

BOC Training Equivalency Crosswalk

Instructions: Complete the profile below, then use the tabs below to cross-walk your training program's learning objectives to the National BOC ® Level I Course learning objectives and in-facility projects.

1. Complete tabs labeled BOC 1001 through BOC 1006.
2. One of the supplemental classes found on tabs Sup_1007 through Sup_1012 must also be addressed to ensure your program provided similar classroom and project time
3. Complete the Contact Information tab

Training Provider Name: _____

Program Name: _____

Program Website: _____

Supplemental Classes Cross-walked circle any that apply):

Sup_1007	Sup_1008	Sup_1009	Sup_1010	Sup_1011
Yes / No	Yes / No	Yes / No	Yes / No	Yes / No

For BOC Reviewer:

TOTAL from individual class tabs

<u>Criterion</u>	<u>Target</u>	<u>Actual</u>
Number of training hours	56	
Number of homework hours	18	
Percent of learning objectives parallel with BOC 1001	75%	
Test/Exam given to confirm understanding of knowledge?	Yes / No	

<p>Area of Knowledge</p> <p>Energy Efficient Operation of Building HVAC Systems</p>	<p>Provides an overview of building systems fundamentals. Focuses on operation and maintenance of envelope, central heating, cooling, air and ventilating systems in buildings. Emphasis is placed on group problem-solving and exercises with respect to preventive maintenance. 14 hours.</p>		
<p>Name of Course</p>	<p>Check all areas that apply</p>	<p>Minutes/Hours (total of 14 hrs)</p>	<p>Comments:</p>
<p>Recall eligibility and certification requirements for earning the Building Operator Certification (BOC®).</p>			
<p>Describe the building operators' role in achieving and sustaining energy-efficient building operation.</p>			
<p>Demonstrate understanding of whole building systems and how components interact with each other, with the building, its occupants, and the environment.</p>			
<p>Recall how to maintain energy using building systems, equipment, and envelope to minimize energy use and resources usages as well as the building envelope and heat transfer characteristics.</p>			
<p>Describe how climate location will likely influence load, operation and maintenance and the energy efficiency of various approaches to HVAC.</p>			
<p>Describe various energy sources currently in use for heating, cooling & ventilation and their likely costs per BTU and impact on carbon dioxide emissions.</p>			
<p>Discuss the benefits of preventive maintenance and troubleshooting service records programs for HVAC equipment and controls.</p>			

Recognize various environmental conditions that emphasize or challenge optimum occupant performance and energy efficiency for a building's air delivery systems (heating, cooling, and ventilation).			
Name of Course	Check all areas that apply	Minutes/Hours (total of 14 hrs)	Comments:
Explain troubleshooting and optimization approaches for heating and cooling units, systematic diagnostic procedures, and determination of repair needs.			
Recall building shell evaluation techniques and proven retrofit approaches to reduce energy use.			
Recall HVAC equipment being deployed in high-performance buildings (e.g., condensing boilers, ground-source heat pumps, chilled beams)			
<u>Project Assignment:</u> Draw a simple floor plan of the facility. Identify primary heating and cooling plants, distribution lines and control points.			

For BOC Reviewer Use:	
<u>Criterion</u>	<u>Measure / Actual</u>
Number of training hours	14
Number of homework hours	6
Percent of learning objectives parallel with BOC 1001	75%
Test/Exam given to confirm understanding of knowledge	Y/N

Area of Knowledge Measuring and Benchmarking Energy Performance	Covers how energy is used in commercial buildings and how to identify and prioritize conservation opportunities. Includes basic principles of energy accounting, evaluation of fuel options, operation and maintenance strategies to improve efficiency, and energy management planning techniques. Covers how to perform quantifiable evaluations of facility energy use in order to be able to target prospects for energy conservation. 7 hours.		
Name of Course	Check all areas that apply	Minutes/Hours (total of 7 hrs)	Comments:
List major energy loads in commercial buildings.			
Convert energy units to BTUs and calculate energy use index for your building.			
Cite the benefit of using spreadsheets to compute energy use indices and construct energy profiles for fuels used in the building.			
Identify and prioritize conservation opportunities.			
Identify opportunities to improve operation and maintenance procedures.			
Benchmark a building			
Successfully complete the take-home facility project assignment			
<u>Project Assignment:</u> Create an energy benchmark for your building using Energy Star ® Portfolio Manager.			

For BOC Reviewer Use:	
<u>Criterion</u>	<u>Measure / Actual</u>
Number of training hours	7
Number of homework hours	3
Percent of learning objectives parallel with BOC 1002	75%
Test/Exam given to confirm understanding of knowledge	Y/N

Area of Knowledge Essential Lighting Fundamentals	Covers lighting fundamentals and types of lighting for economical and energy efficient lighting systems. Participants learn principles of efficient lighting including evaluation of lighting levels, quality and maintenance. Overview of lighting fixture and control technologies, common upgrades, retrofit and redesign options, and management strategies as they apply to space use and function. 7 hours.		
Name of Course	Check all areas that apply	Minutes/Hours (total of 7 hrs)	Comments:
Describe the fundamentals of light and the principles of energy efficient lighting.			
Identify the technology behind modern lighting equipment, including, lamps, ballasts, luminaires, and controls.			
Discuss how energy efficient lighting strategies are implemented.			
Describe O & M procedures for lighting systems in typical commercial spaces.			
Identify possible lighting retro-fit options for typical commercial spaces.			
Recall utility programs that can help with energy efficiency projects			
<u>Project Assignment:</u> Perform a simplified lighting survey including watt densities and lighting levels. Research your local utility's energy efficiency programs and describe the services. Calculate an energy efficiency incentive for an example lighting retrofit.			

For BOC Reviewer Use:	
<u>Criterion</u>	<u>Measure / Actual</u>
Number of training hours	7
Number of homework hours	3
Percent of learning objectives parallel with BOC 1003	75%
Test/Exam given to confirm understanding of knowledge	Y/N

<p style="text-align: center;">Area of Knowledge</p> <p style="text-align: center;">HVAC Control Fundamentals</p>	<p>Introduces automatic control systems for building mechanical systems and equipment and HVAC control sequences and programming. How to target possible inefficiencies in their HVAC systems and to evaluate potential problems as part of an enhanced operation and maintenance program. Introduces Building Automation Systems (BAS) and the graphic user interface as a cost effective tool to review real time data to identify problems and verify proper performance for air handling and central plant systems as part of an enhanced operation and maintenance program. Covers the development and use of key performance indicators (KPIs) to ensure persistence of performance. 7 hours.</p>		
<p style="text-align: center;">Name of Course</p>	<p>Check all areas that apply</p>	<p>Minutes/Hours (total of 7 hrs)</p>	<p>Comments:</p>
<p>List the main devices in a basic control system and tasks required in the preventative maintenance of control systems.</p>			
<p>Differentiate between analog, low voltage, pneumatic and digital control processes.</p>			
<p>Interpret basic control drawings, sequence of operations, and DDC graphics to identify HVAC control applications and explain control processes.</p>			
<p>Analyze graphical user interfaces from a building's BAS system to gather data on building and system performance.</p>			
<p>Prepare screen check data forms to troubleshoot building and equipment level issues.</p>			
<p>Use BAS data to compare actual and expected modes of operation to verify operational efficiency.</p>			
<p>Identify BAS data inconsistencies using trend data to confirm system operations.</p>			
<p>Use key performance indicators in BAS data to troubleshoot system issues.</p>			
<p><u>Project Assignment:</u> Review facility heating, cooling and ventilation operations and maintenance measures. Provide a control system overview identifying strategies by system and running time comparisons.</p>			

For BOC Reviewer Use:	
<u>Criterion</u>	<u>Measure / Actual</u>
Number of training hours	7
Number of homework hours	3
Percent of learning objectives parallel with BOC 1004	75%
Test/Exam given to confirm understanding of knowledge	Y/N

Area of Knowledge Indoor Environmental Quality	Introduces the basic causes of indoor air pollution in commercial and institutional buildings and outlines prevention strategies. Emphasis is placed on an understanding of IAQ dynamics, building system interactions, and the importance of education and communications with building occupants. Practical and effective control strategies will be discussed along with basic IAQ equipment and measurement demonstrations. Discussion and case studies provide the learner with an essential understanding of the key elements of a preventive IAQ program. 7 hours.		
Name of Course	Check all areas that apply	Minutes/Hours (total of 7 hrs)	Comments:
Describe the key factors that determine indoor environmental quality in commercial buildings.			
Identify basic air handling equipment and implications for thermal comfort and indoor air quality.			
List the elements of a basic indoor environmental quality program and assist in creating one.			
Describe the relationship between moisture, mold, and ventilation.			
List the procedures to effectively manage indoor air quality concerns and complaints.			
Communicate effectively with occupants about IEQ issues.			
Identify a minimum of two information resources for managing IEQ			
<u>Project Assignment:</u> Develop an Occupancy Schedule. Profile the occupancy of the facility by week, month and year.			

For BOC Reviewer Use:	
<u>Criterion</u>	<u>Measure / Actual</u>
Number of training hours	7
Number of homework hours	3
Percent of learning objectives parallel with BOC 1005	75%
Test/Exam given to confirm understanding of knowledge	Y/N

Area of Knowledge Common Opportunities for Low-Cost Operational Improvement	Introduces common opportunities that offer the greatest energy savings potential. Examines typical areas and problems associated with different system types and equipment as well as tools and techniques for identifying opportunities. 7 Hours		
Name of Course	Check all areas that apply	Minutes/Hours (total of 7 hrs)	Comments:
Develop a Building system Operations Map			
Schedule building systems and equipment and implement operational strategies to limit equipment on-time			
Identify critical control sensors in a building and recognize symptoms of sensor error.			
Identify control strategies and equipment faults that lead to excessive reheat and recool.			
Recognize common symptoms of simultaneous heating and cooling			
Recognize symptoms of poor outside air control and look for typical problems			
Understand concepts of common HVAC systems and how the design makes them prone to certain problems causing excessive energy use.			
Use loggers for energy profiling, estimating savings potential, trouble shooting			
Identify applications for loggers and analyze logger data for operating hours, temperatures, loading, other parameters.			
Use logger data to estimate savings potential			

For BOC Reviewer Use:	
<u>Criterion</u>	<u>Measure/Actual</u>
Number of training hours	7
Number of homework hours	0
Percent of learning objectives parallel with BOC 1006	75%

Test/Exam given to confirm understanding of knowledge	Y/N
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<p style="text-align: center;">Area of Knowledge</p> <p style="text-align: center;">Facility Electrical Systems</p>	<p>Introduces basic electrical theory and develops a practical understanding of electricity and its use in commercial facilities. An overview of troubleshooting electrical systems is provided to develop the operator's ability to evaluate ongoing electrical problems and work with licensed staff or contractors to provide maintenance support. Covers the fundamentals of electricity, how it is distributed in a typical facility, maintenance considerations, and ways energy might be saved in the distribution system. 7 hours</p>		
<p style="text-align: center;">Name of Course</p>	<p style="text-align: center;">Check all areas that apply</p>	<p style="text-align: center;">Minutes/Hours (total of 7 hrs)</p>	<p style="text-align: center;">Comments:</p>
<p>Explain the basic structure of an atom.</p>			
<p>Define voltage and identify the ways in which it can be produced.</p>			
<p>Explain the difference between conductors and insulators.</p>			
<p>Define the units of measurement that are used to measure the properties of electricity.</p>			
<p>Explain how voltage, current, and resistance are related to each other.</p>			
<p>Using the formula for Ohm's law, calculate an unknown value.</p>			
<p>Explain the different types of meters used to measure voltage, current, and resistance.</p>			
<p>Using the power formula, calculate the amount of power used by a circuit.</p>			
<p>Explain the basic characteristics of a series circuit, parallel circuit, and series-parallel circuit.</p>			

Name of Course	Check all areas that apply	Minutes/Hours (total of 7 hrs)	Comments:
Calculate the voltage drop in series, parallel, and series-parallel circuits.			
Calculate the total current in parallel and series-parallel circuits.			
Find the total amount of resistance in a series circuit, parallel circuit, and series-parallel circuit.			
Identify electrical hazards and recall to avoid or minimize them in the workplace.			
Explain safety issues concerning lockout/tagout procedures, personal protection using assured grounding and isolation programs, confined space entry, respiratory protection, and fall protection systems.			
Identify common symbols, interpret electrical drawings and describe the type of information included in electrical specifications.			
Describe typical preventative maintenance for an electrical distribution system and describe ways to maintain an energy efficient and reliable facility electrical system.			

For BOC Reviewer Use:	
<u>Criterion</u>	<u>Measure / Actual</u>
Number of training hours	7
Number of homework hours	0
Percent of learning objectives parallel with 1007	75%
Test/Exam given to confirm understanding of knowledge	Y/N

<p style="text-align: center;">Area of Knowledge</p> <p>Operation & Maintenance Practices for Sustainable Buildings</p>	<p>Provides an overview of best O&M practices for green or high performance buildings and addresses exterior site issues, water efficiency, cleaning products, material and supply purchasing, energy, and indoor environmental quality. National green building rating systems such as LEED and tools through ENERGY STAR for evaluating the sustainability of the existing buildings are also explored. Participants will learn to identify and apply O&M practices for improving the performance of both existing buildings and newly-designed green buildings. 7 hours.</p>		
<p style="text-align: center;">Name of Course</p>	<p>Check all areas that apply</p>	<p>Minutes/Hours (total of 7 hrs)</p>	<p>Comments:</p>
<p>Discuss the goals and benefits of sustainability and how it relates to operations and maintenance in green buildings.</p>			
<p>Identify the six key areas of sustainable building operation and maintenance.</p>			
<p>Define carbon emission and discuss ways emission is measured and controlled.</p>			
<p>Describe national rating systems, strategies, and energy benchmarking tools for sustainable building design, construction and operation.</p>			
<p>Evaluate the sustainability of a facility and identify opportunities and challenges in making the building's operations more sustainable.</p>			
<p>Evaluate the sustainability of a facility's grounds and identify opportunities and challenges in making the building site and landscape more sustainable.</p>			
<p>Calculate the baseline water consumption for a building and design a fixture schedule to achieve Federal water conservation standards.</p>			
<p>Recall energy cost control strategies and describe a range of O&M practices for improving building energy and resource conservation.</p>			

Name of Course	Check all areas that apply	Minutes/Hours (total of 7 hrs)	Comments:
Evaluate ways a facility can reduce energy consumption, identify challenges, and propose solutions.			
Define Indoor Environmental Quality (IEQ), evaluate chemicals and products against sustainability standards, and discuss strategies for improving the IEQ of a building.			

For BOC Reviewer Use:	
<u>Criterion</u>	<u>Measure / Actual</u>
Number of training hours	7
Number of homework hours	0
Percent of learning objectives parallel with 1008	75%
Test/Exam given to confirm understanding of knowledge	Y/N

Area of Knowledge Building Scoping for Operational Improvement	Focuses on creating a prioritized scope of work for finding opportunities for energy saving operational adjustments. The content includes presentations and group discussions as well as hands-on information gathering and analysis. 7 hours.		
Name of Course	Check all areas that apply	Minutes/Hours (total of 7 hrs)	Comments:
Differentiate between the types of data necessary for a building scoping			
Draw a building utility load shapes and identify common problems			
Use an interval chart to determine the base load and to identify potential energy savings			
Explain how to create a scoping plan			
Cite the benefits and outline procedures for conducting a building walkthrough			
Identify and diagnose causes to common envelope integrity issues found during a building walkthrough			
Interpret utility data as it relates to building operation			
Explain the major components of a written scoping report and how they are used to plan a building tune-up project			

For BOC Reviewer Use:	
<u>Criterion</u>	<u>Measure / Actual</u>
Number of training hours	7
Number of homework hours	0
Percent of learning objectives parallel with 1009	75%
Test/Exam given to confirm understanding of knowledge	Y/N

<p>Area of Knowledge</p> <p>Energy Efficient Ventilation Strategies</p>	<p>Covers the theory, design, and operational practices for displacement ventilation strategies, under-floor air distribution systems, and naturally ventilated and mixed mode strategies in buildings. 7 hours.</p>		
<p>Name of Course</p>	<p>Check all areas that apply</p>	<p>Minutes/Hours (total of 7 hrs)</p>	<p>Comments:</p>
<p>Contrast the key operating characteristics that distinguish between Under Floor Air Distribution UFAD, Displacement Ventilation (DV), Natural Ventilation, and mixed-mode-systems.</p>			
<p>Recognize the most common system components, design configurations, applications, and principles of operation found in the U.S.</p>			
<p>Discuss the relative benefits and challenges of each system.</p>			
<p>Explain how room air stratification affects performance, what are recommended levels, and how adjustments can be made.</p>			
<p>Describe the fundamentals of thermal decay.</p>			
<p>Recall troubleshooting techniques and strategies for addressing energy and indoor environmental quality issues.</p>			
<p>Explain the thermal comfort standards and how they compare to conventional standards.</p>			

Identify ways to improve thermal comfort, reduce system energy use, and maintain an effective and high-performing HP HVAC system.			
Name of Course	Check all areas that apply	Minutes/Hours (total of 7 hrs)	Comments:
Recall key research results that help us understand how occupants interact with and respond to the indoor environments.			
Identify the range of control strategies that people have used to optimize each system type.			
Recall case studies in various climates that can be used as precedents for the design and operation of similar buildings.			

For BOC Reviewer Use:	
<u>Criterion</u>	<u>Measure / Actual</u>
Number of training hours	7
Number of homework hours	0
Percent of learning objectives parallel with 1010	75%
Test/Exam given to confirm understanding of knowledge	Y/N

<p>Area of Knowledge</p> <p>High Performance Heating and Cooling Equipment</p>	<p>Introduces new HVAC equipment technologies being installed in high performance buildings. Covers the financial, energy, operations, maintenance and indoor environmental quality considerations related to high performance HVAC equipment. Examples of high performance HVAC equipment are also presented. 7 hours</p>		
<p>Name of Course</p>	<p>Check all areas that apply</p>	<p>Minutes/Hours (total of 7 hrs)</p>	<p>Comments:</p>
<p>Describe HVAC equipment being deployed in high-performance buildings (e.g., condensing boilers, ground-source heat pumps, chilled beams)</p>			
<p>Explain advanced control sequences and strategies associated with high-performance HVAC equipment</p>			
<p>Apply specific operations and maintenance techniques to maintain good performance</p>			
<p>Determine the difference between initial cost and total cost of ownership for a piece of equipment</p>			
<p>Add the requirement for total cost of ownership analysis to proposals</p>			
<p>Develop specifications for product and equipment vendors that offer energy-efficient products</p>			
<p>Describe how high-performance equipment can help building owners comply with local and state energy efficiency requirements</p>			
<p>Describe typical utility incentives and tax credits that apply to high-performance heating and cooling equipment</p>			

Name of Course	Check all areas that apply	Minutes/Hours (total of 7 hrs)	Comments:
Describe how high-performance equipment can help building owners meet building energy management goals and policies			
Describe industry awards and certifications, such as LEED, that apply to high-performance equipment			

For BOC Reviewer Use:	
<u>Criterion</u>	<u>Measure / Actual</u>
Number of training hours	7
Number of homework hours	0
Percent of learning objectives parallel with 1011	75%
Test/Exam given to confirm understanding of knowledge	Y/N

<p style="text-align: center;">Area of Knowledge</p> <p style="text-align: center;">Energy Savings through Energy Recovery</p>	<p>Introduces methods for capturing heating and cooling energy before it is vented or wasted, and related technologies currently available in the market. Covers the theory, design and operational practices for energy recovery from air and water source systems. Examples of energy recovery equipment are also presented. 7 hours</p>		
<p style="text-align: center;">Name of Course</p>	<p>Check all areas that apply</p>	<p>Minutes/Hours (total of 7 hrs)</p>	<p>Comments:</p>
<p>Describe how and where energy is wasted in a typical building</p>			
<p>Explain the theory of energy recovery from air and water source systems</p>			
<p>List the types of air and water source energy recovery systems</p>			
<p>Implement operational practices for energy recovery from air and water source systems</p>			
<p>Describe the design considerations related to air and water source energy recovery systems</p>			
<p>Describe typical utility incentives and tax credits that apply to implementing energy recovery strategies</p>			
<p>Explain why capturing heating and cooling energy before it is vented or wasted is a cost-effective strategy</p>			
<p>Describe how energy recovery techniques can assist building owners in meeting energy management goals</p>			

Name of Course	Check all areas that apply	Minutes/Hours (total of 7 hrs)	Comments:
Demonstrate the cost effectiveness of energy recovery techniques using energy accounting principles			
Describe how energy recovery strategies can help building owners comply with local and state energy efficiency requirements			
Describe industry awards and certifications (e.g., LEED) that apply to energy recovery strategies			

For BOC Reviewer Use:	
<u>Criterion</u>	<u>Measure / Actual</u>
Number of training hours	7
Number of homework hours	0
Percent of learning objectives parallel with 1012	75%
Test/Exam given to confirm understanding of knowledge	Y/N

Student Contact Information (Please complete all fields and submit with your Crosswalk)

___ Mr. ___ Mrs. ___ Ms. **Name:** _____

Employer: _____ **Job Title:** _____

Length of Employment: _____ **Prior Work Experience:** _____

Work Address: _____ **Suite Number/Mail Stop:** _____

City/State/Zip: _____

Work Phone (with Area Code): _____ **Fax Number:** _____

Email: _____

Home Address: _____ **Apt/Unit No.** _____

Home City/State/Zip: _____ -----

Personal Phone (with Area Code): _____ **Personal Email:** _____