ONGOING COMMISSIONING PLAN

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I. ONGOING COMMISSIONING PROGRAM

Definition of the ongoing commissioning process:

Ongoing commissioning involves performing critical elements of the retro-commissioning process, repeatedly over a series of **two-year cycles**. The idea is to optimize energy powered building systems performance and continue to fine-tune it while actively preventing problems for the lifetime of the building. The tasks of ongoing commissioning are similar to those performed during retro-commissioning, as completed for EAc2.1, Option 1 and EAc2.2 (LEED EB v3). This credit simply repeats those activities over continuous and ongoing two-year cycles.

Ongoing commissioning is the process of proactively monitoring, testing + optimizing of the energy-powered building systems, and focuses on performance at both the system and component levels. Typical preventive maintenance plans do not constitute ongoing commissioning. Similarly, simply monitoring and performing maintenance to maintain the operational standards determined by a previous commissioning event does not rise to the standard of ongoing commissioning. The mechanical systems are big energy consumers, have a high level of complexity, and utilize a building automation system, therefore will realize substantial benefits from the ongoing commissioning activities.

The ongoing commissioning program includes the following elements:

A. Planning + Budget
B. System Testing & Performance Verification
C. Corrective Action Response

The ongoing commissioning plan requires ongoing rigorous functional testing of equipment (e.g., by changing parameters, set points or conditions and observing and documenting the system or equipment response through various modes and conditions over time) by the contract maintenance staff over a two-year cycle. Additionally, the plan provides clear direction regarding the functional tests that need to occur on an ongoing basis.

The ongoing commissioning cycle began with the initial commissioning process; the next step focuses on repeating key aspects of functional testing and performance monitoring on a continuing basis.

II. SYSTEMS TO BE COMMISSIONED

List of equipment included within the ongoing commissioning plan:

1. Mechanical; including HVAC&R equipment and controls
    a. Building Automation System
    b. Air Handling Units
    c. Chillers
    d. Cooling Towers
    e. Boilers
    f. Pumps
    g. Self Contained Air Conditioning Units
    h. Fans
    i. Unit Heaters
    j. Variable Air Volume Boxes

2. Lighting + Daylighting Controls
    a. On / Off Controls
    b. Dimming Controls
    c. Motion Sensors

3. Domestic Hot Water Systems
    a. Natural Gas Water Heaters
    b. Domestic Water Pumps
    c. Plumbing Fixtures

III. PROJECT PLANNING & BUDGET

The Ongoing Commissioning Plan includes (4) major commissioning activities, they are as follows:

- Ongoing Site Assessment
- Energy Use Breakdown
- Diagnostic Monitoring & Functional Testing
- Master List of Findings

The following provides information regarding each commissioning activity complete with responsible party and budget cost.

1. Commissioning Activity: ONGOING SITE ASSESSMENT

    Responsible Party Contract Maintenance Staff

Budget $5,000

The goal of the site assessment is to understand how and why the building systems and equipment are currently operated and to identify the most significant problems with building operations, as noted by building operating staff and building occupants. The site assessment phase includes a review of existing operating documents, and a detailed recording of equipment status and condition. The site assessment serves to inform recommendations on areas or systems where diagnostics and testing may be most appropriate.

The site assessment will be performed by the building's engineering staff on a weekly basis. Each week they will utilize the Building Automation System to review key operating parameters are meeting the programmed set points. Key operating parameters include the following:

- Supply / Return Air Temperatures & Humidities
- Supply / Return Condenser Water Temperatures
- Supply / Return Chilled Water Temperatures
- Supply / Return Hot Water Temperatures
- Space Temperatures
- Operating Schedules
- Outside Air Damper Position

In addition to the information gathered from the BAS the building engineers will take monthly temperature and lighting level readings from a sampling of the space to physically ensure correct levels are achieved. The monthly checks will include lighting control functionality and plumbing controls operations.

2. Commissioning Activity: ENERGY USE BREAKDOWN

Responsible Party Contract Maintenance Staff
Budget $1,500

A detailed end-use breakdown is a crucial component of the commissioning process. Understanding the relative portion of total energy use consumed by individual systems and processes helps identify areas of emphasis for further investigation. Additionally, it provides a useful benchmark for peer-to-peer comparison. The energy use breakdown is

performed by an experienced energy engineer upon review of the mechanical plans, building operations, and sequence of operations.

3. Commissioning Activity: DIAGNOSTIC MONITORING / FUNCTIONAL TESTING

Responsible Party	Contract Maintenance Staff
Budget	$12,000

The three standard diagnostic methods are energy management control system trend logging, stand-alone portable data logging, and manual functional testing. Diagnostic monitoring and testing has been structured to highlight areas of operation that are inconsistent with operating intent and goals identified during the site assessment phase. Monitoring and testing helps identify deficiencies in equipment operating as designed, as well as deficiencies in equipment procedures, performance, and outcomes.

The site assessment phase includes reviewing mechanical operation weekly via the BAS. Additionally, space temperatures and lighting levels, via handheld devices, will be logged on a monthly basis. With respect to functional testing, they will not occur "all at once" every two years; rather the manual functional testing will occur regularly throughout the two-year ongoing commissioning cycle. The equipment specific list of functional tests includes an implementation time schedule.

4. Commissioning Activity: MASTER LIST OF FINDINGS Issues Log

Responsible Party	Contract Maintenance Staff
Budget	$2,500

The master list is the most significant deliverable for the investigation and analysis phase of commissioning. It includes all operating problems that contribute to excess energy consumption and/or poor indoor environmental quality. For each issue identified the master list includes the name of the equipment, or system, a description of the problem as well as possible solutions. The master list thus forms the basis for a list of potential operating changes, technological upgrades, and capital improvements. Each item of the list is provided with a cost payback analysis.

Deficiencies found during the ongoing commissioning process will be noted with a deficiency log (issues log). The log will be reviewed by the owner and a resolution plan complete with a time schedule will be created. Upon implementation of the resolution a functional performance test will occur to verify the resolution. The deficiency log (issues log) will then be updated accordingly.

The building operating plan is updated, as required, throughout the ongoing commissioning process.

IV. SYSTEMS TESTING & PERFORMANCE VERIFICATION

Defined roles and responsibilities:

A. Building Automation System

a. Interval: Weekly on Monday – unless specified otherwise
b. Responsible Entity: Contract Maintenance Staff
c. Tasking
    i. Review overall sequence of operation to ensure it matches the BOP
    ii. Ensure fans / pumps energize properly
    iii. Ensure cooling / heating energize + stage properly
    iv. Review occupied heating / cooling set points, compare to BOP
    v. Review unoccupied heating / cooling set points, compare to BOP
    vi. Review building pressures
    vii. Note supply air temperatures (first Monday of every month)
    viii. Note lighting levels (first Monday of every month)
    ix. Note condenser water supply / return temperatures
    x. Verify sensor's set points and dead bands
    xi. Calibrate sensors (annually)
    xii. Verify systems are utilizing energy efficient sequencing

B. HVAC System: Cooling Towers

d. Interval: Before each cooling season; preferably April
e. Responsible Entity: Contract Maintenance Staff
f. Tasking
    i. Inspect for correct equipment clearances

ii. Inspect for physical damage
iii. Inspect general water quality, fill condition and sump level
iv. Review water treatment log and chemical treatment controller
v. Test make up and blow down valves
vi. Functionally sequence cooling tower fans
vii. Measure condenser water supply / return temperatures

C. HVAC System: Pumps

g. Interval: July & January; "peak clg" and "peak htg" times
h. Responsible Entity: Contract Maintenance Staff
i. Tasking
    i. Inspect for physical damage
    ii. Measure voltage and amperage
    iii. Measure differential pressures

D. HVAC System: Self Contained Units

j. Interval: July & January; "peak clg" and "peak htg" times
k. Responsible Entity: Contract Maintenance Staff
l. Tasking
    i. Inspect for physical damage
    ii. Functionally sequence unit from occupied to unoccupied mode
    iii. Ensure fresh air damper operates in accordance with unit
    iv. Functionally sequence heating / cooling
    v. Measure cooling / heating supply temperatures
    vi. Inspect air filters and DX coil condition
    vii. Inspect dampers for general condition and functionality

E. HVAC System: Fans

m. Interval: July & January; "peak clg" and "peak htg" times
n. Responsible Entity: Contract Maintenance Staff
o. Tasking
    i. Inspect for physical damage
    ii. Functionally sequence fans
    iii. Measure air flow rates and duct static pressure
    iv. Inspect dampers for general condition and functionality

F. HVAC System: Unit Heaters

p. Interval: Before each heating season; preferable September
q. Responsible Entity: Contract Maintenance Staff
r. Tasking
    i. Inspect for physical damage
    ii. Functionally sequence electric heater

G. HVAC System: Variable Air Volume Boxes

s. Interval: July & January; "peak clg" and "peak htg" times
t. Responsible Entity: Contract Maintenance Staff
u. Tasking
    i. Inspect for physical damage
    ii. Functionally sequence box from heating mode to cooling mode
    iii. Functionally sequence box from occupied mode to unoccupied mode
    iv. Functionally sequence VAV fans of perimeter boxes

H. Lighting System: Controls

v. Interval: First Monday of every month
w. Responsible Entity: Contract Maintenance Staff
x. Tasking
    i. Ensure controls operate in accordance with the SOO
    ii. Ensure lighting levels meet IESNA recommended level

I. Domestic Water System: Gas Water Heaters

y. Interval: July & January; "peak clg" and "peak htg" times
z. Responsible Entity: Contract Maintenance Staff
aa. Tasking
    i. Inspect for physical damage
    ii. Measure tank temperature
    iii. Functionally test controls

J. Domestic Water System: Pumps

bb. Interval: July & January; "peak clg" and "peak htg" times
cc. Responsible Entity: Contract Maintenance Staff
dd. Tasking
    i. Inspect for physical damage
    ii. Verify sequence of operations

K. Domestic Water System: Fixtures

ee. Interval: First Monday of every month

ff. Responsible Entity: Contract Maintenance Staff

gg. Tasking

i. Check volumetric flow per usage

ii. Ensure correct operation of manual controls

V. CORRECTIVE ACTION RESPONSE

(i.e. procedures for responding to deviations from expected performance parameters)

A deficiency log (issues log) will be generated, by the responsible entity, during the BAS review, spot checks, and functional testing. The deficiencies will be reviewed with the owner. The goal of this meeting will be to create a resolution plan. Typical resolution plans include quotations from outside mechanical contractors for equipment replacement, outside service contractors for equipment repairs, and outside controls contractors for BAS modifications. Once the repair / replacement occurs another functional test will be performed to verify. The deficiency log will then be updated by the contract maintenance staff. A deficiency log form similar document included in appendix A can be utilized for this process.

VI. SYSTEM EXPANSION AND EQUIPMENT REPLACEMENT

Direction for testing new and retrofitted equipment:

The functional testing forms utilized for the original building construction process can be utilized for commissioning of new equipment, re-commissioning of existing systems or verification of repair and replacement equipment. The blank functional test form can be found in Appendix B. Note: this site utilizes CxAlloy software for commissioning record keeping and deficiency follow through.

VII. APPENDICES

In the following appendices, you will find examples of the forms to be used for commissioning activities and deficiency logs.

A. **Appendix A: Deficiency Log (Issues Log)**

B. **Appendix B: Blank Functional Test Scripts**