SYSTEMS – GENERAL

General

There are several areas in the forms where the user is asked to identify the location on plans or specifications where a requirement is called out. Usually the statement "The plans/specs show compliance in the following locations:" will be followed by a blank space. For instance Line 5 asks the user to identify compliance details for transformer requirements. The user should input what drawing number and detail or specification section and paragraph shows the relevant transformer requirements. This is meant to enable the plan reviewer to easily verify compliance.

Example

1. Applicablity (Section 1317)

Is this form required?

☑ **Form Required.** Complete form if a new HVAC system is being installed, or components of an existing HVAC system are being replaced (I.e., equipment, controls, ductwork, and insulation.)

❑ **Exception.** The building or part of the building qualifies for an exception from HVAC code requirements. Applicable code exception is Section 1317.1. Portions of the building that qualify:

Area: _____ Exception ❑ -1 ❑ -2 ❑ -3

Area: _____ Exception ❑ -1 ❑ -2 ❑ -3

Area: _____ Exception ❑ -1 ❑ -2 ❑ -3

❑ **Form Not Required.** This project does not contain work required to comply with code.

Line 1. Applicability

Check the **Form Required** box if a new HVAC system is being installed, or components of an existing HVAC system is being replaced (i.e., equipment, controls ductwork, and insulation.)

Exceptions – Section 1317 has three exceptions to HVAC code requirements:

Exception 1, Systems for the removal of flammable vapors or residues;

Exception 2, Systems for conveying dust, stock or refuse by means of air currents;

Exception 3, Systems for manufacturing and industrial processes.

If any of the HVAC systems in your project qualifies for any of these exceptions, check appropriate box and identify which systems and portions of the building qualify for the exception. Check the **Form Not Required** if no new HVAC system is being installed, and components of an existing HVAC system are not being replaced or exception applies to entire project.

Example

2. Simple or Complex Systems (Section 1317.9 or 1317.10)

❑ **Simple System**. Building contains only Simple HVAC System(s). Complete this form (4a) and equipment efficiency worksheets as required. Form 4b is not required.

☑ **Complex System**. Project includes a Complex System. Complete this form (4a), form 4b and equipment efficiency worksheets as required.

Line 2. Simple or Complex System

Simple System. The following systems qualify as Simple Systems:

1) air cooled, constant volume packaged unitary equipment, packaged terminal air conditioners and packaged terminal heat pumps that provide heating, cooling, or both and that require only external connection to ductwork and energy services;

2) air cooled, constant volume split systems that provide heating, cooling, or both with cooling capacity of 54,000 Btu/hr or less

3) ground-coupled heat pumps with cooling capacity of 54,000 Btu/hr or less;

4) heating only systems with 5,000 cfm maximum airflow or minimum outside air supply of less than 70 percent of total air circulated.

SYSTEMS – GENERAL

* Note: While a VVT (variable air volume and variable temperature) system has a constant volume fan, they are variable air volume and not categorized as a Simple System.

Complex System. All systems that do not qualify as Simple Systems are considered Complex Systems. Projects containing Complex Systems must complete Form B in addition to Form A.

Simple/ Complex System (cont.)

Example

3. Equipment Performance (Section 1317.5)

☐ **No New HVAC Equipment.** The building plans do not call for new electrical HVAC equipment, combustion heating equipment, or heat-operated cooling equipment.

☑ **Complies**. All new HVAC equipment have efficiencies not less than those required by code. The following equipment efficiency worksheets are attached:

☑ -4a ☐ -4b ☐ -4c ☐ -4d ☐ -4e ☐ -4f ☐ -4g ☐ -4h ☐ -4i ☑ -4j

Line 3. Equipment Performance

Use worksheets 4a through 4j to list all equipment that will be installed. Code-compliant equipment efficiency values are provided on the worksheets. Include the worksheets that pertain to your building. The national rating organization listed on the form, such as the Air-conditioning and Refrigeration Institute (ARI) or the Gas Appliance Manufacturers Association (GAMA) must certify the efficiencies claimed.

Attach a copy of manufacturer's catalog sheet, which contains the pertinent required performance information for each piece of equipment.

Leave this section blank if new HVAC equipment is not installed.

Equipment Efficiency

Heating and cooling equipment shall have a minimum efficiency at a specified rating condition not less than values shown in tables located on the bottom of each worksheet, which are derived from Tables 13-G, 13-H, 13-I, or 13-J of the Oregon Structural Specialty Code.

Electric thermal resistance heating is assumed to operate at 100 percent thermal efficiency. Room air conditioners are portable units and are not normally shown on drawings. Therefore, tables and worksheets do not list electric resistance air heaters or room air conditioners.

Data furnished by the equipment supplier or certified under a nationally recognized certification program or rating procedure satisfy these requirements.

Equipment Definitions

Equipment Definitions

CONDENSING UNITS. A commercial and industrial air-conditioning condensing unit is a factory-made assembly of refrigeration components designed to compress and liquefy a specific refrigerant. It consists of one or more refrigerant compressors, refrigerant condensers (cooling coil), condenser fans and motors (where used) and factory-supplied accessories.

GROUND-WATER-SOURCE HEAT PUMP. A water source heat pump that exchanges heat to and from a loop thermally connected to ground temperature (several feet below grade).

HEAT-OPERATED COOLING EQUIPMENT Heat-operated cooling equipment refers to a chiller that consists of absorption, engine-driven and turbine-driven equipment.

PACKAGED TERMINAL AIR-CONDITIONER. An air-conditioner that installs in a wall sleeve and a separate unencased combination of heating and cooling assemblies specified by the builder and intended for mounting through the wall. It includes a prime source of refrigeration, separable outdoor louvers, forced ventilation, and heating availability by builder's choice of hot water, steam or electric resistance heat.

PACKAGED TERMINAL HEAT PUMP. A heat pump installed in a cabinet of similar function and configuration to that of a packaged terminal air-conditioner. It uses reverse-cycle refrigeration as its primary heat source and should have a supplementary heat source: hot water, steam or electric resistance heat.

Equipment Definitions (cont.)

SPLIT SYSTEM. Where such equipment is provided in more than one assembly, the separate assemblies are to be designed to be used together. The ratings are based on the use of matched assemblies.

UNITARY AIR CONDITIONER. A unitary air conditioner consists of one or more factory-made assemblies that normally include an evaporator (cooling coil), a compressor and condenser combination, and may include a heating function.

UNITARY HEAT PUMP. A unitary heat pump consists of one or more factory-made assemblies that normally include an indoor coil (heating coil), compressor and outdoor coil. It may provide a cooling function.

WATER-SOURCE HEAT PUMP. A heat pump consists of one or more factory-made assemblies that normally include an indoor conditioning coil, compressor and a refrigerant-to-water heat exchanger. It provides both heating and cooling.

ARI

The Air-conditioning and Refrigeration Institute (ARI) provides a complete product listing of capacity and efficiency ratings for certain heating and cooling equipment.

To get a copy of the ARI product directory, write to ARI, 1501 Wilson Boulevard, 6th Floor, Arlington, VA 22209, or visit ARI's Web site: *www.ari.org.*

GAMA

The Gas Appliance Manufacturers Association (GAMA) provides complete product listings of capacity and efficiency ratings for oil- and gas-fired residential heating equipment up to 135,000 Btu/hr capacity.

To get a copy of the GAMA consumers' directory, write to GAMA Efficiency Certification Program, ETL Testing Laboratories, Inc., Industrial Park, Route 11, Cortland, NY 13045, or visit GAMA's Web site: *www.gamanet.org*

Example

4. Duct Insulation and Sealing (Sections 1317.7 & 1317.8)

❑ **No Ducts.** The building plans and specifications do not call for new HVAC ducts or plenums.

☑ **Complies**. The plans and specifications call for all air-handling ducts and plenums to be insulated and sealed as required by Sections 1317.7 &1317.8.

Line 4. Duct Insulation and Sealing

Check the **No Ducts** box if project does not call for new HVAC ducts or plenums.

Insulation – Complies: All air–handling ducts and plenums installed as part of an HVAC air distribution system shall be thermally insulated according to Table 13-S based on ductwork type and location. This does not include factory-installed plenums, casings or ductwork furnished as a part of HVAC equipment. For ducts that convey both heated and cooled air, duct insulation shall be the highest R-value specified in Table 13-S. Insulation for ducts located outside of the insulated building envelope shall be covered by a vapor barrier having a perm rating not exceeding 0.5 perm.

Where a plenum incorporates an exterior wall, ceiling, or floor of a building, those elements shall be insulated either as required for that building envelope component or Table 13-S, whichever have the highest specified R-value.

Insulation is not required on heating, cooling, return air ducts or plenums that are contained within fully conditioned spaces. Ducts conveying outside air, which are within fully conditioned spaces shall be insulated to a minimum R-value of 3.5 .

Sealing – Complies: All joints, longitudinal and transverse seams, and connections in ductwork, shall be securely fastened and sealed with welds, gaskets, mastics (adhesives), mastic-plus-embedded-fabric systems, or approved quality tapes (UL 181A-98 and UL181B-98). Cloth backed, rubber adhesive tape does not comply.

SYSTEMS – GENERAL

Example

5. Distribution Transformers (Section 1316.1)

☐ **No Distribution Transformers.** The plans/specs do not call for new distribution transformers.

☑ **Complies**. All new distribution transformers comply with efficiency, testing, and labeling requirements of Section 1316.1.1.

☐ **Exception.** The project qualifies for an exception per Section 1316.1.1, Exceptiion:

☐-1 ☐-2 ☐-3 ☐-4 ☐-5 ☐-6 ☐-7 ☐-8 ☐-9 ☐-10 ☐-11 ☐-12 ☐-13 ☐-14

Attach relevant documentation for appropriate exception. The plans/specs show compliance in the following locations:

Line 5. Distribution Transformers

Complies. All new distribution transformers comply with efficiency, testing, and labeling requirements of minimum efficiency levels specified in Table 13-J and Table 13-K and the testing and labeling requirements of Sections 1316.1.2 and 1316.1.3.

Exceptions. Section 1316.1.1 contain 14 exceptions under which the transformer efficiency requirements do not apply:

1. Liquid-filled transformers below 10 kVA.
2. Dry-type transformers below 15 kVA.
3. Drive transformers designed only to operate electronic variable speed AC and DC drives.
4. Rectifier transformers designed only to power rectifier circuits that have nameplate ratings for fundamental frequency and RMS.
5. High harmonic transformers with a K-rating of K-4 or greater that are designed to supply loads with higher than normal harmonic current levels. A licensed engineer shall submit verification of need for harmonic current control.
6. Autotransformers in which the primary and secondary windings are not electrically isolated, and in which secondary voltage is derived from at least a portion of the primary winding as specified by a licensed engineer.
7. Non-distribution transformers, such as those designed as an integral part of an uninterruptible power system (UPS).
8. Transformers with special impedance outside the following ranges: 1.5% to 7.0% for 15 kVA – 150 kVA units, 3.0% to 8.0% for 167 kVA - 500 kVA units, and 5.0% to 8.0% for 667 kVA –2500 kVA units.
9. Voltage regulating transformers with load tap changing gear.
10. Sealed transformers that are designed to remain hermetically sealed and non-ventilated transformers designed to prevent airflow through the transformer.
11. Replacement of an existing transformer where a qualified TP-1 transformer will not fit in the space provided.
12. Transformers feeding circuits dedicated to machine tools and/or welders.
13. Transformers with tap ranges greater than 15% or with frequencies other than 50 to 60 Hz.
14. Grounding transformers that only provide a system ground reference point, or testing transformers that are part of, or supply power to, electrical test equipment.

Example

6.1 System Thermostat/Zone Controls (Section 1317.4.1)

☑ **Complies**. All new HVAC systems include at least one temperature control device responding to temperatures within the zones.

☐ **Exception.** HVAC system qualifies for an exception from zone control requirements.

The applicable code exception is Section 1317.4.2, Exception ☐-1 ☐-2

Portions of the building that qualify:

The plans/specs show compliance in the following locations:

Sheet M2.1 and Section 15500, 2.3, A

Line 6.1 System Thermostatic/Zone Controls

Complies. The code requires each new HVAC zone to be controlled by individual thermostatic controls responding to temperature within each zone.

Exceptions. Independent perimeter systems that offset only envelope heat losses or gains, or both, may serve one or more zones also served by an interior system with the following limitations:

Exception 1, The perimeter system shall include at least one thermostatic control zone for each building exposure having exterior walls facing only one orientation for 50 contiguous feet or more; or

Exception 1, The perimeter system heating and cooling supply shall be controlled by thermostat(s) located within the zone(s) served by the system.

If your project qualifies for any of these exceptions, check appropriate box and identify which portions of the building qualify for the exception.

Identify the location in the plans and *specific location within* specifications where the zone and system controls are specified. For example – Sheet M2.1 and Section 15500, 2.3, A, simply inserting Section 15500 is not acceptable. Leave this section blank if new System or Zone Controls are not installed.

Example

6.2 Off-hour Controls - Auto Setback or Shutdown (Section 1317.4.3)

☑ **Complies.** Systems must have **at least one** of the following features:

☑ **Control Setback Complies.** Each system is equipped with automatic control capable of reducing energy through control setback during periods of non-use or alternate use of spaces served.

❑ **Equipment Shutdown Complies.** Each system is equipped with controls capable of reducing energy use through automatic shutdown during periods of non-use or alternate use of spaces.

- ❑ HVAC systems with equipment shutdown are equipped with at least one of the following:
- ❑ Programmable controls (1317.4.3.1 (1))
- ❑ Occupant sensor (1317.4.3.1 (2))
- ❑ Interlocked to a security system (1317.4.3.1 (3))
- ❑ Manually activated timers with 2-hour operation max (1317.4.3.1 (4))

❑ **Exception.** The building qualifies for an exception to the requirement for automatic setback or shutdown controls. The applicable code exception is Section 1317.4.3 Exception ❑ -1 ❑ -2

The plans/specs show compliance in the following locations:

Sheet M2.1 and Section 15500, 2.3, B

Line 6.2 Off-hour Controls – Automatic Setback or Shutdown

Complies. The Code requires new HVAC systems to be equipped with automatic controls capable of accomplishing a reduction of energy use through control setback or equipment shutdown during periods of nonuse or alternate use of the spaces served by the system.

To provide **automatic shutdown**, the HVAC system shall be equipped with at least one of the following:

(a) Controls that can start and stop the system under different time schedules for seven different day-types per week, are capable of retaining programming and time setting during loss of power for a period of at least 10 hours, and that include an accessible manual override, or equivalent function, that allows temporary operation of the system for up to two hours.

(b) An occupant sensor that is capable of shutting the system off when no occupant is sensed for a period of up to 30 minutes.

(c) An interlock to a security system that shuts the system off when the security system is activated.

Automatic shutdown is not required for systems controlled only by manually activated timers with a maximum of two-hour operation.

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Exceptions. The code has two exceptions to the requirement for automatic control setback or equipment shutdown:

Exception 1, Equipment with full load demand of 2 kW (6,826 Btu/hr.) or less may be controlled by readily accessible manual off-hour controls.

Exception 2, Systems intended to operate continuously.

If your project qualifies for any of these exceptions, check appropriate box and identify which portions of the building qualify for the exception.

Identify the location in the plans and *specific location within* specifications where the off-hour controls or specific sequence of operations are specified. For example – Sheet M2.1 and Section 15500, 2.3, A, simply inserting Section 15500 is not acceptable.

Leave this section blank if new System or Zone Controls are not installed.

Example

6.3 Control Capabilities (Sec. 1317.4.2.1)

☑ **Complies.** Zone thermostats are capable of being set to the temperatures described in Sec. 1317.4.2.1. Where used to control both heating and cooling, zone controls shall be capable of providing a temperature range or 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.

❑ **Exception.** The building qualifies for an exception to the deadband requirements.
The applicable code exception is Section 1317.4.2.1 Exception ❑ -1 ❑ -2

Portions of the building that qualify:

The plans/specs show compliance in the following locations:

Sheet M2.1 and Section 15500, 2.3, C

Line 6.3 Control Capabilities

Complies. The Code requires each new HVAC zone to be equipped with a thermostatic control capable of being set locally or remotely down to 55ºF (13ºC) for heating. Where used to control comfort cooling, it must be capable of being set locally or remotely up to 85ºF (29ºC). Where used to control both comfort heating and cooling, zone thermostatic controls shall be capable of providing a temperature range or dead band of at least 5ºF (3ºC).

Exceptions. The code has two exceptions to the thermostat deadband requirements:

Exception 1, Special occupancy, special usage, or code requirements where deadband controls are not appropriate (such as process applications and areas of hospitals normally used by patients).

Exception 1, Thermostats that require manual changeover between heating and cooling modes.

If your project qualifies for any of these exceptions, check appropriate box and identify which portions of the building qualify for the exception.

Identify the location in the plans and *specific location within* specifications where the control capabilities are specified. For example – Sheet M2.1 and Section 15500, 2.3, A, simply inserting Section 15500 is not acceptable.

Leave this section blank if new System or Zone Controls are not installed.

6.4 Optimum Start Controls (Section 1317.4.3.2)

☑ **Complies.** Separate HVAC systems have controls capable of varying start-up time of system to just meet temperature set point at time of occupancy.

❑ **Exception.** HVAC systems have a design supply air capacity not exceeding 10,000 cfm.
The plans/specs show compliance in the following locations:

Sheet M2.1 and Section 15500, 2.3, D

Line 6.4 Optimum Start Controls

Complies. Separate HVAC systems, with a design supply air capacity exceeding 10,000 cfm, have controls that are capable of varying start-up time of system to just meet temperature set point at time of occupancy.

Exception. Check the exception box if HVAC systems have a design supply air capacity not exceeding 10,000 cfm.

Identify the location in the plans and *specific location within* specifications where the optimum start controls or specific sequence of operations are specified. For example – Sheet M2.1 and Section 15500, 2.3, A, simply inserting Section 15500 is not acceptable.

Leave this section blank if new Off-hour Controls are not installed.

6.5 Heat Pump Controls (Section 1317.4.4)

☑ **No Heat Pump.** The plans/specs do not call for a new heat pump

❑ **Complies**. All new heat pumps equipped with supplementary heaters are controlled to minimize the use of supplemental heat as defined in Section 1317.4.4.

The plans/specs show compliance in the following locations:

Line 6.5 Heat Pump Controls

Complies. Heat pumps equipped with supplementary heaters must be installed with controls to prevent heater operation when the heating load can be met by the heat pump alone. Controls 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). A two-stage room thermostat that controls the supplementary heat in its second stage meets this requirement.

Supplementary heating is allowed during periods of less than 15 minutes for start-ups and defrost cycles.

Identify the location in the plans and *specific location within* specifications where the heat pump supplemental heat controls or specific sequence of operations are specified. For example – Sheet M2.1 and Section 73500, 2.3, A, simply inserting Section 73500 is not acceptable.

Leave this section blank if a new Heat Pump or Heat Pump Controls are not installed.

7. Economizer Cooling (Section 1317.3)

❑ **No Cooling.** The building plans do not call for a new fan system with mechanical cooling.

☑ **Complies**. Each new fan system has an air economizer capable of modulating outside-air and return-air dampers to provide up to 100 percent of the design supply air as outside air.

❑ **Exception** At least one new fan system qualifies for an exception. The applicable code exception is Section 1317.3, Exception ❑ -1 ❑ -2 ❑ -3 ❑ -4 ❑ -5 ❑ -6

If Exception 3 is selected complete the following:

(a) Total cooling capacity of exempt units (Btu/hr)

(b) Total installed building cooling capacity (Btu/hr)

❑ **Complies.** Sum of exempt units rated at less than 54,000 Btu/hr is <240,000 or a/b < 0.10 (10% of total building cooling capacity).

Unit Identifier of exempt units:

The plans/specs show compliance in the following locations:

Sheet M2.1 and Section 73500, 2.3, A

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Line 7. Economizer Cooling

. Check the **No Cooling** box if project does not call for a mechanical cooling.

. **Complies.** Section 1317.3 of the code requires that each fan system with mechanical cooling has an outside air economizer and that the economizer be capable of providing partial cooling even when additional mechanical cooling is required to meet the remainder of the cooling load. There are, however, a number of exceptions to this requirement.

Exceptions – The following exceptions from Section 1317.3 apply to both Simple and Complex Systems:

Exception 1, Systems at locations where the quality of the outdoor air is so poor as to require extensive treatment of the air. Supporting documentation regarding air quality inadequacies should be submitted.

Exception 2, Systems serving only residential spaces and hotel or motel guest rooms.

Exception 3, Cooling equipment with direct expansion coils rated at less than 54,000-Btu/hr. (15,827 W) total cooling capacity. It is important to note that the total capacity of all such units without economizers shall not exceed 240,000 Btu/hr per building area served by one utility meter or service, or 10% of the building's total installed cooling capacity, whichever is greater. For example a building with 300 tons (3,600,000 Btu/hr) total cooling capacity would be allowed to install a maximum of 360,000 Btu/hr (10% of building total) of equipment that meets this exception. That portion of the equipment serving dwelling units and guestrooms is not included in determining the total capacity of units without economizers allowed by this exception.

Exception 4, Systems having a water economizer system capable of cooling air by direct and/or indirect evaporation and providing 100 percent of the expected systems cooling load at outside air temperatures of 50ºF (10ºC) dry bulb and 45ºF (7ºC) wet bulb and below.

Exception 5, Ground-coupled heat pumps with cooling capacity of 54,000 Btu/hr. (15,827 W) or less.

Exception 6, Internal/external zone heat recovery is used. An example of a system that would qualify for this exception would be water source heat pumps with both interior and exterior zones served off of the same hydronic loop. This system removes heat from interior zones during cooling and transfers it to the loop where it can be used by perimeter zones in heating mode. Similarly, systems in which a heat recovery chiller is used to provide cooling for interior zones and heating for perimeter zones may also qualify.

If your project qualifies for any of these exceptions, check appropriate box and identify which portions of the building qualify for the exception.

Identify the location in the plans and *specific location within* specifications where the economizer is specified. For example – Sheet M2.1 and Section 73500, 2.3, A, simply inserting Section 15500 is not acceptable.

Example

8. Economizer Pressure Relief & Integration (Section 1317.3.1 and 1317.3.2)

❑ **No Economizers Required.** Project does not contain a new fan system requiring economizers.

❑ **Overpressurization Complies**. The drawings specifically identify a pressure relief mechanism for each fan system that will relieve the extra air introduced by the economizer.

☑ **Integration Complies**. Economizer is capable of providing partial cooling even when additional mechanical cooling is required to meet the remainder of the cooling load.

❑ **Exception.** The applicable exception is Section 1317.3.2, Exception ❑ -1 ❑ -2

The plans/specs show compliance in the following locations:

Sheet M2.1 and Section 15500, 2.3, A

Line 8. Economizer Cooling – Pressure Relief and Integration

. Check the **No Economizers Required** box if project does not call for a fan system requiring economizers.

Overpressurization Complies. A means to preventing over-pressurization of the building during air economizer operation is required. Buildings can meet this requirement several ways. Most rooftop units have built-in pressure relief. This will be indicated in the manufacturer's

Economizer Cooling (cont.)

literature. For systems without built-in pressure relief, relief dampers can be installed virtually anywhere in the building envelope.

There are no exceptions to the requirement for relief from economizer over-pressurization.

Integration Complies. The economizer must be capable of providing partial cooling even when additional mechanical cooling is required to meet remainder of cooling load.

Exceptions – The exceptions in Section 1317.3.2 apply to both Simple and Complex Systems There are four exceptions in Section 1317.3 to the requirement for integrating mechanical cooling with economizer cooling:

Exception 1, Direct–expansion systems may include controls to reduce the quantity of outdoor air as required to prevent coil frosting, but not less than required for ventilation purposes, at the lowest step of compressor unloading.

Exception 2, Individual direct–expansion units that have a cooling capacity of 15 tons (53 kW) (nominal) or less may use economizer controls that preclude economizer operation whenever mechanical cooling is required simultaneously.

If your project qualifies for any of these exceptions, check appropriate box and identify which systems and portions of the building qualify for the exception.
Identify the location in the plans and *specific location within* specifications where the economizer operation or sequence of operations is specified. For example – Sheet M2.1 and Section 15500, 2.3, A, simply inserting Section 15500 is not acceptable.

Line 9. Hot Gas Bypass

No Hot Gas Bypass: Check this box if no cooling equipment in the project utilizes hot gas bypass or there is no cooling equipment.

Complies: The use of hot gas bypass is limited. Indicate the Unit ID, Rated Cooling Capacity, and Hot Gas Bypass Capacity in the provided table within the form. The capacity of hot gas bypass shall be limited as indicated below (this table is also in the form). Cooling systems shall not use hot gas bypass or other evaporative pressure control systems unless the system is designed with multiple steps of unloading or continuous capacity modulation.

Rated Capacity	Max Hot Gas Bypass Capacity (% of total capacity)
≤240,000 Btu/hr	50%
>240,000 Btu/hr	25%

Exception: Check this box there is hot gas bypass only in unitary packaged systems with cooling capacity no greater than 90,000 Btu/hr.

Example

10. Shutoff Dampers (1317.4.3.3)

☐ **Not Required.** Shutoff dampers are not required on this project.
☑ **Complies.** Each outdoor air supply & exhaust system shall be equipped with motorized dampers.
☐ **Exception.** The building qualifies for an exception to the motorized damper requirement. The applicable code exception is Section 1317.4.3.3 Exception ☐ -1 ☐ -2 ☐ -3 ☐ -4 ☐ -5 ☐ -6

The plans/specs show compliance in the following locations:

Sheet M2.1 and Section 15500, 2.3, A

Line 10. Shutoff Dampers

Not Required. Check this box if there are no outside air supply or exhaust systems.

Complies. Check this box if outdoor air supply and exhaust systems are equipped with motorized control dampers.

Exceptions: The code has seven exceptions to the requirement for motorized dampers:

1. .Systems with a design outside air intake or exhaust capacity of 300 cfm (141.6 L/s) or less.

2. Combustion air intake.

3. Cooling equipment rated at less than 54,000 Btu/hr (15,827 W) total cooling capacity.

4. Power relief fans with gravity dampers for packaged HVAC systems under 300,000 Btu/h cooling capacity.

5. Hood vents or ventilators with gravity dampers in buildings less than three stories in height above grade.

6. Ventilation systems serving unconditioned spaces.

7. Type 1 kitchen exhaust hoods.

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If your project qualifies for any of these exceptions, check appropriate box and identify which portions of the building qualify for the exception. Identify the location in the plans and *specific location within* specifications where the shutoff damper controls are specified. For example – Sheet M2.1 and Section 15500, 2.3, A, simply inserting Section 15500 is not acceptable.

Identify the location in the plans and *specific location within* specifications where the motorized dampers are shown.

Example

10.1. Shutoff Damper Controls (Section 1317.4.3.3.1)

☑ **Complies.** Outdoor air supply and exhaust systems shall be provided dampers that automatically shut when systems or spaces served are not in use or during building warm-up, cooldown, or setback.

❑ **Complies.** Stair and shaft vents are capable of being automatically closed during normal building operation and interlocked to open as required by fire and smoke detection systems.

The plans/specs show compliance in the following locations:

Sheet M2.1 and Section 15500, 2.3, A

Line 10.1 Shutoff Damper Controls

Complies (General): Outdoor air supply and exhaust systems dampers are controlled to automatically shut when systems or spaces served are not in use or during building warm-up, cool down, or setback.

Stair and shaft vents, and gravity hoods, vents and ventilators have controls to automatically close dampers when the building is not occupied.

Complies (Stair and shaft vents): Stair and elevator shaft vents are provided with dampers that automatically close during normal building operation and are interlocked to open as required by fire and smoke detection systems. Identify the location in the plans and *specific location within* specifications where the shutoff damper controls are called out.

Example

10.2. Motorized Damper Leakage (1317.4.3.3.2)

❑ **Complies.** Motorized outdoor air supply and exhaust air dampers have a maximum leakage rate of 4 cfm/ft2 at 1.0 in w.g. when tested in accordance with AMCA Standard 500-1998.

☑ **Exception.** Packaged HVAC equipment may have maximum leakage rate of 20 cfm/ft^2 at 1.0 in w.g. when tested in accordance with AMCA Standard 500–1998.

The plans/specs show compliance in the following locations:

Sheet M2.1 and Section 15500, 2.3, A

Line 10.2 Motorized Damper Leakage

Complies. Check this box if outdoor *air supply and exhaust air dampers* have a maximum leakage rate of 4 cfm/ft^2 at 1.0 in w.g. when tested in accordance with AMCA Standard 500 - 1998.

Exception: The code has one exception to the requirement for motorized damper leakage. Packaged HVAC equipment 20 cfm/ft2 (10 L/c per m2) at 1.0 in w.g. when tested in accordance with AMCA standard 500D 1998.

Identify the location in the plans and *specific location within* specifications where the damper leakage rate is specified. For example – Sheet M2.1 and Section 15500, 2.3, A, simply inserting Section 15500 is not acceptable.

Example

11. Piping Insulation (Section 1314)

☑ **No New Piping.** The building plans and specifications do not call for new piping serving a heating or cooling system or part of a circulating service water heating system.

❑ **Complies.** All new piping serving a heating or cooling system or part of a circulating service water heating system complies with the requirements of the Code, Section 1314.1.

❑ **Exception.** New piping qualifies for exception: Section 1314.1, Exception ❑ -1 ❑ -2

Line 11. Piping Insulation

Check the **No New Piping** box if project does not call for new piping serving a heating or cooling system, or part of a circulating service water heating system.

Complies: All new piping serving a heating or cooling system or part of a circulating service water heating system complies with the requirements of the Code, Section 1314.1. and Table 13-D.

Exceptions – Piping insulation, except when needed to prevent condensation, is not required in any of the following:

Exception 1, Factory-installed piping within HVAC equipment or

Exception 2, Piping that conveys fluids with a design operating temperature range between 55 and 105 degrees F.

If your project qualifies for any of these exceptions, check appropriate box and identify which portions of the building qualify for the exception.

Example

12. Occupancy Ventilation

☑ **Complies.** Mechanical ventilation systems provide the required amount of ventilation specified in Chapter 4 of the Oregon Mechanical Specialty Code.

❑ **Complies**. Natural ventilation systems provide required amount of ventilation as certified by a registered architect or engineer as specified by Section1203.4.1, Exception. Attach worksheet 4m.

The plans/specs show compliance in the following locations:	Sheet M2.1 and Section 15500, 2.3, A
The plans/specs show compliance on the following pages:	

Line 12, Occupancy Ventilation

Complies (Mechanical): Mechanical ventilation systems providing the required amount of ventilation specified in Chapter 4 (Section 403.3) of the Oregon Mechanical Specialty Code are provided. The anticipated ventilation occupancy load and occupancy ventilation design methods are documented on plans and specifications. *Most systems incorporate outside air distributed through a mechanical system.*

Complies (Designed Natural): A designed natural ventilation systems provides the amount of ventilation required by Chapter 4 (Section 403.3) of the Oregon Mechanical Specialty Code as demonstrated by standard calculations provided by a licensed Professional Engineer or Architect. Attach a completed Worksheet 4m along with the calculations that are signed and stamped by a Professional Engineer.

Complies (Prescriptive Natural): A natural ventilation systems meets the requirements of Chapter 12 (Section 1203.4.4.2)

Specify the location in the plans and *specific location within* specifications where the anticipated ventilation occupancy load and occupancy ventilation design methods are documented. For example – Sheet M2.1 and Section 15500, 2.3, A, simply inserting Section 15500 is not acceptable.

Leave this section blank if a new HVAC is not being installed.

SYSTEMS – GENERAL

Example

13. High Occupancy Ventilation (Section 1317.2.2)

☐ **Complies.** HVAC systems with ventilation air capacities of 1,500 CFM or greater that serve areas having an average occupant load of 20 square feet per person or less from Table 1004.1.2 have a means to automatically reduce outside air intake.

Identify applicable systems:

Plans/specs indicate where equipment (i.e. carbon dioxide sensor) and sequence is specified:

☐ **Exception.** HVAC systems are equipped with an energy recovery device with at least 50% recovery effectiveness.

☑ **No High Occupancy Systems.** Project does not contain an HVAC system as described above.

Line 13. High Occupancy Ventilation

Complies: All HVAC systems with ventilation air capacities of at least 1,500 CFM and serving areas having an ***average*** occupant load factor of 20 or less (as established in Table 10-A of the *Oregon Structural Specialty Code*) include a means to automatically reduce outside air intake below design rates when spaces are partially occupied. Large rooms served by multiple systems with a combined ventilation air capacity of 1,500 CFM and an occupant load factor of 20 or less must also meet this requirement.

It is important to note that his requirement applies to each HVAC system that has *both* "ventilation air" (not supply air) capacity of 1,500 CFM or greater AND serves area(s) that have an *average* occupancy load of 20 square feet per person or less. Both of these conditions must exist for this requirement to apply.

For example; An HVAC system with 2,000 CFM of outside air supplying mostly office space (at 100 square feet per person) yet also serving a conference room (at 15 square feet per person) would not require High Occupancy Ventilation Control – as the *average* occupant load for area served by system is greater than 20 square feet. This requirement would be applicable if an HVAC system primarily served conference rooms and a small office area – where the *average* occupant load for area served by the system is less than 20 square feet.

Identify on the in the space provided, which systems this requirement is applies to.

Specify the location in the plans and *specific location within* specifications where ventilation control and sequence of operation are specified. For example – Sheet M2.1 and Section 15500, 2.3, A, simply inserting Section 15500 is not acceptable.

No High Occupancy Systems. Check this box if no HVAC systems have at least 1,500 CFM ventilation air and serve areas having an ***average*** occupant load factor of 20 or less

Example

14. Exhaust Air Heat Recovery (Section 1318.3)

☐ **Not Regulated.** HVAC system does not have: 1) design supply air cap. of ≥10,000 cfm, **and** 2) min. outside air supply ≥70%, **and** 3) at least 1 exhaust fan rated at 75% of min outside air supply.

☐ **Complies.** Heat recovery system increases outside air temperature by 20°F (Climte Zone 1) or 30°F (Zone 2) and has provision to provide bypass during air economizer mode.

☑ **Exception.** An HVAC system qualifies for an exception to this requirement. Applicable exception from Section 1318.3 Exception ☑ -1 ☐ -2 ☐ -3 ☐ -4 ☐ -5 ☐ -6 ☐ -7

The plans/specs show compliance in the following locations: Sheet M2.1 and Section 15500, 2.3, A

Exhaust Air Heat Recovery (cont.)

Line 14. Exhaust Air Heat Recovery

If a new HVAC system does not have all of the following:

1. A design supply air capacity of 10,000 cfm (4,720 L/s) or greater,
2. A minimum outside air supply of 70 percent or greater,
3. At least one exhaust fan rated at 75 percent of the minimum outside air supply.

Check the **Not Regulated** box.

Complies: If all of the conditions specified above apply to the system, an exhaust air heat recovery device must be installed. This system must be capable of increasing the outside air supply temperature at design heating conditions by 20°F in Climate Zone 1 and 30°F in Climate Zone 2. A provision shall be made to bypass or control the heat recovery system to permit air economizer operation as required by Section 1317.3.

Exceptions. Section 1317.10.3.1 has three exceptions to the variable speed drive requirements:

Exception 1, HVAC systems with ventilation controls for high occupancy areas per Section 1317.2.2; or

Exception 2, Laboratory systems meeting Section 1317.2.1; or

Exception 3, Systems serving spaces which are not cooled and which are heated to less than 55°F; or

Exception 4, Systems exhausting toxic, flammable, paint exhaust, corrosive fumes, or dust; or

Exception 5, Type 1 kitchen exhaust hoods; or

Exception 6, Where more than 60 percent of the outdoor heating energy is provided from site-recovered or site solar energy; or

Exception 7, Systems that only provide cooling; or

Example

15. Large Volume Fan Systems (Section 1318.4.2.4)

☐ **Not Regulated.** The building plans or specifications do not call for fan systems over 15,000 CFM that serve a single zone and function for the purpose of temperature control.

☑ **Complies.** Fan systems are equipped with variable frequency drive or two speed motor to reduce airflow as required by Section 1318.4.2.3.
The plans/specs show compliance in the following locations: Sheet M2.1 and Section 15500, 2.3, A

Line 15. Large Volume Fan Systems

If a new HVAC system does not call for fan systems over 15,000 CFM that serve a single zone and function for the purpose of temperature control, check the **Not Regulated** box.

Complies: A two-speed motor or variable frequency drive is required for fan systems over 15,000 CFM that serve single zone areas (including but not limited to gymnasiums, cafeterias, auditoriums, and warehouses). The two-speed motor or variable frequency drive is required to reduce airflow based on space thermostat heating and cooling demand, to a maximum 60% of peak airflow or minimum ventilation air requirement as required by Chapter 4 of the Oregon Mechanical Specialty Code, which ever is greater.

Systems where the function of the supply air is for purposes other than temperature control, such as maintaining specific humidity levels or supplying an exhaust system, are not required to comply with Section 1318.4.3.

Specify the location in the plans and *specific location within* specifications where all control, drives, and sequence of operation is specified. For example – Sheet M2.1 and Section 15500, 2.3, A, simply inserting Section 15500 is not acceptable.

SYSTEMS – GENERAL

Example

16. Variable Speed Drives (Section 1317.10.3.1)

☐ **Not Regulated.** The building plans or specifications do not call for fan and pump motors 10 horsepower and greater that serve variable-flow air or liquid systems.

☑ **Complies.** All fan and pump motors 10 hp and greater which serve variable-flow air or liquid systems are controlled by a variable-speed drive.

☐ **Exception.** The building qualifies for an exception to the variable-speed drive requirement.

Portions of the building that qualify: Sheet M2.1 and Section 15500, 2.3, A

Applicable code exception is Section 1317.10.3.1, Exception

The plans/specs show compliance in the following locations:

Line 16. Variable-Speed Drives

If a new HVAC system is not installed, or each HVAC system requires fan and pump motors of less than 10 horsepower, or fan and pump motors of 10 horsepower and greater serve constant flow systems, check the **Not Regulated** box.

Note that a pump serving a hydronic heating or cooling system with 2 or 3-way valves is a variable flow system and if the pump motor is 10 horsepower or greater, would require a variable speed drive. A fan serving an air distribution system with bypass dampers (such as a variable temperature variable volume system VVT) is a variable flow system and if the pump motor is 10 horsepower or greater, would also require a variable speed drive.

Complies. Fan and pump motors 10 horsepower and greater which serve variable-flow air or liquid systems shall be controlled by a variable-speed drive. This includes custom and packaged air handlers serving variable air volume fan systems, heating and cooling hydronic pumping systems with modulating control valves, and cooling tower fans. Variable inlet vanes, throttling valves (dampers), scroll dampers or bypass circuits shall not be allowed.

Exceptions. Section 1317.10.3.1 has three exceptions to the variable speed drive requirements:

Exception 1, Axial vane fans with variable pitch control; or

Exception 2, Dedicated equipment circulation pumps designed to meet minimum flow requirements established by manufacturer, such as boiler or chiller auxiliary circulation pumps; or

Exception 3, Cooling towers designed with two motors (main and small auxiliary motor) or multi-speed motors.

If your project qualifies for any of these exceptions, check appropriate box and identify which portions of the building qualify for the exception.

Specify the location in the plans and *specific location within* specifications where all applicable nameplate motor horsepower is specified. For example – Sheet M2.1 and Section 73500, 2.3, A, simply inserting Section 73500 is not acceptable.

Example

17. Service Water Heating (Sec. 1315)

☑ **No New Water Heating.** The building plans and specifications do not call for new water heaters, hot water storage tanks or service hot water distribution systems.

☐ **Complies.** All new water heaters, hot water storage tanks or service hot water distribution systems comply with the requirements of the Section 1315.

☐ **Exception.** The applicable code exception is Section: Exception:

Portions of the building that qualify:

The plans/specs show compliance in the following locations:

Line 17. Service Water Heating

Check the **No New Water Heating** box if project does not call for new water heaters, hot water storage tanks or service hot water distribution systems.

Complies: Check the Complies box if water heaters, hot water storage tanks or service hot water distribution systems meet the requirements of Section 1315 (reproduced below.)

Exception: There are several exceptions in this section. If one of the exceptions applies to the project, check the exception box, indicate which exception applies and identify the portion of the building or system that the exception applies to.

1315.1 Requirements. All water heaters and hot water storage tanks shall meet the efficiency criteria of Table 13-I. Where multiple criteria are listed in the table; all criteria shall be met.

> **Exception:** Storage water heaters and hot water storage tanks having more than 140 gallons of storage capacity need not meet the standby loss (SL) or heat loss (HL) requirements of Table 13-I if the tank surface area is thermally insulated to R-12.5 and if a standing pilot light is not used.

If your project qualifies for any of these exceptions, check appropriate box and identify which portions of the building qualify for the exception.

Integrated Systems. Service water heating equipment used to provide additional functions (e.g., space heating) as part of a combination (integrated) system shall comply with minimum performance requirements for water heating equipment. (See also Section 1318.4.1.)

1315.3 Non-circulating Systems. The first 8 feet of outlet piping from the hot water storage tank, and the piping between the storage tank and a heat trap, shall be insulated as specified in Table 13-D.

Storage water heaters for non-circulating systems which are not equipped with integral heat traps and which have vertical pipe risers shall be installed with insulated heat traps as close as possible to both the inlet and outlet connections.

Systems without a heat trap to prevent circulation due to natural convection shall be considered circulating systems.

1315.4.1 Pump Operation. Circulating service hot water systems shall be equipped with automatic time switches or other controls that can be set to turn off the system when use of hot water is not required.

Exceptions:

> Exception 1, Where public health standards require 24 hours per day operation of pumps for uses such as swimming pools, spas, and hospitals.
>
> Exception 2, Pumps required to operate solar or waste-heat-recovery pool heating systems.

1315.4.2 Electric Heat Tapes. Electric heat tapes installed to maintain water temperatures in pipes shall have automatic time switches or other controls that can be set to turn off the electricity to the heat tapes when use of hot water is not required.

> **Exception:** Heat tapes installed for freeze protection.

1315.6 Alterations. The requirements of this Section apply to new water heaters, hot water storage tanks, service hot water distribution systems, swimming pools, and spas installed in existing buildings.

If your system meets the terms of any exception, supply the appropriate code section and exception number. Specify those portions of your building that qualify.

Example

18. Swimming Pools, Spas and Hot Tubs (Section 1315.5)

☑ **No New Pools.** The building plans and specifications do not call for new, swimming pools, spas or hot tubs.

❑ **On/Off Controls Complies.** Spa and hot tub heaters are equipped with a readily accessible ON/OFF switch as required by Section 1315.5.1.

❑ **Ventilation Controls Complies.** Pool ventilation system is controlled based on humidity.

❑ **Cover Complies.** All heated pools, hot tubs and spas are equipped with a cover.

❑ **Heat Recovery Complies.** Pools, Spas, and hot tubs, over 200 ft^2 utilize recovered heat as required by Section 1315.5.3.

> ❑ **Exception.** Heat recovery is not necessary as pool is heated by renewable energy or waste heat recovery sources capable of providing at least 70 percent of the heating energy required over an operating season.

SYSTEMS – GENERAL

Line 18. Swimming Pools

If there is now new swimming pool, spa or hot tub within the building, check the **No New Pools** box.

Check the **On/Off Complies** box when all Spas and Hot Tubs heaters are equipped with a readily accessible ON/OFF switch as required by Section 1315.5.1.

Check the **Ventilation Controls Complies** box when pool ventilation systems are controlled based on humidity.

Check the **Cover Complies** box when all heated Pools, Spas and Hot Tubs are equipped with a cover.

Check the **Heat Recovery Complies** box when all heated Pools, Spas and Hot Tubs greater than 200 ft^2 are utilize a heat recovery system that meets on of the following requirements:

1. The ventilating system shall provide a heat recovery of 70 percent at winter design conditions;
2. Heat recovered through dehumidification shall be used to heat pool, spa or hot tub room supply air.

Check the **Exception** box if the pools, spa or hot tub is heated by renewable energy or waste heat recovery sources capable of providing at least 70 percent of the heating energy required over an operating season.

Example

19. Fume Hoods (Section 1317.2.1.)

☑ **No Fume Hoods.** The building plans do not call for fume hood systems that have a total exhaust rate greater than 15,000 cfm.

❑ **Complies**. Fume hood systems have **at least one** of the following features:

- ❑ Variable air volume hood exhaust and room supply systems capable of reducing exhaust and makeup air volume to 50% or less of design values.
- ❑ Direct makeup (auxiliary) air supply equal to at least 75% of the exhaust rate, heated no warmer than 2° F below room set point, cooled no cooler than 3° F above room set point, no humidification added, and no simultaneous heating and cooling used for de
- ❑ Heat recovery systems to precondition makeup air from fume hood exhaust in accordance with 1318.3 - Exhaust Air Energy Recovery, without using any exception.

The plans/specs show compliance in the following locations:

Line 19. Fume Hoods

If there are new fume hoods installed or the sum of the capacities of all fume hoods in the building has an exhaust rate of 15,000 CFM or less, check the **No Fume Hoods** box.

Check the **Complies** box when buildings with fume hood systems having a total exhaust rate greater than 15,000 cfm include at least one of the following features:

1. **Variable air volume hood exhaust** and room supply systems capable of reducing exhaust and makeup air volume to 50% or less of design values.
2. **Direct makeup** (auxiliary) air supply equal to at least 75% of the exhaust rate, heated no warmer than 2° F below room set point, cooled to no cooler than 3° F above room set point, no humidification added, and no simultaneous heating and cooling used for dehumidification control.
3. **Heat recovery** systems to precondition makeup air from fume hood exhaust in accordance with 1318.3 - Exhaust Air Energy Recovery, without using any exception.

If your project includes new fume hoods, select the appropriate check box and specify the location in the plans and *specific location within* specifications where fume hood compliance strategy is specified. For example – Sheet M2.1 and Section 15500, 2.3, A, simply inserting Section 15500 is not acceptable.

Example

20. Parking Garage Ventilation (Section 1317.2.3)

❑ **No Enclosed Garages.** The building plans and specifications do not call for enclosed Group S-2 parking garages with a ventilation exhaust rate greater than 30,000 CFM.

❑ **Complies**. The plans and specifications call for carbon monoxide sensing devices as required by Section 1317.2.3.

☑ **Exception.** Open parking garages.

Line 20. Parking Garage Ventilation

If there is no enclosed parking garages with a ventilation system having an exhaust rate of 30,000 CFM or less, check the **No Enclosed Garages** box.

Complies: Plans and specifications specify carbon monoxide sensing devices as required by Section 1317.2.3 (reproduced below).

> **Exception:** Open parking garages – select this box if the structure meets the requirements for a parking garage that is not enclosed.

1317.2.3 Enclosed parking garage ventilation controls. In Group S-2 parking garages, other than open parking garages, used for storing or handling automobiles operating under their own power having ventilation exhaust rates 30,000 cfm and greater shall employ automatic carbon monoxide sensing devices. These devices shall modulate the ventilation system to maintain a maximum average concentration of carbon monoxide of 50 parts per million during any eight-hour period, with a maximum concentration not greater than 200 parts per million for a period not exceeding one hour. Such system shall be designed to exhaust a minimum of 14,000 cfm (6,608 L/s) for each operating vehicle, but not less than 2.5 percent (or one vehicle) of the garage capacity. Failure of such devices shall cause the exhaust fans to operate in the on position.

Example

21. Kitchen Hoods (Section 1317.11)

☑ **Not Regulated.** The plans/specs do not call for any new kitchen hoods with exhaust capacity greater than 5,000 cfm each.

❑ **Complies**. All new kitchen hoods with a total exhaust capacity greater than 5,000 cfm have at least 50 percent of the required makeup air; (a) unheated or heated to no more than 60°F; and (b) uncooled or evaporatively cooled.

The plans/specs show compliance in the following locations:

Line 21. Kitchen Hoods

If there are new kitchen hoods installed or each kitchen hood system has an exhaust rate of 5,000 CFM or less, check the **Not Regulated** box.

Complies: Kitchen makeup air is required for each kitchen hood exhaust system with a total exhaust capacity greater than 5,000 cfm. Fifty percent of the required makeup air shall be (a) unheated or heated to no more than 60° F; and (b) uncooled or evaporatively cooled.

Specify the location in the plans and *specific location within* specifications where kitchen hood compliance strategy is specified. For example – Sheet M2.1 and Section 15500, 2.3, A, simply inserting Section 15500 is not acceptable.

SYSTEMS – GENERAL

Example

22. Outside Heating Systems (Section 1317.12)

☑ **No Outside Heating Systems.** The plans/specs do not call for new permanently installed heating systems outside the building.

❑ **Complies**. All new permanently installed outside heating systems are radiant gas fired systems controlled by an occupancy sensor or timer switch as required by Section 1317.12.

Line 22. Outside Heating Systems

If there is no new outside heating system (system that is located outside the building envelope) installed, check the **Not Regulated** box.

Complies: Permanently installed heating systems installed outside a building are required to be radiant, gas-fired systems. These heating systems are required to be controlled by an occupancy-sensing device or a timer switch, so that the system is automatically de-energized when no occupants are present.

These systems are most often located in outdoor eating areas and smoking areas of restaurants and bars. Another common location for this system may be at a loading dock.

SYSTEMS – COMPLEX HVAC SYSTEMS

Line 1. Simple or Complex System.

When a project contains a Complex System, Form 4b must be completed in addition to Form 4a. Systems that do not fit the definition of Simple Systems (see Form A, line 2), are considered Complex systems.

Example

2. Air Transport Energy (Section 1318.4.2)

- ❑ **Not Regulated.** Each HVAC system does not have total fan nameplate horsepower of 7.5 HP or greater (include sum of all supply, return, & exhaust fans operating at design conditions).
- ❑ **Brake Horsepower Complies.** The energy demand of all HVAC fan systems meets code requirements. Complete and attach Worksheet 4I.
- ❑ **Nameplate Horsepower Complies.** Selected fan motors have nameplate ratings no larger than is allowed by Section 1318.4.2.3. (Complete Worksheet 4L.)
- ❑ **Exception.** Section 1318.4.2, Exception ❑ -1 ❑ -2 ❑ -3 ❑ -4

Portions of the building that qualify:

The plans/specs show compliance in the following locations:

Line 2. Air Transport Energy

If a new HVAC system is not installed or each HVAC system has a total fan nameplate horsepower of less than 7.5 horsepower, check the **Not Regulated** box.

Brake Horsepower Complies. The energy demand of all HVAC fan systems shall be limited as specified in Sections 1318.4.2.1 and 1318.4.2.2 (of the *Oregon Structural Specialty Code*). For purposes of this requirement, energy demand of a fan system is the sum of motor brake horsepower of all fans operating at **design conditions**, including supply fans, return/exhaust fans and fan-powered terminal units.

If complies is checked, Air Transport Energy Worksheet 4L must be completed. See instructions for completions of Worksheets.

Exceptions. Section 1318.4.2 has four exceptions to the limitation on fan energy demand:

Exception 1, Systems with total fan system motor horsepower of 7.5 hp or less (total of supply and return/exhaust fans).
Exception 2, Individual exhaust fans with fan horsepower of 1 hp or less.
Exception 3, Induction/dilution exhaust fans used in hospitals and laboratories. These specialized fans used increased discharge velocity and often additional outside air to toxic exhaust air away from building air intakes.
Exception 4, Fan-powered, parallel airflow terminal units where the fan does not operate in cooling mode. (Series terminal units that operate when the main fan is running must be included.)

Also note that relief fans that operate only during economizer use to maintain building pressurization are not included since they are not operating at design conditions. There is no specific exception listed for these fans.

If your project qualifies for any of these exceptions, check appropriate box and identify which portions of the building qualify for the exception.

Specify the location in the plans and *specific location within* specifications where all applicable nameplate motor horsepower is specified. For example – Sheet M2.1 and Section 15500, 2.3, A, simply inserting Section 15500 is not acceptable.

Nameplate Horsepower Complies. Selected fan motors have nameplate ratings no larger than is allowed by Section 1318.4.2.3. (Complete Worksheet 4L).

SYSTEMS – COMPLEX HVAC SYSTEMS

Example

3. Cooling Tower Fans (Section 1317.5.4.1)

☐ **No Cooling Tower** There is no cooling tower in this project.

☑ **Complies.** Cooling tower fans have control devices that vary flow by controlling leaving fluid temperature or condenser temperature/pressure of the heat rejection device.

The plans/specs show compliance in the following locations:	Sheet M2.1 and Section 15500, 2.3, A

Line 3. Cooling Tower Fans

If a new cooling tower is not installed or new cooling tower fan or controls are not installed, check the **No Cooling Tower** box.

Complies. Cooling tower fans have control devices that vary airflow in order to control leaving fluid temperature or condenser temperature/pressure of the heat rejection device.

Specify the location in the plans and *specific location within* specifications where all applicable nameplate motor horsepower and sequence of operation is specified. For example – Sheet M2.1 and Section 15500, 2.3, A, simply inserting Section 15500 is not acceptable.

Example

4. Simultaneous Heating and Cooling (Section 1318.2.1)

☐ **No Cooling.** The building HVAC system has no cooling.

☑ **Complies**. Controls prevent reheating, recooling or mixing of mechanically heated and mechanically cooled air.

☑ **Exception.** Code exception is Section 1318.2.1, Exception ☑ -1 ☐ -2 ☐ -3 ☐ -4 ☐ -5
If exception 1 is used, complete and attach Worksheet 4k

Portions of the building that qualify:	All areas servered by VAV terminal units
The plans/specs show compliance in the following locations:	Sheet M2.1 and Section 73500, 2.3, A

Line 4. Simultaneous Heating and Cooling

If new systems do not provide cooling, check the **No Cooling** box.

Complies. The code states that zone thermostatic and humidistat controls shall be capable of sequencing the operation of heating and cooling energy to the zone. Such controls shall prevent: 1) reheating, 2) recooling, and 3) mixing or simultaneous supply of air that has been previously mechanically heated with air that has been previously mechanically cooled.

The simplest way to comply with this requirement is to use separate heating and air conditioning for each zone. Here are some single-zone systems that comply without additional controls, provided that the thermostat and humidity controls are capable of sequencing the supply of heating and cooling to the zone:

- Air handler. The supply fan is constant volume serving a single zone. The cooling and heating system uses chilled and heated water from a central plant.
- Water-source heat pump. The zone supply fan cycles on demand for heating and cooling. The cooling system consists of a cooling tower and circulating pump. The heating system is an electric or fossil fuel boiler.

For some buildings, individual units for each zone often become impractical or expensive. The most common multiple zone system is the Variable Air Volume (VAV) system.

Exceptions. Section 1318.2.1 has five exceptions to the prohibition against simultaneous heating and cooling.

Exception 1, (if exception 1 is taken, user must complete worksheet 4K, instructions below.) Variable air volume (VAV) systems which, during periods of occupancy, are designed to reduce the air supply to each zone to a minimum before reheating, recooling, or mixing takes place. This minimum volume shall be no greater than the larger of the following:

a) 30 percent of the peak supply volume

SYSTEMS – COMPLEX HVAC SYSTEMS

Simultaneous Heating & Cooling (cont.)

b) The minimum required to meet ventilation requirements of this code, unless increasing the volume to critical zones (zones with the highest ratio of outside air to total supply air) beyond the minimum ventilation requirements results in a decrease in overall outside air required by the HVAC system. An increase beyond minimum ventilation rates shall not be applied to more than 20 percent of the zones with reheat, on any one system.

The second part of the above exception was recently added to the code. This exception is provided to allow system designers to optimally solve Equation 6-1 in Standard 62-2001. These equations show that the amount of outdoor air required for a system is a function of how much air is supplied to the "critical zone" in the system. The higher the supply air rate to the critical zone, the less outdoor air is required at the air-handler. The designer would determine which is more energy efficient, increasing outdoor air intake and minimizing reheat at the critical zone, or increasing the supply air rate and reheat energy required at the critical zone and minimizing the outdoor air rate. This "upsizing" of the minimum flow may only be applied to 20% of the zones with reheat on each system. The designer should submit calculations demonstrating that increasing the volume to critical zones reduces overall outdoor air fraction.

c) 0.4 cfm/ft^2 of zone conditioned floor area

Exception 2, Zones where special pressurization relationships or cross-contamination requirements are such that variable-air volume systems are impractical, such as some areas of hospitals and laboratories. Systems which use this exception and supply heated or cooled air to multiple zones shall include controls which automatically reset supply air temperatures by representative building loads or by outside air temperature unless it can be shown that supply air temperature reset increases overall building annual energy costs.

Exception 3, At least 75 percent of the energy for reheating or for providing warm air in mixing systems is provided from a site-recovered or site-generated solar energy source.

Exception 4, Zones where specified humidity levels are required to satisfy process needs, such as computer rooms, museums and areas of hospitals. To claim this exception, these spaces must not be able to maintain required humidity levels with out reheating, recooling, or mixing beyond the amount allowed in exception 1.

Exception 5, Zones with a peak supply air quantity of 300 cfm or less.

If your project qualifies for any of these exceptions, check appropriate box and identify which portions of the building qualify for the exception.

Specify the location in the plans and *specific location within* specifications where all devices are located and sequence of operation is specified. For example – Sheet M2.1 and Section 73500, 2.3, A, simply inserting Section 73500 is not acceptable.

Example

5. Electric Motor Efficiency (Section 1317.10.3 & Table 13-T)

☑ **Not Regulated.** There are no NEMA Design A&B squirrel cage,T-frame induction, permanently wired polyphase motors of one horsepower or more which serve built up HVAC systems.

☐ **Complies**. The efficiency of all regulated motors meets code requirements.

☐ **Exception.** Section 1317.10.3, Exception ☐ -1 ☐ -2

Portions of the building that qualify:	
The plans/specs show compliance in the following locations:	

SYSTEMS – COMPLEX HVAC SYSTEMS

Line 5. Electric Motor Efficiency

If a new electric motor is not being installed, check the **Not Regulated** box.

Complies. NEMA Design A & B squirrel-cage, T-frame induction, permanently wired polyphase (generally three-phase) motors of one horse-power or more shall have a nominal full-load motor efficiency no less than the corresponding values for energy efficient motors provided in Table 13-T. Table 13-T is reproduced at the end of this chapter.

Exceptions. Section 1317.10.3 has two exceptions to the electric motor efficiency requirements:

Exception 1, Motors used in systems designed to use more than one speed of a multi-speed motor

Exception 2, Factory-installed motors for HVAC equipment meeting the equipment efficiency requirements of Section 1317.5 (packaged unitary equipment).

If your project qualifies for any of these exceptions, check appropriate box and identify which portions of the building qualify for the exception.

Specify the location in the plans and *specific location within* specifications where all applicable electric motor horsepower and efficiency is specified. For example – Sheet M2.1 and Section 15500, 2.3, A, simply inserting Section 15500 is not acceptable.

Example

6. VAV System Static Pressure Reset Controls (Section 1318.2.3)

- ☐ **Not Regulated.** The building plans or specifications do not call for a VAV system controlled by a static pressure sensor or direct digital control of individual zone boxes.
- ☑ **Complies.** The system static pressure set point automatically resets to the lowest point possible while still providing the required air flow to the zones with the greatest demand.
- ☐ **Exception.** Section 1318.2.3, Exception

The plans/specs show compliance in the following locations: Sheet M2.1 and Section 15500, 2.3, A

Line 6. Variable Air Volume System Static Pressure Reset Controls

If a new HVAC system does not call for variable air volume, check the **Not Regulated** box.

Complies: The system static pressure set point shall automatically reset to the lowest point possible while still providing the required air flow to the zones with the greatest demand. This is not required for systems that are not controlled by a static pressure sensor or systems without direct digital control of individual zone boxes.

Specify the location in the plans and *specific location within* specifications where all static pressure reset controls and sequence of operation is specified. For example – Sheet M2.1 and Section 15500, 2.3, A, simply inserting Section 15500 is not acceptable.

Example

7. VAV Terminal Units (Section 1317.4.2.1)

- ☐ **Not Regulated.** Project does not contain VAV terminal units.
- ☑ **Complies.** VAV terminal units are programmed to operate at the minimum airflow setting without addition of reheat when the zone temperature is within the set deadband. Complete Worksheet 4k.
- ☐ **Exception.** Section 1317.4.2.1, Exception ☐ -1 ☐ -2

The plans/specs show compliance in the following locations: Sheet M2.1 and Section 15500, 2.3, A

Line 7. Variable Air Volume Terminal Units

If no new HVAC systems call for variable air volume, check the **Not Regulated** box.

Complies: All VAV terminal units are programmed to operate at minimum airflow setting without addition of reheat when the zone temperature is within the set deadband per Section 1317.4.2.1.

Specify the location in the plans and *specific location within* specifications where all air terminal units and sequence of operation are specified. For example – Sheet M2.1 and Section 15500, 2.3, A, simply inserting Section 15500 is not acceptable.

Example

8. Supply-Air Temperature Reset Controls (Section 1318.2.5)

❑ **Not Regulated.** The building plans or specifications do not call for multiple zone HVAC systems.

☑ **Complies.** Multiple zone HVAC systems include controls that automatically reset the supply-air temperatures in response to building loads or outside air temperature.

❑ **Exception.** The building qualifies for an exception to the supply-air reset controls requirement. Applicable code exception is Section 1318.2.5, Exception ❑ -1 ❑ -2 ❑ -3

Portions of the building that qualify:	
The plans/specs show compliance in the following locations:	Sheet M2.1 and Section 15500, 2.3, A

Line 8. Supply-Air Temperature Reset Controls

If no new HVAC systems serve multiple zones, check the **Not Regulated** box.

Complies: Multiple zone HVAC systems include controls that automatically reset the supply-air temperature in response to representative building loads, or to outdoor air temperature. The controls must be capable of resetting the supply air temperature at least 25% of the difference between the design supply-air temperature and the design room air temperature. For example if the cooling design room temperature is 75 deg. F and the cooling design supply air temperature is 55 deg.F, the supply air temperature must be reset a minimum of 5 deg.F. (60 deg. F.), during periods of minimum load.

Exceptions:

Exception 1. Systems that prevent re-heating, re-cooling, or mixing of heated and cooled supply air.

Exception 2. 75% of the energy for reheating is from site-recovered or site solar energy sources.

Exception 3. Zones with peak supply air quantities of 300 cfm or less.

If your project qualifies for any of these exceptions, check appropriate box and identify which portions of the building qualify for the exception.

Specify the location in the plans and *specific location within* specifications where all applicable supply-air temperature reset control and sequence of operation is specified. For example – Sheet M2.1 and Section 15500, 2.3, A, simply inserting Section 15500 is not acceptable.

Example

9. Chilled and Hot Water Temperature Reset Controls (Section 1318.2.4)

☑ **Not Regulated.** The building plans or specifications do not call for chilled or hot water systems with a design capacity exceeding 300,000 Btu/hr.

❑ **Complies.** Chilled and hot water systems include controls that automatically reset supply water temperatures by representative building loads or by outside air temperature.

❑ **Exception.** Section 1318.2.4, Exception ❑ -1 ❑ -2

Portions of the building that qualify:	
The plans/specs show compliance in the following locations:	

Line 9. Chilled and Hot Water Temperature Reset Controls

If a new HVAC system does not call for chilled or hot water systems with a design capacity exceeding 300,000 Btu/hr, check the **Not Regulated** box.

Complies: Controls that automatically reset supply water temperatures by representative building loads (including return water temperature) or by outside air temperature are required for chilled and/or hot water systems with a design capacity exceeding 300,000 Btu/hr.

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Exceptions. Section 1318.2.4 has two exceptions to this requirement:

Exception 1. Where the supply temperature reset controls cannot be implemented without causing improper operation of dehumidifying systems.

Exception 2. Hydronic systems that use variable flow to reduce pumping energy. Since all hydronic systems of 10 hp or greater require variable speed drives (discussed on form 4A, line 21), they should qualify for this exception.

If your project qualifies for any of these exceptions, check appropriate box and identify which portions of the building qualify for the exception.

Specify the location in the plans and *specific location within* specifications where all applicable chilled and hot water temperature reset control and sequence of operation is specified. For example – Sheet M2.1 and Section 15500, 2.3, A, simply inserting Section 15500 is not acceptable.

Example

10. Separate Air Distribution Systems (Section 1318.2.7)

☑ **Not Regulated.** The building plans or specifications do not call for zones with special process temperature or humidity requirements.

☐ **Complies.** Separate air distribution systems serve zones with special process temperature or humidity requirements from those zones serving only comfort conditions, or supplementary control provisions are included so primary systems are specifically controlled for comfort purposes only.

☐ **Exception.** Section 1318.2.7, Exception ☐ -1 ☐ -2

Identify zones with special process requirements:	
The plans/specs show compliance in the following locations:	

Line 10. Separate Air Distribution Systems

If a new HVAC system does not call for zones with special process temperature or humidity requirements, check the **Not Regulated** box.

Complies: Air distribution to zones with special process temperature requirements and/or humidity requirements, such as computer rooms, must be separated from those serving conventional zones that only require comfort conditions. This can be achieved through separate air distribution systems, or by inclusion of supplementary control provisions so that the primary systems may be specifically controlled for comfort purposes only. For instance, a system serving an office occupancy as well as a computer server room that needed additional dehumidification would be allowable, if the there was a secondary dehumidification coil on the branch duct serving server room controlled by a humidistat within the server room.

Exceptions. Section 1318.2.7 has two exceptions to this requirement:

Exception 1, The total supply air to those comfort zones is no more than 25% of the total system supply air.

Exception 2, The total conditioned floor area of the zones is less than 1,000 square feet.

If your project qualifies for any of these exceptions, check appropriate box and identify which portions of the building qualify for the exception.

Specify the location in the plans and *specific location within* specifications where all applicable systems and control, and sequence of operation are specified. For example – Sheet M2.1 and Section 15500, 2.3, A, simply inserting Section 15500 is not acceptable.

Example

11. Zone Isolation Controls (Section 1318.2.6)

❑ **Not Regulated.** Building plans or specifications do not call for HVAC systems serving multiple occupancies or floors with ≥240,000 Btu/hr cooling capacity, or ≥300,000 Btu/hr heating capacity.

☑ **Complies.** HVAC systems serving multiple occupancies or floors with >240,000 Btu/hr cooling capacity, or >300,000 Btu/hr heating capacity are equipped with isolation devices capable of automatically shutting off supply air to and from each isolated area. Each isolated area is controlled independently and satisfies temperature setback (Section 1317.4.2) and optimum start control requirements. Central fan system air volume is reduced through fan speed reduction.

The plans/specs show compliance in the following locations:	Sheet M2.1 and Section 15500, 2.3, A

Line 11. Zone Isolation Controls

If a new HVAC system does not call for systems serving multiple occupancy groups or floors with 240,000 Btu/hr or greater cooling capacity, or 300,000 Btu/hr or greater heating capacity, check the **Not Regulated** box.

Complies. Systems serving multiple occupancies or floors are required to be equipped with isolation devices capable of automatically shutting off the supply air (conditioned and outside) to and from each isolated area. Each isolated area must be controlled independently and satisfy temperature setback (Section 1317.4.2) and optimum start control requirements. The central fan system air volume is reduced through fan speed reduction. A typical VAV system could comply if terminal units serving different floors or occupancies are controlled to completely shut off supply air to each floor or occupancy independently while other floors or occupancies still receive supply air.

Specify the location in the plans and *specific location within* specifications where all applicable isolation control and sequence of operation is specified. For example – Sheet M2.1 and Section 15500, 2.3, A, simply inserting Section 15500 is not acceptable.

Example

12. Humidity Controls (Section 1318.2.2)

☑ **No Moisture Added to Building.** The building plans do not call for means to add moisture to maintain specific humidity levels.

❑ **Complies**. All new humidity control systems equipped with a humidistat when required. All humidifier preheating devices have an automatic value to shut off preheat when humidification is not required.

The plans/specs show compliance in the following locations:	

Line 12. Humidity Controls

If a new HVAC system does not add moisture to the supply air (humidify), check the **No Moisture Added to Building** box.

Complies. If a system is equipped with a means for adding moisture to maintain specific humidity levels in a zone or zones, a humidistat shall be provided. This device shall be capable of being set to prevent the use of fossil fuel or electricity to produce relative humidity in excess of 30 percent for comfort purposes. Where a humidistat is used for comfort dehumidification, it shall be capable of being set to prevent the use of fossil fuel or electricity to reduce relative humidity below 60 percent. Humidifiers with preheating devices mounted in the airstream shall be provided with an automatic valve to shut off preheat when humidification is not required.

Specify the location in the plans and *specific location within* specifications where all applicable humidity control is specified. For example – Sheet M2.1 and Section 15500, 2.3, A, simply inserting Section 15500 is not acceptable.

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Example

13. Hydronic System Controls (Section 1318.2.8)
☐ **No Hydronic System.** The building plans or specifications do not call for a new hydronic system.
☑ **Complies.** The hydronic system complies as follows:

Line 13. Hydronic System Controls

If a new HVAC system does not call for a new hydronic system, check the **No Hydronic System** box.

If the system meets the required hydronic system controls as follows check the **Complies** box:

Each of the following requirements has its own **Complies** box which should be checked if the system meets the requirement.

Example

13.1 Variable Flow Controls (Section 1318.2.8.4)
☑ System does not have a 10 hp or greater motor
☐ Complies. System has controls capable of varying pump flow

The plans/specs show compliance in the following locations:	Sheet M2.1 and Section 15500, 2.3, A

13.1 Variable Flow Controls

If the hydronic system does not have a 10 hp or greater motor check the box stating "system does not have a 10 hp or greater motor"

If the hydronic system does have a 10 hp or greater motor that is controlled with a variable speed drive, check the box that says "**Complies. System has controls capable of varying pump flow"**

Example

13.2 Three-Pipe System (Section 1318.2.8.1)
☑ System does not have a common return system (a three-pipe system) for both hot water and chilled water.

13.2 Three-Pipe System.

If there is no three-pipe system in the building check the box that says, **"Hydronic systems that use a common return system for both hot water and chilled water *shall be prohibited*."**

Example

13.3 Two-Pipe Changeover System (Section 1318.2.8.2)
☑ System is not a Two-Pipe Changeover System
☐ Complies. System is:
a. Designed to allow a deadband between changeover from one mode to the other of at least 15°F outside air temperature.
b. Designed to operate and provided with controls that will allow operation in one mode for at least four hours before changing over to the other mode.
c. Provided with reset controls that allow heating and cooling supply temperatures at the changeover point to be no more than 30°F apart.

The plans/specs show compliance in the following locations:	

13.3 Two-Pipe Changeover System

(Systems that use a common distribution system to supply both heated and chilled water).

If there is no two pipe change over system in the building check the box that says **"System is not a two pipe change-over system."**

If there is a two pipe change over system it must meet the following requirements (each appropriate box should be checked):

1. The system is designed to allow a deadband between changeover from one mode to the other of at least 15°F outside air temperature.
2. The system is designed to operate and is provided with controls that will allow operation in one mode for at least four hours before changing over to the other mode.

3. Reset controls are provided that allow heating and cooling supply temperatures at the changeover point to be no more than 30°F apart.

Example

13.4 Hydronic (Water Loop) Heat Pump System (Section 1318.2.8.3)

☑ System is not a Hydronic (Water Loop) Heat Pump System

☐ Complies. Hydronic heat pumps connected to a common heat pump water loop with central devices for heat rejection (e.g., cooling tower) and heat addition (e.g., boiler) have the following:

13.4 Hydronic (Water Loop) Heat Pump Systems.

Hydronic heat pumps connected to a common heat pump water loop with central devices for heat rejection (e.g., cooling tower) and heat addition (e.g., boiler) shall meet the following requirements (each appropriate box should be checked):

1. Controls shall be installed that are capable of providing a heat pump water supply temperature deadband of at least 20°F between initiation of heat rejection and heat addition by the central devices (e.g., tower and boiler).
2. Closed-circuit tower (fluid cooler) shall have either an automatic valve installed to bypass all but a minimal flow of water around the tower (for freeze protection) or low-leakage positive closure dampers.
3. Open-circuit tower installed directly in the heat pump loop shall have an automatic valve installed to bypass all heat pump water flow around the tower. Shutting down the circulation pump on the cooling tower loop shall control open-circuit towers used in conjunction with a separate heat exchanger to isolate the tower from the heat pump loop.
4. A two-position valve at each hydronic heat pump for hydronic systems having a total pump system power exceeding 10 hp.

Specify the location in the plans and *specific location within* specifications where all applicable hydronic controls and sequence of operation is specified. For example – Sheet M2.1 and Section 15500, 2.3, A, simply inserting Section 15500 is not acceptable.

SYSTEMS – WORKSHEETS

Example Section of Worksheet 4a

(a) Equip. ID	(b) Model Designation	(c) Cooling Capacity (Btu/h)	(d) Steady State	(d) Seasonal or Part Load	(e) Compliance Schedule (A-E)

Example Section of Worksheet 4i

(a) Equip. ID	(b) Model Designation	(c) Heating Capacity (Btu/hr)	(d) Proposed Minimum AFUE (%)	(e) Proposed Minimum E_c or E_T (%)	(f) Compliance Schedule (A-D)

Worksheets 4a – 4g, 4i and 4j

These are simple worksheets that document code equipment efficiency requirements. Equipment efficiency requirements are based on rated conditions established by a rating authority (such as ARI or GAMA), not actual or design conditions. Equipment efficiency may be better or worse than rated conditions at actual or design conditions.

Insert the piece of HVAC equipment identification(s) as shown on plans or indicated in specifications in column (a). Insert the manufacturer's model designation each piece of HVAC equipment identified, in column (b).

For worksheets 4a through 4g, insert the cooling capacity at rated conditions (not actual/design conditions) in column (c). For worksheets 4i and 4j, insert the output rating of heating capacity. Enter the entering water temperature for each piece of equipment at rated entering water temperature column (d) for Worksheet 4e. The last column(s) on the right-hand side are the values required as code minimum requirements. The columns between these code compliant values (far right-side column(s)) and column (c) (column (d) on worksheets 4e) are the efficiency for each piece of equipment at rated conditions. The installed equipment efficiency must be equal to or better than code-required performance (smaller value).

The required documentation must accompany each worksheet for each piece of HVAC equipment. For worksheets 4a through 4g, provide either a copy of the appropriate sheet from the ARI directory with equipment identified by circling the line item(s) or highlighting them or attach a copy of the data sheet provided by the equipment manufacturer (i.e., "cut sheets"). For worksheets 4i and 4j, provide either a copy of the appropriate sheet from the GAMA Consumer Directory or attach a copy of the data sheet provided by the equipment manufacturer (i.e., "cut sheets").

When installing equipment that provides both heating and cooling, such as a unitary packaged air conditioner with gas fired heat, do not forget to provide worksheet 4j as well as 4a (or appropriate worksheet).

Worksheet 4l, Air Transport Energy

This worksheet is used to calculate the maximum energy demand of each HVAC system.

An individual Worksheet 4L must be completed for each HVAC system in the building with a total nameplate horsepower greater than 7.5. This includes the sum of all fans in the HVAC system operating at **design conditions,** including supply fans, return/exhaust fans and fan-powered terminal units.

The following types of fans are not included in this worksheet:

1. Individual exhaust fans with nameplate fan horsepower of 1 hp or less.
2. Induction/dilution exhaust fans used in hospitals and laboratories. These specialized fans used increased discharge velocity and often additional outside air to toxic exhaust air away from building air intakes.
3. Fan-powered, parallel airflow terminal units where the fan does not operate in cooling mode. (Series terminal units that operate when the main fan is running must be included.)

Worksheet 4l (cont.)

The energy demand of all HVAC fan systems is limited as specified in Sections 1318.4.2.1 and 1318.4.2.2 (of the *Oregon Structural Specialty Code*). For purposes of this requirement, energy demand of a fan system is the sum of motor brake horsepower of all fans operating at **design conditions**, including supply fans, return/exhaust fans and fan-powered terminal units.

The maximum energy demand for constant volume fan systems is limited as follows:

Constant volume fan systems. For fan systems which provide a constant air volume whenever the fans are operating, the power required by the motors for the combined fan system at design conditions shall not exceed Formula CV-1 shown below. This requirement includes 2-speed motors. Constant volume systems in hospitals and laboratories that include flow control devices on both the supply and return/exhaust for maintaining precise pressure control may use the formula for VAV systems.

Formula CV-1

$$BHP = \frac{\text{Design Airflow (CFM)} * 4.3}{4131}$$

Fan systems with filtration systems that have a pressure drop at design airflow in excess of one-inch w.c. **when the filters are clean**, heat recovery, or direct evaporative humidifier/cooler may use Formula CV-2:

Formula CV-2

$$BHP = \frac{\text{Design Airflow (CFM)} * (PD + 4.3)}{4131}$$

where: BHP = the maximum combined fan brake motor horsepower
CFM = the maximum design supply air flow in cubic feet per minute
PD = the combined pressure drop at design airflow of all filtering systems in excess of 1" w.c. when the filters are clean plus the pressure drop of heat recovery and direct evaporative humidifier/cooler in inches water gauge.

The maximum energy demand for VAV systems is limited as follows:

Variable air volume (VAV) fan systems. For fan systems which are able to vary system air volume automatically as a function of load, the power required by the motors for the combined fan system shall not exceed Formula VAV-1 shown below.

Formula VAV-1

$$BHP = \frac{\text{Design Airflow (CFM)} * 6.0}{4131}$$

Fan systems with filtration systems that have a pressure drop at design airflow in excess of one-inch w.c. **when the filters are clean**, heat recovery, or direct evaporative humidifier/cooler may use Formula VAV-2:

Formula VAV-2

$$BHP = \frac{\text{Design Airflow (CFM)} * (PD + 6.0)}{4131}$$

where: HP = the maximum combined fan brake motor horsepower
CFM = the maximum design supply air flow in cubic feet per minute
PD = the combined pressure drop at design airflow of all filtering systems in excess of 1" w.c. when the filters are clean plus the pressure drop of heat recovery and direct evaporative humidifier/cooler in inches water gauge and additional pressure drops for hospitals and laboratories that have fully ducted return and/or systems or return and/or exhaust airflow control devices or high filtration as specified in the following table.

Additional Pressure Drop for Hospitals and Laboratories	
Measure	**Additional PD**
Fully ducted return and/or exhaust air systems	0.5 in w.c.
Return and/or exhaust air flow control devices	0.5 in w.c.
Filter systems of individual filter efficiency > or = 85%	0.5 in w.c.

Selecting and sizing nameplate motor horsepower: Selected fan motor shall be no larger than the first available motor size greater than the brake horsepower.

SYSTEMS – WORKSHEETS

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