Mechanical Summary MECH-SUM

Project Info			Date
	Project Address	1 -	For Building Dept. Use
		2 -	
		3 -	
	Applicant Name:	4 -	
	Applicant Address:	5 -	
	Applicant Phone:	6 -	

Project Description	
Briefly describe mechanical system type and features.	
☐ Includes Plans	Include documentation requiring compliance with commissioning requirements, Section 1416.

Compliance Option	◯ Simple System ◯ Complex System ◯ Systems Analysis (See Decision Flowchart (over) for qualifications. Use separate MECH-SUM for simple & complex systems.)

Equipment Schedules	The following information is required to be incorporated with the mechanical equipment schedules on the plans. For projects without plans, fill in the required information below.

Cooling Equipment Schedule

Equip. ID	Brand Name[1]	Model No.[1]	Capacity[2] Btu/h	Total CFM	OSA CFM or Econo?	SEER or EER	IPLV[3]	Location

Heating Equipment Schedule

Equip. ID	Brand Name[1]	Model No.[1]	Capacity[2] Btu/h	Total CFM	OSA cfm or Econo?	Input Btuh	Output Btuh	Efficiency[4]

Fan Equipment Schedule

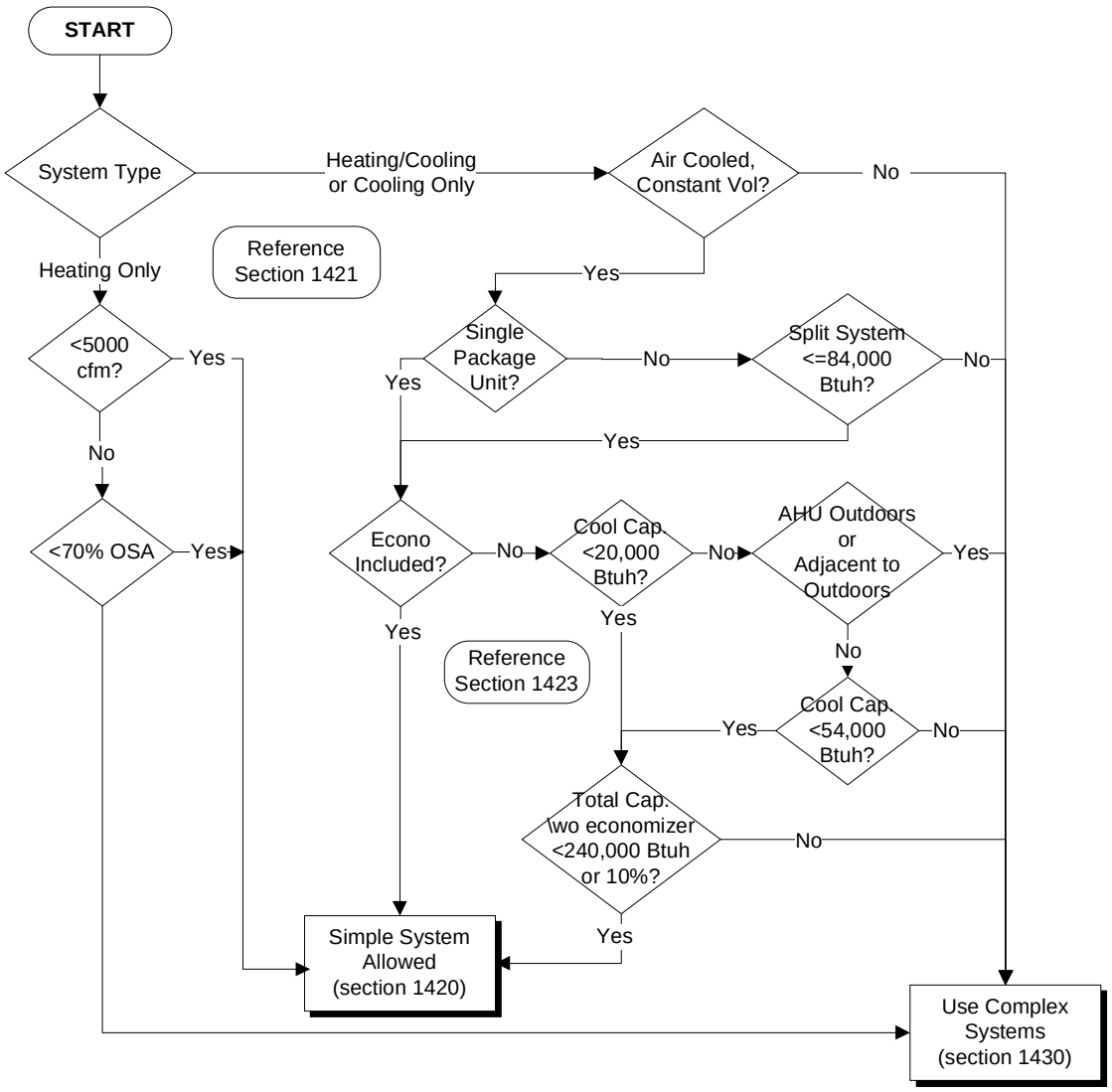
Equip. ID	Brand Name[1]	Model No.[1]	CFM	SP[1]	HP/BHP	Flow Control[5]	Location of Service

[1] If available. [2] As tested according to Table 14-1A through 14-1G. [3] If required. [4] COP, HSPF, Combustion Efficiency, or AFUE, as applicable.
[5] Flow control types: variable air volume(VAV), constant volume (CV), or variable speed (VS).

Mechanical Summary (back) MECH-SUM

System Description See Section 1421 for full description of Simple System qualifications.	If Heating/Cooling or Cooling Only:	☐ Constant vol?	☐ Air cooled?	☐ Packaged sys?	☐ <20,000 Btuh?
		☐ Split system?	☐ Economizer included?		
	If Heating Only:	☐ <5000 cfm?	☐ <70% outside air?		

Decision Flowchart	Use this flowchart to determine if project qualifies for Simple System Option. If not, either the Complex System or Systems Analysis Options must be used.



Complex Systems	Refer to MECH-COMP Mechanical Complex Systems for assistance in determining which Complex Systems requirements are applicable to this project.

Mechanical Summary MECH-SUM

Project Info			Date
	Project Address	1 -	For Building Dept. Use
		2 -	
		3 -	
	Applicant Name:	4 -	
	Applicant Address:	5 -	
	Applicant Phone:	6 -	

Project Description	
Briefly describe mechanical system type and features.	
☐ Includes Plans	Include documentation requiring compliance with commissioning requirements, Section 1416.

Compliance Option	◯ Simple System ◯ Complex System ◯ Systems Analysis (See Decision Flowchart (over) for qualifications. Use separate MECH-SUM for simple & complex systems.)

Equipment Schedules	The following information is required to be incorporated with the mechanical equipment schedules on the plans. For projects without plans, fill in the required information below.

Cooling Equipment Schedule

Equip. ID	Brand Name[1]	Model No.[1]	Capacity[2] Btu/h	Total CFM	OSA CFM or Econo?	SEER or EER	IPLV[3]	Location

Heating Equipment Schedule

Equip. ID	Brand Name[1]	Model No.[1]	Capacity[2] Btu/h	Total CFM	OSA cfm or Econo?	Input Btuh	Output Btuh	Efficiency[4]

Fan Equipment Schedule

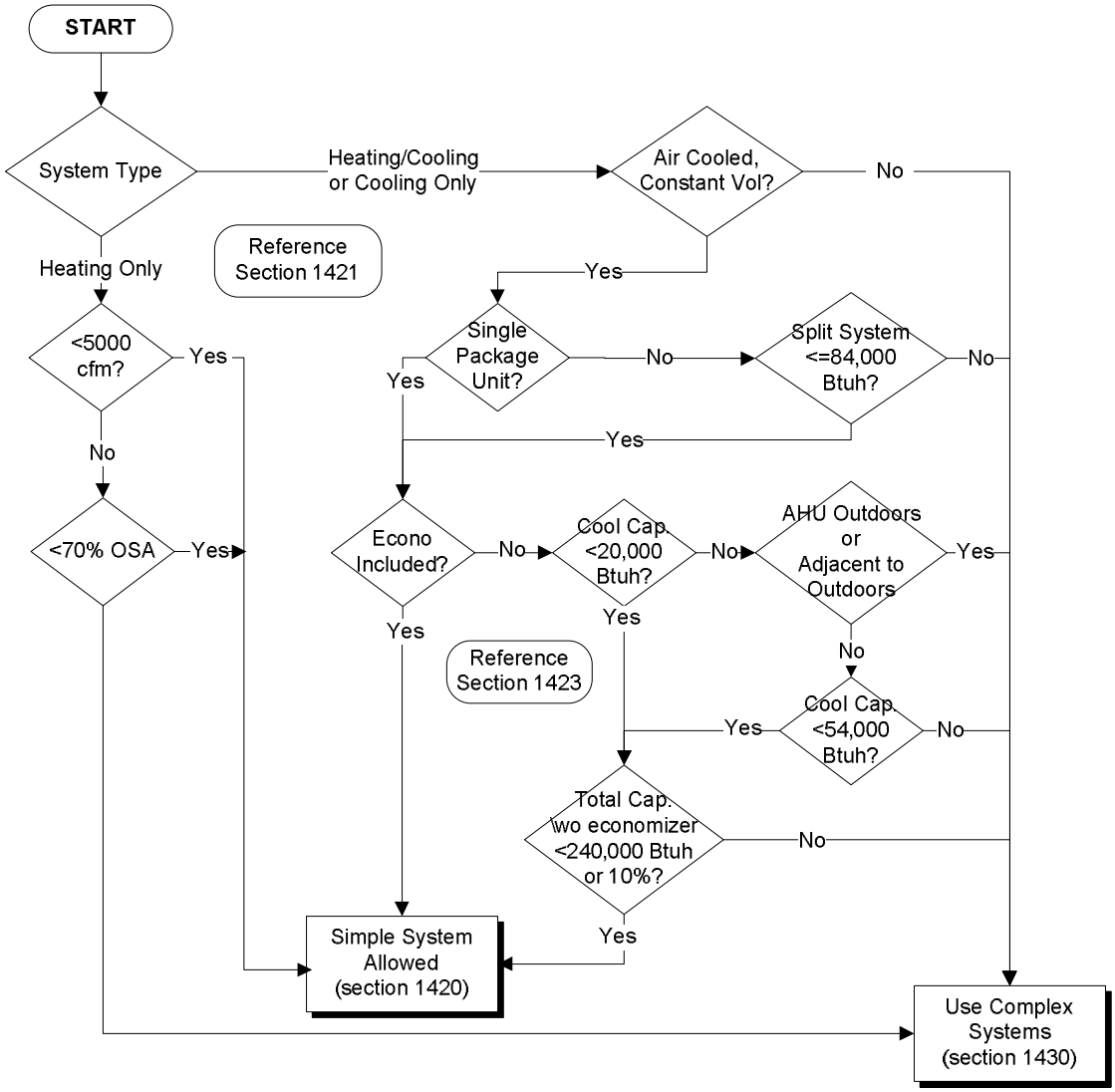
Equip. ID	Brand Name[1]	Model No.[1]	CFM	SP[1]	HP/BHP	Flow Control[5]	Location of Service

[1] If available. [2] As tested according to Table 14-1A through 14-1G. [3] If required. [4] COP, HSPF, Combustion Efficiency, or AFUE, as applicable.
[5] Flow control types: variable air volume(VAV), constant volume (CV), or variable speed (VS).

Mechanical Summary (back) MECH-SUM

System Description					
See Section 1421 for full description of Simple System qualifications.	If Heating/Cooling or Cooling Only:	☐ Constant vol?	☐ Air cooled?	☐ Packaged sys?	☐ <20,000 Btuh?
		☐ Split system?	☐ Economizer included?		
	If Heating Only:	☐ <5000 cfm?	☐ <70% outside air?		

Decision Flowchart	
	Use this flowchart to determine if project qualifies for Simple System Option. If not, either the Complex System or Systems Analysis Options must be used.



Complex Systems	
	Refer to MECH-COMP Mechanical Complex Systems for assistance in determining which Complex Systems requirements are applicable to this project.

Mechanical - Complex Systems Checklist MECH-COMP

2006 Washington State Nonresidential Energy Code Compliance Forms Revised July 2007

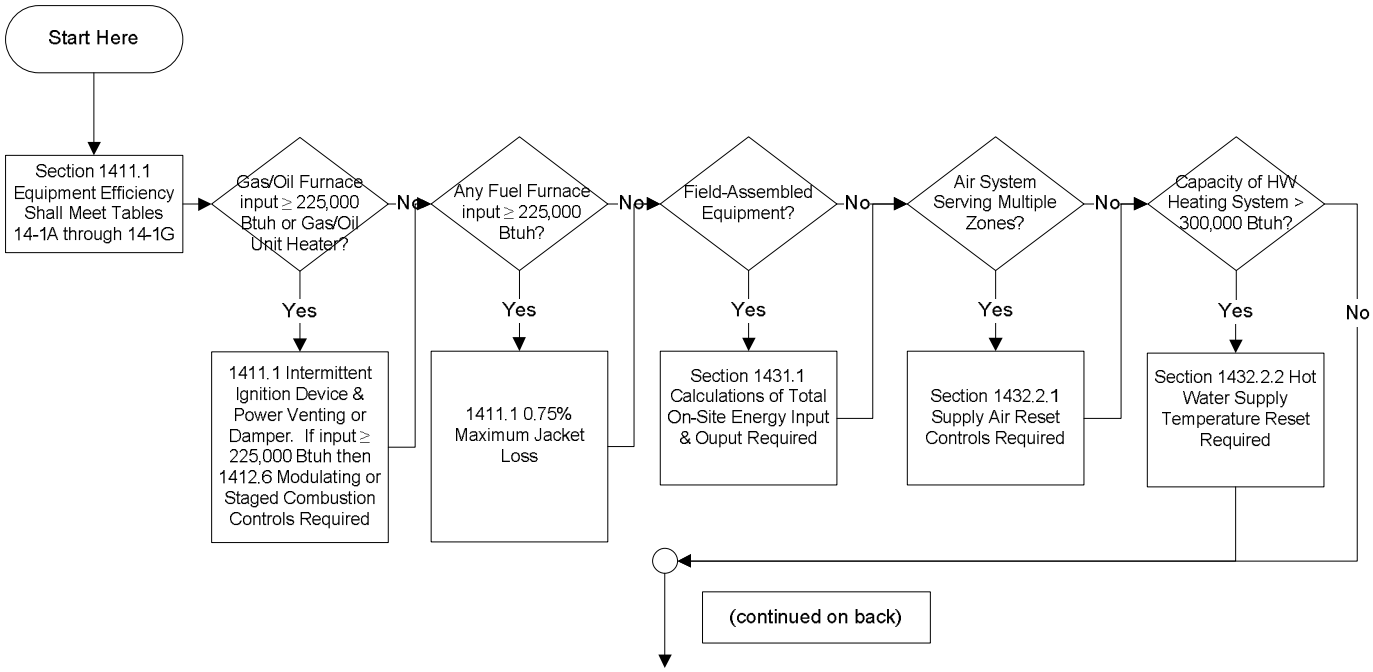
Project Address 1 -	Date
The following additional information is necessary to check a mechanical permit application for a complex mechani system for compliance with the mechanical requirements in the Washington State Nonresidential Energy Code. Use the checklist as a reference for notes added to the mechanical drawings (see the MECH-CHK checklist for additional system requirements). This information must be on the plans since this is the official record of the permit. Having this information in separate specifications alone is NOT an acceptable alternative.	For Building Department Use

Applicability (yes, no, n.a.)	Code Section	Component	Information Required	Location on Plans	Building Department Notes
ADDITIONAL CHECKLIST ITEMS FOR COMPLEX SYSTEMS ONLY					
	1431.1	Field assem. sys.	Provide calculations		
	1432.1	Setback & shut-off	Indicate separate systems or show isolation devices on plans		
	1432.2.1	Air system reset	Indicate automatic reset		
	1432.2.2	Hydronic System	Indicate automatic reset, cooling tower, & heat pump loop valves		
	1433	Air Economizer	Indicate economizer on equipment schedule or provide calculations to justify exemption and demonstrate 10% higher efficiency for equipment with out economizer.		
	1433	Water Economizer	Indicate water economizer and provide calculations if 1433 Exception 2 is utilized		
	1434	Separate air sys.	Indicate separate systems on plans		
	1435	Simul. htg. & clg.	Indicate that simultaneous heating and cooling is prohibited, unless use of exception is justified		
	1436	Heat recovery	Indicate heat recovery on plans; complete and attach heat recovery calculations		
	1437	Elec. motor effic.	MECH-MOT or Equip. Schedule with hp, rpm, efficiency		
	1438	Variable flow sys.	Indicate variable flow on fan and pump schedules		
	1439.1	Kitchen Hoods	Indicate uncooled and unheated make-up air		
	1439.2	Fume Hoods	Indicate VAV, unheated/uncooled or heat rec. makeup		

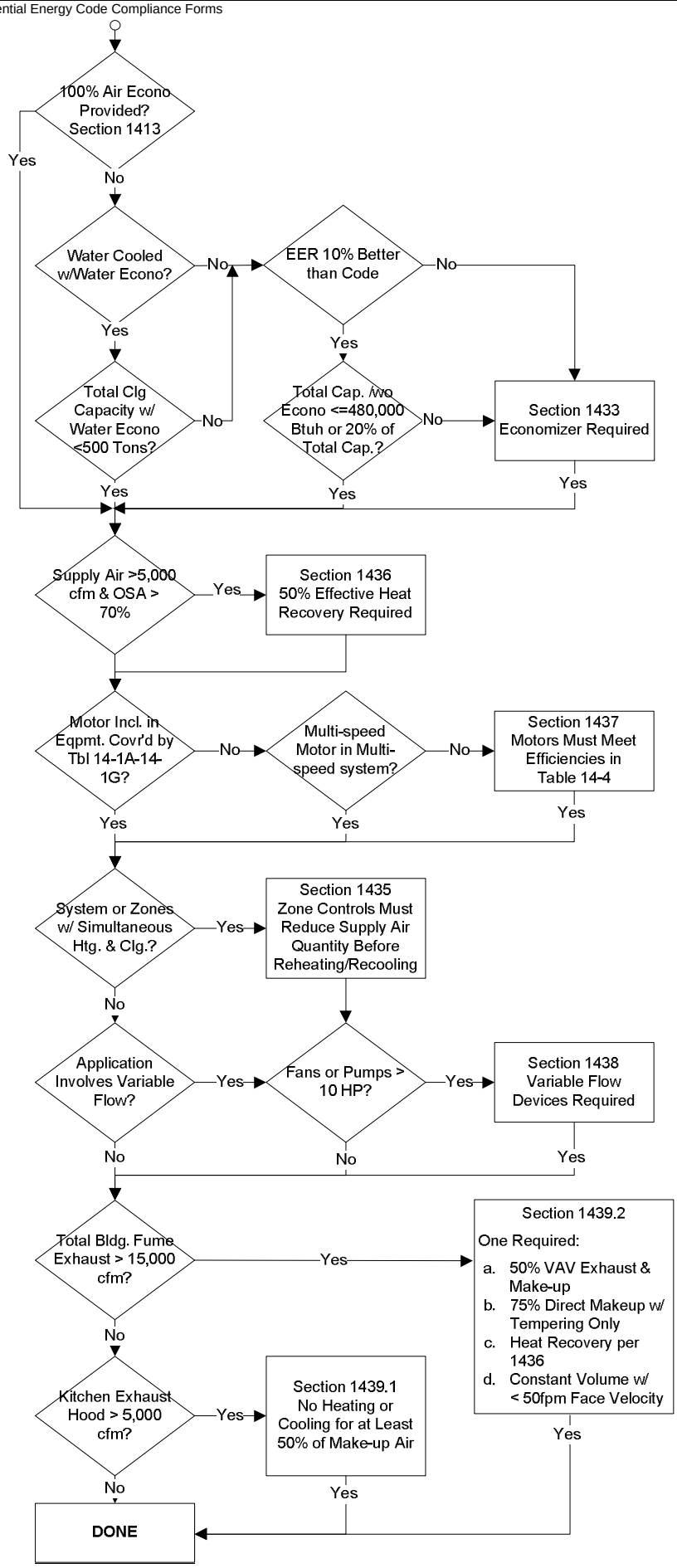
If "no" is circled for any question, provide explanation:

Decision Flowchart

Use this flowchart to determine how the requirements of the Complex Systems Option apply to project. Refer to the indicated Code sections for more complete information on the requirements.



Mechanical - Complex Systems (back) MECH-COMP



Electric Motors MECH-MOT

2006 Washington State Nonresidential Energy Code Compliance Forms Revised July 2007

Project Address 1 -	Date
Complete the following for all design A & B squirrel-cage, T-frame induction permanently wired polyphase motors from 1 hp to 200 hp having synchronous speeds of 3600, 1800 or 1200 rpm (unless one of the exceptions below applies).	For Building Department Use

Motor No. or Location	HP	Type (open/closed)	Description of Application or Use	Synch. Speed	Min.Nom. Full load Efficiency

Minimum Nominal Full-Load Efficiency

	Open Motors			Closed Motors		
Synchronous Speed (RPM)	3,600	1,800	1,200	3,600	1,800	1,200
HP	Efficiency (%)			Efficiency (%)		
1.0	-	82.5	80.0	75.5	82.5	80.0
1.5	82.5	84.0	84.0	82.5	84.0	85.5
2.0	84.0	84.0	85.5	84.0	84.0	86.5
3.0	84.0	86.5	86.5	85.5	87.5	87.5
5.0	85.5	87.5	87.5	87.5	87.5	87.5
7.5	87.5	88.5	88.5	88.5	89.5	89.5
10	88.5	89.5	90.2	89.5	89.5	89.5
15	89.5	91.0	90.2	90.2	91.0	90.2
20	90.2	91.0	91.0	90.2	91.0	90.2
25	91.0	91.7	91.7	91.0	92.4	91.7
30	91.0	92.4	92.4	91.0	92.4	91.7
40	91.7	93.0	93.0	91.7	93.0	93.0
50	92.4	93.0	93.0	92.4	93.0	93.0
60	93.0	93.6	93.6	93.0	93.6	93.6
75	93.0	94.1	93.6	93.0	94.1	93.6
100	93.0	94.1	94.1	93.6	94.5	94.1
125	93.6	94.5	94.1	94.5	94.5	94.1
150	93.6	95.0	94.5	94.5	95.0	95.0
200	94.5	95.0	94.5	95.0	95.0	95.0

Exceptions:

1. Motors in systems designed to use more than one speed of a multi-speed motor.
2. Motors already included in the efficiency requirements for HVAC equipment (Tables 14-1A or 14-1B) .
3. Motors that are an integral part (i.e. not easi removed and replaced) of specialized process equipment (i.e. equipment which requires a special motor, such as an explosion-proof motor).
4. Motors integral to a listed piece of equipmer for which no qualifying motor has been approved (i.e. if the only U.L. listing for the equipment is with a less-efficient motor and there is no energy efficient motor option).

For motors claiming an exception, list motor and note which exception applies.

Mechanical Permit Plans Checklist MECH-CHK

2006 Washington State Nonresidential Energy Code Compliance Forms Revised July 2007

Project Address 1 -	Date

The following information is necessary to check a mechanical permit application for compliance with the mechanical requirements in the Washington State Nonresidential Energy Code.

Applicability (yes, no, n.a.)	Code Section	Component	Information Required	Location on Plans	Building Department Notes
HVAC REQUIREMENTS (Sections 1401-1424)					
	1411	**Equipment performance**			
	1411.4	Pkg. elec. htg.& clg.	List heat pumps on schedule		
	1411.1	Minimum efficiency	Equipment schedule with type, capacity, efficiency		
	1411.1	Combustion htg.	Indicate intermittent ignition, flue/draft damper & jacket loss		
	1412	**HVAC controls**			
	1412.1	Temperature zones	Indicate locations on plans		
	1412.2	Deadband control	Indicate 5 degree deadband minimum		
	1412.3	Humidity control	Indicate humidistat		
	1412.4	Automatic setback	Indicate thermostat with night setback and 7 diff. day types		
	1412.4.1	Dampers	Indicate damper location and auto. controls & max. leakage		
	1412.4.2	Optimum Start	Indicate optimum start controls		
	1412.5	Heat pump control	Indicate microprocessor on thermostat schedule		
	1412.6	Combustion htg.	Indicate modulating or staged control		
	1412.7	Balancing	Indicate balancing features on plans		
	1412.8	Ventilation Control	Indicate demand control ventilation for high-occupancy areas		
	1422	Thermostat interlock	Indicate thermostat interlock on plans		
	1423	Economizers	Equipment schedule		
	1413	**Air economizers**			
	1413.1	Air Econo Operation	Indicate 100% capability on schedule		
	1413.1	Wtr Econo Operation	Indicate 100% capacity at 45 degF db & 40 deg F wb		
	1413.2	Water Econo Doc	Indicate clg load & water econoe & clg tower performance		
	1413.3	Integrated operation	Indicate capability for partial cooling		
	1413.4	Humidification	Indicate direct evap or fog atomization w/ air economizer		
	1414	**Ducting systems**			
	1414.1	Duct sealing	Indicate sealing necessary		
	1414.2	Duct insulation	Indicate R-value of insulation on duct		
	1415.1	Piping insulation	Indicate R-value of insulation on piping		
	1416	**Completion Requirements**			
	1416.2.1	Commissioning	Provide commissioning plan		
	1416.2.2-3	Sys.Bal & Func.Test	Indicate air and water system balancing & functional testing		
	1416.2.4	Commissioning	Indicate O&M manuals, record drawings, staff training		
	1416.2.5	Comm. Report	Indicate requirements for prelim. & final commissioning report		
	1434	Separate air sys.	Indicate separate systems on plans		
		Mechanical Summary Form	Completed and attached. Equipment schedule with types, input/output, efficiency, cfm, hp, economizer		
SERVICE WATER HEATING AND HEATED POOLS (Sections 1440-1454)					
	1440	**Service water htg.**			
	1441	Elec. water heater	Indicate R-10 insulation under tank		
	1442	Shut-off controls	Indicate automatic shut-off		
	1443	Pipe Insulation	Indicate R-value of insulation on piping		
	1452	Heat Pump COP	Indicate minimum COP of 4.0		
	1452	Heater Efficiency	Indicate pool heater efficiency		
	1453	Pool heater controls	Indicate switch and 65 degree control		
	1454	Pool covers	Indicate vapor retardant cover		
	1454	Pools 90+ degrees	Indicate R-12 pool cover		

If "no" is circled for any question, provide explanation:

Mechanical Permit Plans Checklist MECH-CHK

Mechanical - General Requirements

1411.1 General: Equipment shall have a minimum performance at the specified rating conditions not less than the values shown in Table 14-1A through 14-1G. If a nationally recognized certification program exists for a product covered in Tables 14-1A through 14-1G, and it includes provisions for verification and challenge of equipment efficiency ratings, then the product shall be listed in the certification program.

Gas-fired and oil-fired forced air furnaces with input ratings ≥ 225,000 Btu/h (65 kW) and all unit heaters shall also have an intermittent ignition or interrupted device (IID), and have either mechanical draft (including power venting) or a flue damper. A vent damper is an acceptable alternative to a flue damper for furnaces where combustion air is drawn from the conditioned space. All furnaces with input ratings ≥ 225,000 Btu/h (65 kW), including electric furnaces, that are not located within the conditioned space shall have jacket losses not exceeding 0.75% of the input rating.

1411.2 Rating Conditions: Cooling equipment shall be rated at ARI test conditions and procedures when available. Where no applicable procedures exist, data shall be furnished by the equipment manufacturer.

1411.3 Combination Space and Service Water Heating: For combination space and service water heaters with a principal function of providing space heat, the Combined Annual Efficiency (CAE) may be calculated by using ASHRAE Standard 124-1991. Storage water heaters used in combination space heat and water heat applications shall have either an Energy FActor (EF) or a CAE of not less than the following:

	EF	CAE
< 50 gal storage	0.58	0.71
50 to 70 gal storage	0.57	0.71
> 70 gal storage	0.55	0.70

1411.4 Packaged Electric Heating and Cooling Equipment: Packaged electric equipment providing both heating and cooling with a total cooling capacity greater than 20, Btu/h shall be a heat pump.

Exception: Unstaffed equipment shaelters or cabinets used solely for personal wireless service facilities**.**

1412 Controls

1412.1 Temperature Controls: Each system shall be provided with at least one temperature control device. Each zone shall be controlled by individual thermostatic controls responding to temperature within the zone. At a minimum, each floor of a building shall be considered as a separate zone.

1412.2 Deadband Controls: When used to control both comfort heating and cooling, zone thermostatic controls shall be capable of a deadband of at least 5 degrees F within which the supply of heating and cooling energy to the zone is shut off or reduced to a minimum.

Exceptions:

1. Special occupancy, special usage, or code requirements where deadband controls are not appropriate.
2. Buildings complying with Section 1141.4, if in the proposed building energy analysis, heating and cooling thermostat setpoints are set to the same temperature between 70 degrees F and 75 degrees F inclusive, and assumed to be constant throughout the year.
3. Thermostats that require manual changeover between heating and cooling modes.

1412.3 Humidity Controls: If a system is equipped with a means for adding moisture, a humidistat shall be provided.

1412.4 Setback and Shut-Off: HVAC systems shall be equipped with automatic controls capable of accomplishing a reduction of energy use through control setback or equipment shutdown during periods of non-use or alternate use of the spaces served by the system. The automatic controls shall have a minimum seven-day clock and be capable of being set for seven different day types per week. It must retain programming and time for a power loss of 10 hours and include an accessible manual override of up to 2 hours.

Exceptions:

1. Systems serving areas which require continuous operation at the same temperature setpoint.
2. Equipment with full load demands of 2 kW (6,826 Btu/h) or less may be controlled by readily accessible manual off-hour controls.
3. Systems controlled by an occupant sensor that is capable of shutting the system off when no occupant is sensed for a period of up to 30 minutes.
4. Systems controlled solely by a manually operated timer capable of operating the system for no more than two hours.

1412.4.1 Dampers: Outside air intakes, exhaust outlets and relief outlets serving conditioned spaces shall be equipped with dampers which close automatically when the system is off or upon power failure. Stair shaft and elevator shaft smoke relief openings shall be equipped with normally open (fails to open upon loss of power) dampers. These dampers shall remain closed until activated by the fire alarm system or other approved smoke detection system.

Exceptions:

1. Systems serving areas which require continuous operation.
2. Combustion air intakes.
3. Gravity (nonmotorized) dampers are acceptable in buildings less than 3 stories in height.
4. Gravity (nonmotorized) dampers are acceptable in exhaust and relief outlets in the first story and levels below the first story of buildings three or more stories in height.

1412.4.2 Optimum Start Controls: Heating and cooling systems with design supply air capacities exceeding 10,000 cfm shall have optimum start controls. Optimum start controls shall be designed to automatically adjust the start time of an HVAC system each day to bring the space to desired occupied temperature levels immediately before scheduled occupancy. The control algorithm shall, as a minimum, be a function of the difference between space temperature and occupied setpoint and the amount of time prior to scheduled occupancy.

1412.5 Heat Pump Controls: Unitary air cooled heat pumps shall include microprocessor controls that minimize supplemental heat usage during start-up, set-up, and defrost conditions. These controls shall anticipate need for heat and use compression heating as the first stage of heat. Controls shall indicate when supplemental heating is being used through visual means (e.g., LED indicators).

1412.6 Combustion Heating Equipment Controls: Combustion heating equipment with a capacity over 225,000 Btu/h shall have modulating or staged combustion control. 000

EXCEPTIONS: 1. Boilers. 2. Radiant heaters.

1412.7 Balancing: Each air supply outlet or air or water terminal device shall have a means for balancing, including but not limited to, dampers, temperature and pressure test connections and balancing valves.

1412.8 Ventilation Controls for High-Occupancy Areas: Demand control ventilation (DCV) is required for spaces that are larger than 500 ft2, have a design occupancy for ventilation of greater than 40 people for 1000 ft2 of floor area, and are served by systems with one or more of the following:

a. An air-side economizer,
b. Automatic modulating control of the outdoor air damper, or
c. A design outdoor airflow greater than 3000 cfm.

Exceptions:

1.Systems with energy recovery complying with Section 1436.
2. Multiple-zone systems without direct-digital control of individual zones communicating with a central control panel.
3. Systems with a design outdoor airflow less than 1200 cfm.
4. Spaces where the supply airflow rate minus any makeup or outgoing transfer air requirement is less than 1200 cfm.

1413 Air Economizers

1413.1 Operation: Air economizers shall be of automatically modulating outside and return air dampers to provide 100 percent of the design supply air as outside air to reduce or eliminate the need for mechanical cooling. Water economizers shall be capable of providing the total concurrent cooling load served by the conneted terminal equipment lacking airside economizer, at outside air temperatures of 45^{0}F dry-bulb/40^{0}F wet-bulb and below. For this calculation, all factors including solar and internal load shall be the same as those used for peak load calculations, except for the outside temperatures.

Exception: Water economizers using air-cooled heat rejection equipment may use a 35^{0}F dry-bulb outside air temperature for this calculation. This exception is limited to a maximum of 20 tons per building.

1413.2 Documentation: Water economizer plans submitted for approval shall include the following information:

1. Maximum outside air conditions for which economizer is sized to provide full cooling.
2. Design cooling load to be provided by economizer at this outside air condition.
3. Heat rejection and terminal equipment performance data including model number, flow rate, capacity, entering and leaving temperature in full economizer cooling mode.

1413.3 Integrated Operation: Air economizers shall be capable of providing partial cooling even when additional mechanical cooling is required to meet the remainder of the cooling load.

Exceptions:

1. Individual, direct expansion units that have a rated capacity less than 65,000 Btu/h and use nonintegrated economizer controls that preclude simultaneous operation of the economizer and mechanical cooling.
2. Water-cooled water chillers with waterside economizer.

1413.4 Humidification: If an air economizer is required on a cooling system for which humidification equipment is to be provided to maintain minimum indoor humidity levels, then the humidifier shall be of the adiabatic type (direct evaporative media or fog atomization type).

Exceptions:

1. Health care facilities where WAC 246-320-525 allows only steam injection humidifiers in ductwork downstream of final filters. 1412.6 Combustion Heating Equipment Controls: Combustion heating equipment with a capacity over 225,000 Btu/h shall have modulating or staged combustion control.
2. Systems with water economizer
3. 100% outside air systems with no provisions for air recirculation to the central supply fan.
4. Nonadiabatic humidifiers cumulatively serving no more than 10% of a building's air economizer capacity as measured in cfm. This refers to the system cfm serving rooms with stand alone or duct mounted humidifiers.

1414 Ducting Systems

1414.1 Sealing: Duct work which is designed to operate at pressures above 1/2 inch water column static pressure shall be sealed in accordance with Standard RS-18. Extent of sealing required is as follows:

1. Static pressure: 1/2 inch to 2 inches; seal transverse joints.
2. Static pressure: 2 inches to 3 inches; seal all transverse joints and longitudinal seams.
3. Static pressure: above 3 inches; seal all transverse joints, longitudinal seams and duct wall penetrations.

Duct tape and other pressure sensitive tape shall not be used as the primary sealant where ducts are designed to operate at static pressures of 1 inch W.C. or greater.

1414.2 Insulation: Ducts and plenums that are constructed and function as part of the building envelope, by separating interior space from exterior space, shall meet all applicable requirements of Chapter 13. These requirements include insulation installation, moisture control, air leakage, and building envelope insulation levels. Unheated equipment rooms with combustion air louvers must be isolated from the conditioned space by insulating interior surfaces to a minimum of R-11 and any exterior envelope surfaces per Chapter 13. Outside air ducts serving individual supply air units with less than 2,800 cfm of total supply air capacity shall be insulated to a minimum of R-7 and are not considered building envelope. Other outside air duct runs are considered building envelope until they,

1. connect to the heating or cooling equipment, or
2. are isolated from the exterior with an automatic shut-off damper complying with Section 1412.4.1.

Once outside air ducts meet the above listed requirements, any runs within conditioned space shall comply with Table 14-5 requirements.

Other ducts and plenums shall be thermally insulated per Table 14-5.

Exceptions:

1. Within the HVAC equipment.
2. Exhaust air ducts not subject to condensation.
3. Exposed ductwork within a zone that serves that zone.

1415 Piping Systems

1415.1 Insulation: Piping shall be thermally insulated in accordance with Table 14-6.

Exception: Piping installed within unitary HVAC equipment.

Water pipes outside the conditioned space shall be insulated in accordance with Washington State Plumbing Code (WAC 51-26)

1416 Completion Requirements *(Refer to NREC Section 1416 and the Building Commissioning Guidelines, published by the Building Commissioning Association, for complete text and guidelines for building completion and commissioning requirements.)*