

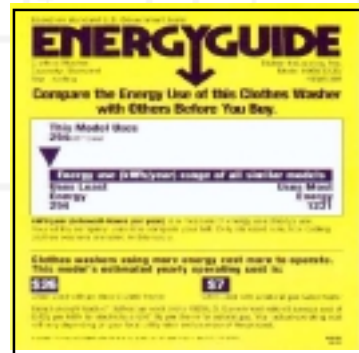
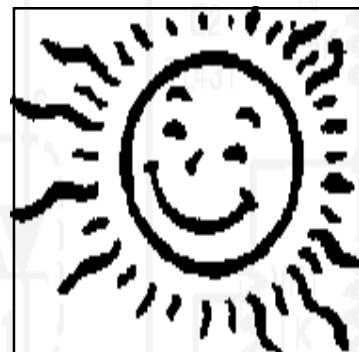
GUIDE to

Commercial Energy Conservation Ordinance

Berkeley
Municipal
Code 19.72

Revised July 2005

Performing a Self-Audit for CECO



City of Berkeley
*Housing Department, Office of Energy &
Sustainable Development*
2180 Milvia Street, 2nd Floor
Berkeley, CA 94704
Telephone: 510-981-5434

City of Berkeley
*Permit Service Center,
Building & Safety Division*
2120 Milvia Street
Berkeley, CA 94704
Telephone: 510-981-7440

**City of Berkeley
Commercial Energy Conservation Ordinance (CECO) 6176 N.S.
Municipal Code 19.72**

CECO Self-Audit Guidelines

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2118 Milvia Street
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Introduction

City of Berkeley
**Building and Safety
Permit Service Center**
2118 Milvia St.
Berkeley, CA 94704
Tel: 510-981-7440
Email: planning@ci.berkeley.ca.us
www.ci.berkeley.ca.us/buildingandsafety

City of Berkeley
**Energy & Sustainable
Development**
2180 Milvia St.
Berkeley, CA 94704
Tel: 981-5434
Email: Energy@ci.berkeley.ca.us
www.ci.berkeley.ca.us/ENERGY

The City of Berkeley's Commercial Energy Conservation Ordinance (CECO) effective April 23, 1994, requires commercial buildings in Berkeley that are sold or renovated to comply with certain energy conservation measures.

CECO may require you to:

- obtain an energy audit of your building and file it with Building and Safety;
- install all required energy conservation measures that apply to your building; and,
- obtain a final energy inspection and file it with Codes and Inspections.

At your option, you may decide to complete a "self audit" of your building to determine which energy conservation measures you need to install. The purpose of these guidelines is to assist you in completing a self-audit. These guidelines are for information only. The actual Ordinance No. 6176-N.S. is the controlling document and should be considered for further clarification.

For more information on CECO and how to obtain the proper CECO forms, you should refer to, "Information about the City of Berkeley's Commercial Energy Conservation Ordinance". This free informational brochure is available through the City's Building and Safety Division.

Who Should Use These Guidelines?

Depending on the complexity of your building, and your knowledge and experience with energy conservation, a self-audit may not be right for you. In fact, it may increase the time and expense required in complying with CECO. To complete a self-audit, you are undertaking a risk that an energy inspection from Codes and Inspections may find omissions in your energy audit that will require you to go back and complete additional energy conservation work in order to comply with CECO, and then get another inspection from the City.

To complete a self-audit, you, or anyone who assists you with the audit, should have basic knowledge about the energy systems in your building and the various energy conservation equipment and controls that currently exist. If you feel uncertain of your ability to complete a self-audit, you should obtain an energy audit from a City of Berkeley "Authorized CECO Auditor." For information on current Authorized CECO Auditors, please call the Building and Safety Division. If you begin a self-audit and are unable to finish, be sure to keep your notes since they may help an authorized CECO auditor complete your audit.

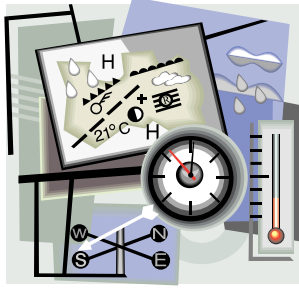
How To Use These Guidelines

These guidelines contain information on each of the 32 energy conservation measures, or "ECMs" required by CECO. For each ECM, there is a brief description of what is required, any exemption that may be available, and what to look for when conducting your energy audit. For many of the ECMs, there is a direct relationship between what is required by CECO and what is required by the State's Title 24, Part 6, energy standards for new construction. This relationship to Title 24 is also described for each ECM.

To complete a self-audit, you will need the following forms in addition to these Guidelines:

- **CECO Form 1: General Application and Compliance Transfer Form** This form is used to record information for each building subject to CECO, including the Assessor's Parcel Number, the address, and other important data. This form starts the CECO process.

- **CECO Form 2: Energy Audit/Inspection Compliance Form.** This form is used to record the results of your energy audit and to verify compliance during the energy inspection.



It will also be very helpful to have a copy of the “CECO Informational Brochure”. After completing your self-audit, both FORM 1 and FORM 2 must be filed with Building and Safety, and a filing fee of \$16.50 must be paid. (File the forms at Building and Safety Permit Service Center, 2118 Milvi St. Berkeley. 94704 along with the filing fee.)

In completing your self-audit, you should walk around your building with this Guideline booklet and FORM 2. A clip board for writing will be helpful. For each energy conservation measure listed on FORM 2, Part B, check to see whether any of the following apply, and if so put one of the following letter codes in the “Not Required” box:

- **NA - Not Applicable:** Use this code if the measure does not apply to your building because you do not have the particular equipment or system that the measure refers to.
- **COM - In Compliance:** Use this code if you checked your equipment and found the measure already installed or otherwise in compliance.
- **NCE - Not Cost Effective:** This code should only be used if the economic payback of a particular measure would exceed 5 years. If you are claiming this, you will have to provide detailed documentation of the cost of installing the measure, as well as detailed calculations of the expected energy savings and payback time. You can expect the inspector to scrutinize these calculations very carefully.
- **T24 - Title 24 Compliance:** Use this code if the measure complied with State Title 24 energy standards within the last 10 years and the conditions that allowed it to comply still exist.

If none of these letter codes apply, the measure is required in your building, so put a check mark in the “Required” box.

Exemptions

To call for an inspection after your self-audit, please have:

1. Permit Application Number (for construction/remodeling)
2. Project Address
3. Type of Inspection needed (CECO)
4. Day and date requested for inspection

Remember that in completing a self-audit, all decisions you make in terms of measure applicability, compliance, cost-effectiveness, and Title 24 standards are subject to review by an Energy Inspector from Codes and Inspections. To the extent possible, you should have documentation to substantiate any specific exemptions you may claim. This documentation may include building plans, previous Title 24 calculations, cost-effectiveness calculations, contractor receipts and certificates, etc. The burden of proof is on you to show that any particular energy conservation measure is not required for your building.

As a final note, in completing a self-audit, you may be inclined to complete some or all of the required measures prior to filing FORM 2 with Codes and Inspections. This approach is not advisable due to the impact it may have on your “expenditure limit”. (See the Informational Brochure for more detail concerning expenditure limits.) Full credit of expenditures towards the expenditure limit is only available for those measure which were marked as “required” during the audit. The completion of measures prior to filing FORM 2 may thus increase the overall amount you may have to spend to comply with CECO.

Financial Incentives

PG&E Rebate Programs

1-800-468-4PGE
www.pge.com/biz/rebates/index.html
 510-848-8658

Low-Interest Loans

Safe-BidCo
 1-800-273-8637
www.safe-bidco.com

For many of the energy conservation measures required by CECO, you may be eligible to receive a cash rebate from PG&E. In some cases, rebates may cover 50% or more of the cost of materials. General maintenance measures, such as repair of HVAC dampers or cleaning of a boiler, are not eligible to receive rebates. For more information on PG&E’s rebate programs, and to receive a rebate application form, call PG&E’s Hotline at 1-800-468-4PGE, ext. 125 or PG&E’s Berkeley office at 510-848-8658.

Your energy conservation upgrades may also be eligible for funding with a low interest loan. SAFE-BIDCO, a state-owned small business assistance agency, will finance most energy projects up to a maximum of \$350,000. Loans are currently available at 5% interest for loan terms of up to 5 years. For more information, and to receive a loan application package, contact SAFE-BIDCO.

Heating Ventilating and Air Conditioning (HVAC) Energy Conservation Measures

#1 Thermostats

Description:

A faulty thermostat can waste a lot of energy. Check to make sure that all thermostats are working properly. Faulty or inaccurate thermostats should be replaced.

Exemptions:

NONE

What to look for:

Unless the thermostat is obviously broken, inspecting can sometimes be tricky. The easiest method is to simply turn the thermostat setting up or down, and see if the HVAC system responds. Once in the heating mode, a warm source, such as a hair dryer, can be brought near the thermostat to determine if the systems turns off. Be careful not to damage the thermostat with excessive heat.

Relationship to Title 24:

Section 122(a) requires thermostatic controls in new construction and for HVAC systems undergoing renovation. Title 24 does not require any inspection to determine if nonfunctional thermostats need repair.

NOTES:

#2 Time Clocks

Description:

A time clock, also known as a time switch, is a simple device that turns equipment on and off according to a predetermined schedule. CECO requires that time clocks be used to control:

- cold water chillers, air conditioners, or other cooling equipment;
- chilled water, hot water, and heat exchanger circulation pumps;
- boilers or other space heating equipment; and
- supply, return and exhaust fans.

Time clocks may be mechanical or electronic, and may also include an “occupant override.” An override will allow a temporary override of the programmed time clock settings if the equipment needs to run outside of normal hours. If an override control is used, the time clock must automatically revert to regular time clock control within 12 hours. Alternatively, a more sophisticated computerized “energy management system” (EMS) may also be used to provide HVAC control.

Exemptions:

You may be exempt from this requirement if your building is normally occupied 24 hours per day, or has special requirements that depend on 24-hour space conditioning. Exemptions are also available for HVAC systems which are already controlled by setback thermostats in a majority of their zones. Particular equipment may also be exempt if the manufacturer specifies that the equipment must not shut off.

What to look for:

The simplest mechanical time clocks are enclosed in a metal box with a door. Inside is a timer dial with “pins”, or “trippers” at selected ON and OFF times. Electronic time clocks are generally more expensive, but often have more sophisticated features such as manual override, 365-day settings, a built-in calendar, and the ability to control more than one piece of equipment. Check to make sure the clock reads the current time, and that ON and OFF times are properly set for your building’s operating schedule. Manually switch the time clock to see if the equipment responds (assuming other controls, such as thermostat, are not preventing the equipment from running). If a computerized EMS is present, you may need assistance to determine what equipment is being controlled, and what the current schedule is. Check with the person in charge of monitoring and maintaining the EMS.

Relationship to Title 24:

Section 122(e) requires timeclock controls for HVAC equipment in new buildings and in buildings undergoing renovation. The exemptions in Title 24 are the same as those allowed by CECO.

NOTES:

#3 Outside Air Economizer

Description:

An economizer takes advantage of the outside air for cooling as much as possible, rather than rely only on mechanical cooling. The Bay Area's mild climate is ideally suited for economizers. All cooling systems which have a cooling capacity greater than 6.25 tons (about 75,000 BTUs/hr) or provide more than 2,500 cubic feet per minute of air flow, should have an operating outside air economizer.

Exemptions:

Cooling systems which do not have a manufacturer-approved method for adding an economizer are exempt. Any of the following conditions may also allow your cooling system to be exempt from adding an economizer:

- the building has special uses which require 100% outside air ventilation;
- the system already has a water-based economizer;
- the system does not have an outside air intake;
- special economizer operations, such as carefully-controlled humidity, would use more energy than would be conserved;
- there is insufficient space to install the economizer equipment;
- an economizer would require major changes to a building's life-safety system; or,
- the existing system is multi-zone, where the same intake air may be used at the same time for heating or cooling in different zones.

What to look for:

Determining if your system has or needs an economizer can be tricky and may require the help of a trained professional. Check to see if a controller is connected to outdoor and return air temperature sensors and dampers. To check for proper operation of an economizer, switch the unit to cooling mode and turn up the outside air set point higher than the outside air temperature. Dampers should open fully. Finally, switch to heating mode and the dampers should close. If you can't tell if you have an economizer, try to find out from the company that services the unit. Also try to find out from the service company if a manufacturer-approved economizer is available for "add-on" and could be installed without major changes to your duct work.

Relationship to Title 24:

Section 144(e) requires integrated air or water economizers on new air conditioning units greater than 2,500 cfm air flow, and over 75,000 BTUs/hr cooling capacity in all new construction and renovation.

NOTES:

#4 Air Ducts -- Leaks

Description:

Leaky ducts will rob your HVAC system of its efficiency. CECO requires that all leaking air ducts be repaired.

Exemptions:

Duct repairs are not required in areas that are “inaccessible” or would require major modification of the building to gain access. For example, leaking ducts in walls or between suspended ceilings and floors would be exempt from repairs unless there was an easy method of reaching and repairing them.

What to look for:

With the system operating, carefully check all accessible air supply and air return ducts, especially at joints, to make sure they are not leaking. Dirty spots and streaks in insulation wrapping often indicate air leaks.

Leaks may also be heard as well as felt. Be sure to inspect the ducts in each mechanical room and around each air handling or packaged HVAC unit, especially at flexible connections.

In multi-story buildings, try to find a place on each floor to inspect the ducting, usually in the floor’s mechanical room. If ducts are found to be leaking, they should only be repaired with metal-faced or mesh tape and mastic. Do not use duct tape, as it dries out and will fail.

Relationship to Title 24:

Section 124(c) requires air handling ducts and plenums to be sealed in accordance with the SMACNA HVAC Duct Construction Standards-Metal and Flexible, 1985.

NOTES:

#5 Air Dampers

Description:

As in the repair of air duct leaks, damper adjustment is a general maintenance measure which can greatly improve the efficiency of older HVAC systems. CECO requires that HVAC air dampers, damper controls, and mechanical linkages be properly operating and adjusted.

Exemptions:

NONE

What to look for:

Determining if dampers need adjustment should best be performed by a qualified energy auditor, or a service person familiar with your system. In general, all accessible dampers should be checked for freedom of movement and tightness of seals. Controls that operate dampers, including actuator motors and linkages, should also be checked to see if they are working properly.

Relationship to Title 24:

No relationship.

NOTES:

#6 Air Ducts and Plenums -- Insulation

Description:

Uninsulated air ducts and plenums waste energy and reduce your HVAC system's efficiency. All heating and cooling air ducts and plenums found in mechanical rooms, around air handling units, and in other unconditioned areas should be insulated to current Title 24 standards.

The minimum Title 24 standard is currently R-6.3 for ducts located on roofs.

Exemptions:

Insulation is not required for ducts and plenums located within HVAC equipment, or ducts and plenums that are not accessible. Exhaust air ducts or ducts containing asbestos are also exempt.

What to look for:

Look for insulation on all air ducts and plenums in and around mechanical rooms, air handling units, and in any other building areas that are not heated or cooled. If insulation is present, but you cannot determine the R-value, note that fiberglass, or mineral fiber will be about R-3 per inch of thickness. Foam insulation is about R-4 per inch of thickness. Some ducts may be insulated on the inside and can be checked by opening a duct access door.

Relationship to Title 24:

Section 124(c) requires ducts and plenums to be insulated in compliance with Sections 1002, 1003, and 1005 of the Uniform Mechanical Code.

NOTES:

#7 Pipes-- Insulation

Description:

Uninsulated pipes reduce cooling and heating system efficiency. All accessible hot water, steam, steam condensate return and chilled water piping should be insulated to current Title 24 standard, including any piping located above suspended ceilings. Pipe insulation is generally inexpensive and easy to install.

Exemptions:

Piping that is within HVAC equipment, in conditioned spaces that carries fluids between 60 degree and 105 degrees F. , or piping that is already insulated where the insulation is in good condition is exempt. Inaccessible piping is also exempt. Piping that would require major structural alteration to insulate it is also exempt.

What to look for:

Check for insulation on all hot water, steam, steam condensate return and chilled water pipes. Also check piping above suspended ceilings. The amount of pipe insulation required by Title 24 depends on the pipe diameter, the temperature of the fluids in the pipe, and the pipe's function. R-values are specified in terms of inches of insulation, In general, pipes should have at least 1- to 1.5 inches of insulation unless they are greater than one inch in diameter, or carry fluids over 200 degrees F.; Title 24 should be check for the specific requirement.

Relationship to Title 24:

Section 123 requires pipes installed during new construction or renovation to be insulated.

NOTES:

#8 Furnaces -- Cleaning and Tuning

Description:
Furnace burner units should be cleaned and tuned for optimal efficiency within the year prior to a CECO inspection. Dirty Filters should also be replaced and any heat exchange equipment should be inspected for cracks.
Exemptions:
NONE
What to look for:
Building maintenance records should be checked to see if the furnace burner has been cleaned and adjusted within the year prior to the inspection. If this work was performed, but records are not available, try to get the person who serviced the furnace to verify it in writing.
Relationship to Title 24:
No relationship.
NOTES:

#9 Boilers -- Cleaning and Tuning

Description:

Removal of excessive soot and scale build-up on boiler heat transfer surfaces can increase a boiler's efficiency by 10% or more. Many boilers can also increase combustion efficiency by as much as 5 to 105 through proper adjustment of the fuel-to-air ratio.

This work should ONLY be completed by trained boiler service personnel, as they contain fragile and brittle parts.) Boilers should be cleaned and tuned within the year prior to a CECO inspection.

Exemptions:

NONE

What to look for:

As in furnace cleaning, (see Energy Conservation Measure #8), building maintenance records should be checked to see if boiler cleaning and tuning occurred within the year prior to the inspection. If possible, try to get confirmation of this work in writing from the boiler service person.

Relationship to Title 24:

No relationship.

NOTES:

#10 Reset Controls for Boilers

Description:

A “lock-out” thermostat is a simple outside thermostat which shuts off the space heating boiler when the outside air temperature rises above a pre-set level (e.g., 65 degrees F.).

A temperature reset control automatically adjusts the boiler water supply temperature based on the temperature of the outside air of the return boiler water. Boilers must be controlled by either an outdoor air “lock-out” thermostat or a temperature reset control.

Exemptions:

NONE

What to look for:

Either of these controls can be difficult for an untrained person to find. A professional auditor or boiler service person should be consulted. If either of the controls are found, check to make sure they are working and are properly set to maximize their effectiveness in saving energy. There should also be a sufficient “deadband” setting of the controls so that the boiler does not “short cycle” on and off around the temperature set points.

Relationship to Title 24:

Section 144(f) requires space conditioning systems to have controls which either automatically reset the supply air temperature in response to building loads, or to outdoor temperature.

NOTES:

#11 Repair Hot Water and Steam Leaks

Description:

CECO requires that hot water and steam leaks be repaired to improve HVAC system efficiency. This includes repairing or replacing any defective steam traps, radiator controls and relief vent valves.

Exemptions:

Piping that is “inaccessible” (e.g., between walls and floors) is exempt.

What to look for:

Check to ensure there are no hot water or steam leaks in pipping. Check carefully for leaks around radiator fixtures and in the boiler room. For pipes running between floors, try to find at least one inspection point per floor. To find leaks in radiator valves, turn on the heating system, then look, listen, and feel for internal and external steam leaks while valves are both open and closed. Also check around condensate pump for excessive steam venting.

Relationship to Title 24:

No relationship.

NOTES:

#12 Chillers -- Cleaning and Tuning

Description:
Cleaning and tuning of chiller systems can be a very cost-effective maintenance measure. Excessive scale or dirt in cooling towers, condensers and evaporators will reduce the efficiency of the system. Proper adjustment of chilled and condenser water temperatures is also important. As with boiler equipment, adjustments to a chiller's control system should only be performed by a qualified service personnel. Chiller systems should be cleaned and tuned within the year prior to a CECO inspection.
Exemptions:
NONE
What to look for:
Building maintenance records should be checked to verify that chiller cleaning and tuning occurred within the year prior to inspection. If this work was performed, but no records are available, try to get the person who serviced the chiller to verify it in writing.
Relationship to Title 24:
No relationship.
NOTES:

#13 Chillers -- Repairing Leaks

Description:
As with hot water steam leaks, chilled water leaks can be very costly. CECO requires that leaks in chilled water lines and equipment be repaired.
Exemptions:
Leaks which are not accessible without structural modification are exempt.
What to look for:
Check the chiller and all accessible chilled water lines for signs of leakage. In multi-floor buildings, find at least one observation point per floor to check for leaks.
Relationship to Title 24:
No relationship.
NOTES:

#14 Chillers -- Reset Controls

Description:
Outdoor air lockouts and water reset controls for chillers operate similarly to the controls required for boilers (i.e., they cause the equipment to operate more in concert with outside conditions.) Chiller water reset controls are especially important in helping to reduce the need for simultaneous heating and cooling in a building. CECO requires that chillers have both an outdoor air lockout thermostat and a chilled water reset control.
Exemptions:
NONE
What to look for:
As with boilers, these controls may be difficult to locate and should be inspected and/or adjusted by a trained professional.
Relationship to Title 24:
No relationship.
NOTES:

Service Hot Water Energy Conservation Measures

#15 Hot Water Temperature Adjustment

Description:

Reducing your water temperature is a no-cost action that will provide an immediate savings. Water heaters should be set to provide hot water no higher than 110 degrees F. at the faucet, and other points of use to reduce the potential for scalding.

Exemptions:

Exemptions are granted for sanitizing equipment, such as dishwashers, or other equipment, such as instantaneous “demand” water heaters.

What to look for:

Using a thermometer, measure the temperature of the hot water at a faucet or shower. Be sure to wait until the water has reached its maximum temperature before taking a reading.

Relationship to Title 24:

Section 113(b) requires controls for new public restroom lavatories to limit the water temperature to no more than 110 degrees F.

NOTES:

#16 Insulation: Water Heater, Tanks and Piping

Description:

Water heaters and hot water storage tanks should be insulated to at least R-6, including both internal and external insulation. Accessible hot water pipes, including recirculating hot water pipes, should be insulated to the R-values specified in Title 24. This is currently R-4 for pipes 1-inch diameter and under.

Exemptions:

NONE

What to look for:

Look for insulation on water heaters, storage tanks and piping. Internal water heater storage tank insulation must have manufacturer's certification (usually on the name plate) to be accepted. Where R-values of insulation are not indicated, you can estimate using R-3 per inch of fiberglass blanket or batt insulation and R-4 per inch of foam insulation.

Relationship to Title 24:

Section 123 requires hot water pipes installed during new construction or renovation to be insulated. Section 113(b)(4) requires R-16 insulation for new unfired water heater storage tanks. Insulation for new water heaters is covered by the State's new appliance efficiency standards.

NOTES:

#17 Water Heater P-T Valve

Description:

A P-T (Pressure-Temperature) release valve is an important safety measure designed to prevent a water heater from exploding in the event of a malfunction. All water heater with capacities of 30 gallons or must have a P-T release valve installed.

Exemptions:

Water heaters with capacities of less than 30 gallons are exempt.

What to look for:

Check the top of the water heater for a P-T valve. P-T valves are typically cylindrical in shape, with a release lever or handle at the top. The valve is connected to an overflow pipe. Check to ensure that the rating of the new valve is greater than or equal to the rating of the burner or heating element. The valve rating, in BTUs/hr. is typically located on a metal tag attached to the top of the P-T valve. Also, make sure the valve releases water when the handle is manually operated, and that it shuts off completely when released.

Relationship to Title 24:

No relationship.

NOTES:

#18 Water Heater Earthquake Bracing

Description:

Falling water heaters and breaking gas lines represent a great hazard during earthquakes. All water heaters and water storage tanks with capacities of 30 gallons or more should be strapped or secured to prevent them from tipping or falling over in an earthquake. Bracing may be attached to either a wall stud, floor or ceiling to secure the tank. Water, gas or overflow pipes cannot be used as securing, since they may easily break.

Gas water heaters must also have a flexible gas line entering the heater to prevent breakage during an earthquake.

Exemptions:

NONE

What to look for:

Check for strapping or bracing around each water heater and storage tank. If bracing exists, make sure it is securely anchored to the surrounding structure. Also verify that a flexible, non-rigid gas line is used to join the gas line to the heater.

Relationship to Title 24:

No relationship.

NOTES:

#19 Recirculation Pump -- Timeclock Control

Description:

Some buildings have hot water circulating pumps that continuously circulate hot water through the building to provide nearly “instant” hot water at faucets. This is wasteful if there is little or no consumption during certain times of the day (e.g., 11 PM to 5 AM). CECO requires that such hot water circulation pumps be controlled by a timeclock

Exemptions:

Hospitals, hotels and motels, and 24-hour laundromats, etc. that require access to hot water 24 hours per day are exempt.

What to look for:

Check the water pump for a timeclock. The clock will be located on the power line to the pump. If a timeclock exists, verify that it is properly set to turn off the pump at night or other “off” hours. Try operating the clock manually to confirm that it is working.

Relationship to Title 24:

Section 113(b)(2) requires a “control capable of automatically turning off the circulating pump when hot water is not required” on all new service water heating systems.

NOTES:

#20 Low-Volume Showerheads

Description:
All showerheads should be “water having” or “low flow” models, and should have a maximum flow rate of no more than 2.5 gallons per minute.
Exemptions:
NONE
What to look for:
To measure the flow rate, place a bucket under the shower for one minute when the showerhead is running at its maximum flow, and measure the volume of water collected. You can also measure the amount of water collected over a shorter time (e.g., 20 seconds) and then multiply the result to determine the flow rate per minute.
Relationship to Title 24:
Section 114 requires that all new showerheads sold or installed in California be rated at no more than 2.5 gallons per minute at 80 p.s.i.
NOTES:

#21 Repair Leaks in All Hot and Cold Water Pipes

Description:
All leaks in accessible hot and cold water pipes should be repaired.
Exemptions:
NONE
What to look for:
Check accessible pipes for leaks or signs of leakage, such as standing water or water staining.
Relationship to Title 24:
No relationship.
NOTES:

#22 Toilets -- Low Volume

Description:

All tank toilets should not use more than 1.6 gallons of water per flush. Existing toilets not meeting this standard should be modified to the extent feasible to reduce the amount of water used per flush. If a toilet is being removed during a renovation, an ultra-low flow model using 1.6 gallons or less must be re-installed.

Exemptions:

If a toilet cannot be modified to meet the 1.6 gallon standard without operating incorrectly, then it is exempt.

What to look for:

Check to determine if the existing toilet has a manufacturer's rating other than "low volume" designation. Older toilets with larger tanks are almost certain to not meet the 1.6 gallon per flush requirement and should be modified with "toilet dams" or other "water displacement" devices, such as filled containers in the tank. These devices should be used to reduce the water usage as much as possible, while still allowing the toilet to work properly.

If using water displacement devices, do not use brick, since they can damage the plumbing.

Relationship to Title 24:

All new toilets are required to be low volume models.

NOTES:

Lighting Measures

#23 Interior Lighting Load Reduction

Description:

New lighting technologies exist that can provide as much, if not more light while using less energy. There are two ways to comply with this measure:

- Comply with current Title 24 standards; or,
- Remove standard incandescent and halogen lighting.

The first method requires verification that interior lighting complies with current Title 24 standards, in terms of “allowable watts per square foot,” based on the building use. Offices, for example, may currently use up to 1.5 watts/ft² of interior lighting under Title 24. Retail applications are allowed up to 2 watts/ft².

The second compliance method is to replace all interior standard incandescent and halogen bulbs with fluorescent lighting and/or compact fluorescent lamps (CFLs), that can be screwed into existing light sockets. CFLs come in a variety of shapes and sizes, including a candelabra-base size, and last 7- to 10 times longer than incandescent lamps. They also produce approximately the same light levels with a 75% reduction in energy use. Most CFLs cannot be operated on circuits with dimmer switches. Where a dimming capability is needed in a fixture, look for CFLs that are specifically rated for dimming.

Exemptions:

There are numerous exemption allowed and special allowances under the Title 24 compliance approach based on the type of work conducted in certain areas, the room “cavity” volume, and the types of lighting controls present. Title 24 should be consulted for more specific information.

Under the second compliance method, standard incandescent and halogen lighting would be allowed only in the following cases:

- permanently disabled fixtures;
- lighting controlled by occupancy sensors;
- emergency lighting (excluding exit signs);
- portable task lighting;
- ornamental lighting, such as chandeliers, if CFLs would significantly degrade a fixture’s appearance;
- stage, entertainment or audio-visual system lighting;
- lighting inside appliances or display cases;
- spotlights or floodlights;
- lighting used an average of two hours per day or less; or
- lighting used an average of six hours per day or less in fixtures that would have to be replaced to accept CFLs.

What to look for:

Using the Title 24 compliance method, the existing amount of light per square foot must first be calculated. Note that the number of watts per fixture must also include the energy used by the lamps' ballasts.

$$[\text{Number of fixtures} \times \text{\# watts per fixture}] / \text{floor area} = \text{\# watts/ft}^2$$

Professional assistance is strongly advised for this approach! Under the "replace incandescent" method, the entire building, including hallways, basements and storage rooms, should be inspected for incandescent and halogen lamps that can be replaced with either CFLs or full-size fluorescent lamps (tube fixtures). When checking for incandescent, keep in mind the various exemptions, especially fixtures that are used infrequently, or on dimmers.

Relationship to Title 24:

Performance standards that comply with Title 24 are outlined in Sections 119 and 146.

NOTES:

#24 Exterior Lighting Load Reduction

Description:

All outside lighting fixtures, including exit signs and lights in parking garages, must not use incandescent lamps. This requirement also applies to lighting fixtures having removed or burned-out bulbs. Halogen bulbs may only be used in spot lights. Tungsten-halogen bulbs are acceptable to use and are not considered to be incandescent under CECO.

Exemptions:

Fixtures which are normally used less than two hours per day, for emergency lighting, or which are permanently disconnected or disabled are exempt. Fixtures normally used less than 6 hours per day AND would need to be replaced in order to use a more efficient lamps are also exempt.

What to look for:

Carefully check all exterior lighting fixtures, exit signs, and parking lot lighting for incandescent lamps. Lamps that are used more than 2 hours per day or night, and are not otherwise exempt, must be replaced.

Most exterior fixtures can be retrofitted with either screw-in or hardwired CFLs at a low cost without replacing the entire fixture.

For higher light levels and greater efficiency, consider using new high-pressure sodium or metal halide fixtures.

Relationship to Title 24:

No relationship.

NOTES:

#25 Exterior Lighting Controls

Description:

All exterior lighting fixtures should have automatic controls to turn off lighting during daylight hours. These controls may include a time clock, a photocell, or a combination of both.

Exemptions:

Lighting fixtures normally used less than 2 hours per day are exempt. Lighting in exit signs, parking garages, tunnels, and large covered areas that require daytime illumination are also exempt.

What to look for:

Check each exterior lighting fixture or circuit for either a timeclock or photocell that will keep lights off during the day. Some controls may also use an infra red motion sensor to turn lights on only when people are present. If a motion sensor is used, make sure that a photocell or timeclock is also present that will prevent lights from coming on during the day.

Check to ensure that all time clocks show the current time, and that they are programmed to turn lights off and on at proper times. Also, manually switch the timeclock and see if lights turn on and off. If a photocell is present, check it for proper operation by covering it during the day, or inspect it by using a flashlight on it at night, to see if the lights react properly.

Relationship to Title 24:

Section 131(f) requires exterior lighting controls for new construction and renovation.

NOTES:

Commercial Refrigeration Equipment Energy Conservation Measures

#26 Refrigeration Equipment -- Cleaning and Tune-Up

Description:

Dirty condenser coils can reduce the efficiency of refrigeration equipment by 5- to-10%. All commercial refrigeration equipment should be cleaned and tuned for peak efficiency. This includes cleaning condenser coils and evaporators, and replacing any defective or worn door gasket and seals.

Exemptions:

NONE

What to look for:

Check to ensure the outside surfaces of condensers and evaporators appear clean and free of dirt and dust build-up. Also, check and door gaskets or seals to ensure that they are not leaking cold air.

Compressors should also be checked to ensure that they are not dirty--a condition that can both lower efficiency and decrease motor life.

Relationship to Title 24:

No relationship.

NOTES:

#27 Thermal Doors and Curtains

Description:

Low and medium temperature refrigeration cases should have either doors, strip curtains, or some other method of keeping warmer air out of the case. Once these modifications are made, the compressor system should also be modified to compensate for the reduced cooling load. This may include installing a new, smaller compressor and adjusting or replacing the expansion valves.

Exemptions:

“Open tub” refrigeration cases with cooling capacities under 25,000 BTUs per hour are exempt.

What to look for:

Check each refrigerated cooler or case for doors or strip curtains. If the equipment was retrofitted with doors or curtains, check to ensure the compressor modifications were also made. This might be determined by checking the maintenance records or finding a maintenance tag left by a contractor.

Relationship to Title 24:

No relationship.

NOTES:

Motor-Driven Equipment Energy Conservation Measures

#28 Compressed Air and Hydraulic Lines -- Leak Detection and Repair

Description:

All leaks in accessible compressed air lines and fluids should be repaired. All filters should be cleaned or replaced as needed. Belts or other coupling systems which are worn or defective should be replaced or repaired.

A wide variety of equipment may fall under this requirement, including elevators, pneumatic tools, and specialized equipment used in manufacturing.

Exemptions:

NONE

What to look for:

Carefully inspect all compressed air lines, water lines, and hydraulic fluid lines near and around motor-driven equipment for leaks. Air leaks can often be heard or can be checked by watching the compressed air gauge for a rapid decline in air pressure when no compressed air equipment is in use.

All motor-driven equipment located in mechanical rooms, on roofs, and around air handlers should be checked. If a line appears to be leaking, try opening the controls to verify. Check all filters for cleanliness, and all motor-driven belts for tightness and wear.

Relationship to Title 24:

No relationship.

NOTES:

Swimming Pools and Spas Energy Conservation Measures

#29 Swimming Pool and Spa Covers

Description:

All heated swimming pools and spas must have a cover.

Exemptions:

Indoor pools and spas which have water temperatures of less than 80 degrees F. when they are not being used are exempt.

What to look for:

Verify that the pool or spa has a cover in good working condition, and that it is used when the pool is not in use.

Relationship to Title 24:

Section 114(b)(2) requires covers for new outdoor pools and spas.

NOTES:

#30 Timeclock Control of Recirculation Pump

Description:

All pool and spa recirculation pumps should be controlled by a timeclock.

Exemptions:

NONE

What to look for:

Verify that the recirculation pump has a timeclock. If a timeclock exists, check to ensure that the clock shows the current time, and that on and off times are properly set. Try operating the clock manually to confirm that it works properly.

Relationship to Title 24:

Section 114(b)(3B) requires timeclock controls for all new pools and spas.

NOTES:

**#31 Pool and Spa
Heaters --
Clean and Tune**

Description:
Pools and spa heaters should be cleaned and tuned for peak efficiency within one year prior to a CECO inspection.
Exemptions:
NONE
What to look for:
This measure should be verified by building maintenance records, or through a written verification from the service person. Check all water lines and valves for leaks. Burners and heat exchangers should be checked for build-up of soot, scale, and dirt, which can lower efficiency. Also, verify that the thermostat is properly working.
Relationship to Title 24:
No relationship.
NOTES:

#32 Ceiling Insulation

Description:

Buildings with three or fewer above-ground stories should have a minimum of R-19 ceiling insulation in all accessible attic spaces directly above conditioned space (space that is heated or air conditioned). If there is sufficient space for R-19 insulation, then the maximum amount of insulation compatible with the space and the use of the building should be installed.

Exemptions:

Attic spaces that are inaccessible are exempt.

What to look for:

Visually check for at least R-19 insulation in crawl spaces above conditioned spaces. R-19 insulation is typically 6 inches of fiberglass or cellulose insulation.

For the purposes of CECO, “accessible attic space” means that there is at least 24 inches of space between the top of the ceiling joist and the underside of the roof sheathing at the roof ridge. If the available space is less than this, good judgement should be used to determine how much insulation can reasonable be used.

Relationship to Title 24:

Section 143(a)(1) requires new commercial buildings in Berkeley to have a minimum of R-19 ceiling insulation, or to meet a calculated building shell performance standard.

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