

**Building Operator Certification Training
For Custodian Engineers**

Practical Project 1 Description

The Practical Projects are a requirement of the BOC – Level 1 Certification. They are also one of the most valuable aspects of the course, as they provide opportunity for each operator to gain a systematic perspective on his or her own facility with particular focus on energy usage and conservation opportunities.

Project 1 - BUILDING SYSTEMS PROJECT

The Practical Project for the Building Systems is divided into three parts:

- (A) Site Plan Sketch & Conditions Mapping
- (B) Electrical System Schematic & Lighting Inventory
- (C) HVAC System Schematic & Zone Sketch

Work in this project emphasizes **schematic sketches** that will be developed by the student. Schematics are simplified, “one-line” drawings that show relationships between elements rather than physical location (as on floor plans) or full installation detail. While schematics should actually be done by hand rather than with a ruler on a drawing table, neatness, clarity and legibility are key to their usefulness and will be considered in evaluation. Students will also have the opportunity to coordinate schematics with **floor plan sketches** to improve the documentation of operating conditions.

The Project(s) require you to become proficient at simple, clear sketching and notation of field conditions. It is strongly recommended that you **work in pencil**. It is REQUIRED that your work be submitted on **11 x 17 paper**, in landscape orientation, with your name in the upper right corner. If you are unable to obtain 11 x 17 paper from your copy center, you can make it by taping two pieces of 8-1/2 x 11 sheets together along the 11-inch edge.

Survey forms are provided that must accompany the schematic drawing submissions.

Each part is due at the end of its associated module, every 5th week of the course. Students may review progress with the instructor in advance of the final submission date. An in-class group review of projects will be conducted in 4th class of each module – students should have preliminary draft projects ready for this group review as it can be a very valuable aid in submitting a good project.

PRACTICAL PROJECT COMPONENTS AND SCHEDULE

Each Practical Project is arranged in six parts, the three parts of Practical Project 1 will be due on the schedule as shown:

Project Component	Course Module	Due Date	Due Date
Part 1A	1	Week 5	July 11 th
Part 1B	2	Week 10	August 15 th
Part 1C	3	Week 15	October 3 rd

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PART A: SITE PLAN SKETCH & CONDITIONS MAPPING

Assigned: Week 2

Due: Week 5

Develop a site plan sketch of your site and all of the buildings on the site. This sketch does not need to be drawn to scale but try to reflect the approximate relative sizes of buildings. Use plans as possible to assist in your sketching. Include the following on the sketch:

- Site Boundary (usually the sidewalk on front of building and fence on three sides)
- Site Orientation - north/south/east/west (show North with an arrow)
- Buildings and building shapes
- Number of floors for each building and as they may vary within your building(s)
- Major functional areas - boiler room, cafeteria, gym, auditorium
- Building exposures to sun and prevailing wind
- Shading from other buildings, trees (evergreen or deciduous)
- Ventilation Outdoor Air Intakes, Rooftop units

Map Building IEQ Conditions On your building sketch, record notes about building conditions that you observe. In particular, record IEQ problem conditions related to ventilation, heating, or other. Typical conditions are Temperature is too high / low; Ventilation is too low; Lighting is too low.

Document your current window-opening patterns during winter months by notation on your sketch with the following coding:

W-A = lots of opening / **W-B** = some opening / **W-C** = generally kept closed

Complete the Building Information Survey Form. Complete this for your school buildings.

Checklist: Make sure you have completed these before you submit your project.

- Show the North with an arrow and Shading from other buildings and trees
- Number of floors for each building
- Major functional areas - boiler room, cafeteria, gym, auditorium
- Ventilation Outdoor Air Intakes, Rooftop units
- Window Opening codes: **W-A** , **W-B** , **W-C**
- Make a copy of your project for your records before you submit the project
- Your name is placed on the top, right corner with your class (eg. Tuesday, PM)

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PART B: ELECTRICAL SYSTEM SCHEMATIC & LIGHTING INVENTORY

Assigned: Week 6

Due: Week 10

Draw a schematic of the Building Electrical Distribution system. Draw a one-line diagram from the service entry to distribution (breaker) panels. Include the main distribution panel, the HVAC panel, motor starter panels, lighting panels and power panels on each floor. This is an electrical riser diagram with the sub-panels on every floor. Note the major loads and physical locations, meters and any sub-meters. Include notes on controls and operating schedules for various loads.

Obtain facility Electrical Plans as possible. Assess the plans for consistency with existing system conditions and your schematic. On the plans, see the equipment schedules that describe load characteristics and reference them on your schematic. Select one major load (for example, motor bank or lighting branch circuit) and compare the plan data to actual equipment. Or, if you don't have plans with the necessary data, take off data from the equipment and describe the selected load and its electric characteristics.

Major Loads List & Demand Response List – Complete the Form

Develop a list of the largest electric loads in the building, such as motors on HVAC equipment and in the boiler room, and the lighting in large areas. Determine the loads which can be turned off during a request to shed loads during a peak load event, during school hours, in the afternoon of a hot, summer day.

Lighting Survey Form – Perform a lighting inventory for the lighting equipment in one classroom and one corridor of your school, using the Lighting Survey Form.

Checklist: Make sure you have completed these before you submit your project.

- Show the electric entrance to building, the electric meter and main distribution panel
- Show the major panels, such as the HVAC panel and motor starter panels
- Show the electrical riser diagram with the lighting panels / power panels on each floor
- Complete the Major Loads List & Demand Response List
- Complete the Lighting Survey Form
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PART C: HVAC SYSTEM SCHEMATIC & ZONE SKETCH

Assigned: Week 11

Due: Week 15

Identify a system that you will describe schematically, such as a large heating or cooling system. The preference is to select a major heating system which has at least two zones of temperature control. The system should include at least one major equipment component (eg. a Boiler) and a complete circuit of system flow and a control mechanism.

If your facility has very complex systems (eg – perimeter and core multi-zoned distribution systems), you may define a one sub-system that you will work on.

Walk the system and develop an initial schematic diagram with major pieces of equipment. This is a key step and should result in a first sketch that shows the relationships between the system major components. Note: A schematic diagram shows the equipment and components in a system and how they relate to each other, without regard to the physical locations of the pieces of equipment.

Required: Show the zone control valves in the heating distribution system / cooling distribution system. Each zone control valve should be labeled with a number or identification label.

Obtain facility plans as possible and identify the elements of your system on them. Review the plans for equipment schedules and details related to your system. Compare what you have found in the plans to the equipment in the field. You may use any useful notes and information from the building plans to add as details on your schematic sketch.

Floor Plan & Zone Map - Make a simplified floor plan sketch of your facility which contains the system which you have drawn, and show the zones of heating / cooling as they are laid out in the building. Label each area of zoning with the same zone names which were used in the system schematic diagram. Note the location of HVAC components, distribution elements and system piping.

HVAC Survey Form – Complete this form for your HVAC systems.

Checklist: Make sure you have completed these before you submit your project.

Select the Checklist that applies to your project, below:

Boiler and Steam Distribution

- Diagram shows boilers, main steam header and steam distribution piping
- Diagram shows condensate return to condensate tanks / vacuum tanks
- Diagram shows steam to auxiliary, such as Hot Water Heater or Fuel Oil Heater
- Show the zone control valves in the heating distribution system
- Zone Map shows the location of heating zones in the building
- HVAC Survey Form is completed
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HVAC Air Distribution System OR Circulating Hot Water Heating System

- Diagram shows the main components of the system, including the circulating pumps or blowers, the system flow path to two zones (or more) in the building
- Diagram shows the location of outdoor air intakes and dampers (for HVAC systems)
- Show the zone control valves in the heating distribution system / cooling distribution
- Zone Map shows the location of heating zones in the building
- HVAC Survey Form is completed
- Make a copy of your project for your records before you submit the project
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