



CALIFORNIA ENERGY COMMISSION

2008 Nonresidential Mechanical System Requirements

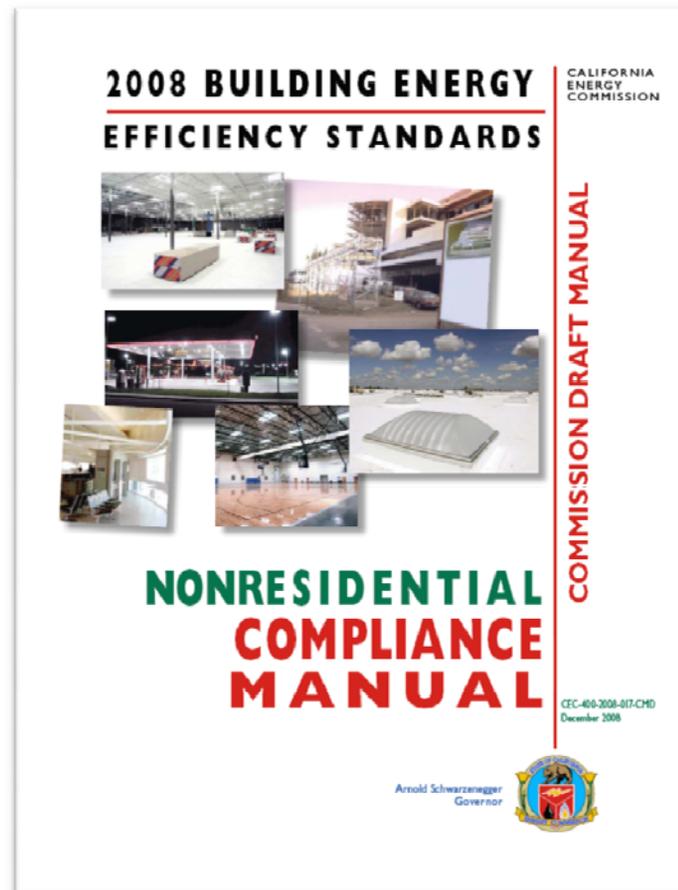
Mark Alatorre
Building Standards Implementation
Efficiency and Renewable Energy

ICC Chapter Presentation
May 20, 2009



2008 Documents

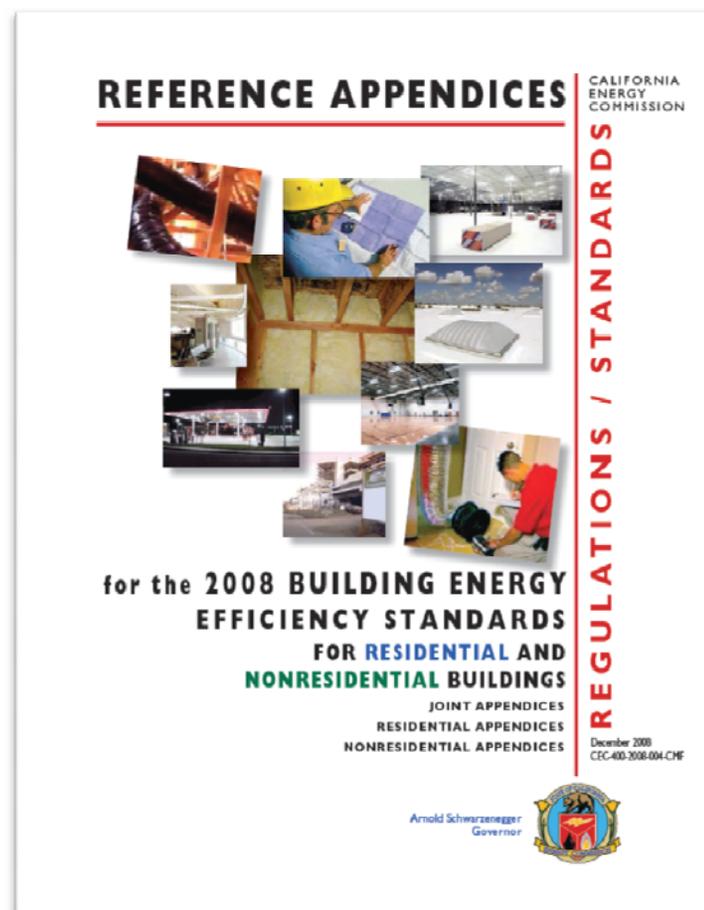
- *Building Energy Efficiency Standards*
- *Nonresidential Alternative Calculation Method (ACM) Manual*
- *Nonresidential Compliance Manual*
- *Reference Appendices*
 - Joint Appendices
 - Nonresidential Appendices (NA)
 - <http://www.energy.ca.gov/title24/2008standards/>





Reference Appendices

- *Joint Appendices*
 - Contains definitions, Climate Zone listings, Construction Assemblies, Weather Data, HERS measures and LED lighting testing methods.
- *Nonresidential Appendices*
 - HERS procedures and Acceptance testing methods





Plan Examiner's Checklist

The MECH-2C can double as the Mandatory Measures note block. If so, the form must be incorporated onto the plans.

Mechanical – Is the Mandatory Measures note block on the plans?			
Were all applicable forms submitted?			
Is the Field Inspection Checklist completed and included on the plans?			
Are all appropriate Acceptance Tests checked AND Equipment/Controls requiring testing identified on the Certificate of Compliance?			
Do all pages have the same run number and date? (<i>Performance Only</i>)			
Efficiencies and capacities of HVAC equipment			
Thermostat and Controls			
Ventilation and Ventilation Rates (cfm)			
Duct Insulation			
Pipe Insulation			
Service Hot Water Equipment			
Pool and Spa Equipment			



Plan Examiner's Checklist

Mechanical – Is the Mandatory Measures note block on the plans?			
Were all applicable forms submitted?			
Is the Field Inspection Checklist completed and included on the plans?			
Are all appropriate Acceptance Tests checked AND Equipment/Controls requiring testing identified on the Certificate of Compliance?			
Do all pages have the same run number and date? (<i>Performance Only</i>)			
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Service Hot Water Equipment			
Pool and Spa Equipment			

MECH-1C: All submittals.

MECH-2C: All submittals. Can be included on plans as mandatory measures note block

MECH-3C: Submit when the occupied space is supplied with mechanical ventilation.

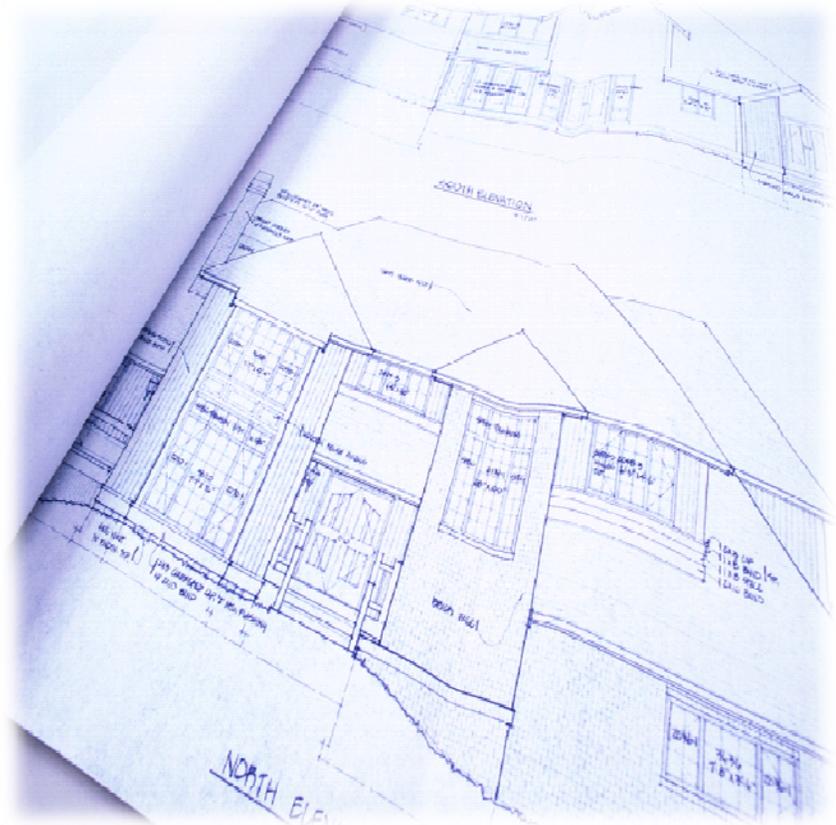
MECH-4C: Submit when total fan system horsepower is greater than 25 hp (Prescriptive Method Only).

MECH-5C: Submit when demonstrating compliance with the Performance Approach (Equipment Details).



CERTIFICATE OF COMPLIANCE

- Who is responsible?
 - Principal Designer
- When is it submitted?
 - At time of permit application
 - Prescriptive
 - Performance
- Who uses the form?
 - The Plans Examiner for verification





AIR/WATER SYSTEM REQUIREMENTS MECH-2C

- Who is responsible?
 - Principal Designer
- When is it submitted?
 - At time of permit application
 - Prescriptive (Mandatory Measures Note block)
 - Performance (Mandatory Measures Note block)
- Who uses the form?
 - The Plans Examiner for verification



MECHANICAL VENTILATION AND REHEAT MECH-3C

- Who is responsible?
 - Principal Designer
- When is it submitted?
 - When mechanical ventilation is provided
 - Prescriptive
 - Performance
- Who uses the form?
 - The Plans Examiner for verification



POWER CONSUMPTION OF FANS MECH-4C

- Who is responsible?
 - Principal Designer
- When is it submitted?
 - At time of the permit application
 - Prescriptively, when the total system fan horsepower exceeds 25 HP.
 - Total system fan horsepower includes supply, return and exhaust fans.
- Who uses the form?
 - The Plans Examiner for verification



Plan Examiner's Checklist

The Field Inspection Checklist is a summary of the installed energy features.

Mechanical – Is the Mandatory Measures note block on the plans?			
Were all applicable forms submitted?			
Is the Field Inspection Checklist completed and included on the plans?			
Are all appropriate Acceptance Tests checked AND Equipment/Controls requiring testing identified on the Certificate of Compliance?			
Do all pages have the same run number and date? (<i>Performance Only</i>)			
Efficiencies and capacities of HVAC equipment			
Thermostat and Controls			
Ventilation and Ventilation Rates (cfm)			
Duct Insulation			
Pipe Insulation			
Service Hot Water Equipment			
Pool and Spa Equipment			



FIELD INSPECTION ENERGY CHECKLIST

- The field inspection energy checklist is new for the 2008 Standards.
- Who is responsible?
 - Documentation Author/Principal Designer
- When is it submitted?
 - At time of the permit application, along with the compliance documentation.
 - This form is automatically completed when using the performance approach.
 - The Energy Commission recommends this checklist be printed on the plans, along with the Certificate of Compliance.
- Who uses the form?
 - The Field Inspector during the applicable stages of inspection.



Plan Examiner's Checklist

Detailed on the Certificate of Compliance (MECH-1C)

Mechanical – Is the Mandatory Measures note block on the plans?			
Were all applicable forms submitted?			
Is the Field Inspection Checklist completed and included on the plans?			
Are all appropriate Acceptance Tests checked AND Equipment/Controls requiring testing identified on the Certificate of Compliance?			
Do all pages have the same run number and date? (<i>Performance Only</i>)			
Efficiencies and capacities of HVAC equipment			
Thermostat and Controls			
Ventilation and Ventilation Rates (cfm)			
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Pipe Insulation			
Service Hot Water Equipment			
Pool and Spa Equipment			



CALIFORNIA ENERGY COMMISSION

ACCEPTANCE TESTING

Test Description		MECH-2A	MECH-3A	MECH-4A	MECH-5A	MECH-6A	MECH-7A	MECH-8A	MECH-9A	MECH-10A	MECH-11A
Equipment Requiring Testing or verification	# of	Outdoor Ventilation for VAV & CAV	Constant Volume & Single-Zone Unitary	Air Distribution Ducts	Economizer Controls	Demand Control Ventilation DCV	Supply Fan VAV	Valve Leakage Test	Supply Water Temp. Reset	Hydronic System Variable Flow Control	Automatic Demand Shed Control
Carrier 48DJH048	3	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

The designer must specify the applicable Acceptance Test to be performed.



ACCEPTANCE TESTING

MECH-2A:	Ventilation Systems	Applies to new Variable Air Volume (VAV) and Constant Air Volume (CAV) Systems
MECH-3A:	Constant-Volume, Single-Zone, Unitary Air Conditioner and Heat Pumps	Applies to new constant volume, single-zone, and unitary units with direct expansion (DX) cooling.
MECH-4A:	Air Distribution Systems	Applies ONLY to single zone units serving 5,000 ft ² of space or less and where 25% or more of the duct surface area is in an unconditioned space. (HERS Verification)
MECH-5A:	Air Economizer Controls	Applies to new equipment with air economizer controls (Does not apply to factory installed economizers).
MECH-6A:	Demand Control Ventilation (DCV)	Applies to new DCV controls installed with HVAC systems.
MECH-7A:	Supply Fan Variable Flow Controls (VFC)	Applies to new VAV fan volume controls installed with HVAC systems.
MECH-8A:	Valve Leakage Test	Applies to new chilled and hot water systems that are designed for variable flow, or when there is more than one boiler and chiller in the plant and the primary pumps are connected to a common header.



ACCEPTANCE TESTING *New for 2008*

MECH-9A:	<i>Supply Water Temperature Reset</i>	Applies to new chilled or hot water systems that have a supply temperature reset control strategy programmed into the building automation system.
MECH-10A:	<i>Hydronic System Variable Flow Control</i>	Applies to new water systems that have been designed for variable flow, where the pumps are controlled by variable frequency drives (i.e. chilled and hot water systems; water-loop heat pump and air-conditioning systems).
MECH-11A:	<i>Automatic Demand Shed Control</i>	Applies to new Direct Digital Controls (DDC) to the zone level installed with HVAC system.
MECH-12A:	<i>Fault Detection Shed Control for DX Units</i>	Applies to new Fault Detection and Diagnostics (FDD) for Packaged Direct-Expansion (DX) units.
MECH-13A:	<i>Automatic Fault Detection & Diagnostics for Air Handling & Zone Terminal Units</i>	Applies to new Fault Detection and Diagnostics (FDD) for air handler and zone terminal units.
MECH-14A:	<i>Distributed Energy Storage DX AC Systems</i>	Applies to new constant and variable direct expansion (DX) systems with distributed energy storage (DES/DXAC)
MECH-15A:	<i>Thermal Energy Storage (TES) Systems</i>	Applies to new thermal energy storage systems installed in conjunction with chilled water air conditioning systems.



Plan Examiner's Checklist

All pages of the Title 24 Report

Mechanical – Is the Mandatory Measures note block on the plans?			
Were all applicable forms submitted?			
Is the Field Inspection Checklist completed and included on the plans?			
Are all appropriate Acceptance Tests checked AND Equipment/Controls requiring testing identified on the Certificate of Compliance?			
Do all pages have the same run number and date? (<i>Performance Only</i>)			
Efficiencies and capacities of HVAC equipment			
Thermostat and Controls			
Ventilation and Ventilation Rates (cfm)			
Duct Insulation			
Pipe Insulation			
Service Hot Water Equipment			
Pool and Spa Equipment			



Plan Examiner's Checklist

Includes Unitary Air conditioners/Heat Pumps and Water sourced equipment.

Mechanical – Is the Mandatory Measures note block on the plans?			
Were all applicable forms submitted?			
Is the Field Inspection Checklist completed and included on the plans?			
Are all appropriate Acceptance Tests checked AND Equipment/Controls requiring testing identified on the Certificate of Compliance?			
Do all pages have the same run number and date? (<i>Performance Only</i>)			
Efficiencies and capacities of HVAC equipment			
Thermostat and Controls			
Ventilation and Ventilation Rates (cfm)			
Duct Insulation			
Pipe Insulation			
Service Hot Water Equipment			
Pool and Spa Equipment			



CALIFORNIA ENERGY COMMISSION

AIR SYSTEM REQUIREMENTS

Part 1 of 2 **MECH-2-C**

PROJECT NAME Nonresidential Sample Building	DATE 5/5/2009
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SYSTEM FEATURES

ITEM OR SYSTEM TAG(S)
Number of Systems

AIR SYSTEMS, Central or Single Zone		
Retail Mech. System	Office Mech System	Restaurant Mech Sys.
1	1	1

MANDATORY MEASURES

T-24 Section

Reference on Plans or Specification

Heating Equipment Efficiency
Cooling Equipment Efficiency
Heat Pump Thermostat
Furnace Controls
Natural Ventilation
Minimum Ventilation
VAV Minimum Position Control
Demand Control Ventilation
Time Control
Setback and Setup Control
Outdoor Damper Control
Isolation Zones
Pipe Insulation
Duct Insulation

112(a)	81% AFUE	81% AFUE	82% AFUE
112(a)	9.0 EER	9.0 EER	10.5 EER
112(b)	n/a	n/a	n/a
112(c), 115(a)	n/a	n/a	n/a
121(b)	Yes	Yes	Yes
121(b)	320 cfm	288 cfm	640 cfm
121(c)	No	No	No
121(e)	Yes	Yes	Yes
121(c), 122(e)	Programmable Switch	Programmable Switch	Programmable Switch
122(e)	Heating & Cooling Required	Heating & Cooling Required	Heating & Cooling Required
122(f)	Auto	Auto	Auto
122(g)	n/a	n/a	n/a
123			
124	R-8.0	R-8.0	R-8.0



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Each column represents a cooling and/or heating system. Multiple system of the same type can be represented in a single column

AIR SYSTEM REQUIREMENTS

Part 1 of 2 **MECH-2-C**

PROJECT NAME Nonresidential Sample Building	DATE 5/5/2009
--	------------------

SYSTEM FEATURES

ITEM OR SYSTEM TAG(S)

Number of Systems

MANDATORY MEASURES

- Heating Equipment Efficiency
- Cooling Equipment Efficiency
- Heat Pump Thermostat
- Furnace Controls
- Natural Ventilation
- Minimum Ventilation
- VAV Minimum Position Control
- Demand Control Ventilation
- Time Control
- Setback and Setup Control
- Outdoor Damper Control
- Isolation Zones
- Pipe Insulation
- Duct Insulation

	AIR SYSTEMS, Central or Single Zone		
	Retail Mech. System	Office Mech System	Restaurant Mech Sys.
	1	1	1
T-24 Section	Reference on Plans or Specification		
112(a)	81% AFUE	81% AFUE	82% AFUE
112(a)	9.0 EER	9.0 EER	10.5 EER
112(b)	n/a	n/a	n/a
112(c), 115(a)	n/a	n/a	n/a
121(b)	Yes	Yes	Yes
121(b)	320 cfm	288 cfm	640 cfm
121(c)	No	No	No
121(c)	Yes	Yes	Yes
121(c), 122(e)	Programmable Switch	Programmable Switch	Programmable Switch
122(e)	Heating & Cooling Required	Heating & Cooling Required	Heating & Cooling Required
122(f)	Auto	Auto	Auto
122(g)	n/a	n/a	n/a
123			
124	R-8.0	R-8.0	R-8.0



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The efficiencies of each system must be specified or referenced on the plans.

AIR SYSTEM REQUIREMENTS

Part 1 of 2 **MECH-2-C**

PROJECT NAME Nonresidential Sample Building	DATE 5/5/2009
--	------------------

SYSTEM FEATURES

AIR SYSTEMS, Central or Single Zone		
Retail Mech. System	Office Mech System	Restaurant Mech Sys.
1	1	1

ITEM OR SYSTEM TAG(S)

Number of Systems

MANDATORY MEASURES

T-24
Section

Reference on Plans or Specification

Heating Equipment Efficiency
Cooling Equipment Efficiency
Heat Pump Thermostat
Furnace Controls
Natural Ventilation
Minimum Ventilation
VAV Minimum Position Control
Demand Control Ventilation
Time Control
Setback and Setup Control
Outdoor Damper Control
Isolation Zones
Pipe Insulation
Duct Insulation

112(a)	81% AFUE	81% AFUE	82% AFUE
112(a)	9.0 EER	9.0 EER	10.5 EER
112(b)	n/a	n/a	n/a
112(c), 115(a)	n/a	n/a	n/a
121(b)	Yes	Yes	Yes
121(b)	320 cfm	288 cfm	640 cfm
121(c)	No	No	No
121(c)	Yes	Yes	Yes
121(c), 122(e)	Programmable Switch	Programmable Switch	Programmable Switch
122(e)	Heating & Cooling Required	Heating & Cooling Required	Heating & Cooling Required
122(f)	Auto	Auto	Auto
122(g)	n/a	n/a	n/a
123			
124	R-8.0	R-8.0	R-8.0



CALIFORNIA ENERGY COMMISSION

Not all the mandatory measures may apply to the system identified.

AIR SYSTEM REQUIREMENTS

Part 1 of 2 **MECH-2-C**

PROJECT NAME Nonresidential Sample Building	DATE 5/5/2009
--	------------------

SYSTEM FEATURES

AIR SYSTEMS, Central or Single Zone		
Retail Mech. System	Office Mech System	Restaurant Mech Sys.
1	1	1

ITEM OR SYSTEM TAG(S)

Number of Systems

MANDATORY MEASURES

T-24
Section

Reference on Plans or Specification

Heating Equipment Efficiency	112(a)	81% AFUE	81% AFUE	82% AFUE
Cooling Equipment Efficiency	112(a)	9.0 EER	9.0 EER	10.5 EER
Heat Pump Thermostat	112(b)	n/a	n/a	n/a
Furnace Controls	112(c), 115(a)	n/a	n/a	n/a
Natural Ventilation	121(b)	Yes	Yes	Yes
Minimum Ventilation	121(b)	320 cfm	288 cfm	640 cfm
VAV Minimum Position Control	121(c)	No	No	No
Demand Control Ventilation	121(c)	Yes	Yes	Yes
Time Control	121(c), 122(e)	Programmable Switch	Programmable Switch	Programmable Switch
Setback and Setup Control	122(e)	Heating & Cooling Required	Heating & Cooling Required	Heating & Cooling Required
Outdoor Damper Control	122(f)	Auto	Auto	Auto
Isolation Zones	122(g)	n/a	n/a	n/a
Pipe Insulation	123			
Duct Insulation	124	R-8.0	R-8.0	R-8.0



CALIFORNIA ENERGY COMMISSION

WATER SIDE SYSTEM REQUIREMENTS

Part 2 of 2 **MECH-2-C**

PROJECT NAME TES Sample Project	DATE 5/19/2009
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SYSTEM FEATURES

Each column represents a cooling and/or heating system. Multiple system of the same type can be represented in a single column

ITEM OR SYSTEM TAG(S)	T-24 Section	² WATER SIDE SYSTEMS: Chillers, Towers, Boilers, Hydronic Loops		
		800 ton Trane HCFC-123	866 TON TOWERS	Steam Boilers
Number of Systems		1	1	1
MANDATORY MEASURES		Reference on Plans or Specification		
Equipment Efficiency	112(a)	0.460 kW/ton	7 F App	81%
Pipe Insulation	123	CHW Piping	n/a	HW Piping
PRESCRIPTIVE MEASURES				
Calculated Capacity	144 (a & b)	n/a	866 tons	n/a
Proposed Capacity	144 (a & b)	800 tons	n/a	16,733,648 btuh
Tower Fan Controls	144 (h)	n/a	Two-Speed-Fan	n/a
Tower Flow Controls	144 (h)	n/a	Fixed-Temp	n/a
Variable Flow System Design	144 (i)	Required	n/a	
Chiller and Boiler Isolation	144 (i)	n/a	n/a	n/a
CHW and HHW Reset Controls	144 (i)	Required	n/a	Required
WLHP Isolation Valves	144 (i)	n/a	n/a	n/a
VSD on CHW, CW & WLHP Pumps > 5 HP	144 (i)	Required	n/a	n/a
DP Sensor Location	144 (i)		n/a	n/a

1: For each chiller, cooling tower, boiler, and hydronic loop (or groups of similar equipment) fill in the reference to sheet number and/or specification section and paragraph number where the required features are documented. If a requirement is not applicable, put "N/A" in the column.

2: Water side systems include wet side system using other liquids such as glycol or brine.



CALIFORNIA ENERGY COMMISSION

WATER SIDE SYSTEM REQUIREMENTS

Part 2 of 2 **MECH-2-C**

PROJECT NAME TES Sample Project	DATE 5/19/2009
------------------------------------	-------------------

SYSTEM FEATURES

²WATER SIDE SYSTEMS: Chillers, Towers, Boilers, Hydronic Loops

800 ton Trane HCFC-123	866 TON TOWERS	Steam Boilers
1	1	1

Not all the measures may apply to the system identified.

Note: Prescriptive

ITEM OR SYSTEM TAG(S)

Number of Systems

MANDATORY MEASURES

Equipment Efficiency

Pipe Insulation

PRESCRIPTIVE MEASURES

Calculated Capacity

Proposed Capacity

Tower Fan Controls

Tower Flow Controls

Variable Flow System Design

Chiller and Boiler Isolation

CHW and HHW Reset Controls

WLHP Isolation Valves

VSD on CHW, CW & WLHP Pumps > 5 HP

DP Sensor Location

	T-24 Section	Reference on Plans or Specification		
Equipment Efficiency	112(a)	0.460 kW/ton	7 F App	81%
Pipe Insulation	123	CHW Piping	n/a	HHW Piping
Calculated Capacity	144 (a & b)	n/a	866 tons	n/a
Proposed Capacity	144 (a & b)	800 tons	n/a	16,733,648 btuh
Tower Fan Controls	144 (h)	n/a	Two-Speed-Fan	n/a
Tower Flow Controls	144 (h)	n/a	Fixed-Temp	n/a
Variable Flow System Design	144 (i)	Required	n/a	
Chiller and Boiler Isolation	144 (i)	n/a	n/a	n/a
CHW and HHW Reset Controls	144 (i)	Required	n/a	Required
WLHP Isolation Valves	144 (i)	n/a	n/a	n/a
VSD on CHW, CW & WLHP Pumps > 5 HP	144 (i)	Required	n/a	n/a
DP Sensor Location	144 (i)		n/a	n/a

1: For each chiller, cooling tower, boiler, and hydronic loop (or groups of similar equipment) fill in the reference to sheet number and/or specification section and paragraph number where the required features are documented. If a requirement is not applicable, put "N/A" in the column.

2: Water side systems include wet side system using other liquids such as glycol or brine.



HVAC SYSTEM EQUIPMENT EFFICIENCIES

Equipment Efficiencies found in §112 and §113:

- Unitary Air conditioners and Heat pumps $\geq 65,000$ BTU/h
- Air Cooled Gas-Engine Heat Pumps – All capacities
- Water Chilling Packages
- PTAC and PTHP – All capacities
- Heat Rejection Equipment
- Non-Standard Centrifugal Chillers

Equipment not regulated by §112 and §113 is addressed in the Appliance Efficiency Regulations.



HVAC SYSTEM EQUIPMENT EFFICIENCIES

Only equipment regulated by the Appliance Efficiency Regulations are required to be certified to the Energy Commission.

To verify certification, use one of the following:

- Appliance Efficiency Database:

<http://www.energy.ca.gov/appliances/database/index.html>

- The Energy Standards Hotline 1-800-752-6245 or (916) 654-5106 or Title24@energy.state.ca.us



Plan Examiner's Checklist

Every project with mechanical cooling/heating or ventilation must have a controls system identified.

Mechanical – Is the Mandatory Measures note block on the plans?			
Were all applicable forms submitted?			
Is the Field Inspection Checklist completed and included on the plans?			
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Do all pages have the same run number and date? (<i>Performance Only</i>)			
Efficiencies and capacities of HVAC equipment			
Thermostat and Controls			
Ventilation and Ventilation Rates (cfm)			
Duct Insulation			
Pipe Insulation			
Service Hot Water Equipment			
Pool and Spa Equipment			



CALIFORNIA ENERGY COMMISSION

Example of an incomplete submittal.

Note: Heat Pump thermostats may not always apply. However, furnace controls always apply.

AIR SYSTEM REQUIREMENTS

Part 1 of 2 **MECH-2-C**

PROJECT NAME Nonresidential Sample Building	DATE 5/5/2009
--	------------------

SYSTEM FEATURES

AIR SYSTEMS, Central or Single Zone		
Retail Mech. System	Office Mech System	Restaurant Mech Sys.
1	1	1

ITEM OR SYSTEM TAG(S)

Number of Systems

MANDATORY MEASURES

T-24
Section

Reference on Plans or Specification

Heating Equipment Efficiency	112(a)	81% AFUE	81% AFUE	82% AFUE
Cooling Equipment Efficiency	112(a)	9.0 EER	9.0 EER	10.5 EER
Heat Pump Thermostat	112(b)	n/a	n/a	n/a
Furnace Controls	112(c), 115(a)	n/a	n/a	n/a
Natural Ventilation	121(b)	Yes	Yes	Yes
Minimum Ventilation	121(b)	320 cfm	288 cfm	640 cfm
VAV Minimum Position Control	121(c)	No	No	No
Demand Control Ventilation	121(c)	Yes	Yes	Yes
Time Control	121(c), 122(e)	Programmable Switch	Programmable Switch	Programmable Switch
Setback and Setup Control	122(e)	Heating & Cooling Required	Heating & Cooling Required	Heating & Cooling Required
Outdoor Damper Control	122(f)	Auto	Auto	Auto
Isolation Zones	122(g)	n/a	n/a	n/a
Pipe Insulation	123			
Duct Insulation	124	R-8.0	R-8.0	R-8.0



THERMOSTATS AND CONTROLS

Heat Pump Thermostat

Controls for heat pumps with supplementary electric resistance heaters must meet both of the following:

- Prevent supplementary heater operation when the heating load can be met by the heat pump alone.
- The cut-on/off temperature for compression heating must be higher than the cut-on/off temperature for supplementary heating.

Furnace Controls

Thermostats controlling unitary heating and/or cooling systems (including heat pumps) not connected to a central energy management control system must be a setback thermostat.



THERMOSTATS AND CONTROLS

Each HVAC system must be installed with controls capable of the following:

1. Automatic shut off during periods of nonuse and shall have:
 - An automatic time switch [§119(c)] with an accessible 4 hour manual override; or
 - An occupancy sensor; or
 - A manually operated 4 hour timer.

2. Automatic restart and temporary operation as required to maintain:
 - A setback heating thermostat setpoint if the system provides mechanical heating; and
 - A setup cooling thermostat setpoint if the system provides mechanical cooling.



THERMOSTATS AND CONTROLS

Outdoor Damper Control

The installed damper for outdoor air supply and exhaust equipment must automatically close upon fan shutdown.

Isolation Zones

A space conditioning system serving multiple zones with a combined conditioned floor area of more than 25,000 square feet must be controlled to serve isolation areas. Also, each isolation area shall be controlled by a device that meets the following:

- Automatic shut off during periods of nonuse; and
- Automatic time switch [§119(c)] with an accessible 4 hour manual override; or
- Occupancy Sensor; or
- Manually operated 4 hour timer



Plan Examiner's Checklist

Either Natural Ventilation or Mechanical Ventilation needs to be identified.

Mechanical – Is the Mandatory Measures note block on the plans?			
Were all applicable forms submitted?			
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Are all appropriate Acceptance Tests checked AND Equipment/Controls requiring testing identified on the Certificate of Compliance?			
Do all pages have the same run number and date? (<i>Performance Only</i>)			
Efficiencies and capacities of HVAC equipment			
Thermostat and Controls			
Ventilation and Ventilation Rates (cfm)			
Duct Insulation			
Pipe Insulation			
Service Hot Water Equipment			
Pool and Spa Equipment			



CALIFORNIA ENERGY COMMISSION

If Minimum Ventilation is identified, then a MECH-3C form must be completed.

AIR SYSTEM REQUIREMENTS

Part 1 of 2 **MECH-2-C**

PROJECT NAME Nonresidential Sample Building	DATE 5/5/2009
--	------------------

SYSTEM FEATURES

AIR SYSTEMS, Central or Single Zone		
Retail Mech. System	Office Mech System	Restaurant Mech Sys.
1	1	1

ITEM OR SYSTEM TAG(S)

Number of Systems

MANDATORY MEASURES

- Heating Equipment Efficiency
- Cooling Equipment Efficiency
- Heat Pump Thermostat
- Furnace Controls
- Natural Ventilation
- Minimum Ventilation
- VAV Minimum Position Control
- Demand Control Ventilation
- Time Control
- Setback and Setup Control
- Outdoor Damper Control
- Isolation Zones
- Pipe Insulation
- Duct Insulation

T-24 Section

Reference on Plans or Specification

112(a)	81% AFUE	81% AFUE	82% AFUE
112(a)	9.0 EER	9.0 EER	10.5 EER
112(b)	n/a	n/a	n/a
112(c), 115(a)	n/a	n/a	n/a
121(b)	Yes	Yes	Yes
121(b)	320 cfm	288 cfm	640 cfm
121(c)	No	No	No
121(e)	Yes	Yes	Yes
121(c), 122(e)	Programmable Switch	Programmable Switch	Programmable Switch
122(e)	Heating & Cooling Required	Heating & Cooling Required	Heating & Cooling Required
122(f)	Auto	Auto	Auto
122(g)	n/a	n/a	n/a
123			
124	R-8.0	R-8.0	R-8.0



CALIFORNIA ENERGY COMMISSION

MECHANICAL VENTILATION

MECH-3-C

PROJECT NAME Sample Single Story Prescriptive Office Building	DATE 5/5/2009
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MECHANICAL VENTILATION (Section 121(b)2)										PRESCRIPTIVE REHEAT LIMITATION (Section 144(d))			
A ZONE/SYSTEM	AREA BASIS			OCCUPANCY BASIS			H REQ'D V.A. Max of (D or G)	I Design Vent. Air CFM	VAV MINIMUM				
	B Condition Area (SF)	C CFM per Square Foot	D Min CFM by Area (B x C)	E Number of People	F CFM per Person	G Min CFM by Occupant (E x F)			J 30% of Design Zone Supply CFM	K B x 0.4 CFM/sq.ft.	L Max of Columns H, J, K or 300 CFM	M Design Min. Air Setpoint	N Transfer Air
North Perimeter Zone	750	0.15	113				113	112		300	300		
East Perimeter Zone	495	0.15	74				74	74					
West Perimeter Zone	495	0.15	74				74	74					
Core Zone	820	0.15	123				123	123					
AHU-1							Total	384	384				
East Perimeter Zone	495	0.15	74				74	74					
South Perimeter Zone	750	0.15	113				113	112					
West Perimeter Zone	495	0.15	74				74	74					
Core Zone	820	0.15	123				123	123					
AHU-2							Total	384	384				

Each system providing Mechanical Ventilation must be documented on this form. Additional MECH-3C forms may need to be submitted to accommodate multiple systems.



CALIFORNIA ENERGY COMMISSION

MECHANICAL VENTILATION

MECH-3-C

PROJECT NAME Sample Single Story Prescriptive Office Building	DATE 5/5/2009
--	------------------

MECHANICAL VENTILATION (Section 121(b)2)										PRESCRIPTIVE REHEAT LIMITATION (Section 144(d))			
A ZONE/SYSTEM	AREA BASIS			OCCUPANCY BASIS			V&V MINIMUM				N Transfer Air		
	B Condition Area (SF)	C square foot per CFM (B x C)	D Min CFM by Area (B x C)	E Number of People	F per Person	G CFM by Occupant (E x F)	H REQ'D V/A Max of (D or G)	I Design Vert. Air CFM	J 30% of Design Zone Supply CFM	K B x 0.4 CFM/sq.ft.		L Max of Columns H, J, K or 300 CFM	M Design Min. Air Setpoint
North Perimeter Zone	750	0.15	113				113	112		300	300		
East Perimeter Zone	495	0.15	74				74	74					
West Perimeter Zone	495	0.15	74				74	74					
Core Zone	820	0.15	123				123	123					
AHU-1						Total	384	384					
East Perimeter Zone	495	0.15	74				74	74					
South Perimeter Zone	750	0.15	113				113	112					
West Perimeter Zone	495	0.15	74				74	74					
Core Zone	820	0.15	123				123	123					
AHU-2						Total	384	384					

The highlighted columns should be verified for correctness. The Plans Examiner should ensure that all the conditioned floor area is accounted for and supplied with the proper amount of ventilation air.





CALIFORNIA ENERGY COMMISSION

MECHANICAL VENTILATION

MECH-3-C

PROJECT NAME Sample Single Story Prescriptive Office Building	DATE 5/5/2009
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MECHANICAL VENTILATION (Section 121(b)2)										PRESCRIPTIVE REHEAT LIMITATION (Section 144(d))			
A ZONE/SYSTEM	AREA BASIS			OCCUPANCY BASIS			V&V MINIMUM				N Transfer Air		
	B Condition Area (SF)	C square foot per CFM (B x C)	D Min CFM by Area (B x C)	E Number of People	F CFM per Person	G Min CFM by Occupant (E x F)	H REQ'D V/A Max of (D or G)	I Design Vert. Air CFM	J 30% of Design Zone Supply CFM	K B x 0.4 CFM/sq.ft.		L Max of Columns H, J, K or 300 CFM	M Design Min. Air Setpoint
North Perimeter Zone	750	0.15	113				113	112		300	300		
East Perimeter Zone	495	0.15	74				74	74					
West Perimeter Zone	495	0.15	74				74	74					
Core Zone	820	0.15	123				123	123					
AHU-1						Total	384	384					
East Perimeter Zone	495	0.15	74				74	74					
South Perimeter Zone	750	0.15	113				113	112					
West Perimeter Zone	495	0.15	74				74	74					
Core Zone	820	0.15	123				123	123					
AHU-2						Total	384	384					

Column N is only completed when transfer air is needed to satisfy the minimum amount (when H ≥ M). Transfer air must be greater than or equal to H-M.



VENTILATION AND VENTILATION RATES (CFM)

Natural Ventilation

Natural outdoor ventilation may be provided for spaces where:

- Operable wall or roof opening is permanently accessible within 20 feet (25 feet for hotel/motel guest rooms).
- The operable open areas must total at least 5 percent of the floor area.
- The openings must also be readily accessible to the occupants of the space at all times.
- Airflow through the openings must come directly from the outdoors.



VENTILATION AND VENTILATION RATES (CFM)

Minimum Ventilation

- Mechanical outdoor ventilation must be provided for all spaces normally occupied that are not naturally ventilated.
- The amount of outdoor air must be equal to or exceed the calculated ventilation rates detailed on the MECH-3C for each occupied space.
- The required ventilation can be provided either directly through supply air or indirectly through transfer of air from the plenum or an adjacent space.



VENTILATION AND VENTILATION RATES (CFM)

For each *space* requiring mechanical ventilation the ventilation rates must be the greater of either:

- The conditioned floor area of the space, multiplied by the applicable minimum ventilation rate from the Standards in Table 121-A.
- 15 cfm per person, multiplied by the expected number of occupants.
 - For spaces with fixed seating the expected number of occupants is the number of fixed seats.
 - For spaces without fixed seating, the expected number of occupants is no less than one-half the maximum occupant load assumed for egress purposes (2008 Nonresidential Compliance Manual Table 4-2).



VENTILATION AND VENTILATION RATES (CFM)

Demand Control Ventilation

The Standards require the use of DVC systems for spaces with all of the following characteristics:

- Served by single zone units with any controls or multiple zone systems with Direct Digital Controls (DDC) to the zone level; and
- Have a design occupancy of 40 ft²/person or smaller (for areas without fixed seating where the design density for egress purposes in the 2008 Nonresidential Compliance Manual Table 4-2 is 40 ft²/person or smaller); and
- Has an air economizer



VENTILATION AND VENTILATION RATES (CFM)

There are four exceptions to this requirement:

1. The following spaces are permitted to use DCV but are not required to: Classrooms, call centers, office spaces served by multiple zone systems that are continuously occupied during normal business hours with occupant density greater than 25 people per 1000 ft² per §121(b)2B (Tables 4-1 and 4-2 above), healthcare facilities and medical buildings, and public areas of social services buildings.
2. Where the space exhaust is greater than the required ventilation rate minus 0.2 cfm/ft²



VENTILATION AND VENTILATION RATES (CFM)

3. DCV devices are not allowed in the following spaces: Spaces that have processes or operations that generate dust, fumes, mists, vapors, or gases and are not provided with local exhaust ventilation, such as indoor operation of internal combustion engines or areas designated for unvented food service preparation, or beauty salons.
4. Spaces with an area of less than 150 ft², or a design occupancy of less than 10 people per §121(b)2B (Tables 4-1 and 4-2 above).



Plan Examiner's Checklist

Most duct system require insulation. Only ducts enclosed entirely in conditioned space may be uninsulated.

Mechanical – Is the Mandatory Measures note block on the plans?			
Were all applicable forms submitted?			
Is the Field Inspection Checklist completed and included on the plans?			
Are all appropriate Acceptance Tests checked AND Equipment/Controls requiring testing identified on the Certificate of Compliance?			
Do all pages have the same run number and date? (<i>Performance Only</i>)			
Efficiencies and capacities of HVAC equipment			
Thermostat and Controls			
Ventilation and Ventilation Rates (cfm)			
Duct Insulation			
Pipe Insulation			
Service Hot Water Equipment			
Pool and Spa Equipment			



CALIFORNIA ENERGY COMMISSION

The specified amount of insulation should be verified on the plans.

AIR SYSTEM REQUIREMENTS

Part 1 of 2 **MECH-2-C**

PROJECT NAME Nonresidential Sample Building	DATE 5/5/2009
--	------------------

SYSTEM FEATURES

AIR SYSTEMS, Central or Single Zone		
Retail Mech. System	Office Mech System	Restaurant Mech Sys.
1	1	1

ITEM OR SYSTEM TAG(S)

Number of Systems

MANDATORY MEASURES

- Heating Equipment Efficiency
- Cooling Equipment Efficiency
- Heat Pump Thermostat
- Furnace Controls
- Natural Ventilation
- Minimum Ventilation
- VAV Minimum Position Control
- Demand Control Ventilation
- Time Control
- Setback and Setup Control
- Outdoor Damper Control
- Isolation Zones
- Pipe Insulation
- Duct Insulation

T-24 Section

Reference on Plans or Specification

112(a)	81% AFUE	81% AFUE	82% AFUE
112(a)	9.0 EER	9.0 EER	10.5 EER
112(b)	n/a	n/a	n/a
112(c), 115(a)	n/a	n/a	n/a
121(b)	Yes	Yes	Yes
121(b)	320 cfm	288 cfm	640 cfm
121(c)	No	No	No
121(e)	Yes	Yes	Yes
121(e), 122(e)	Programmable Switch	Programmable Switch	Programmable Switch
122(e)	Heating & Cooling Required	Heating & Cooling Required	Heating & Cooling Required
122(f)	Auto	Auto	Auto
122(g)	n/a	n/a	n/a
123			
124	R-8.0	R-8.0	R-8.0



DUCT INSULATION

Portions of the supply and return ducts located in any of the following places shall be insulated to a minimum level of R-8:

- Outdoors;
- In a space between the roof and an insulated ceiling;
- In a space directly under a roof with fixed vents or opening to the outside or unconditioned spaces;
- In an unconditioned crawlspace;
- In other unconditioned spaces



DUCT INSULATION

Portions of the supply duct that are not located in any of the listed spaces (unconditioned space), including ducts buried in concrete slabs, shall be insulated to a minimum installed level of R-4.2 (or any higher level required by CMC section 605) or be enclosed in conditioned space.



Plan Examiner's Checklist

Pipe insulation is required for piping connected to HVAC systems and Service Hot Water systems

Mechanical – Is the Mandatory Measures note block on the plans?			
Were all applicable forms submitted?			
Is the Field Inspection Checklist completed and included on the plans?			
Are all appropriate Acceptance Tests checked AND Equipment/Controls requiring testing identified on the Certificate of Compliance?			
Do all pages have the same run number and date? (<i>Performance Only</i>)			
Efficiencies and capacities of HVAC equipment			
Thermostat and Controls			
Ventilation and Ventilation Rates (cfm)			
Duct Insulation			
Pipe Insulation			
Service Hot Water Equipment			
Pool and Spa Equipment			



CALIFORNIA ENERGY COMMISSION

The specified amount of insulation should be verified on the plans.

WATER SIDE SYSTEM REQUIREMENTS

Part 2 of 2 **MECH-2-C**

PROJECT NAME NR Hydronic Example	DATE 5/5/2009
-------------------------------------	------------------

SYSTEM FEATURES

ITEM OR SYSTEM TAG(S)	2 WATER SIDE SYSTEMS: Chillers, Towers, Boilers, Hydronic Loops		
	TELEDYNE LAARS JVS050ND(I/L)		
Number of Systems			
MANDATORY MEASURES	T-24 Section	Reference on Plans or Specification	
Equipment Efficiency	112(a)	84%	
Pipe Insulation	123	HW Piping	
PRESCRIPTIVE MEASURES			
Calculated Capacity	144 (a & b)	n/a	
Proposed Capacity	144 (a & b)	42,200 btuh	
Tower Fan Controls	144 (h)	n/a	
Tower Flow Controls	144 (h)	n/a	
Variable Flow System Design	144 (i)		
Chiller and Boiler Isolation	144 (i)	n/a	
CHW and HHW Reset Controls	144 (i)	n/a	
WLHP Isolation Valves	144 (i)	n/a	
VSD on CHW, CW & WLHP Pumps > 5 HP	144 (i)	n/a	
DP Sensor Location	144 (i)	n/a	

1: For each chiller, cooling tower, boiler, and hydronic loop (or groups of similar equipment) fill in the reference to sheet number and/or specification section and paragraph number where the required features are documented. If a requirement is not applicable, put "N/A" in the column.

2: Water side systems include wet side system using other liquids such as glycol or brine.



PIPE INSULATION

TABLE 123-A PIPE INSULATION THICKNESS

The required thickness of piping insulation depends on:

Temperature,
Thermal Conductivity
Pipe Diameter, and
Function of the pipe

FLUID TEMPERATURE RANGE (°F)	CONDUCTIVITY RANGE (in Btu-inch per hour per square foot per °F)	INSULATION MEAN RATING TEMPERATURE (°F)	NOMINAL PIPE DIAMETER (in inches)					
			Runouts up to 2	1 and less	1.25-2	2.50-4	5-6	8 and larger
INSULATION THICKNESS REQUIRED (in inches)								
Space heating systems (steam, steam condensate and hot water)								
Above 350	0.32-0.34	250	1.5	2.5	2.5	3.0	3.5	3.5
251-350	0.29-0.31	200	1.5	2.0	2.5	2.5	3.5	3.5
201-250	0.27-0.30	150	1.0	1.5	1.5	2.0	2.0	3.5
141-200	0.25-0.29	125	0.5	1.5	1.5	1.5	1.5	1.5
105-140	0.24-0.28	100	0.5	1.0	1.0	1.0	1.5	1.5
Service water-heating systems (recirculating sections, all piping in electric trace tape systems, and the first 8 feet of piping from the storage tank for nonrecirculating systems)								
Above 105	0.24-0.28	100	0.5	1.0	1.0	1.5	1.5	1.5
Space cooling systems (chilled water, refrigerant and brine)								
40-60	0.23-0.27	75	0.5	0.5	0.5	1.0	1.0	1.0
Below 40	0.23-0.27	75	1.0	1.0	1.5	1.5	1.5	1.5



PIPE INSULATION

Piping that does not require insulation includes the following:

- Factory installed piping within space-conditioning equipment certified under §111 or §112.
- Piping that conveys fluid with a design operating temperature range between 60°F and 105°F, such as cooling tower piping or piping in water loop heat pump systems.
- Piping that serves process loads, gas piping, cold domestic water piping, condensate drains, roof drains, vents or waste piping.



PIPE INSULATION

When insulating materials are used that have conductivities different from those listed in Table 123-A for the applicable fluid range, such as calcium silicate, Standards Equation 123-A may be used to calculate the required insulation thickness.

EQUATION 123-A INSULATION THICKNESS EQUATION

$$T = PR \left[\left(1 + \frac{t}{PR} \right)^{\frac{K}{k}} - 1 \right]$$

WHERE:

- T = Minimum insulation thickness for material with conductivity K , inches.
- PR = Pipe actual outside radius, inches.
- t = Insulation thickness from TABLE 123-A, inches.
- K = Conductivity of alternate material at the mean rating temperature indicated in TABLE 123-A for the applicable fluid temperature range, in Btu-inch per hour per square foot per °F.
- k = The lower value of the conductivity range listed in TABLE 123-A for the applicable fluid temperature range, Btu-inch per hour per square foot per °F.



PIPE INSULATION

Exposed pipe insulation must be protected from damage by moisture, UV and physical abrasion including but not limited to the following:

- Protected by aluminum, sheet metal, painted canvas, or plastic cover.
- Cellular foam insulation shall be protected as above or painted with a coating that is water retardant and provides shielding from solar radiation that can cause degradation of the material.
- Insulation covering chilled water piping and refrigerant suction piping located outside the conditioned space shall include a vapor retardant located outside the insulation (unless the insulation is inherently vapor retardant).



Plan Examiner's Checklist

Includes:
Efficiency,
Controls, and
Installation

Mechanical – Is the Mandatory Measures note block on the plans?			
Were all applicable forms submitted?			
Is the Field Inspection Checklist completed and included on the plans?			
Are all appropriate Acceptance Tests checked AND Equipment/Controls requiring testing identified on the Certificate of Compliance?			
Do all pages have the same run number and date? (<i>Performance Only</i>)			
Efficiencies and capacities of HVAC equipment			
Thermostat and Controls			
Ventilation and Ventilation Rates (cfm)			
Duct Insulation			
Pipe Insulation			
Service Hot Water Equipment			
Pool and Spa Equipment			



CALIFORNIA ENERGY COMMISSION

WATER SIDE SYSTEM REQUIREMENTS

Part 2 of 2 **MECH-2-C**

PROJECT NAME Built Up VAV Sample	DATE 5/5/2009
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SYSTEM FEATURES

Each column represents a water heating system. Multiple system of the same type can be represented in a single column.

ITEM OR SYSTEM TAG(S)

Number of Systems

Service Hot Water, Pool Heating		
DHW Heater		
1		

MANDATORY MEASURES

Water Heater Certification
 Water Heater Efficiency
 Service Water Heating Installation
 Pool and Spa Efficiency and Control
 Pool and Spa Installation
 Pool Heater - No Pilot Light
 Spa Heater - No Pilot Light

		Reference on Plans or Specification	
113 (a)	Standard Gas 50 gal or Less		
113 (b)	78%		
113 (c)			
114 (a)	n/a		
114 (b)	n/a		
115 (c)	n/a		
115 (d)	n/a		

1: For each water heater, pool heater and domestic water loop (or groups of similar equipment) fill in the reference to sheet number and/or specification section and paragraph number where the required features are documented. If a requirement is not applicable, put "N/A" in the column.



CALIFORNIA ENERGY COMMISSION

WATER SIDE SYSTEM REQUIREMENTS

Part 2 of 2 MECH-2-C

PROJECT NAME Built Up VAV Sample	DATE 5/5/2009
-------------------------------------	------------------

SYSTEM FEATURES

All systems must meet the applicable minimum level of efficiency.

ITEM OR SYSTEM TAG(S)

Number of Systems

MANDATORY MEASURES

Water Heater Certification
 Water Heater Efficiency
 Service Water Heating Installation
 Pool and Spa Efficiency and Control
 Pool and Spa Installation
 Pool Heater - No Pilot Light
 Spa Heater - No Pilot Light

Service Hot Water, Pool Heating		
DHW Heater		
1		

Reference on Plans or Specification		
113 (a)	Standard Gas 50 gal or Less	
113 (b)	78%	
113 (c)		
114 (a)	n/a	
114 (b)	n/a	
115 (c)	n/a	
115 (d)	n/a	

1: For each water heater, pool heater and domestic water loop (or groups of similar equipment) fill in the reference to sheet number and/or specification section and paragraph number where the required features are documented. If a requirement is not applicable, put "N/A" in the column.



SERVICE HOT WATER HEATING

Water Heater Efficiency

- All systems and equipment must meet the applicable efficiency requirements of the Appliance Efficiency Regulations as required by §111.

Service Water Heater Installation

- Outlet Temperature Controls, on systems that have a total capacity greater than 167,000 Btu/hr shall have:
 - Separate remote heaters;
 - Heat exchangers; or
 - Boosters to supply the outlet with the higher temperature.



SERVICE HOT WATER HEATING

Service Water Heating Installation Continued...

Controls for Hot Water Distribution Systems

Systems with a circulating pump or electrical heat trace shall include an automatic shut off control when hot water is not required:

- Automatic time switches;
- Interlocks with HVAC time switches;
- Occupancy sensors; and
- Other controls that accomplish the intended purpose.



SERVICE HOT WATER HEATING

Public Lavatories

Temperature controls for public lavatories shall limit the outlet temperature to 110°F.

Storage Tank Insulation

Unfired water heater storage tanks and backup tanks for solar water heating systems shall have:

- External insulation with an installed R-value of at least R-12; or
- Internal and external insulation with a combined R-value of at least R-16; or
- The heat loss of the tank based on an 80° F water-air temperature difference shall be less than 6.5 Btu per hour per ft². This corresponds to an effective resistance of R-12.3.



SERVICE HOT WATER HEATING

Service Water Heaters in State Buildings

State Buildings shall derive its service water heating from a system that provides at least 60 percent of the energy needed from site solar energy or recovered energy.

Note: This requirement may be waived by the State Architect.



Plan Examiner's Checklist

Includes:
Efficiency,
Controls,
Installation, and
Pilot Lights

Mechanical – Is the Mandatory Measures note block on the plans?			
Were all applicable forms submitted?			
Is the Field Inspection Checklist completed and included on the plans?			
Are all appropriate Acceptance Tests checked AND Equipment/Controls requiring testing identified on the Certificate of Compliance?			
Do all pages have the same run number and date? (<i>Performance Only</i>)			
Efficiencies and capacities of HVAC equipment			
Thermostat and Controls			
Ventilation and Ventilation Rates (cfm)			
Duct Insulation			
Pipe Insulation			
Service Hot Water Equipment			
Pool and Spa Equipment			



CALIFORNIA ENERGY COMMISSION

WATER SIDE SYSTEM REQUIREMENTS

Part 2 of 2 **MECH-2-C**

PROJECT NAME Built Up VAV Sample	DATE 5/5/2009
-------------------------------------	------------------

SYSTEM FEATURES

All pool and spa equipment must comply with these mandatory requirements.

ITEM OR SYSTEM TAG(S)

Number of Systems

MANDATORY MEASURES

- Water Heater Certification
- Water Heater Efficiency
- Service Water Heating Installation
- Pool and Spa Efficiency and Control
- Pool and Spa Installation
- Pool Heater - No Pilot Light
- Spa Heater - No Pilot Light

Service Hot Water, Pool Heating		
DHW Heater		
1		

Reference on Plans or Specification		
113 (a)	Standard Gas 50 gal or Less	
113 (b)	78%	
113 (c)		
114 (a)	n/a	
114 (b)	n/a	
115 (c)	n/a	
115 (d)	n/a	

1: For each water heater, pool heater and domestic water loop (or groups of similar equipment) fill in the reference to sheet number and/or specification section and paragraph number where the required features are documented. If a requirement is not applicable, put "N/A" in the column.



POOL AND SPA EFFICIENCY AND CONTROL

All pool and spa heating systems and equipment must be certified by the manufacturer and listed by the Energy Commission with:

- An efficiency that complies with the Appliance Efficiency Regulations; and
- No electric resistance heating

Inspectors shall verify the following:

- A readily accessible on-off switch that allows the heater to be shut off without adjusting the thermostat setting; and
- A permanent plate or card that gives instructions for the energy efficient operation and proper care of the pool or spa heater.



POOL AND SPA INSTALLATION

- If a pool or spa heating system does not currently use solar heating collectors, piping must be installed to accommodate for future solar installation:
 - Leave at least 36 in. of pipe between the filter and heater to allow for the future addition of solar heating equipment; or
 - Plumb separate suction and return lines to the pool dedicated to future solar heating; or
 - Install built-up or built-in connections for future piping to solar water heating. An example of a built-in connection could be a capped off tee fitting between the filter and heater.
- Outdoor pool and spa systems with gas or electric heaters must use a pool cover.



POOL AND SPA INSTALLATION

All pool systems must be installed with all of the following:

- Directional inlets that adequately mix the pool water; and
- A time switch or similar control mechanism to control the operation of the circulation control system. The time switch shall allow the pump to be set or programmed to run in the off-peak demand period for the minimum time necessary to maintain the water.

Pool Heater – No Pilot Light

Pool heaters may not have a continuously burning pilot light per §115.

Spa Heater – No Pilot Light

Spa heaters may not have a continuously burning pilot light per §115.



CALIFORNIA ENERGY COMMISSION

PRESCRIPTIVE SECTION 144



CALIFORNIA ENERGY COMMISSION

AIR SYSTEM REQUIREMENTS

Part 1 of 2 **MECH-2-C**

PROJECT NAME Sample Single Story Prescriptive Office Building	DATE 5/18/2009
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SYSTEM FEATURES

ITEM OR SYSTEM TAG(S)

Number of Systems

PRESCRIPTIVE MEASURES

Calculated Heating Capacity^{1,4,5}

Proposed Heating Capacity²

Calculated Sensible Cooling Capacity^{2,1}

Proposed Sensible Cooling Capacity²

Fan Control

DP Sensor Location

Supply Pressure Reset (DDC only)

Simultaneous Heat/Cool

Economizer

Heating Air Supply Reset

Cooling Air Supply Reset

Duct Sealing for Prescriptive Compliance³

AIR SYSTEMS, Central or Single Zone

AHU-1	AHU-2
1	1

144 (a & b)	107,480 btuh	118,357 btuh
144 (a & b)	184,500 btuh	58,000 btuh
144 (a & b)	119,953 btuh	152,256 btuh
144 (a & b)	91,282 btuh	126,102 btuh
144 (c)	Constant Volume	Constant Volume
144 (c)	n/a	n/a
144 (c)	No	No
144 (d)	No	No
144 (e)	Fixed Temp (Integrated)	Fixed Temp (Integrated)
144 (f)	Constant Temp	Constant Temp
144 (f)	Constant Temp	Constant Temp
144 (k)	No	No

1: For each central and single zone air systems (or group of similar units) fill in the reference to sheet number and/or specification section and paragraph number where the required features are documented. If a requirement is not applicable, put "N/A" in the column.

2: Not required for hydraulic heating and cooling. Either enter a value here or put in reference to plan and specifications per footnote 1.

3: Enter Yes if System is: Constant Volume, Single Zone; Series < 5,000 sqft; Has > 25% duct in unconditioned space. Duct sealing is required for Prescriptive Compliance, see PERF-1 for performance method duct sealing requirement.

NOTES TO FIELD - For Building Department Use Only

Each column represents a cooling and/or heating system. Multiple system of the same type can be represented in a single column



CALIFORNIA ENERGY COMMISSION

AIR SYSTEM REQUIREMENTS

Part 1 of 2 **MECH-2-C**

PROJECT NAME Sample Single Story Prescriptive Office Building	DATE 5/18/2009
--	-------------------

SYSTEM FEATURES

ITEM OR SYSTEM TAG(S) Number of Systems	AIR SYSTEMS, Central or Single Zone	
	AHU-1	AHU-2
	1	1

PRESCRIPTIVE MEASURES

Calculated Heating Capacity ^{1,4,5}	144 (a & b)	107,480 btuh	118,357 btuh
Proposed Heating Capacity ²	144 (a & b)	184,500 btuh	58,000 btuh
Calculated Sensible Cooling Capacity ^{2,1}	144 (a & b)	119,953 btuh	152,256 btuh
Proposed Sensible Cooling Capacity ²	144 (a & b)	91,282 btuh	126,102 btuh
Fan Control	144 (c)	Constant Volume	Constant Volume
DP Sensor Location	144 (c)	n/a	n/a
Supply Pressure Reset (DDC only)	144 (c)	No	No
Simultaneous Heat/Cool	144 (d)	No	No
Economizer	144 (e)	Fixed Temp (Integrated)	Fixed Temp (Integrated)
Heating Air Supply Reset	144 (f)	Constant Temp	Constant Temp
Cooling Air Supply Reset	144 (f)	Constant Temp	Constant Temp
Duct Sealing for Prescriptive Compliance ³	144 (k)	No	No

1: For each central and single zone air systems (or group of similar units) fill in the reference to sheet number and/or specification section and paragraph number where the required features are documented. If a requirement is not applicable, put "N/A" in the column.

2: Not required for hydraulic heating and cooling. Either enter a value here or put in reference to plan and specifications per footnote 1.

3: Enter Yes if System is: Constant Volume, Single Zone; Series < 5,000 sqft; Has > 25% duct in unconditioned space. Duct sealing is required for Prescriptive Compliance, see PERF-1 for performance method duct sealing requirement.

NOTES TO FIELD - For Building Department Use Only

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The Mechanical Designer has confirmed that the heating/cooling capacity as well as the proposed sensible heating/cooling capacity is calculated according to sections 144 a and b.



HVAC SYSTEM CALCULATED CAPACITIES

§144 (a) - Sizing and Equipment Selection shall be the smallest size.

§144(b) – Equipment sizing calculations shall be based on the following:

- Commission approved computer programs, inputs and assumptions;
- Heating and Cooling Loads as calculated by ASHRAE Handbook, Fundamentals Volume;
- Indoor design temperature and humidity conditions based on ASHRAE Standard 55 or the ASHRAE Handbook, Fundamentals Volume 8; (winter humidification and summer dehumidification not required)



HVAC SYSTEM CALCULATED CAPACITIES

§144(b) – Continued.....

- Outdoor design conditions selected from the Reference Joint Appendix JA2;
- Outdoor air ventilation loads shall be calculated using the ventilation rates from §121;
- Envelope heating and cooling loads shall be based on the actual building characteristics;
- Lighting loads shall be based on the actual design lighting levels;
- Occupant density shall be the same used for the minimum amount of outdoor air ventilation;
 - Sensible and latent heat gains shall be listed in ASHRAE Handbook, Fundamentals, Chapter 30, Table 1



HVAC SYSTEM CALCULATED CAPACITIES

§144(b) – *Continued.....*

- Process loads shall be based upon actual information on the intended use of the building;
- Miscellaneous equipment loads shall be based on any of the following:
 - Actual information on the intent of the building;
 - Published data from the manufacturer;
 - Data based on designer's expected loads.
- Internal Heat gains shall be ignored for heating load calculations;
- Safety factor of 10 percent shall be allowed;
- Other loads shall be calculated based upon the heat capacity of the building and its contents.



CALIFORNIA ENERGY COMMISSION

AIR SYSTEM REQUIREMENTS

Part 1 of 2 **MECH-2-C**

PROJECT NAME Sample Single Story Prescriptive Office Building	DATE 5/18/2009
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SYSTEM FEATURES

ITEM OR SYSTEM TAG(S) Number of Systems	AIR SYSTEMS, Central or Single Zone	
	AHU-1	AHU-2
	1	1

PRESCRIPTIVE MEASURES

Calculated Heating Capacity ^{1,4,3}	144 (a & b)	107,480 btuh	118,357 btuh
Proposed Heating Capacity ²	144 (a & b)	184,500 btuh	58,000 btuh
Calculated Sensible Cooling Capacity ²	144 (a & b)	119,953 btuh	152,256 btuh
Proposed Sensible Cooling Capacity ²	144 (a & b)	91,282 btuh	126,102 btuh
Fan Control	144 (c)	Constant Volume	Constant Volume
DP Sensor Location	144 (c)	n/a	n/a
Supply Pressure Reset (DDC only)	144 (c)	No	No
Simultaneous Heat/Cool	144 (d)	No	No
Economizer	144 (e)	Fixed Temp (Integrated)	Fixed Temp (Integrated)
Heating Air Supply Reset	144 (f)	Constant Temp	Constant Temp
Cooling Air Supply Reset	144 (f)	Constant Temp	Constant Temp
Duct Sealing for Prescriptive Compliance ³	144 (k)	No	No

1: For each central and single zone air systems (or group of similar units) fill in the reference to sheet number and/or specification section and paragraph number where the required features are documented. If a requirement is not applicable, put "N/A" in the column.

2: Not required for hydraulic heating and cooling. Either enter a value here or put in reference to plan and specifications per footnote 1.

3: Enter Yes if System is: Constant Volume, Single Zone; Series < 5,000 sqft; Has > 25% duct in unconditioned space. Duct sealing is required for Prescriptive Compliance, see PERF-1 for performance method duct sealing requirement.

NOTES TO FIELD - For Building Department Use Only

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Constant Volume Fans systems exceeding 25 horsepower must complete a MECH-4C and be less than 0.8 W/CFM

Or

1.25 W/CFM for Variable Air Volume Systems (VAV).



CALIFORNIA ENERGY COMMISSION

AIR SYSTEM REQUIREMENTS

Part 1 of 2 **MECH-2-C**

PROJECT NAME Sample Single Story Prescriptive Office Building	DATE 5/18/2009
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SYSTEM FEATURES

ITEM OR SYSTEM TAG(S)	AIR SYSTEMS, Central or Single Zone	
	AHU-1	AHU-2
Number of Systems	1	1

PRESCRIPTIVE MEASURES

Calculated Heating Capacity ^{1,4,5, 2}	144 (a & b)	107,480 btuh	116,357 btuh
Proposed Heating Capacity ²	144 (a & b)	184,500 btuh	58,000 btuh
Calculated Sensible Cooling Capacity ^{2,1}	144 (a & b)	119,953 btuh	152,256 btuh
Proposed Sensible Cooling Capacity ²	144 (a & b)	91,282 btuh	126,102 btuh
Fan Control	144 (c)	Constant Volume	Constant Volume
DP Sensor Location	144 (c)	n/a	n/a
Supply Pressure Reset (DDC only)	144 (c)	No	No
Simultaneous Heat/Cool	144 (d)	No	No
Economizer	144 (e)	Fixed Temp (Integrated)	Fixed Temp (Integrated)
Heating Air Supply Reset	144 (f)	Constant Temp	Constant Temp
Cooling Air Supply Reset	144 (f)	Constant Temp	Constant Temp
Duct Sealing for Prescriptive Compliance ³	144 (k)	No	No

1: For each central and single zone air systems (or group of similar units) fill in the reference to sheet number and/or specification section and paragraph number where the required features are documented. If a requirement is not applicable, put "N/A" in the column.

2: Not required for hydraulic heating and cooling. Either enter a value here or put in reference to plan and specifications per footnote 1.

3: Enter Yes if System is: Constant Volume, Single Zone; Series < 5,000 sqft; Has > 25% duct in unconditioned space. Duct sealing is required for Prescriptive Compliance, see PERF-1 for performance method duct sealing requirement.

NOTES TO FIELD - For Building Department Use Only

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If the fans system is a VAV system then Static Pressure Sensors will be specified here. The inspector should be aware of their existence and should look for them during inspection.

Also for VAV systems, if a Direct Digital Control is specified to be installed it would be specified here.



CALIFORNIA ENERGY COMMISSION

AIR SYSTEM REQUIREMENTS

Part 1 of 2 **MECH-2-C**

Controls must be installed to prevent simultaneous heating/cooling.

PROJECT NAME	Sample Single Story Prescriptive Office Building	DATE	5/18/2009
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SYSTEM FEATURES

ITEM OR SYSTEM TAG(S)	AIR SYSTEMS, Central or Single Zone	
	AHU-1	AHU-2
Number of Systems	1	1

PRESCRIPTIVE MEASURES

Calculated Heating Capacity ^{1,4,5}	144 (a & b)	107,480 btuh	116,357 btuh
Proposed Heating Capacity ²	144 (a & b)	184,500 btuh	58,000 btuh
Calculated Sensible Cooling Capacity ^{2,1}	144 (a & b)	119,953 btuh	152,256 btuh
Proposed Sensible Cooling Capacity ²	144 (a & b)	91,282 btuh	126,102 btuh
Fan Control	144 (c)	Constant Volume	Constant Volume
DP Sensor Location	144 (c)	n/a	n/a
Supply Pressure Reset (DDC only)	144 (c)	No	No
Simultaneous Heat/Cool	144 (d)	No	No
Economizer	144 (e)	Fixed Temp (Integrated)	Fixed Temp (Integrated)
Heating Air Supply Reset	144 (f)	Constant Temp	Constant Temp
Cooling Air Supply Reset	144 (f)	Constant Temp	Constant Temp
Duct Sealing for Prescriptive Compliance ³	144 (k)	No	No

1: For each central and single zone air systems (or group of similar units) fill in the reference to sheet number and/or specification section and paragraph number where the required features are documented. If a requirement is not applicable, put "N/A" in the column.

2: Not required for hydraulic heating and cooling. Either enter a value here or put in reference to plan and specifications per footnote 1.

3: Enter Yes if System is: Constant Volume, Single Zone; Series < 5,000 sqft; Has > 25% duct in unconditioned space. Duct sealing is required for Prescriptive Compliance, see PERF-1 for performance method duct sealing requirement.

NOTES TO FIELD - For Building Department Use Only

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HVAC SYSTEM CONTROLS

EXCEPTION 1 TO §144 (d) – Simultaneous Heating/Cooling

A. For each zone with DDC:

1. The volume of primary air that is reheated, re-cooled, or mixed supply air shall not exceed the larger of:
 - a) 50% of the peak primary airflow; or
 - b) The design zone outdoor airflow rate per §121;
2. The primary airflow in the deadband shall not exceed the larger of:
 - a) 20% of the peak primary airflow; or
 - b) The design zone outdoor airflow rate per §121.
3. Airflow between deadband and full heating or full cooling must be modulated.



HVAC SYSTEM CONTROLS

EXCEPTION 1 TO §144 (d):

B. For each zone without DDC:

1. The volume of primary airflow that is reheated, re-cooled, or mixed supply air shall not exceed the larger of the following:
 - a) 30% of the peak primary airflow; or
 - b) The design zone outdoor airflow rate per §121.

EXCEPTION 2 TO §144 (d):

Zones with special pressurization relationships or cross-contamination control needs.



HVAC SYSTEM CONTROLS

EXCEPTION 3 TO §144 (d):

Zones served with at least 75% of the reheat energy from site-recovered or site-solar energy sources.

EXCEPTION 4 TO §144 (d):

Zones with specific humidity levels required by a process need.

EXCEPTION 5 TO §144 (d):

Zones with a peak supply air quantity of 300 cfm or less.



CALIFORNIA ENERGY COMMISSION

AIR SYSTEM REQUIREMENTS

Part 1 of 2 **MECH-2-C**

PROJECT NAME Sample Single Story Prescriptive Office Building	DATE 5/18/2009
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SYSTEM FEATURES

ITEM OR SYSTEM TAG(S)	AIR SYSTEMS, Central or Single Zone	
	AHU-1	AHU-2
Number of Systems	1	1

PRESCRIPTIVE MEASURES

Calculated Heating Capacity ^{1,4,3 2}	144 (a & b)	107,480 btuh	116,357 btuh
Proposed Heating Capacity ²	144 (a & b)	184,500 btuh	58,000 btuh
Calculated Sensible Cooling Capacity ^{2,1 2}	144 (a & b)	119,953 btuh	152,256 btuh
Proposed Sensible Cooling Capacity ²	144 (a & b)	91,282 btuh	126,102 btuh
Fan Control	144 (c)	Constant Volume	Constant Volume
DP Sensor Location	144 (c)	n/a	n/a
Supply Pressure Reset (DDC only)	144 (c)	No	No
Simultaneous Heat/Cool	144 (d)	No	No
Economizer	144 (e)	Fixed Temp (Integrated)	Fixed Temp (Integrated)
Heating Air Supply Reset	144 (f)	Constant Temp	Constant Temp
Cooling Air Supply Reset	144 (f)	Constant Temp	Constant Temp
Duct Sealing for Prescriptive Compliance ³	144 (k)	No	No

1: For each central and single zone air systems (or group of similar units) fill in the reference to sheet number and/or specification section and paragraph number where the required features are documented. If a requirement is not applicable, put "N/A" in the column.

2: Not required for hydraulic heating and cooling. Either enter a value here or put in reference to plan and specifications per footnote 1.

3: Enter Yes if System is: Constant Volume, Single Zone; Series < 5,000 sqft; Has > 25% duct in unconditioned space. Duct sealing is required for Prescriptive Compliance, see PERF-1 for performance method duct sealing requirement.

NOTES TO FIELD - For Building Department Use Only

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Economizers are triggered when an individual cooling fan system exceeds a design supply capacity of 2,500 cfm and a total mechanical cooling capacity of 75,000 BTU/h.



HVAC SYSTEM ECONOMIZERS

§144 (e) – Economizers

Prescriptively economizers are required when an individual cooling fan system that exceeds both 2,500 cfm for the design supply capacity and 75,000 BTU/h for the mechanical cooling capacity. One of the following must be met:

- An air economizer capable of supplying 100% of the design supply air as outside air; or
- A water economizer capable of providing 100% of the system cooling load at outside air temperatures of 50°F drybulb/ 45°F wet bulb and below.



HVAC SYSTEM ECONOMIZERS

§144 (e) – Economizers

Also, economizers must be designed and equipped with controls so that economizer operation does not increase the building heating energy use.

Additionally, the economizer must be capable of providing partial cooling even when the additional mechanical cooling is required to meet the cooling load.

For air-side economizers, a high limit shutoff control must be installed according to Table 144-C.



HVAC SYSTEM ECONOMIZERS

TABLE 144-C AIR ECONOMIZER HIGH LIMIT SHUT OFF CONTROL REQUIREMENTS

Device Type	Climate Zones	Required High Limit (Economizer Off When):	
		Equation	Description
Fixed Dry Bulb	1, 2, 3, 5, 11, 13, 14, 15 & 16	$T_{OA} > 75^{\circ}\text{F}$	Outdoor air temperature exceeds 75°F
	4, 6, 7, 8, 9, 10 & 12	$T_{OA} > 70^{\circ}\text{F}$	Outdoor air temperature exceeds 70°F
Differential Dry Bulb	All	$T_{OA} > T_{RA}$	Outdoor air temperature exceeds return air temperature
Fixed Enthalpy ^a	4, 6, 7, 8, 9, 10 & 12	$h_{OA} > 28 \text{ Btu/lb}^b$	Outdoor air enthalpy exceeds 28 Btu/lb of dry air ^b
Electronic Enthalpy	All	$(T_{OA}, RH_{OA}) > A$	Outdoor air temperature/RH exceeds the "A" set-point curve ^c
Differential Enthalpy	All	$h_{OA} > h_{RA}$	Outdoor air enthalpy exceeds return air enthalpy

^a Fixed Enthalpy Controls are prohibited in climate zones 1, 2, 3, 5, 11, 13, 14, 15 & 16.

^b At altitudes substantially different than sea level, the Fixed Enthalpy limit value shall be set to the enthalpy value at 75°F and 50% relative humidity. As an example, at approximately 6000 foot elevation the fixed enthalpy limit is approximately 30.7 Btu/lb.

^c Set point "A" corresponds to a curve on the psychometric chart that goes through a point at approximately 75°F and 40% relative humidity and is nearly parallel to dry bulb lines at low humidity levels and nearly parallel to enthalpy lines at high humidity levels.



HVAC SYSTEM ECONOMIZERS

§144 (e) – Economizers Trade Off Tables

Electrically operated unitary air conditioners and heat pumps that meet or exceed the efficiencies listed in Tables 144-A or 144-B are exempted from installing an economizer.



CALIFORNIA ENERGY COMMISSION

TABLE 144-A ECONOMIZER TRADEOFF TABLE FOR ELECTRICALLY OPERATED UNITARY AIR CONDITIONERS

Climate Zone	Size Category			
	≥760,000	≥240,000 and <760,000	≥135,000 and <240,000	≥65,000 and <135,000
1	N/A	N/A	N/A	N/A
2	N/A	N/A	N/A	N/A
3	N/A	N/A	N/A	N/A
4	11.9 (before 1/1/2010) 12.5 (as of 1/1/2010)	12.2 (before 1/1/2010) 12.9 (as of 1/1/2010)	12.4 (before 1/1/2010) 14.1 (as of 1/1/2010)	N/A
5	N/A	N/A	N/A	N/A
6	N/A	N/A	N/A	N/A
7	N/A	N/A	N/A	N/A
8	11.9 (before 1/1/2010) 12.5 (as of 1/1/2010)	12.2 (before 1/1/2010) 12.9 (as of 1/1/2010)	12.4 (before 1/1/2010) 14.1 (as of 1/1/2010)	N/A
9	11.6 (before 1/1/2010) 12.2 (as of 1/1/2010)	11.9 (before 1/1/2010) 12.5 (as of 1/1/2010)	12.1 (before 1/1/2010) 13.7 (as of 1/1/2010)	N/A
10	11.4 (before 1/1/2010) 12.0 (as of 1/1/2010)	11.7 (before 1/1/2010) 12.3 (as of 1/1/2010)	11.9 (before 1/1/2010) 13.5 (as of 1/1/2010)	12.4 (before 1/1/2010) 13.5 (as of 1/1/2010)
11	11.5 (before 1/1/2010) 12.1 (as of 1/1/2010)	11.8 (before 1/1/2010) 12.4 (as of 1/1/2010)	12.0 (before 1/1/2010) 13.6 (as of 1/1/2010)	N/A
12	11.7 (before 1/1/2010) 12.3 (as of 1/1/2010)	12.0 (before 1/1/2010) 12.6 (as of 1/1/2010)	12.2 (before 1/1/2010) 13.8 (as of 1/1/2010)	N/A
13	11.2 (before 1/1/2010) 11.8 (as of 1/1/2010)	11.5 (before 1/1/2010) 12.1 (as of 1/1/2010)	11.7 (before 1/1/2010) 13.3 (as of 1/1/2010)	12.3 (before 1/1/2010) 13.4 (as of 1/1/2010)
14	11.7 (before 1/1/2010) 12.3 (as of 1/1/2010)	12.0 (before 1/1/2010) 12.6 (as of 1/1/2010)	12.2 (before 1/1/2010) 13.8 (as of 1/1/2010)	N/A
15	10.0 (before 1/1/2010) 10.6 (as of 1/1/2010)	10.4 (before 1/1/2010) 11.0 (as of 1/1/2010)	10.6 (before 1/1/2010) 12.0 (as of 1/1/2010)	11.3 (before 1/1/2010) 12.3 (as of 1/1/2010)
16	N/A	N/A	N/A	N/A



CALIFORNIA ENERGY COMMISSION

TABLE 144-B ECONOMIZER TRADEOFF TABLE FOR ELECTRICALLY OPERATED UNITARY HEAT PUMPS

Climate Zone	Size Category		
	≥240,000	≥135,000 and <240,000	≥65,000 and <135,000
1	N/A	N/A	N/A
2	N/A	N/A	N/A
3	N/A	N/A	N/A
4	11.7 (before 1/1/2010) 13.8 (as of 1/1/2010)	12.1 (before 1/1/2010) 13.8 (as of 1/1/2010)	N/A
5	N/A	N/A	N/A
6	N/A	N/A	N/A
7	12.3 (before 1/1/2010) 14.5 (as of 1/1/2010)	N/A	N/A
8	11.7 (before 1/1/2010) 13.8 (as of 1/1/2010)	12.0 (before 1/1/2010) 13.7 (as of 1/1/2010)	N/A
9	11.3 (before 1/1/2010) 13.3 (as of 1/1/2010)	11.7 (before 1/1/2010) 13.3 (as of 1/1/2010)	12.5 (before 1/1/2010) 13.6 (as of 1/1/2010)
10	11.1 (before 1/1/2010) 13.1 (as of 1/1/2010)	11.5 (before 1/1/2010) 13.1 (as of 1/1/2010)	12.3 (before 1/1/2010) 13.4 (as of 1/1/2010)
11	11.3 (before 1/1/2010) 13.3 (as of 1/1/2010)	11.6 (before 1/1/2010) 13.2 (as of 1/1/2010)	12.4 (before 1/1/2010) 13.5 (as of 1/1/2010)
12	11.5 (before 1/1/2010) 13.5 (as of 1/1/2010)	11.8 (before 1/1/2010) 13.4 (as of 1/1/2010)	N/A
13	10.9 (before 1/1/2010) 12.8 (as of 1/1/2010)	11.3 (before 1/1/2010) 12.9 (as of 1/1/2010)	12.1 (before 1/1/2010) 13.2 (as of 1/1/2010)
14	11.5 (before 1/1/2010) 13.5 (as of 1/1/2010)	11.8 (before 1/1/2010) 13.4 (as of 1/1/2010)	N/A
15	9.8 (before 1/1/2010) 11.5 (as of 1/1/2010)	10.1 (before 1/1/2010) 11.5 (as of 1/1/2010)	11.1 (before 1/1/2010) 12.1 (as of 1/1/2010)
16	N/A	N/A	N/A



CALIFORNIA ENERGY COMMISSION

AIR SYSTEM REQUIREMENTS

Part 1 of 2 **MECH-2-C**

Heating/Cooling supply air reset controls

PROJECT NAME	Sample Single Story Prescriptive Office Building	DATE	5/18/2009
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SYSTEM FEATURES

ITEM OR SYSTEM TAG(S)	AIR SYSTEMS, Central or Single Zone	
	AHU-1	AHU-2
Number of Systems	1	1

PRESCRIPTIVE MEASURES

Calculated Heating Capacity ^{1,4,5, 2}	144 (a & b)	107,480 btuh	118,357 btuh
Proposed Heating Capacity ²	144 (a & b)	184,500 btuh	58,000 btuh
Calculated Sensible Cooling Capacity ^{2,1}	144 (a & b)	119,953 btuh	152,256 btuh
Proposed Sensible Cooling Capacity ²	144 (a & b)	91,282 btuh	126,102 btuh
Fan Control	144 (c)	Constant Volume	Constant Volume
DP Sensor Location	144 (c)	n/a	n/a
Supply Pressure Reset (DDC only)	144 (c)	No	No
Simultaneous Heat/Cool	144 (d)	No	No
Economizer	144 (e)	Fixed Temp (Integrated)	Fixed Temp (Integrated)
Heating Air Supply Reset	144 (f)	Constant Temp	Constant Temp
Cooling Air Supply Reset	144 (f)	Constant Temp	Constant Temp
Duct Sealing for Prescriptive Compliance ³	144 (k)	No	No

1: For each central and single zone air systems (or group of similar units) fill in the reference to sheet number and/or specification section and paragraph number where the required features are documented. If a requirement is not applicable, put "N/A" in the column.

2: Not required for hydraulic heating and cooling. Either enter a value here or put in reference to plan and specifications per footnote 1.

3: Enter Yes if System is: Constant Volume, Single Zone; Series < 5,000 sqft; Has > 25% duct in unconditioned space. Duct sealing is required for Prescriptive Compliance, see PERF-1 for performance method duct sealing requirement.

NOTES TO FIELD - For Building Department Use Only



HVAC SYSTEM RESET CONTROLS

Automatic reset supply air temperature controls are required for systems that supply heated or cooled air to multiple zones.

These controls must be capable of the following:

1. Reset in response to building loads or outdoor temperature; and
2. Reset temperatures by at least 25 percent of the difference between the design supply-air temperature and the design room air temperature.



CALIFORNIA ENERGY COMMISSION

AIR SYSTEM REQUIREMENTS

Part 1 of 2 **MECH-2-C**

Duct sealing is required for specific applications.

PROJECT NAME	Sample Single Story Prescriptive Office Building	DATE	5/18/2009
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SYSTEM FEATURES

ITEM OR SYSTEM TAG(S)	AIR SYSTEMS, Central or Single Zone	
	AHU-1	AHU-2
Number of Systems	1	1

PRESCRIPTIVE MEASURES

Calculated Heating Capacity ^{1,43 2}	144 (a & b)	107,480 btuh	118,357 btuh
Proposed Heating Capacity ²	144 (a & b)	184,500 btuh	58,000 btuh
Calculated Sensible Cooling Capacity ^{21 2}	144 (a & b)	119,953 btuh	152,256 btuh
Proposed Sensible Cooling Capacity ²	144 (a & b)	91,282 btuh	126,102 btuh
Fan Control	144 (c)	Constant Volume	Constant Volume
DP Sensor Location	144 (c)	n/a	n/a
Supply Pressure Reset (DDC only)	144 (c)	No	No
Simultaneous Heat/Cool	144 (d)	No	No
Economizer	144 (e)	Fixed Temp (Integrated)	Fixed Temp (Integrated)
Heating Air Supply Reset	144 (f)	Constant Temp	Constant Temp
Cooling Air Supply Reset	144 (f)	Constant Temp	Constant Temp
Duct Sealing for Prescriptive Compliance ³	144 (k)	No	No

1: For each central and single zone air systems (or group of similar units) fill in the reference to sheet number and/or specification section and paragraph number where the required features are documented. If a requirement is not applicable, put "N/A" in the column.

2: Not required for hydraulic heating and cooling. Either enter a value here or put in reference to plan and specifications per footnote 1.

3: Enter Yes if System is: Constant Volume, Single Zone; Series < 5,000 sqft; Has > 25% duct in unconditioned space. Duct sealing is required for Prescriptive Compliance, see PERF-1 for performance method duct sealing requirement.

NOTES TO FIELD - For Building Department Use Only

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HVAC SYSTEM DUCT SEALING

Ducts system leakage rate of 6% or less is required for the following types of duct systems:

1. Connected to a constant volume, single zone air conditioner/heat pump/furnace ; and
2. Serves less than 5,000 ft²; and
3. Has more than 25% of duct surface located in unconditioned/outdoor space.



CALIFORNIA ENERGY COMMISSION

WATER SIDE SYSTEM REQUIREMENTS

Part 2 of 2 **MECH-2-C**

Limitation of Air-Cooled Chillers

PROJECT NAME TES Sample Project	DATE 5/19/2009
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SYSTEM FEATURES

ITEM OR SYSTEM TAG(S)	2 WATER SIDE SYSTEMS: Chillers, Towers, Boilers, Hydronic Loops		
	800 ton Trane HCFC-123	866 TON TOWERS	Steam Boilers
Number of Systems	1	1	1
MANDATORY MEASURES	T-24 Section	Reference on Plans or Specification	
Equipment Efficiency	112(a)	0.460 kW/ton	7 F App
Pipe Insulation	123	CHW Piping	n/a
PRESCRIPTIVE MEASURES			
Calculated Capacity	144 (a & b)	n/a	866 tons
Proposed Capacity	144 (a & b)	800 tons	n/a
Tower Fan Controls	144 (h)	n/a	Two-Speed-Fan
Tower Flow Controls	144 (h)	n/a	Fixed-Temp
Variable Flow System Design	144 (i)	Required	n/a
Chiller and Boiler Isolation	144 (i)	n/a	n/a
CHW and HHW Reset Controls	144 (i)	Required	n/a
WLHP Isolation Valves	144 (i)	n/a	n/a
VSD on CHW, CW & WLHP Pumps > 5 HP	144 (i)	Required	n/a
DP Sensor Location	144 (i)		n/a

1: For each chiller, cooling tower, boiler, and hydronic loop (or groups of similar equipment) fill in the reference to sheet number and/or specification section and paragraph number where the required features are documented. If a requirement is not applicable, put "N/A" in the column.

2: Water side systems include water side system using other liquids such as glycol or brine.



HVAC SYSTEM CHILLER LIMITATION

Any chilled water plant exceeding 300 tons of total capacity shall not have more than 100 tons provided by air-cooled chillers.



CALIFORNIA ENERGY COMMISSION

WATER SIDE SYSTEM REQUIREMENTS

Part 2 of 2 **MECH-2-C**

Open cooling tower fan and flow controls

PROJECT NAME TES Sample Project	DATE 5/19/2009
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SYSTEM FEATURES

ITEM OR SYSTEM TAG(S)	2 WATER SIDE SYSTEMS: Chillers, Towers, Boilers, Hydronic Loops		
	800 ton Trane HCFC-123	866 TON TOWERS	Steam Boilers
Number of Systems	1	1	1
MANDATORY MEASURES	T-24 Section	Reference on Plans or Specification	
Equipment Efficiency	112(a)	0.460 kW/ton	7 F App
Pipe Insulation	123	CHW Piping	H/W Piping
PRESCRIPTIVE MEASURES			
Calculated Capacity	144 (a & b)	n/a	866 tons
Proposed Capacity	144 (a & b)	800 tons	n/a
Tower Fan Controls	144 (h)	n/a	Two-Speed-Fan
Tower Flow Controls	144 (h)	n/a	Fixed-Temp
Variable Flow System Design	144 (i)	Required	n/a
Chiller and Boiler Isolation	144 (i)	n/a	n/a
CHW and HHW Reset Controls	144 (i)	Required	n/a
WLHP Isolation Valves	144 (i)	n/a	n/a
VSD on CHW, CW & WLHP Pumps > 5 HP	144 (i)	Required	n/a
DP Sensor Location	144 (i)	n/a	n/a

1: For each chiller, cooling tower, boiler, and hydronic loop (or groups of similar equipment) fill in the reference to sheet number and/or specification section and paragraph number where the required features are documented. If a requirement is not applicable, put "N/A" in the column.

2: Water side systems include wet side system using other liquids such as glycol or brine.



HVAC SYSTEM HEAT REJECTION EQUIPMENT

Fan Control

Each fan powered by a motor of 7.5 hp (5.6 kW) or larger must be capable of operating at 2/3 speed or less and must have controls that automatically change the fan speed to control the fluid temperature or condensing temperature/pressure.

Open cooling towers of a centrifugal chiller system shall use propeller fans rather than centrifugal fans when the system meets all the following:

1. 900 gpm or greater; and
2. 95°F condenser water return; and
3. 85°F condenser supply; and
4. 75°F outdoor wet bulb temperature.



HVAC SYSTEM HEAT REJECTION EQUIPMENT

Flow Control

Open cooling towers with multiple condenser water pumps must be capable of running in parallel on the larger of:

1. The flow that's produced by the smallest pump; or
2. 33% of the design flow



CALIFORNIA ENERGY COMMISSION

WATER SIDE SYSTEM REQUIREMENTS

Part 2 of 2 **MECH-2-C**

Variable fluid flow for
hydraulic heat pumps

PROJECT NAME TES Sample Project	DATE 5/19/2009
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SYSTEM FEATURES

ITEM OR SYSTEM TAG(S) Number of Systems	² WATER SIDE SYSTEMS: Chillers, Towers, Boilers, Hydronic Loops		
	800 ton Trane HCFC-123	866 TON TOWERS	Steam Boilers
	1	1	1

MANDATORY MEASURES	T-24 Section	Reference on Plans or Specification		
	Equipment Efficiency	112(a)	0.460 kW/ton	7 F App
Pipe Insulation	123	CHW Piping	n/a	HW Piping

PRESCRIPTIVE MEASURES	Calculated Capacity	144 (a & b)	n/a	866 tons	n/a
	Proposed Capacity	144 (a & b)	800 tons	n/a	16,733,648 btuh
	Tower Fan Controls	144 (h)	n/a	Two-Speed-Fan	n/a
	Tower Flow Controls	144 (h)	n/a	Fixed-Temp	n/a
	Variable Flow System Design	144 (i)	Required	n/a	
	Chiller and Boiler Isolation	144 (i)	n/a	n/a	n/a
	CHW and HHW Reset Controls	144 (j)	Required	n/a	Required
	WLHP Isolation Valves	144 (j)	n/a	n/a	n/a
	VSD on CHW, CW & WLHP Pumps > 5 HP	144 (j)	Required	n/a	n/a
	DP Sensor Location	144 (j)		n/a	n/a

1: For each chiller, cooling tower, boiler, and hydronic loop (or groups of similar equipment) fill in the reference to sheet number and/or specification section and paragraph number where the required features are documented. If a requirement is not applicable, put "N/A" in the column.
 2: Water side systems include wet side system using other liquids such as glycol or brine.



HVAC SYSTEM VARIABLE FLOW

Hydronic systems must be variable fluid flow and be capable of reducing pump flow rates not exceeding the following:

1. 50% or less of the design flow rate; or
2. The minimum flow required by equipment manufacturer for proper operation.



CALIFORNIA ENERGY COMMISSION

WATER SIDE SYSTEM REQUIREMENTS

Part 2 of 2 **MECH-2-C**

Chiller/Boiler Isolation

PROJECT NAME TES Sample Project	DATE 5/19/2009
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SYSTEM FEATURES

ITEM OR SYSTEM TAG(S)	2 WATER SIDE SYSTEMS: Chillers, Towers, Boilers, Hydronic Loops		
	800 ton Trane HCFC-123	866 TON TOWERS	Steam Boilers
Number of Systems	1	1	1
MANDATORY MEASURES	T-24 Section	Reference on Plans or Specification	
Equipment Efficiency	112(a)	0.460 kW/ton	7 F App 81%
Pipe Insulation	123	CHW Piping	n/a HW Piping
PRESCRIPTIVE MEASURES			
Calculated Capacity	144 (a & b)	n/a	866 tons n/a
Proposed Capacity	144 (a & b)	800 tons	n/a 16,733,648 btuh
Tower Fan Controls	144 (k)	n/a	Two-Speed-Fan n/a
Tower Flow Controls	144 (h)	n/a	Fixed-Temp n/a
Variable Flow System Design	144 (i)	Required	n/a
Chiller and Boiler Isolation	144 (i)	n/a	n/a n/a
CHW and HHW Reset Controls	144 (j)	Required	n/a Required
WLHP Isolation Valves	144 (j)	n/a	n/a n/a
VSD on CHW, CW & WLHP Pumps > 5 HP	144 (j)	Required	n/a n/a
DP Sensor Location	144 (j)		n/a n/a

1: For each chiller, cooling tower, boiler, and hydronic loop (or groups of similar equipment) fill in the reference to sheet number and/or specification section and paragraph number where the required features are documented. If a requirement is not applicable, put "N/A" in the column.

2: Water side systems include water side system using other liquids such as glycol or brine.



HVAC SYSTEM CHILLER/BOILER ISOLATION

Chiller – when a chiller plant includes more than one chiller, an automatic shut off control must be installed to run a single chiller.

- Chillers that are piped in series for the purpose of increased temperature differential shall be considered a single chiller.

Boiler – hot water plants that include more than one boiler, an automatic shut off control must be installed to run a single boiler.



CALIFORNIA ENERGY COMMISSION

WATER SIDE SYSTEM REQUIREMENTS

Part 2 of 2 **MECH-2-C**

Chiller and hot water systems exceeding 500,000 BTU/h

PROJECT NAME TES Sample Project	DATE 5/19/2009
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SYSTEM FEATURES

ITEM OR SYSTEM TAG(S)	2 WATER SIDE SYSTEMS: Chillers, Towers, Boilers, Hydronic Loops			
	800 ton Trane HCFC-123	866 TON TOWERS	Steam Boilers	
Number of Systems	1	1	1	
MANDATORY MEASURES	T-24 Section	Reference on Plans or Specification		
Equipment Efficiency	112(a)	0.460 kW/ton	7 F App	81%
Pipe Insulation	123	CHW Piping	n/a	HW Piping
PRESCRIPTIVE MEASURES				
Calculated Capacity	144 (a & b)	n/a	866 tons	n/a
Proposed Capacity	144 (a & b)	800 tons	n/a	16,733,648 btuh
Tower Fan Controls	144 (h)	n/a	Two-Speed-Fan	n/a
Tower Flow Controls	144 (i)	n/a	Fixed-Temp	n/a
Variable Flow System Design	144 (j)	Required	n/a	
Chiller and Boiler Isolation	144 (j)	n/a	n/a	n/a
CHW and HHW Reset Controls	144 (j)	Required	n/a	Required
WLHP Isolation Valves	144 (j)	n/a	n/a	n/a
VSD on CHW, CW & WLHP Pumps > 5 HP	144 (j)	Required	n/a	n/a
DP Sensor Location	144 (j)		n/a	n/a

1: For each chiller, cooling tower, boiler, and hydronic loop (or groups of similar equipment) fill in the reference to sheet number and/or specification section and paragraph number where the required features are documented. If a requirement is not applicable, put "N/A" in the column.

2: Water side systems include wet side system using other liquids such as glycol or brine.



HVAC SYSTEM CHILLED/HOT RESET

Chilled/Hot water systems with a design supply capacity exceeding 500,000 BTU/h must have controls installed capable of automatically resetting the supply temperatures according to building load or outside air temperatures.



CALIFORNIA ENERGY COMMISSION

WATER SIDE SYSTEM REQUIREMENTS

Part 2 of 2 **MECH-2-C**

WLHP Isolation Valves

PROJECT NAME TES Sample Project	DATE 5/19/2009
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SYSTEM FEATURES

ITEM OR SYSTEM TAG(S)	2 WATER SIDE SYSTEMS: Chillers, Towers, Boilers, Hydronic Loops		
	800 ton Trane HCFC-123	866 TON TOWERS	Steam Boilers
Number of Systems	1	1	1

MANDATORY MEASURES	T-24 Section	Reference on Plans or Specification		
Equipment Efficiency	112(a)	0.460 kW/ton	7 F App	81%
Pipe Insulation	123	CHW Piping	n/a	HW Piping
PRESCRIPTIVE MEASURES				
Calculated Capacity	144 (a & b)	n/a	866 tons	n/a
Proposed Capacity	144 (a & b)	800 tons	n/a	16,733,648 btuh
Tower Fan Controls	144 (h)	n/a	Two-Speed-Fan	n/a
Tower Flow Controls	144 (h)	n/a	Fixed-Temp	n/a
Variable Flow System Design	144 (i)	Required	n/a	
Chiller and Boiler Isolation	144 (j)	n/a	n/a	n/a
CHW and HHW Reset Controls	144 (j)	Required	n/a	Required
WLHP Isolation Valves	144 (j)	n/a	n/a	n/a
VSD on CHW, CW & WLHP Pumps > 5 HP	144 (j)	Required	n/a	n/a
DP Sensor Location	144 (j)		n/a	n/a

1: For each chiller, cooling tower, boiler, and hydronic loop (or groups of similar equipment) fill in the reference to sheet number and/or specification section and paragraph number where the required features are documented. If a requirement is not applicable, put "N/A" in the column.

2: Water side systems include wet side system using other liquids such as glycol or brine.



HVAC SYSTEM WLHP ISOLATION VALVES

Water circulation systems serving air conditioners/heat pumps exceeding 5 hp must have variable flow controls. Additionally, each air conditioner/heat pump must have an interlocked valve that automatically shuts off fluid flow when the compressor is off.



CALIFORNIA ENERGY COMMISSION

WATER SIDE SYSTEM REQUIREMENTS

Part 2 of 2 **MECH-2-C**

Variable Speed Drives

PROJECT NAME TES Sample Project	DATE 5/19/2009
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SYSTEM FEATURES

ITEM OR SYSTEM TAG(S)	2 WATER SIDE SYSTEMS: Chillers, Towers, Boilers, Hydronic Loops			
	800 ton Trane HCFC-123	866 TON TOWERS	Steam Boilers	
Number of Systems	1	1	1	
MANDATORY MEASURES	T-24 Section	Reference on Plans or Specification		
Equipment Efficiency	112(a)	0.460 kW/ton	7 F App	81%
Pipe Insulation	123	CHW Piping	n/a	HW Piping
PRESCRIPTIVE MEASURES				
Calculated Capacity	144 (a & b)	n/a	866 tons	n/a
Proposed Capacity	144 (a & b)	800 tons	n/a	16,733,648 btuh
Tower Fan Controls	144 (h)	n/a	Two-Speed-Fan	n/a
Tower Flow Controls	144 (h)	n/a	Fixed-Temp	n/a
Variable Flow System Design	144 (i)	Required	n/a	
Chiller and Boiler Isolation	144 (j)	n/a	n/a	n/a
CHW and HHW Reset Controls	144 (j)	Required	n/a	Required
WLHP Isolation Valves	144 (j)	n/a	n/a	n/a
VSD on CHW, CW & WLHP Pumps > 5 HP	144 (j)	Required	n/a	n/a
DP Sensor Location	144 (j)		n/a	n/a

1: For each chiller, cooling tower, boiler, and hydronic loop (or groups of similar equipment) fill in the reference to sheet number and/or specification section and paragraph number where the required features are documented. If a requirement is not applicable, put "N/A" in the column.

2: Water side systems include wet side system using other liquids such as glycol or brine.



HVAC SYSTEM VARIABLE FLOW CONTROL

Individual pumps serving variable flow systems exceeding 5 hp must be capable of running on 30% of its design wattage while supplying 50% of the fluid flow.



CALIFORNIA ENERGY COMMISSION

WATER SIDE SYSTEM REQUIREMENTS

Part 2 of 2 **MECH-2-C**

Differential Pressure Sensors

PROJECT NAME TES Sample Project	DATE 5/19/2009
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SYSTEM FEATURES

ITEM OR SYSTEM TAG(S)	² WATER SIDE SYSTEMS: Chillers, Towers, Boilers, Hydronic Loops			
	800 ton Trane HCFC-123	866 TON TOWERS	Steam Boilers	
Number of Systems	1	1	1	
MANDATORY MEASURES	T-24 Section	Reference on Plans or Specification		
Equipment Efficiency	112(a)	0.460 kW/ton	7 F App	81%
Pipe Insulation	123	CHW Piping	n/a	HHW Piping
PRESCRIPTIVE MEASURES				
Calculated Capacity	144 (a & b)	n/a	866 tons	n/a
Proposed Capacity	144 (a & b)	800 tons	n/a	16,733,648 btuh
Tower Fan Controls	144 (h)	n/a	Two-Speed-Fan	n/a
Tower Flow Controls	144 (h)	n/a	Fixed-Temp	n/a
Variable Flow System Design	144 (i)	Required	n/a	
Chiller and Boiler Isolation	144 (i)	n/a	n/a	n/a
CHW and HHW Reset Controls	144 (j)	Required	n/a	Required
WLHP Isolation Valves	144 (j)	n/a	n/a	n/a
VSD on CHW, CW & WLHP Pumps > 5 HP	144 (j)	Required	n/a	n/a
DP Sensor Location	144 (j)		n/a	n/a

1: For each chiller, cooling tower, boiler, and hydronic loop (or groups of similar equipment) fill in the reference to sheet number and/or specification section and paragraph number where the required features are documented. If a requirement is not applicable, put "N/A" in the column.

2: Water side systems include wet side system using other liquids such as glycol or brine.



HVAC SYSTEM VARIABLE FLOW CONTROL

Systems with Direct Digital Control (DDC) reporting to a central control panel the sensor will be located at the most remote heat exchanger or the heat exchanger requiring the greatest differential pressure.

The static pressure set point shall be reset based on the valve requiring the most pressure and must not be less than 80% open. The static pressure sensor can be mounted anywhere.



CALIFORNIA ENERGY COMMISSION

MECH – 4C PRESCRIPTIVE ONLY



CALIFORNIA ENERGY COMMISSION

Each cooling and/or heating system will submit a separate MECH-4C

MECHANICAL SIZING AND FAN POWER MECH-4-C

PROJECT NAME Sample Single Story Prescriptive Office Building	DATE 5/5/2009
SYSTEM NAME AHU-2	FLOOR AREA 2,560

FAN POWER CONSUMPTION

A FAN DESCRIPTION	B DESIGN BRAKE HP	C EFFICIENCY		E NUMBER OF FANS	F PEAK WATTS $B \times E \times 746 / (C \times D)$
		MOTOR	DRIVE		
Supply Fan	2.000	84.0%	97.0%	1.0	1,831

Total Adjustments	
FILTER PRESSURE ADJUSTMENT EQUATION 144-A	1) TOTAL FAN SYSTEM POWER (Watts, Sum Column F) 1,831
A) If filter pressure drop is greater than 1 inch W.C. enter filter pressure drop. SPa on line 4 and Total Fan pressure SPf on Line 5.	2) SUPPLY DESIGN AIRFLOW (CFM) 4,000
B) Calculate Fan Adjustment and enter on Line 6.	3) TOTAL FAN SYSTEM POWER INDEX (Row 1/Row 2)
C) Calculate Adjusted Fan Power Index and enter on Line 7.	4) SPa
	5) SPf
	6) Fan Adjustment = $1 - (SPa - 1)SPf$
	7) ADJUSTED FAN POWER INDEX (Line 3 x Line 6) 0.458

1. TOTAL FAN SYSTEM POWER INDEX or ADJUSTED FAN POWER INDEX must not exceed 0.8 Wtch for Constant Volume systems or 1.25 Wtch for VAV systems.



CALIFORNIA ENERGY COMMISSION

MECHANICAL SIZING AND FAN POWER MECH-4-C

PROJECT NAME Sample Single Story Prescriptive Office Building	DATE 5/5/2009
SYSTEM NAME AHU-2	FLOOR AREA 2,560

FAN POWER CONSUMPTION

A FAN DESCRIPTION	B DESIGN BRAKE HP	C EFFICIENCY		E NUMBER OF FANS	F PEAK WATTS B x E x 746 / (C x D)
		MOTOR	DRIVE		
Supply Fan	2.000	84.0%	97.0%	1.0	1,831

Each fan system with a combined brake horse power greater than 25 hp must complete this form.

Systems that do not exceed 25 hp should be noted in column A.

Total Adjustments	
FILTER PRESSURE ADJUSTMENT EQUATION 144-A	1) TOTAL FAN SYSTEM POWER (Watts, Sum Column F) 1,831
A) If filter pressure drop is greater than 1 inch W.C. enter filter pressure drop, SPa on line 4 and Total Fan pressure SPf on Line 5.	2) SUPPLY DESIGN AIRFLOW (CFM) 4,000
B) Calculate Fan Adjustment and enter on Line 6.	3) TOTAL FAN SYSTEM POWER INDEX (Row 1/Row 2)
C) Calculate Adjusted Fan Power Index and enter on Line 7.	4) SPa
	5) SPf
	6) Fan Adjustment = 1-(SPa - 1)SPf
	7) ADJUSTED FAN POWER INDEX (Line 3 x Line 6) 0.458

1. TOTAL FAN SYSTEM POWER INDEX or ADJUSTED FAN POWER INDEX must not exceed 0.8 Wtch for Constant Volume systems or 1.25 Wtch for VAV systems.



CALIFORNIA ENERGY COMMISSION

MECHANICAL SIZING AND FAN POWER MECH-4-C

PROJECT NAME Sample Single Story Prescriptive Office Building	DATE 5/5/2009
SYSTEM NAME AHU-2	FLOOR AREA 2,560

FAN POWER CONSUMPTION

A FAN DESCRIPTION	B DESIGN BRAKE HP	C EFFICIENCY		E NUMBER OF FANS	F PEAK WATTS B x E x 746 / (C x D)
		MOTOR	DRIVE		
Supply Fan	2.000	84.0%	97.0%	1.0	1,831

The adjusted fan power index should not exceed 0.8 W/CFM for constant volume systems and 1.25 W/CFM for VAV systems.

Total Adjustments	
FILTER PRESSURE ADJUSTMENT EQUATION 144-A	1) TOTAL FAN SYSTEM POWER (Watts, Sum Column F) 1,831
A) If filter pressure drop is greater than 1 inch W.C. enter filter pressure drop, SPa on line 4 and Total Fan pressure SPf on Line 5.	2) SUPPLY DESIGN AIRFLOW (CFM) 4,000
B) Calculate Fan Adjustment and enter on Line 6.	3) TOTAL FAN SYSTEM POWER INDEX (Row 1/Row 2)
C) Calculate Adjusted Fan Power Index and enter on Line 7.	4) SPa
	5) SPf
	6) Fan Adjustment = 1-(SPa - 1)/SPf
	7) ADJUSTED FAN POWER INDEX (Line 3 x Line 6) 0.458

1. TOTAL FAN SYSTEM POWER INDEX or ADJUSTED FAN POWER INDEX must not exceed 0.8 W/CFM for Constant Volume systems or 1.25 W/CFM for VAV systems.



CALIFORNIA ENERGY COMMISSION

QUESTIONS?



CALIFORNIA ENERGY COMMISSION

- **Energy Standards Website:** www.energy.ca.gov/title24
- **Energy Standards Hotline:**
 - 1 (800) 752-6245 (Building Dept. Staff Only)
 - 1 (800) 772-3300 (Public)
 - (916) 654-5106 (Outside of CA)title24@energy.state.ca.us
- **Personal Contact Information:**

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