

How to Commission a CALGreen Project

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Commissioning Group, LLC

- **CALGreen References**

- **BSC CALGreen Non-residential Commissioning Guide**
- **California Green Building Standards (T24)**
- **California Building Energy Efficiency Code**

CALGreen References

New buildings must incorporate sustainable design and construction features

- *Owners Program Requirements (OPR) developed by the Owner and Architect*
- *Basis of Design documents developed by MPE engineers directly addressing the OPR as to how the goals will be met*

Reduce electrical energy consumption

Reduce electrical energy base and peak demand

Reduce water and water heating energy consumption

CALGreen Objectives

Enforcement

- **Validate system performance according to the design intent**
- **Verify code ventilation and air quality features**
- **Verify code energy and water performance features**
- **Verify that the Owner receives properly operating and documented systems**

Sustainability

- **Train the Owner's operating personnel to keep the systems running in an accountable manner**

CALGreen Objectives

- **10,000 square feet or larger triggers Cx mandate**
- **CxA must be involved in the design and construction process**
 - **Cx Plan written and submitted to plan-check**
 - **Cx measures explained and coordinated in construction documents**
- **Mechanical, Plumbing, Electrical & Irrigation Systems involved**
- **T24 mandatory measures including MECH form acceptance items**
- **CxA must be regularly engaged in projects of similar size and type; not affiliated with the design team; contracted by the Owner**
- **TAB agency must be engaged with results sample-checked by CxA**

Commissioning Mandate

Mechanical Systems with DDC Controls

- **Equipment energy sub-metering (as provided)**
- **VAV air conditioning systems with economizers**
- **Return-exhaust or relief-exhaust fan control**
- **Constant OA ventilation air control**
- **CO₂ sensing and control**
- **VAV & fan assisted VAV zones**
- **VAV/reheat and fan assisted VAV/reheat zones**
- **Integrated occupancy detection control**
- **Supply air duct static pressure reset**
- **Supply air cooling/heating temperature reset**
- **Heating water systems**
- **Demand management (as provided)**

Systems to be Commissioned

Plumbing Systems

- **Water and Gas metering**
- **Service water heating**
- **Recirculation pump control**
- **One-pipe electronic faucets with laminar flow emitters**
- **Warm water wait times**

Systems to be Commissioned

Electrical Systems

- **Energy metering and sub-metering**
- **Time scheduled equipment control**
- **Schedule override control**
- **Occupancy sensing control**
- **Daylight harvesting systems**
- **Lumen maintenance programs**
- **Demand management control**

Systems to be Commissioned

Irrigation Control Systems

- **Water metering**
- **Schedule and area controllers**
- **Rain detectors**
- **Water flow accounting**
- **Broken sprinkler or line detection**
- **Failure to irrigate**

Systems to be Commissioned

Mechanical Systems

- **Detailed Sequence of Operation (CRITICAL)**
 - *Must be provided by the system designer (not DDC control contractor)*
 - *Must have setpoints, schedule times, event triggers and logic decisions clearly defined.*
 - *Sequences must be cross-checked after DDC system is programmed*
 - *Sequences form the basis for functional testing*
- **Review Documents**
 - *TAB results; review and comment*
 - *Startup forms for equipment*
- **Functional Performance Tests**
 - *Test different modes of operation*
 - *Verify VAV zone control operation; modes and flows*
 - *Verify VAV Reheat mode; dual-maximum flow, 90 degree discharge temperature limit*
 - *Test zone/system/group scheduling control operation*
 - *Validate basic central system sequences of operation*
 - *Check overall system dynamic tuning for stable control*
 - *Validate energy saving reset sequences (mandated and voluntary)*

How to Commission

Plumbing Systems

- **Obtain system performance information**
 - *Water temperature setpoints and schedules*
 - *Recirculation pump operating speed/temperature setting*
 - *Mixing valve temperature settings*
 - *Acceptable wait time for warm water*
- **Functional Performance Tests**
 - *Verify water and gas metering and logging*
 - *Verify water heating equipment operation at setpoint*
 - *Verify recirculation system scheduling and operation*
 - *Verify wait time to get warm water at lavatories*
 - *Verify flow and laminar emitter function*

How to Commission

Electrical Systems

- **Sequence of Operation**

- *Must be provided by the system designer in specifications or on plans (not by field sub-contractors)*
- *Must be detailed with settings, schedule times and event triggers*
- *Must be cross-checked with applied system and system must be programmed*
- *Forms the basis for functional testing*

- **Functional Performance Tests**

- *Test each system through different modes of operation*
- *Verify lighting scheduling control (indoor and outdoor)*
- *Verify daylight harvesting operation; dimming, control*
- *Verify lumen maintenance control as provided*
- *Verify proper operation of occupancy sensors; sensing areas and delay times*
- *Verify OCC sensor interlocks to HVAC zone for vacancy standby control*

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Irrigation System

- **Functional Performance Tests**

- *Verify irrigation water meter integration with controller*
- *Verify irrigation zone watering schedules programmed in*
- *Verify zone water flow operation and integration with controller*
- *Verify that flow settings with low and high flow alarms are programmed for each zone*
- *Verify failure to irrigate alarm and reset function*
- *Verify operation of rain sensor through actual test to cause irrigation to be halted.*
- *Verify time setting from halt to resume normal irrigation*

How to Commission

- **Review O&M Manuals and make Systems Manual**
 - Enhance O&M Manuals with materials gathered in the field
 - Insert project contact information gathered during commissioning
- **Review Contractor's Training Outline**
 - Make suggestions for improved content
 - Insert narrative of major systems description
 - Insert OSHA and California Code Regulations where they apply
 - Observe training sessions and interact with audience

Documentation & Training

- **Prepare a comprehensive report of commissioning activities from design through construction**
 - **Executive summary**
 - **Cx Issues logs of problems and resolutions**
 - **Performance tests and results**
 - **Training materials provided during training sessions**

Commissioning Report

- **Include commissioning process documents**

- *OPR and BODs*

- *Cx Plan*

- *Installation Startup Checklists*

- *Executed functional performance test documents*

- *Warranty checks and recommendations for rechecks*

- *Recommissioning recommendations and blank forms*

Commissioning Report

Questions?

CALGreen Commissioning