a single document. Sections previously submitted should not be modified but rather be addressed as necessary in the new section related to the

current submittal.

- d. Non-narrative type information should generally be provided in a BoD appendix for each submittal and be referenced in the narrative.
- e. The main body of the BoD should be concise, providing the reader with concise descriptions of systems and later modifications and detail on those systems.
- f. The BoD should duplicate information provided in plans and specifications but should reference that information as appropriate.
- g. The BoD should address how the OPR are implemented into the design. For any criteria of the OPR that could not be met, documentation detailing what was done, its impact on the OPR, and how the OPR was modified should be included. It is not intended that the BoD repeat the text of the OPR with comments addressing each individual OPR criterion, but rather that the BoD remain a concise, readable document that is useful throughout the design and construction processes and into occupancy.

06.2.5 Acceptance. The BoD should include signature blocks for acceptance by the Owner and the CxP of each BoD submittal.