

Mechanical Summary

MECH-SUM

2012 Washington State Energy Code Compliance Forms for Commercial Buildings including R2 & R3 over 3 stories and all R1

Revised May 2015

Project Info	Project Address: HUB VANCOUVER	Date: 1/1/2015
	SE MILLPLAIN & SE 177T	For Building Dept. Use
	VANCOUVER, WASHINGTON	
	Applicant Name: TAKAKO BAKER	
	Applicant Address: 2007 SE ASH STREET, PORTLAND OR 97213	
	Applicant Phone: 503-234-0548	

Project Description <i>Briefly describe mechanical systems in the text box provided</i>	<input checked="" type="checkbox"/> New Building <input type="checkbox"/> Building Addition <input type="checkbox"/> System Upgrade <input type="checkbox"/> No System Changes
<input type="checkbox"/> Total Bldg Performance <i>Total Bldg Performance compliance includes all mandatory provisions per C401.2 Option 2. Only MECH-SUM and MECH-CHK forms required.</i>	

Mechanical Systems Summary

Equip ID	Type of System (Note 1)	Space(s) Served	Compliance Path	Heating and Cooling	Fan Flow Controls	Air Economizer (Note 2)	Ventilation (Note 3)	Energy Recovery
RTU-1	SINGLE PACKAGED RTU	DINING	Complex single zone system	Heating and cooling	Constant volume (CV)	Yes	Minimum per IMC	Not Applicable
RTU-2	SINGLE PACKAGED RTU	BREWERY	Simple single zone system	Heating and cooling	Constant volume (CV)	Yes	Minimum per IMC	Not Applicable
RTU-3	SINGLE PACKAGED RTU	KITCHEN	Simple single zone system	Heating and cooling	Constant volume (CV)	Yes	Minimum per IMC	Not Applicable

Note 1 - Provide basic description of system type, for example: unitary rooftop air handler, built-up central air handler; single-packaged, split system or packaged terminal air conditioner or heat pump; unit heater, warm-air furnace, electric resistance heater, 4-pipe fan coil, VRF system, energy recovery air handler, make-up air system, ground or water-source heat pump, etc.

Note 2 - If taking an exception to air economizer, select exception taken from drop down menu and complete MECH-ECONO form. Summary definitions of each exception are listed in MECH-ECONO.

Note 3 - If ventilation "Not applicable" is selected, provide explanation in Project Description box above.

HVAC Hydronic Systems	<input type="checkbox"/> Hydronic chilled water <input type="checkbox"/> Water-loop heat pump <input checked="" type="checkbox"/> No hydronic systems <input type="checkbox"/> Hydronic heating <input type="checkbox"/> Geothermal
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Service Water Heating Systems	Equipment Type (s) <input checked="" type="checkbox"/> Hot water heating tank(s) <input type="checkbox"/> Instantaneous <input type="checkbox"/> No service water systems <input type="checkbox"/> Dedicated boiler <input type="checkbox"/> Heat exchange from space heat boiler or central hot water/steam Distribution Type (s) <input type="checkbox"/> Circulation System <input type="checkbox"/> On-demand
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Mechanical Schedules	<input checked="" type="checkbox"/> Mechanical Plans <input type="checkbox"/> MECH-EQ Form <i>Indicate location of equipment compliance information. If provided on plans then MECH-EQ forms are not required, however, include on plans all applicable compliance information listed in MECH-EQ tables.</i>
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Design Load Calculations

- Load calculation summary MECH-LOAD-CALC Form Equipment retrofit or repair

Provide design load calculations for all mechanical systems and equipment serving the building heating, cooling or ventilating needs. If a load calculation summary is provided with the permit documents that includes all applicable compliance information then the MECH-LOAD-CALC form is not required.

Equipment retrofit and repair projects where design loads in space(s) served have not changed from original design conditions are not required to perform load calculations.

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Fan Power	<input checked="" type="radio"/> Air system exceeding 5hp <input type="radio"/> No air system exceeds 5hp <input type="radio"/> <p><i>Provide a MECH-FANSYS form for each HVAC system having a total fan system motor nameplate horsepower exceeding 5 horsepower. Refer to Section C403.2.10 and MECH-FANSYS-DOC for requirements and exceptions.</i></p>
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Commissioning Exception Summary <i>Describe means of eligibility for commissioning exception (capacity, etc) for all systems noted as taking exception in Mechanical Systems Summary table. Refer to Section C408.2 and C408.4 for exceptions.</i>	<input type="checkbox"/> Commissioning will be provided for all applicable systems Commissioning Exceptions: <input type="checkbox"/> Mechanical system(s) _____ <input type="checkbox"/> Service water heating system(s) _____ <p><i>For systems requiring commissioning, Figure C408.1.2.1 Commissioning Compliance Checklist shall be submitted to the code official upon project completion.</i></p>
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Low Energy and Semi-Heated Spaces (Note 6 and 7)

Space Type	Location in Plan(s)	Space(s) Served	Area Served, square feet	Heating Capacity, Btu/h (Note 4)	Cooling Capacity, Btu/h (Note 5)	Peak Space Conditioning Capacity, Btu/h-sf	Compliance Check	Notes

*Note 4 - Provide total installed heating output capacity of systems serving Low Energy or Semi-Heated space(s) in btuh.
 Note 5 - Provide total installed cooling capacity of system serving Low Energy space(s) in Btu/h. Not allowed for semi-heated spaces. Enter 0 if no cooling.
 Note 6 - Refer to Section C101.5.2 Low Energy Building. Installed peak space conditioning capacity, heating or cooling, may not exceed 3.4 Btu/h-sf.
 Note 7 - Refer to Section C402.1.4 and Semi-Heated Space definition in Chapter 2. Total heating output capacity may not exceed 8 btuh/sf. Only systems without electric resistance heating and no cooling are eligible for the wall insulation exception under semi-heated.*

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The following information is necessary to check a permit application for compliance with the mechanical systems and equipment requirements of the Washington State Energy Code, Commercial Provisions.						
Applicable (yes,no,na)	Code Section	Code Provision	Information Required - <i>Must be in permit documents</i>		Location in Documents	Building Department Notes
GENERAL PROVISIONS						
Equipment Sizing & Performance						
YES	C403.2.1	Load calculations	Load calculations performed per ASHRAE Std 183 or equivalent per Chapter 3		SEE ATTACHED	
YES	C403.2.2	Equipment and system sizing	Output capacity of heating and cooling equipment and systems do not exceed calculated loads, note exceptions taken		SEE ATTACHED	
YES	C403.2.5	Minimum ventilation	Ventilation (natural or mechanical) provided per IMC; indicate mechanical ventilation is capable of being reduced to minimum requirement per IMC		M600	
YES	C403.2.3 & C403.2.3.2 & C403.2.12.1	Equipment minimum efficiency	Provide equipment schedules or complete MECH-SUM tables with type, capacity, efficiency, test standard (or other efficiency source) for all mechanical equipment		M600	
YES	C403.2.13	Electric motor efficiency	Provide equipment schedule with hp, rpm, and efficiency for all motors; note exceptions taken		EXC 2	
YES	C403.2.10.1	Fan power limitation	For all applicable systems > 5hp, provide system total nameplate hp in MECH-FANSYS-SUM form		SEE ATTACHED	
YES	C403.2.10.1	Fan power limitation	For all applicable fan systems > 5hp, verify fan system motor hp or bhp complies with fan power limits per Table C403.2.10.1(1), provide MECH-FANSYS form for each system		SEE ATTACHED	
YES	C403.2.10.2	Motor nameplate hp	Indicate fan motors specified are the smallest available motor hp size greater than fan bhp, note exceptions taken		SEE ATTACHED	
YES	C403.2.10.3 & C403.2.13	Fractional hp fan motors	Indicate fan motors 1/12 to 1 hp are ECM type or meet minimum efficiency req.		M600	
NONE	C403.2.3	Maximum air cooled chiller capacity	Indicate air-cooled chiller capacity does not exceed air-cooled chiller limit			
NONE	C403.2.3.1	Non-standard water-cooled chillers	Full-load and NPLV values for water-cooled centrifugal chiller adjusted for non-standard operational conditions			
NONE	C403.2.12.1.2	Centrifugal fan cooling towers	Large capacity cooling towers with centrifugal fan(s) meet efficiency requirements for axial fan open circuit cooling towers			
NONE	C403.2.3	Forced air furnace and unit heaters	Indicate intermittent ignition or IID, flue/draft damper & jacket loss			
NONE	C403.2.3.3	Packaged electric heating/cooling equipment	Verify all packaged electric equipment that provides > 20,000 Btu/h cooling capacity and heating is a heat pump, note in equipment schedule			
NONE	C403.2.3.4	Humidification	Indicate method of humidification (note requirements for systems with economizer)			
HVAC System Controls & Criteria						
YES	C403.2.4.1	Thermostatic controls	Indicate locations of thermostatic control zones on plans, including perimeter systems		SPECS, M101, M102	
NONE	C403.2.4.1.1	Heat pump supplementary heat	Indicate staged heating (compression/supplemental) and outdoor lock-out temperature is set to 40°F or less			
YES	C403.2.4.2	Setpoint overlap (deadband)	Indicate 5°F deadband minimum for systems controlling both heating & cooling		SPECS,	
YES	C403.2.4.3	Automatic setback and shutdown	Indicate zone t-stat controls with required automatic setback & manual override		SPECS	
YES	C403.2.4.3.3	Automatic (optimum) start	Indicate system controls that adjust equip start time to match load conditions		SOECS	
YES	C402.4.5.2 & C403.2.4.4	OSA, exhaust, and relief air dampers	Indicate location of outdoor air supply intake, and exhaust and relief outlet dampers; verify Class 1 leakage rating and control type (motorized or gravity); note exceptions taken		SPECS	
NONE	C402.4.5.2	Return air dampers	Indicate location of return air dampers; verify motorized control; verify Class 1 leakage rating for all return air dampers not integral to packaged equipment			
NONE	C402.4.5.1	Stairway and shaft vents	Indicate location of stairway and shaft vents, verify Class 1 leakage rated motorized dampers and method of activation			
NONE	C403.2.11	Heating outside a building	Indicate radiant heat system and occupancy controls			
NONE	C403.2.4.5	Snow melt systems	Indicate shut-off controls based on outdoor conditions			
YES	C403.2.4.6	Combustion heating equipment	Indicate modulating or staged control		M6.0	
NONE	C403.2.4.7	Group R1 hotel/motel systems	Indicate method for guest room temperature automatic setback (heating) & set-up (cooling), confirm adjustment of at least 5°F minimum.			
NONE	C403.2.4.8 / 9	Group R2/R3 dwelling and sleeping unit systems	Indicate 5-2 programmable thermostats in primary spaces with minimum of two setback periods; note exceptions taken			

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YES	C403.2.5.1	Demand controlled ventilation	Indicate high-occupancy spaces and systems requiring DCV	M101,M102	
YES	C403.2.5.2	Occupancy sensors	Indicate spaces requiring occupancy-based system control and method; or alternate means provided to automatically reduce OSA when partially occupied	M101,M102	

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GENERAL PROVISIONS, CONTINUED					
HVAC System Controls & Criteria, Continued					
NA	C403.2.5.3	Enclosed loading dock/parking garage ventilation	Indicate enclosed loading dock and enclosed parking garage ventilation system activation and control method		
YES	C403.2.5.4.1	Kitchen exhaust hoods	Indicate kitchen hoods requiring make-up air; indicate make-up air source and conditioning method	M101	
NA	C403.2.5.4.2	Laboratory exhaust systems	Indicate lab exhaust systems requiring heat recovery, method & efficiency; or alternative method taken (VAV, semi-conditioned makeup, or CERM calculation)		
NA	C403.2.6.1	Energy recovery (ER) - ventilation systems	Indicate ventilation systems requiring ER, method & efficiency; note exceptions		
NA	C403.2.6.2	Energy recovery (ER) - condensate systems	Indicate on-site steam heating systems requiring energy recovery		
NA	C403.2.6.3	Energy recovery (ER) - cooler/freezer condensers	Indicate remote refrig. condensers requiring ER and use of captured energy		
NA	C403.4.6	Energy recovery (ER) - condenser systems	Indicate condenser systems requiring ER to pre-heat service water; indicate ER effectiveness; note exceptions taken		
NA	C403.2.12	Variable flow control - fans/pumps	Indicate fan and pump motors requiring variable flow control and method (VSD or equivalent controls)		
NA	C403.2.12.1	Variable flow control - heat rejection equipment	Indicate heat rejection equipment and cooling tower fans requiring variable flow control and method		
NA	C403.2.12.2	Large volume fan systems	Indicate fan systems requiring airflow reduction based on heating and cooling demand; note exceptions taken		
NA	C403.2.12.2	Single zone AC systems	Indicate method of cooling demand-based fan control for sys. > 110,000 Btu/h		
NA	C403.2.4.10	DDC system capabilities	Identify all DDC system input/output control points and indicate capability for trending and demand response setpoint adjustment		
Ducting Systems					
YES	C403.2.7.1 & C403.2.7.3	Duct construction	Indicate all ductwork constructed and sealed per IMC, C402 leakage requirements and IBC vapor retarder requirements	SPECS	
NA	C403.2.7.3.1-3	Duct pressure classifications	Identify location of low, medium and high pressure ductwork on plans	M101,102,103	
NA	C403.2.7.3.3	High pressure duct leakage test	Indicate high pressure duct leakage testing requirements on plans; provide test results to jurisdiction when completed	NONE	
YES	C403.2.7.1 / 2	Duct insulation	Indicate R-value of insulation on ductwork	SPECS	
Piping Systems					
NA	C403.2.8	Piping insulation	Indicate R-value of insulation on piping		
NA	C403.2.8.1	Piping insulation exposed to weather	Indicate method of protection from damage/degradation		
SIMPLE SYSTEMS					
Qualifying Systems					
YES	C403.3	Qualifying single zone systems	Verify unitary or packaged equipment does not exceed capacity limits, does not have active humidification or simultaneous heating/cooling	M6.0	
NA	C403.3	Qualifying 2-pipe heating systems	Verify 2-pipe heating-only system does not exceed capacity limits		
NA	C403.3.2	Hydronic system controls	Refer to Complex Systems Section C403.4.3		
Simple System Economizers					
YES	C403.3.1	Air economizer required	Indicate cooling systems requiring economizer controls; note in equipment schedule	M6.0	
NA	C403.3.1	Air economizer exceptions	Indicate eligible exception(s) taken and provisions to comply with exception(s)	NA	
YES	C403.3.1.1.1	Air economizer capacity	Indicate modulating OSA control capability up to 100% OSA; note exceptions taken	M6.0	

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NA	C403.3.1.1.2	Integrated air economizer operation	Indicate capability for partial air economizer operation for systems with capacity > 65,000 Btu/h		
YES	C403.3.1.1.3	Air economizer high limit controls	Indicate high limit shut-off control method per Table C403.3.1.1.3(2)	M6.0	

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COMPLEX SYSTEMS					
Complex System Economizers					
YES	C403.4.1	Air economizer required	Indicate cooling systems requiring economizer controls; note in equipment schedule	M6.0	
NA	C403.4.1	Air economizer exceptions	Indicate eligible exception(s) taken and provisions to comply with exception(s)		
NA	C403.4.1.1	Water economizer capacity	For eligible systems where water economizer may be provided in lieu of air economizer, indicate system is capable of 100% cooling capacity at 50 °F db/45 °F wb OSA		
NA	C403.4.1.2	Water economizer maximum pressure drop	Indicate precooling coils and heat exchangers in water economizer system do not exceed pressure drop limit		
NA	C403.4.1.3	Integrated economizer operation	Indicate capability for partial economizer operation for air or water economizer systems		
NA	C403.4.1.4	Economizer heating system impact	Verify control method of HVAC systems with economizers does not increase building heating energy usage during normal operation		
Specific System Requirements					
NA	C403.4.2 & C403.2.12	VAV fan control	Indicate fans requiring variable flow control and method		
NA	C403.4.2.1	VAV fan static pressure sensors	Indicate sensor locations on plans; include at least one sensor per major duct branch		
NA	C403.4.2.2	VAV fan static pressure setpoint	Indicate fan system static pressure setpoint based on zone requiring most pressure		
NA	C403.4.5	VAV systems serving multiple zones	Indicate supply air systems serving multiple zones, method of primary air control, and zones served; Indicate VAV or note exceptions taken		
NA	C403.4.5	VAV systems serving multiple zones	For each air system terminal, indicate the maximum air flow rate of primary supply air during zone peak cooling and the maximum air flow rates during zone peak heating.		
NA	C403.4.5.4	VAV system supply air reset	Indicate controls that automatically reset supply air temp in response to loads		
NA	C403.4	Large capacity cooling systems	Indicate method of multi-stage or variable control for building cooling system capacity > 300 tons		
NA	C403.4.7	Hot gas bypass limitation	Indicate cooling equipment unloading or capacity modulation method		
NA	C403.4.3	Large capacity boiler systems	Indicate multi-stage or modulating burner for single boilers > 500,000 Btu/h		
NA	C403.4.3	Boiler sequencing	Indicate automatic controls that sequence operation of multiple boilers		
NA	C403.4.3.5	Chiller / boiler plant pump isolation	Indicate capability to automatically reduce overall plant flow and shut-off flow through chillers & boilers when not in use		
NA	C403.4.3.6 & C403.2.12	Variable flow control - pumps	Indicate pumps requiring variable flow control & method		
NA	C403.2.12.1 & C403.4.4	Variable flow control - cooling towers	Indicate cooling tower fans requiring variable flow control and method		
NA	C403.4.3.4	Hydronic system part load controls	Indicate heating & chilled water systems have the capability to automatically reset supply water temp AND reduce flow by ≥ 50% for systems > 300,000 Btu/h		
NA	C403.4.3.2	Two-pipe changeover systems	Indicate deadband, heating/cooling mode scheduling and changeover temperature range		
NA	C403.4.3.3.1	Water loop heat pump - deadband	Indicate capability of central equipment to provide min. 20 °F water supply temp deadband between heat rejection and heat addition modes		
NA	C403.4.3.3.2.1	Water loop heat pump - heat rejection, Zone 4	Indicate method used to limit system heat loss when heat rejections is not needed		
NA	C403.4.3.3.2.2	Water loop heat pump - heat rejection, Zone 5	Provide heat exchanger that separates cooling tower and heat pump loop		
NA	C403.4.3.3.3	Water loop heat pump - isolation	Indicate 2-way isolation valve on each heat pump and variable flow control for systems with total pump power > 10 hp		
NA	C403.5	Walk-in cooler / freezer - anti-sweat heaters	Indicate w/sf & control method for walk-in cooler/freezer door anti-sweat heaters		
NA	C403.5 / 6	Cooler / freezer - evaporator and condenser fans	Indicate motor type for evaporator and condenser fans < 1 hp		

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SERVICE WATER HEATING						
Service Water Systems						
YES	C404.2	Water-heating equip min. efficiency	Provide equipment schedule with type, capacity, efficiency, test standard or other efficiency source	P6.0		
YES	C404.3	Temperature controls	Indicate temperature controls have required setpoint capability	P6.0		
YES	C404.4	Heat traps	Indicate piping connected to equipment have heat traps on supply & discharge	P6.0		
NONE	C404.5	Insulation under water heater	Indicate R-10 insulation under electric water heater tanks			
YES	C404.6	Service water piping insulation	Indicate R-value of insulation on piping; note exceptions taken	SPECS		
YES	C404.7 / 8	Circulation systems and heat trace shut-off	Indicate shut-off capability based on occupancy and periods of limited demand	SPECS		
NONE	C404.9	Group R-2 service hot water meters	Indicate method of usage metering for dwelling units served by a central service hot water system			
Pools & In-Ground Permanently Installed Spas						
NONE	C404.10.1	Pool heating equip min. efficiency	Provide equipment schedule with type, capacity, efficiency, test standard or other efficiency source			
NONE	C404.10.1 / 2	Pool heater on / off controls	Indicate automatic on/off control based on scheduling & accessible on/off switch on heater that operates independent of thermostat setting; note exceptions taken			
NONE	C404.10.3	Pool covers	Indicate vapor retardant cover and insulation rating as required			
NONE	C404.10.3	Pool assembly insulation	Indicate rating of insulation on sides and bottom of pools heated to > 90 °F			
NONE	C404.10.4	Heat recovery	Indicate method, exhaust air temperature reduction and recovered energy use; note exceptions taken			
COMMISSIONING						
Specific System Requirements						
YES	C408.2	Mechanical systems commissioning	Indicate all mechanical systems to be commissioned; for those that will not be commissioned, note exception taken	M6.0		
YES	C408.4	Service water heating systems commissioning	Indicate all service water heating systems to be commissioned; for those that will not be commissioned, note exception taken	P6.0		
YES	C408.1.1	Commissioning plan	Provide commissioning plan for all systems requiring commissioning; include in plan all required items per this section	M6.0		
YES	C408.2.2.1 & C408.2.2.2	Air system and hydronic system balancing	Include in commissioning plan that air and hydronic systems shall be balanced in a manner to first minimize throttling losses, then adjust to meet design flow conditions	M6.0, SPECS		
YES	C408.2.2.1	Air system balancing devices	Indicate devices that provide the capability to balance all supply air outlets, zone terminals and equipment requiring system balancing	M6.0, SPECS		
NONE	C408.2.2.2	Hydronic system balancing devices	Indicate devices that provide the capability to isolate, balance and measure flow for all hydronic equipment requiring system balancing			
YES	C408.2.3	Mechanical systems functional performance testing	Provide description of functional performance testing procedures for all applicable systems including: equipment, controls, economizers	M6.0		
YES	C408.4.1	Service water heating functional performance testing	Provide description of functional performance testing procedures for all applicable systems including: equipment, controls, pools and spas	M6.0		
YES	C408.1.4	Systems operation training	Indicate required systems operation training measures to be provided	M6.0 SPECS		
YES	C408.1.2 & C403.1.3	Documentation	Indicate required documentation including: record documents, manuals, balancing reports, commissioning preliminary and final reports	M6.0 SPECS		
YES	C408.1.2.1	Acceptance report	Indicate that Commissioning Compliance Checklist (Figure C408.1.2.1) is required upon completion of preliminary commissioning report	M6.0 SPECS		

Mechanical Fan System Power Allowance **MECH-FANSYS-SUM**

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	SE MILLPLAIN & SE 177T	For Building Dept. Use
	VANCOUVER, WASHINGTON	
	Applicant Name: TAKAKO BAKER	
	Applicant Address: 2007 SE ASH STREET, PORTLAND OR 97213	
Applicant Phone: 503-234-0548		

HVAC Air Distribution System Schedule
List all HVAC systems that have the capability to provide heating and/or cooling to the spaces they serve.

Fan System ID	Speed Control (Note 1)	Description	System Total Nameplate HP (Note 2)	Fan Power Calculation (Note 3)
RTU-1 SUPPLY	CV	SUPLY FAN	7.5	Yes
RTU-1 EXHAUST	CV	EXHAUST	3	<5 HP
RTU-2	CV	SUPPLY AND EXHAUST	2	< 5 hp
RTU-3	CV	SUPPLY AND EXHAUST	2	< 5 hp

Note 1 - Constant Volume (CV), Variable Air Volume (VAV), or Hospital/Lab CV system that qualifies for VAV budget per C403.2.10.1 Exception 1
Note 2 - Enter the total nameplate hp of all fans associated with the delivery and removal of conditioned air by the system. Include all supply, return/relief, exhaust and exhaust hoods (>1 hp), make-up air, dedicated outside air (DOAS), booster fans, and series fan-powered terminals. VAV parallel fan-powered terminals and economizer relief fans do not need to be included if the fans do not operate at peak conditions.
Note 3 - Indicate if MECH-FANSYS form is required (Yes), or the system is not required to provide this information because it has a combined total nameplate motor hp less than 5 hp (< 5 hp) or the system is ventilation only and thus has no heating or cooling capacity (No).

MECH-FANSYS Forms
A MECH-FANSYS form shall be provided for each system with total nameplate hp greater than 5 hp. Select (Add Fan System Form) to generate an additional form. Added forms can be deleted with button in cell E38 of the added

Mechanical Fan System Power Allowance MECH-FANSYS

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		SE MILLPLAIN & SE 177T	For Building Dept. Use	
		VANCOUVER, WASHINGTON		
	Applicant Name:	TAKAKO BAKER		
	Applicant Address:	2007 SE ASH STREET, PORTLAND OR 97		
	Applicant Phone:	503-234-0548		

Fan System ID	RTU-1	A separate MECH-FANSYS form must be completed for every HVAC system that exceeds the 5hp threshold.
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System Supply Fan Speed Control	CV	Constant Volume (CV), Variable Air Volume (VAV), or Hospital/Lab CV system that qualifies for VAV budget per C403.2.10.1, Exception 1
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Compliance Option	Brake HP	Compliance is based upon either the fan motor nameplate horse power (Option 1) or the fan brake horsepower (Option 2). The bhp calculation provides adjustments for special equipment per Table C403.2.13.1(2).
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Fan System Supply CFM Total	6,000	Provide maximum design supply airflow rate (CFM) of all supply fans serving the conditioned space in Fan Equipment Schedule below. Fan System CFM Total is the supply airflow of the central air handler at peak design conditions. Additional volumetric air flow provided at zone fan terminals, booster fans, or through induction is not included in the supply CFM total. However, the fan power of this equipment is included in the HP and BHP calculations.
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Fan Equipment Schedule					
Fan ID and Location	Fan Type	Quantity of Fan Type	Total CFM (Note 1)	Total Nameplate HP (Note 2)	Total BHP (Note 3)
RTU-1	Supply	1	6,000	7.5	5.9

Note 1 - Total CFM is the maximum CFM of the listed fan(s) when operating at peak design operating conditions.

Note 2 - Total nameplate hp of the listed fan(s).

Note 3 - Total brake horsepower (bhp) of the listed fan(s) at peak design operating conditions. Not required if Nameplate HP compliance option chosen.

Total Proposed:	7.5	5.9
Total Allowance:	6.6	6.4

Compliance Message: COMPLIES

Brake Horsepower Allowance Adjustments

Device Type	Description and Location	CFM through this device (CFMD)	Assigned Pressure Drop, PD in w.c. (Note 5)	Calculated Pressure Drop, PD in w.c. (Note 6)	Adjustment, A in bhp (Note 7)
Fully ducted return and/or exhaust	RTU-1	6,000	0.5		0.726

Total Adjustment (bhp): 0.73

Note 4 - Bhp allowance for energy recovery devices and run around coil loops includes both air streams, so the CFMD is the sum of the supply CFM and exhaust CFM if both go through the device.

Note 5 - Assigned pressure drop (PD) adjustment per Table C403.2.10.1(2).

Note 6 - Pressure drop (PD) adjustment shall be calculated per the applicable method defined in Table C403.2.10.1(2) based on specific system conditions.

Note 7 - $A = PD * CFMD / 4131$ where A is the allowed system brake horse power adjustment, PD is pressure drop allowance, and CFMD is the cfm through the device.

General Instructions:

- *Include all fans associated with the delivery and removal of conditioned air by the system. Enter CFM and brake horsepower (bhp) of each fan at peak design conditions and the nameplate horsepower (hp). Include supply, return and relief fans, exhaust and exhaust hood fans (>1 hp), booster fans and fans included as part of make-up air units, dedicated outside air systems(DOAS), energy recovery ventilators (ERV), and series fan-powered terminal equipment. VAV parallel fan-powered terminals and economizer relief fans do not need to be included if the fans do not operate at peak conditions.*
- *Fan power calculations are not required for non-central air HVAC systems such as 4-pipe fan coils and variable refrigerant flow (VRF) systems unless individual fan systems are greater than 5hp.*
- *In the Brake Horsepower Allowance Adjustments table, if a Device Type is selected that has an Assigned Pressure Drop, this value will autofill into the Assigned Pressure Drop cell and the Calculated Pressure Drop cell will be write-protected. If the Device Type requires a Calculated Pressure Drop, then enter this value into the Calculated Pressure Drop cell and the Assigned Pressure Drop cell will be write-protected.*
- *Refer to FAQ section of MECH-FANSYS-DOC for additional instructions.*

Fan Power Allowance Adjustment Factors**MECH-FANSYS-DOC**

2012 Washington State Energy Code Compliance Forms for Commercial Buildings including R2 & R3 over 3 stories and all R1

Revised May 2015

TABLE C403.2.10.1(2)
FAN POWER LIMITATION PRESSURE DROP ADJUSTMENT

Device	Adjustment
Credits	
Fully ducted return and/or exhaust air systems	0.5 inch w.c. (2.15 inches w.c. for laboratory and vivarium systems)
Return and/or exhaust air flow control devices	0.5 inch w.c.
Exhaust filters, scrubbers, or other exhaust treatment	The pressure drop of device calculated at fan system design condition
Particulate filtration credit: MERV 9 - 12	0.5 inch w.c.
Particulate filtration credit: MERV 13 - 15	0.9 inch w.c.
Particulate filtration credit: MERV 16 and greater and electronically enhanced filters	Pressure drop calculated at 2x clean filter pressure drop at fan system design condition
Carbon and other gas-phase air cleaners	Clean filter pressure drop at fan system design condition
Biosafety cabinet	Pressure drop of device at fan system design condition
Energy recovery device, other than coil runaround loop	$(2.2 \times \text{energy recovery effectiveness}) - 0.5$ inch w.c. for each airstream
Coil runaround loop	0.6 inch w.c. for each airstream
Evaporative humidifier/cooler in series with another cooling coil	Pressure drop of device at fan system design conditions
Sound attenuation section	0.15 inch w.c.
Exhaust system serving fume hoods	0.35 inch w.c.
Laboratory and vivarium exhaust systems in high-rise buildings	0.25 inch w.c./100 feet of vertical duct exceeding 75 feet

w.c. = water column.

For SI: 1 inch w.c.= 249 Pa, 1 inch.= 25.4 mm.

System Checksums

By MFIA Inc.

RTU-1

Single Zone

COOLING COIL PEAK					CLG SPACE PEAK			HEATING COIL PEAK			TEMPERATURES							
Peaked at Time:		Mo/Hr: 7 / 14			Mo/Hr: Sum of			Mo/Hr: Heating Design			Cooling			Heating				
Outside Air:		OADB/WB/HR: 84 / 67 / 73			OADB: Peaks			OADB: 23			SADB	60.0	74.8	Ra Plenum	75.3	69.6		
Space Sens. + Lat.	Plenum Sens. + Lat	Net Total	Percent Of Total (%)	Space Sensible	Percent Of Total (%)	Space Peak	Coil Peak	Percent	Space Sens	Tot Sens	Of Total (%)	Return <td>75.3</td> <td>69.6</td> <td>Ret/OA</td> <td>78.4</td> <td>53.7</td>	75.3	69.6	Ret/OA	78.4	53.7	
Btu/h	Btu/h	Btu/h		Btu/h		Btu/h	Btu/h		Btu/h	Btu/h		Fn MtrTD	0.0	0.0	Fn BldTD	0.0	0.0	
												Fn Frict	0.0	0.0				
Envelope Loads					Envelope Loads			Envelope Loads										
Skylite Solar	0	0	0	0	0	0	0	0.00	0	0	0.00	Skylite Solar	0	0	0.00			
Skylite Cond	0	0	0	0	0	0	0	0.00	0	0	0.00	Skylite Cond	0	0	0.00			
Roof Cond	0	-47	-47	0	0	0	0	0.97	0	-1,765	0.97	Roof Cond	0	0	0.00			
Glass Solar	41,258	0	41,258	21	47,276	37	0	0.00	0	0	0.00	Glass Solar	0	0	0.00			
Glass/Door Cond	1,855	0	1,855	1	-678	-1	-38,842	21.33	-38,842	-38,842	21.33	Glass/Door Cond	-38,842	-38,842	21.33			
Wall Cond	154	25	179	0	512	0	-1,989	2.50	-1,989	-4,559	2.50	Wall Cond	0	0	0.00			
Partition/Door	0	0	0	0	0	0	0	0.00	0	0	0.00	Partition/Door	0	0	0.00			
Floor	0	0	0	0	0	0	0	0.00	0	0	0.00	Floor	0	0	0.00			
Adjacent Floor	0	0	0	0	0	0	0	0	0	0	0	Adjacent Floor	0	0	0			
Infiltration	0	0	0	0	0	0	0	0.00	0	0	0.00	Infiltration	0	0	0.00			
Sub Total ==>	43,267	-22	43,246	21	47,109	36	-40,831	24.80	-40,831	-45,166	24.80	Sub Total ==>	-40,831	-45,166	24.80			
Internal Loads					Internal Loads			Internal Loads										
Lights	10,594	2,648	13,242	7	10,594	8	0	0.00	0	0	0.00	Lights	0	0	0.00			
People	142,267	0	142,267	71	71,133	55	0	0.00	0	0	0.00	People	0	0	0.00			
Misc	0	0	0	0	0	0	0	0.00	0	0	0.00	Misc	0	0	0.00			
Sub Total ==>	152,861	2,648	155,509	77	81,727	63	0	0.00	0	0	0.00	Sub Total ==>	0	0	0.00			
Ceiling Load	373	-373	0	0	648	1	-540	0.00	-540	0	0.00	Ceiling Load	-540	0	0.00			
Ventilation Load	0	0	3,390	2	0	0	-138,232	75.91	0	-138,232	75.91	Ventilation Load	0	-138,232	75.91			
Adj Air Trans Heat	0	0	0	0	0	0	0	0	0	0	0	Adj Air Trans Heat	0	0	0			
Dehumid. Ov Sizing	0	0	0	0	0	0	0	0.00	0	0	0.00	Ov/Undr Sizing	0	0	0.00			
Ov/Undr Sizing	0	0	0	0	0	0	0	0.00	0	0	0.00	Exhaust Heat	1,293	-0.71	0.00			
Exhaust Heat	0	-893	-893	0	0	0	0	0.00	0	0	0.00	OA Preheat Diff.	0	0.00	0.00			
Sup. Fan Heat	0	0	0	0	0	0	0	0.00	0	0	0.00	RA Preheat Diff.	0	0.00	0.00			
Ret. Fan Heat	0	0	0	0	0	0	0	0.00	0	0	0.00	Additional Reheat	0	0.00	0.00			
Duct Heat Pkup	0	0	0	0	0	0	0	0.00	0	0	0.00	Underflr Sup Ht Pkup	0	0.00	0.00			
Underflr Sup Ht Pkup	0	0	0	0	0	0	0	0.00	0	0	0.00	Supply Air Leakage	0	0.00	0.00			
Supply Air Leakage	0	0	0	0	0	0	0	0.00	0	0	0.00	Grand Total ==>	196,501	1,361	201,252	100.00	129,484	100.00
Grand Total ==>	196,501	1,361	201,252	100.00	129,484	100.00	-41,371	-182,105	100.00	-41,371	-182,105	Grand Total ==>	196,501	1,361	201,252	100.00	129,484	100.00

AIRFLOWS		
	Cooling	Heating
Diffuser	7,744	7,744
Terminal	7,744	7,744
Main Fan	7,744	7,744
Sec Fan	0	0
Nom Vent	2,638	2,638
AHU Vent	2,638	2,638
Infil	0	0
MinStop/Rh	0	0
Return	7,744	7,744
Exhaust	2,638	2,638
Rm Exh	0	0
Auxiliary	0	0
Leakage Dwn	0	0
Leakage Ups	0	0

ENGINEERING CKS		
	Cooling	Heating
% OA	34.1	34.1
cfm/ft²	2.00	2.00
cfm/ton	461.74	
ft²/ton	231.35	
Btu/hr-ft²	51.87	-46.93
No. People	259	

COOLING COIL SELECTION										
	Total Capacity		Sens Cap.	Coil Airflow	Enter DB/WB/HR			Leave DB/WB/HR		
	ton	MBh			°F	°F	gr/lb	°F	°F	gr/lb
Main Clg	16.8	201.3	150.7	7,744	78.0	65.7	75.4	60.0	57.5	67.0
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Total	16.8	201.3								

AREAS			
	Gross Total	Glass	
		ft² (%)	
Floor	3,880		
Part	0		
Int Door	0		
ExFlr	0		
Roof	1,200	0	0
Wall	2,847	1,841	65
Ext Door	0	0	0

HEATING COIL SELECTION				
	Capacity	Coil Airflow	Ent	Lvg
Main Htg	-182.1	7,744	53.7	74.8
Aux Htg	0.0	0	0.0	0.0
Preheat	-54.4	7,744	53.7	60.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-182.1			

System Checksums

By MFIA Inc.

RTU-3

Single Zone

COOLING COIL PEAK					CLG SPACE PEAK			HEATING COIL PEAK			TEMPERATURES					
Peaked at Time:		Mo/Hr: 7 / 16			Mo/Hr: Sum of			Mo/Hr: Heating Design			Cooling			Heating		
Outside Air:		OADB/WB/HR: 84 / 66 / 65			OADB: Peaks			OADB: 23			SADB			Ra Plenum		
	Space Sens. + Lat.	Plenum Sens. + Lat	Net Total	Percent Of Total (%)	Space Sensible	Percent Of Total (%)	Space Peak	Coil Peak	Percent	Return	Ret/OA	Fn MtrTD	Fn BidTD	Fn Frict		
	Btu/h	Btu/h	Btu/h	(%)	Btu/h	(%)	Space Sens	Tot Sens	Of Total (%)	Btu/h	Btu/h					
Envelope Loads																
Skylite Solar	0	0	0	0	0	0	0	0	0.00	0	0	0.00	0	0.0	0.0	0.0
Skylite Cond	0	0	0	0	0	0	0	0	0.00	0	0	0.00	0	0.0	0.0	0.0
Roof Cond	0	18,023	18,023	34	0	0	0	-10,987	69.26	0	0	0.00	0	0.0	0.0	0.0
Glass Solar	0	0	0	0	0	0	0	0	0.00	0	0	0.00	0	0.0	0.0	0.0
Glass/Door Cond	0	0	0	0	0	0	0	0	0.00	0	0	0.00	0	0.0	0.0	0.0
Wall Cond	0	0	0	0	0	0	0	0	0.00	0	0	0.00	0	0.0	0.0	0.0
Partition/Door	0	0	0	0	0	0	0	0	0.00	0	0	0.00	0	0.0	0.0	0.0
Floor	0	0	0	0	0	0	0	0	0.00	0	0	0.00	0	0.0	0.0	0.0
Adjacent Floor	0	0	0	0	0	0	0	0	0.00	0	0	0.00	0	0.0	0.0	0.0
Infiltration	0	0	0	0	0	0	0	0	0.00	0	0	0.00	0	0.0	0.0	0.0
Sub Total ==>	0	18,023	18,023	34	0	0	0	-10,987	69.26	0	0	0.00	0	0.0	0.0	0.0
Internal Loads																
Lights	3,276	819	4,096	8	3,276	10	0	0	0.00	0	0	0.00	0	0	0	0
People	3,300	0	3,300	6	1,650	5	0	0	0.00	0	0	0.00	0	0	0	0
Misc	26,621	0	26,621	51	26,621	78	0	0	0.00	0	0	0.00	0	0	0	0
Sub Total ==>	33,198	819	34,017	65	31,548	92	0	0	0.00	0	0	0.00	0	0	0	0
Ceiling Load	2,687	-2,687	0	0	2,740	8	-1,567	0	0.00	0	0	0.00	0	0	0	0
Ventilation Load	0	0	1,275	2	0	0	-5,344	33.69		0	0		0	0	0	0
Adj Air Trans Heat	0	0	0	0	0	0	0	0		0	0		0	0	0	0
Dehumid. Ov Sizing	0	0	0	0	0	0	0	0		0	0		0	0	0	0
Ov/Undr Sizing	0	0	0	0	0	0	0	0		0	0		0	0	0	0
Exhaust Heat	0	-804	-804	-2	0	0	469	-2.95		0	0		0	0	0	0
Sup. Fan Heat	0	0	0	0	0	0	0	0		0	0		0	0	0	0
Ret. Fan Heat	0	0	0	0	0	0	0	0		0	0		0	0	0	0
Duct Heat Pkup	0	0	0	0	0	0	0	0		0	0		0	0	0	0
Underflr Sup Ht Pkup	0	0	0	0	0	0	0	0		0	0		0	0	0	0
Supply Air Leakage	0	0	0	0	0	0	0	0		0	0		0	0	0	0
Grand Total ==>	35,885	15,351	52,511	100.00	34,288	100.00	-1,567	-15,863	100.00	0	0		0	0	0	0

TEMPERATURES		
	Cooling	Heating
SADB	60.0	70.7
Ra Plenum	82.1	65.9
Return	82.1	65.9
Ret/OA	82.2	63.8
Fn MtrTD	0.0	0.0
Fn BidTD	0.0	0.0
Fn Frict	0.0	0.0

AIRFLOWS		
	Cooling	Heating
Diffuser	2,051	2,051
Terminal	2,051	2,051
Main Fan	2,051	2,051
Sec Fan	0	0
Nom Vent	102	102
AHU Vent	102	102
Infil	0	0
MinStop/Rh	0	0
Return	2,051	2,051
Exhaust	102	102
Rm Exh	0	0
Auxiliary	0	0
Leakage Dwn	0	0
Leakage Ups	0	0

ENGINEERING CKS		
	Cooling	Heating
% OA	5.0	5.0
cfm/ft ²	1.71	1.71
cfm/ton	468.61	
ft ² /ton	274.23	
Btu/hr-ft ²	43.76	-13.22
No. People	6	

COOLING COIL SELECTION										
	Total Capacity		Sens Cap.	Coil Airflow	Enter DB/WB/HR			Leave DB/WB/HR		
	ton	MBh			°F	°F	gr/lb	°F	°F	gr/lb
Main Clg	4.4	52.5	50.7	2,051	82.2	64.5	62.4	60.0	56.1	61.1
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Total	4.4	52.5								

AREAS			
	Gross Total	Glass	
		ft ²	(%)
Floor	1,200		
Part	0		
Int Door	0		
ExFlr	0		
Roof	1,200	0	0
Wall	0	0	0
Ext Door	0	0	0

HEATING COIL SELECTION				
	Capacity	Coil Airflow	Ent °F	Lvg °F
Main Htg	-15.9	2,051	63.8	70.7
Aux Htg	0.0	0	0.0	0.0
Preheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-15.9			