Energy Smart Design™– Office Package A

TECHNICAL SPECIFICATIONS

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CHAPTER 1: PRESCRIPTIVE PATH FOR Energy Smart Design™ – Offices

1.0 Eligibility Requirements for Energy Smart Design™ – Offices:

Buildings located in the City of Seattle are not eligible for Package A.

a) To be eligible, a project shall be a new office building, an office addition, or a major renovation for an office. A renovation requires multiple changes in end-uses. The building can be mixed use, but the incentive will only apply to the office area. Banks, libraries, dental offices and medical offices qualify as offices for this prescriptive path. The incentive calculation is based on the conditioned square footage of office occupancy. In the case of office occupancies in other building types, the incentive calculation is based on the area of office occupancy in the building. Partial office occupancy projects shall include all of the listed measures to be eligible under this prescriptive path.

b) The new office building shall use one or more of the following HVAC systems for at least 70 percent of the conditioned space:

1. Packaged variable-air-volume system with electric reheat
2. Packaged variable-air-volume system with a non-electric reheat
3. Packaged or split system single zone equipment with non-electric heat

c) The building shall be 3 stories or less, a maximum of 100,000 square feet and have a maximum Window-to-Wall Ratio of 30%. Window wall area ratio is defined as the total exterior window area (including glazed doors) divided by the total exterior wall area, including demising walls but not including below grade walls. Window wall ratio calculation shall not include semi-conditioned spaces, mechanical penthouses, and parking garages.

1.1 Prescriptive Path for New Offices:

Description	Requirements
Cooling system minimum efficiency level	CEE Tier 2
Effective window U-value	Fixed 0.35 Maximum Curtain wall 0.40 Maximum
Window solar heat gain coefficient	0.30 Maximum
Enhanced economizer	Required
Integrated Design of HVAC System	Required
Lighting Budget (whole building)	0.75 Watts/SF Maximum, while providing illuminance levels as recommended by IESNA
Lighting Controls	Occupancy Sensors-install where lighting loads are over 100 watts

Trade-Offs Buildings must include all 7 measures to qualify. Slight deviations can be qualified using the Trade-Off form located at: www.bpa.gov/ESD as long as the building savings will be greater than or equal to the package savings.

Cooling System Minimum Efficiency Install high-efficiency cooling equipment meeting Consortium for Energy Efficiency (CEE) Tier 2 performance levels in effect at the time of permitting in a minimum of 70 percent of the conditioned floor area. The rated equipment efficiency values shall be based on Air-Conditioning and Refrigeration Institute (ARI) test protocols. Where no Tier 2 performance evaluation protocol or commercially available equipment exists, equipment shall meet CEE Tier 1 requirements. CEE performance values can be found at: http://www.cee1.org/com/hecac/hecac-main.php3

Documentation: Provide manufacturer cut sheets for each piece of cooling equipment demonstrating that the equipment's rated efficiency meets or exceeds CEE Tier 2 requirements.

Effective Window U-Value Install windows with an area-weighted U-value of 0.35 or below for fixed glazing and 0.40 or below for operable windows, storefront and curtain wall glazing systems. All glazing installed as part of the building envelope shall have a U-value rating as determined by the National Fenestration Rating Council (NFRC) rating protocol. If an NFRC rating is not available, the default performance tables in the Oregon energy code (http://oregon.gov/ENERGY/CONS/Codes/docs/2007_CH-13_ODOE-040107.pdf) shall be used. Center of glass U-value is not an acceptable standard for achieving this requirement. Glass doors are considered part of the glazing area and shall be included in these calculations; skylights are excluded.

Documentation: Provide a copy of the NFRC Label for each glazing product installed in the project. If any window performance exceeds the U-value limits above, provide an area-weighted calculation of average window thermal performance for all windows in the project, showing that the area-weighted U-value is 0.35 or below for fixed glazing and 0.40 or below for operable windows, storefront and curtain wall glazing systems.

Window Solar Heat Gain Coefficient All glazing installed as part of the building envelope shall have a Solar Heat Gain Coefficient (SHGC) of 0.30 or below, and a visible light transmittance (VLT) of 50% or higher. Glazing shading coefficient is not an acceptable standard for achieving this requirement.

Documentation: Provide a copy of manufacturer's literature or NFRC label for each glazing product installed in the project, along with a table identifying where in the project each product type is installed.

Enhanced Economizer Economizers shall incorporate the following features in a minimum of 70 percent of the conditioned floor area. The performance of the following features shall be verified during economizer commissioning:

Step 1 Enhanced Economizer Requirements:

- *Fully modulating damper motor:* A fully modulating damper motor shall allow proper mixed air temperature control and maximize economizer operating hours.
- *Damper drive mechanism:* A direct modulating actuator with gear-driven interconnections and a permanently lubricated bushing or bearing on the outside and return air dampers shall be installed.
- *Primary damper-control sensor:* The primary damper-control sensor, sometimes referred to as the mixed-air or discharge-air sensor, shall be located in the discharge air position after the cooling coil or in the supply duct.
- *Relief air and modulating return air damper:* Relief air shall be provided with a barometric damper in the return air duct upstream of the return air damper, a motorized exhaust air damper or an exhaust fan.
- *Minimum outside air (OSA) ventilation:* The minimum OSA ventilation shall be verified. If verified by air temperature measurement, the temperature of the mixed air, return air and outside air shall be used to calculate the percentage of outside air at the minimum setting. Verification by measuring OSA with a flow hood, flow plate or other is also acceptable. The final minimum OSA ventilation shall be adjusted to the amount indicated in the designer's sequence of operation.
- *Dedicated thermostat stage for economizer:* A thermostat with two stages of cooling, with the primary cooling stage dedicated to economizer control, shall be installed so the economizer satisfies the cooling load before the mechanical air conditioning compressor is engaged.
- *Differential changeover with both a return and outside air sensor:* The economizer controller shall utilize differential logic, a dry-bulb return air sensor, and outside air sensor for differential

changeover. In western climates, high humidity rarely occurs near changeover temperatures, and dry-bulb sensors provide higher expected reliability at lower cost. If the economizer controller has a changeover selector, this shall be set to the differential/comparative control position per manufacturer's instructions.

- Outside air changeover sensor set point shall be between 55°and 65°F, Honeywell dry bulb changeover control "D" setting, or equivalent.
- System controls are wired correctly to ensure economizer is fully integrated (i.e. economizer will operate when mechanical cooling is enabled).
- Economizer lockout control sensor location is adequate (open to air but not exposed to direct sunlight nor in an enclosure; away from sources of building exhaust.
- If no relief fan system is installed, barometric relief dampers are installed to relieve building pressure when the economizer is operating.

Step 2 Economizer Functional Testing:

Simulate a cooling load and enable the economizer by adjusting the lockout control set point. Verify and document the following:

- Economizer damper modulates open to maximum position to satisfy cooling space temperature set point.
- Return air damper modulates closed and is completely closed when economizer damper is 100% open.
- Economizer damper is 100% open before mechanical cooling is enabled.
- Relief fan is operating or relief dampers freely swing open.
- Mechanical cooling is only enabled if cooling space temperature set point is not met with the economizer at 100% open.
- Relief fan system (if installed) operates only when the economizer is enabled.
- Doors are not pushed ajar from over pressurization.

Step 3 Economizer Shut Down:

Disable the economizer by adjusting the lockout control set point. Verify and document the following:

- Outside air damper closes to minimum position when economizer is disabled.
- Relief fan shuts off or relief or barometric dampers close when economizer is disabled.
- Mechanical cooling remains enabled until cooling space temperature set point is met.
- Return air damper opens to normal operating position.
- Outside air damper closes completely when unit is off.

Documentation: Provide a completed Economizer Commissioning Checklist (a sample is available in appendix 2 of these specifications), documenting that the economizer was tested per the parameters listed above.

Integrated HVAC Design Best practices and design techniques shall be employed to improve system performance and meet ASHRAE Standard 55. The mechanical designer shall implement the following actions in the design process:

1) When sizing the heating and cooling equipment, perform load calculations using interior load assumptions that are consistent with code requirements and the elements of this prescriptive incentive program. This includes using the design interior lighting power density, glazing performance characteristics, and HVAC system efficiencies required by these Specifications. Load calculations should use diversity factors consistent with all aspects of intended building performance characteristics.

2) Assumptions about occupancy, equipment and miscellaneous loads in the project should be based on actual loads, rather than default assumptions. These loads should also include a diversity factor when accounted for in building load calculations. Document the basis for assumed interior equipment and occupant load assumptions for owner concurrence and use in load calculations.

3) Apply the following criteria when sizing the fan and air distribution systems:

- Document fan sizing calculations with zone-by-zone load calculations.
- Perform calculations to determine critical path supply duct pressure loss. Compare fitting selections for the critical branch to minimize fan horsepower requirements. Do not design or install high pressure duct systems. Maximum design pressure loss through the duct system should be 0.4 in. WC per 100 ft. of duct run. Use 0.05 in. WC per 100 ft. as a target.
- Exterior duct systems shall be sealed and insulated to a minimum of R-8.
- Duct systems shall conform to ASHRAE Leakage Class 3.
- Additional duct design guidelines:
    - Minimize duct length, turns, and fittings.
    - Utilize round or oval duct wherever feasible to lower leakage and reduce pressure loss.
    - Use radius or section elbows for all turns greater than 45 degrees. Use square elbows with turning vanes where radius elbows will not fit.
    - Turning vanes should be single thickness rather than airfoil.
    - Use smooth wye branch fittings instead of right angle fittings at branch takeoffs.
    - Avoid turns immediately before a supply or return air register.
    - Avoid duct connection details at the unit that degrade fan performance. Provide a minimum of two feet of straight duct before the first turn. Install turning vanes in supply ducts at the first turn after entering the building (if rectangular duct is used).
    - Limit flex duct runs to a maximum of six feet. When longer runs must be used, make sure the duct is well supported at five-foot intervals.
- Use relief fans in lieu of return fans where possible and provide automatic dampers on exhaust in lieu of barometric dampers to reduce fan power and increase barometric relief.

4) For variable air volume systems perform peak coincident-load calculations and use for maximum equipment sizing. Include diversity factors for interior loads and other factors that will allow proper assessment of part-load operation.
5) Develop a Sequence of Operations document, including the system operation at design conditions and describe features of the design that will facilitate efficient operation at part-load conditions. Describe minimum ventilation airflow, economizer operation, how the system will maintain comfort in accordance with ASHRAE Standard 55 and operate in an energy efficient manner. This document shall be included in the building owner's manual to inform subsequent building operation.
6) Use a separate HVAC system for any spaces that have occupancy or process loads or schedules that differ significantly from the rest of the building. Peak thermal loads that differ by 10 Btu/h·ft2 or more from the average of other spaces served by the system or schedules that differ by more than 40 equivalent full load hours per week from other spaces served by the system, are considered to differ significantly. Examples where this exception may be applicable include, but are not limited to, computer server rooms and continually occupied areas.

Documentation
Provide a completed Integrated Design Checklist (a sample is available in appendix 3 of these specifications), documenting that the HVAC system has been designed as indicated.

Lighting Power Density Installed lighting power density (LPD) shall not exceed 0.75 watts per square foot using a whole building calculation. Installed lighting power calculations shall be consistent with ASHRAE 90.1 2004 or local codes. Light levels in the space shall meet the design and illumination standards of the Illuminating Engineering Society of North America (IESNA) appropriate for each space within the building.

Documentation:
- Provide an LPD calculation table in a format similar to those required by regional code jurisdictions for project approval. This form shall indicate building floor area and fixture quantity and watt consumption for each type of fixture installed.

Automatic Lighting Controls Occupancy sensors shall be installed to control general lighting in all spaces with connected lighting loads over 100 watts. Occupancy sensors shall be commissioned and time delays shall be no more than 10 minutes. Information about occupancy sensor performance shall be included in the building commissioning report.

Automatic Lighting Controls are not required in the following areas:

- Lighting required by a health or life safety statute, ordinance or regulation, including but not limited to emergency lighting.
- Emergency lighting.
- Health care patient rooms.

Documentation:

- Provide a completed Lighting Control Checklist (a sample is available in appendix 4 of these specifications) documenting that the occupancy sensors operate in an efficient manner.

1.2 Existing Codes and Regulations: These specifications are intended to meet or exceed applicable existing building codes and Federal regulations. In any case where a Federal, State or local code or regulation exceeds these requirements, that code or regulation applies.

1.3 Qualification: Building design and construction shall be reviewed and verified by the design professional to meet these Energy Smart Design™– Office Technical Specifications. Any deviation from the specifications shall have written BPA approval.

1.4 Additional Utility Requirements: Utilities may add requirements more stringent than those in this specification.

Appendices

Appendix 1

Sample Certification letter

Sample Certification letter

Date

Participating Utility Representative Name & Title

Utility Name

Address

This letter is a certification that all the measures installed and commissioned meet the specifications for Energy Smart Design™ – Office Package A for the new office building located at (address) and owned by

(owner's name and address). Construction on this building started on (date) and this building has (building area) square feet of conditioned space. The building uses the following packaged HVAC systems for at least 70 percent of the conditioned space: (VAV with electric reheat, VAV with non-electric reheat, heat pumps, single zone equipment with non-electric heat). (Cross out all systems that have not been installed.)

Attached are the documents required for Energy Smart Design™ – Office Package A.

By signature below, the undersigned hereby acknowledges that the above is true to the best of his/her knowledge and that he/she is a professional familiar with the building design. Professionals can be a qualified utility representative, registered architect, licensed engineer or commissioning agent.

Professional familiar with the building design:

Name & Title: _____

Signature: _____

Date: _____

Attachments:

- Cooling system cut sheets demonstrating that equipment is rated to perform at CEE Tier 2 or above
- Copy of window NFRC label for each glazing product or documentation of default U-value and SHGC
- If any window performance exceeds the specified U-values, provide an area-weighted calculation of average window thermal performance for all windows, showing that the area-weighted U-value is 0.35 or below for fixed glazing and 0.40 or below for operable windows, storefront and curtain wall glazing systems.
- Economizer Commissioning Checklist
- Integrated Design Checklist
- Copy of lighting budget form required for permit and “any submitted code compliance documents” (PDF format preferred).
- Building drawings in PDF format.
- Lighting Control Checklist

Appendix 2

Economizer Commissioning Checklist

Energy Smart Design™ – Office
Economizer Commissioning Checklist

This form must be completed by the HVAC technician. ***Complete one checklist for each economizer installed.***

_____
Facility Name

_____
Installing Technician's Name **Company**

Step 1

Area Served by Economizer:_____HVAC Tag#:_____
(Specify: conference room, computer area, interior zone, etc.)

Economizer Control Manufacturer/Model #: _____

Thermostat Manufacturer/Model #: _____

☐ Installed according to manufacturers recommendations
☐ Installation meets Energy Smart Design™ – Office requirements
☐ OSA sensor connected and located in outside air stream and not subject to condenser heat
☐ Has dry Bulb OSA and RA Sensor (Differential/Comparative Changeover Type)
☐ Has OSA changeover sensor or dry bulb changeover control; setting _____(degrees or setting)

Step 2

☐ Complete economizer cycle observed; dampers operate freely, linkage adjusted properly
☐ Compressor staged appropriately during economizer cycle
☐ Thermostat has Dedicated Economizer Stage

Method of return air building pressure relief:_____
(Specify: powered fan, actuated damper, barometric/gravity damper)

Total system cfm:_____System cfm determined by: ☐ Nameplate ☐ Measured

Minimum Outside Air (OSA) setting_____percent or _____cfm

OSA percent method: ☐ Calculated ☐ Measured ☐ Temperature Split

Explain:_____

Step 3

☐ Shutdown sequence verified per specifications

Signed & Certified: _____ Date: _____

Appendix 3

Integrated Design Checklist

Energy Smart Design™ – Office
Integrated Design Checklist

Description	yes / no
1. Load calculations were based on actual design conditions	
2. The owner concurs with the assumed interior equipment load assumptions	
3. The fan and air distribution systems were sized using zone-by-zone load calculations and duct design minimizes static pressure drop	
4. Load calculations were performed for part-load conditions	

Appendix 4

Package A Lighting Control Checklist

Energy Smart Design™ – Office Package A
Lighting Control Checklist

1) Area Served by occupancy sensor:_____Connected Load (kW)_____
(Specify: conference room, computer area, etc.) Time Delay (minutes) _____
Occupancy sensor Manufacturer/Model #: _____

Comments: _____

2) Area Served by occupancy sensor: Connected Load (kW)
(Specify: conference room, computer area, etc.) Time Delay (minutes) _____
Occupancy sensor Manufacturer/Model #: _____

Comments: _____

3) Area Served by occupancy sensor: Connected Load (kW)
(Specify: conference room, computer area, etc.) Time Delay (minutes) _____
Occupancy sensor Manufacturer/Model #: _____

Comments: _____

4) Area Served by occupancy sensor: Connected Load (kW)
(Specify: conference room, computer area, etc.) Time Delay (minutes) _____
Occupancy sensor Manufacturer/Model #: _____

Comments: _____

5) Area Served by occupancy sensor: Connected Load (kW)
(Specify: conference room, computer area, etc.) Time Delay (minutes) _____
Occupancy sensor Manufacturer/Model #: _____

Comments: _____

6) Area Served by occupancy sensor: Connected Load (kW)
(Specify: conference room, computer area, etc.) Time Delay (minutes) _____
Occupancy sensor Manufacturer/Model #: _____

Comments: _____

7) Area Served by occupancy sensor: Connected Load (kW)
(Specify: conference room, computer area, etc.) Time Delay (minutes) _____
Occupancy sensor Manufacturer/Model #: _____

Comments: _____