### Sizing:System

The Sizing:System object contains the input needed to perform a central forced air system design air flow, heating capacity, and cooling capacity calculation for a system serving one or more zones. The information needed consists of the outside environmental conditions and the design supply air temperatures, outdoor air flow rate, and minimum system air flow ratio.

The outside conditions come from the design days in the input. A system sizing calculation is performed for every design day in the input file and the resulting maximum heating and cooling air flow rates and capacities are saved for use in the component sizing calculations.

Supply air conditions are specified by inputting a supply air temperature for cooling, a supply air temperature for heating, and a preheat temperature.

The system sizing calculation sums the zone design air flow rates to obtain a system supply air flow rate. The design conditions and the outdoor air flow rate are used to calculate a design mixed air temperature. The temperature plus the design supply air temperatures allows the calculation of system design heating and cooling capacities.

#### Field: AirLoop Name

The name of the AirLoopHVAC corresponding to this Sizing:System object. This is the air system for which the design calculation will be made using the input data of this Sizing:System Object.

#### Field: Type of Load to Size On

The user specified type of load on which to size the central system. The choices are *Sensible*, *Total* and *VentilationRequirement*. *Sensible* means that the central system supply air flow rate will be determined by combining the zone design air flow rates, which have been calculated to meet the zone sensible loads from the design days. *VentilationRequirement* means that the central system supply air flow rate will be determined by the system ventilation requirement. In addition *Sensible* tells the program to size the central cooling coil using entering air flow rate and air conditions at the sensible load peak; *Total*  indicates that the program should size the central cooling coil at the air flow rate and conditions at the total load peak. The central heating coil is always sized at the conditions at the peak sensible heating load.

#### Field: Design Outdoor Air Flow Rate

The design outdoor air flow rate in cubic meters per second. Generally this should be the minimum outdoor air flow. It is used for both heating and cooling design calculations. The assumption for cooling is that any outdoor air economizer will be closed. If *Autosize* is input the outdoor air flow rate will be taken from the sum of the zone outdoor air flow rates or calculated based on the System Outdoor Air Method selection (field below).

#### Field: Central Heating Maximum System Air Flow Ratio

The ratio of the maximum system air flow rate for heating to the maximum system air flow rate. The value must be between 0 and 1. For constant volume systems the ratio should be set to 1. This ratio should be set to reflect what the user expects the system flow rate to be when maximum heating demand occurs. This ratio is used in calculating the central system heating capacity. Thus if the system is VAV with the zone VAV dampers held at minimum flow when there is a zone heating demand, this ratio should be set to the minimum flow ratio. If the zone VAV dampers are reverse action and can open to full flow to meet heating demand, this ratio should be set to 1. The default is set to 0.5, reflecting the fact that VAV dampers are typically not allowed to fully open during heating.

#### Field: Preheat Design Temperature

The design air temperature exiting the preheat coil (if any) in degrees Celsius.

#### Field: Preheat Design Humidity Ratio

The design humidity ratio exiting the preheat coil (if any) in kilograms of water per kilogram of dry air. (kgWater/kgDryAir)

#### Field: Precool Design Temperature

The design air temperature exiting the precooling coil (if any) in degrees Celsius.

#### Field: Precool Design Humidity Ratio

The design humidity ratio exiting the precooling coil (if any) in kilograms of water per kilogram of dry air. (kgWater/kgDryAir)

#### Field: Central Cooling Design Supply Air Temperature

The design supply air temperature for cooling in degrees Celsius. This should be the temperature of the air exiting the central cooling coil.

#### Field: Central Heating Design Supply Air Temperature

The design supply air temperature for heating in degrees Celsius. This can be either the reset temperature for a single duct system or the actual hot duct supply air temperature for dual duct systems. It should be the temperature at the exit of the main heating coil.

#### Field: Type of Zone Sum to Use

If the input is *coincident* the central system air flow rate will be sized on the sum of the coincident zone air flow rates. If the input is *noncoincident* the central system air flow rate will be sized on the sum of the noncoincident zone air flow rates. The default is noncoincident.

#### Field: 100% Outdoor Air in Cooling

Entering *Yes* means the system will be sized for cooling using 100% outdoor air. Entering *No* means the system will be sized for cooling using minimum outside air (the default).

#### Field: 100% Outdoor Air in Heating

Entering *Yes* means the system will be sized for heating using 100% outdoor air. Entering *No* means the system will be sized for heating using minimum outside air (the default).

#### Field: Central Cooling Design Supply Air Humidity Ratio

The design humidity ratio in kilograms of water per kilogram of dry air at the exit of the central cooling coil. (kgWater/kgDryAir) The default is .008.

#### Field: Central Heating Design Supply Air Humidity Ratio

The design humidity ratio in kilograms of water per kilogram of dry air at the exit of the central heating coil. (kgWater/kgDryAir) The default is .008.

#### Field: Cooling Design Air Flow Method

The input of this field must be the method used to determine the airloop cooling supply air volume flow rate or the cooling supply air flow rate value. The input allowed must be is either, *DesignDay*, *Flow/System, FlowPerFloorArea*, *FractionOfAutosizedCoolingAirflow*, or *FlowPerCoolingCapacity*. *DesignDay* means the program will calculate the system design cooling air flow rate using the System Sizing input data and a design day simulation. *Flow/System* means that the the program will use the input of the field *Cooling Design Air Flow Rate* as the system design cooling air flow rate. *FlowPerFloorArea* means the program calculates the cooling supply air volume flow rate from zone floor area served by the airloop and user specified *Flow Per Floor Area* value. *FractionOfAutosizedCoolingAirflow* means the program calculates the cooling supply air volume flow rate from user specified fraction and the autosized design cooling supply air volume flow rate value determined by the simulation. *FlowPerCoolingCapacity* means the supply air volume is calculated from user specified flow per cooling capacity and design cooling capacity determined by the simulation. The default method is *DesignDay*: i.e., the program uses the calculated design values.

#### Field: Cooling Design Air Flow Rate

The design system cooling air flow rate in cubic meters per second. This input is an alternative to using the program autocalculated value. This input is used if Cooling Design Air Flow Method is Flow/System. This value will *not* be multiplied by any sizing factor or by zone multipliers. If using zone multipliers, this value must be large enough to serve the multiplied zones.

#### Field: Cooling Design Supply Air Flow Rate Per Floor Area {m3/s-m2}

Enter the cooling supply air volume flow rate per zone conditioned floor area in m3/s-m2. This field is required field when the Cooling Design air Flow Method is *FlowPerFloorArea*. This field may be left blank if a cooling coil is not included in the airloop or the Cooling Design Air Flow Method is not *FlowPerFloorArea*. The program calculates the cooling supply air volume flow rate from the cooled floor area served by the air loop and the *Flow Per Unit Area* value specified by the user.

#### Field: Fraction of Autosized Cooling Design Supply Air Flow Rate {-}

Enter the cooling supply air volume flow rate as a fraction of the airloop autosized cooling supply air flow rate. This input field is required when the Cooling Design air Flow Method is *FractionOfAutosizedCoolingAirflow*. This input field may be left blank if a cooling coil is not included in the airloop or the Cooling Design air Flow Method is not *FractionOfAutosizedCoolingAirflow*. The program calculates the cooling supply air volume flow rate from the design autosized cooling supply air flow rate and user specified fraction.

#### Field: Cooling Design Supply Air Flow Rate Per Unit Cooling Capacity {m3/s-W}

Enter the cooling supply air volume flow rate per unit cooling capacity in m3/s-W. This input field is required when the Cooling Design air Flow Method is *FlowPerCoolingCapacity*. This field may be left blank if a cooling coil is not included in the airloop or the Cooling Design air Flow Method is not *FlowPerCoolingCapacity*. The program calculates the airloop cooling supply air volume flow rate from the design autosized cooling capacity and user specified *Flow Per Cooling Capacity* value.

#### Field: Heating Design Air Flow Method

The input of this field must be the method used to determine the airloop heating supply air volume flow rate or the heating supply air flow rate value. The input allowed must be is either, *DesignDay*, *Flow/System, FlowPerFloorArea*, *FractionOfAutosizedHeatingAirflow*, *FractionOfAutosizedCoolingAirflow* or *FlowPerHeatingCapacity*. *DesignDay* means the program will calculate the system design heating air flow rate using the System Sizing input data and a design day simulation. *Flow/System* means that the program will use the input of the field *Heating Design Air Flow Rate* as the system design heating air flow rate. *FlowPerFloorArea* means the program calculates the system heating supply air volume flow rate from zone floor area served by the airloop and user specified *Flow Per Floor Area* value. *FractionOfAutosizedHeatingAirflow* means the program calculates the system heating supply air volume flow rate from user specified fraction and the autosized system design heating supply air volume flow rate value determined by the simulation. *FractionOfAutosizedCoolingAirflow* means the program calculates the system heating supply air volume flow rate from user specified fraction and the autosized system design cooling supply air volume flow rate value determined by the simulation. *FlowPerHeatingCapacity* means the system heating supply air volume is calculated from user specified flow per heating capacity and design heating capacity determined by the simulation. The default method is *DesignDay*: i.e., the program uses the calculated design values.

#### Field: Heating Design Air Flow Rate

The design system heating air flow rate in cubic meters per second. This input is an alternative to using the program autocalculated value. This input is used if Heating Design Air Flow Method is Flow/System. This value will *not* be multiplied by any sizing factor or by zone multipliers. If using zone multipliers, this value must be large enough to serve the multiplied zones.

#### Field: Heating Design Supply Air Flow Rate Per Floor Area {m3/s-m2}

Enter the heating supply air volume flow rate per zone conditioned floor area in m3/s-m2. This field is required field when the Heating Design air Flow Method is *FlowPerFloorArea*. This field may be left blank if a heating coil is not included in the airloop or the Heating Design Air Flow Method is not *FlowPerFloorArea*. The program calculates the heating supply air volume flow rate from the heated or cooled floor area served by the air loop and the *Flow Per Unit Area* value specified by the user.

#### Field: Fraction of Autosized Heating Design Supply Air Flow Rate {-}

Enter the heating supply air volume flow rate as a fraction of the airloop autosized heating supply air flow rate. This input field is required when the Heating Design air Flow Method is *FractionOfAutosizedHeatingAirflow*. This input field may be left blank if heating coil is not included in the airloop or the Heatng Design air Flow Method is not *FractionOfAutosizedHeatingAirflow*. The program calculates the heating supply air volume flow rate from the design autosized heating supply air flow rate and user specified fraction.

#### Field: Fraction of Autosized Cooling Design Supply Air Flow Rate {-}

Enter the heating supply air volume flow rate as a fraction of the airloop autosized cooling supply air flow rate. This input field is required when the Heating Design air Flow Method is *FractionOfAutosizedCoolingAirflow*. This input field may be left blank if heating coil is not included in the airloop or the Heatng Design air Flow Method is not *FractionOfAutosizedCoolingAirflow*. The program calculates the heating supply air volume flow rate from the design autosized cooling supply air flow rate and user specified fraction.

#### Field: Heating Design Supply Air Flow Rate Per Unit Heating Capacity {m3/s-W}

Enter the heating supply air volume flow rate per unit heating capacity in m3/s-W. This input field is required when the Heating Design air Flow Method is *FlowPerCoolingCapacity*. This field may be left blank if a heating coil is not included in the airloop or the Heating Design air Flow Method is not *FlowPerHeatingCapacity*. The program calculates the airloop heating supply air volume flow rate from the design autosized heating capacity and user specified *Flow Per Heating Capacity* value.

#### Field: System Outdoor Air Method

The method used to calculate the system minimum outdoor air flow. The two choices are ZoneSum and VentilationRateProcedure (VRP). ZoneSum sums the outdoor air flows across all zones served by the system. VRP uses the multi-zone equations defined in 62.1-2007 to calculate the system outdoor air flow. VRP considers zone air distribution effectiveness and zone diversification of outdoor air fractions.

#### Field: Zone Maximum Outdoor Air Fraction

This positive numeric input is the zone maximum outdoor air fraction. For an air loop, when a zone requires outdoor air higher than the user specified Zone Maximum Outdoor Air Fraction, the zone supply air flow will be increased to cap the outdoor air fraction at the maximum value. This allows the system level outdoor air flow to be reduced while the total supply air flow increases. Valid values are from 0 to 1.0. Default is 1.0 which indicates zones can have 100% outdoor air maintaining backward compatibility. This inputs work for constant volume air systems, single and dual duct VAV systems.

#### Field Cooling Design Capacity Method

Enter the method used to determine the cooling design capacity for scalable sizing. Input allowed is either *None*, *CoolingDesignCapacity*, *CapacityPerFloorArea*, and *FractionOfAutosizedCoolingCapacity*. None is used when a cooling coil is not included in the airloop. If this input field is left blank, or None is specified, then the autosized design cooling capacity determined by the program is used. *CoolingDesignCapacity* means user specifies the magnitude of cooling capacity or the program calculates the design cooling capacity if autosize is specified. *CapacityPerFloorArea* means the program calculates the design cooling capacity from user specified cooling capacity per floor area and floor area of the zones served by the airloop. *FractionOfAutosizedCoolingCapacity* means the program calculates the design cooling capacity from user specified fraction and the auto-sized design cooling capacity. If the value this input field is blank or specified as None, then the next three input fields are not required. The default method is *CoolingDesignCapacity*.

#### Field: Cooling Design Capacity {W}

Enter the magnitude of the cooling capacity in Watts. This input is an alternative to using the program auto-calculated cooling capacity value. This input is a required field when the Cooling Design Capacity Method is *CoolingDesignCapacity*. This field may be left blank if a cooling coil is not included in the air loop or alternative method is specified. This input field is autosizable.

#### Field: Cooling Design Capacity Per Floor Area {W/m2}

Enter the cooling capacity per unit floor area in m3/s-m2. This field is required field when the Cooling Design Capacity Method is *CapacityPerFloorArea*. This field may be left blank if a cooling coil is not included in the airloop or the Cooling Design Capacity Method is not *CapacityPerFloorArea*. The program calculates the cooling capacity from floor area of the zones served by the airloop and the cooling capacity per unit floor area value specified by the user.

#### Field: Fraction of Autosized Cooling Design Capacity {-}

Enter the cooling capacity as a fraction of the autosized cooling capacity. This input field is required when the Cooling Design Capacity Method is *FractionOfAutosizedCoolingCapacity*. This input field may be left blank if a cooling coil is not included in the zone HVAC equipment or the Cooling Design Capacity Method is not *FractionOfAutosizedCoolingCapacity*. The program calculates the cooling capacity from the design autosized cooling capacity and user specified fraction. Design day sizing run must be specified.

#### Field: Heating Design Capacity Method

Enter the method used to determine the heating design capacity for scalable sizing. Input allowed is either *None*, *HeatingDesignCapacity*, *CapacityPerFloorArea*, and *FractionOfAutosizedHeatingCapacity*. *None* is used when a heating coil is not included in the airloop. If this input field is left blank, then the autosized design heating capacity determined by the program is used. *HeatingDesignCapacity* means user specifies the magnitude of heating capacity or the program calculates the design heating capacity if autosize is specified. *CapacityPerFloorArea* means the program calculates the design heating capacity from user specified heating capacity per floor area and floor area of the zones served by the airllop. *FractionOfAutosizedHeatingCapacity* means the program calculates the design heating capacity from user specified fraction and the auto-sized design heating capacity. If the value this input field is blank or specified as None, then the next three input fields are not required. The default method is *HeatingDesignCapacity*.

#### Field: Heating Design Capacity {W}

Enter the magnitude of the heating capacity in Watts. This input is an alternative to using the program auto-calculated heating capacity value. This input is a required field when the Heating Design Capacity Method is *HeatingDesignCapacity*. This field may be left blank if a heating coil is not included in the airloop or alternative method is specified. This input field is autosizable.

#### Field: Heating Design Capacity Per Floor Area {W/m2}

Enter the heating capacity per unit floor area in m3/s-m2. This field is required field when the Heating Design Capacity Method is *CapacityPerFloorArea*. This field may be left blank if a heating coil is not included in the airloop or the Heating Design Capacity Method is not *CapacityPerFloorArea*. The program calculates the heating capacity from floor area of the zones served by the airloop and the heating capacity per unit floor area value specified by the user.

#### Field: Fraction of Autosized Heating Design Capacity {-}

Enter the heating capacity as a fraction of the autosized heating capacity. This input field is required when the Heating Design Capacity Method is FractionOfAutosizedHeatingCapacity. This input field may be left blank if heating coil is not included in the airloop or the Heating Design Capacity Method is not FractionOfAutosizedHeatingCapacity. The program calculates the heating capacity from the design autosized cooling capacity and user specified fraction.

#### Field: Central Cooling Capacity Control Method

Specifies how the central cooling coil will be controlled, which affects the coil sizing calculation. There are 4 choices: *VAV*, *Bypass*, *VT*, and *OnOff*. Choose *VAV*  if the cooling output is controlled by varying the air flow. *Bypass*  should be chosen if the capacity is controlled by bypassing a variable fraction of the mixed air around the coil face. *VT*  indicates that cooling coil output is controlled by varying the coil exit temperature while the flow rate is constant. And *OnOff* means that the cooling output is controlled by cycling the air flow.

An IDF example:

Sizing:System,

VAV Sys 1, !- name of an AirLoopHVAC object

sensible, !- type of load to size on

autosize, !- Design (minimum) outside air volumetric flow rate {m3/s}

0.3, !- minimum system air flow ratio

4.5, !- Preheat design temperature {C}

.008, !- Preheat design humidity ratio {kgWater/kgDryAir}

11.0, !- Precool design temperature {C}

.008, !- Precool design humidity ratio {kgWater/kgDryAir}

12.8, !- Central cooling design supply air temperature {C}

16.7, !- Central heating design supply air temperature {C}

noncoincident, !- Sizing Option

no, !- Cooling 100% Outside Air

no, !- Heating 100% Outside Air

0.008, !- Central cooling design supply air humidity ratio {kgWater/kgDryAir}

0.008, !- Central heating design supply air humidity ratio {kgWater/kgDryAir}

designday, !- Cooling Design Air Flow Method

0, !- cooling design air flow rate {m3/s}

, !- Supply Air Flow Rate Per Floor Area During Cooling Operation {m3/s-m2}

, !- Fraction of Autosized Design Cooling Supply Air Flow Rate {-}

, !- Design Supply Air Flow Rate Per Unit Cooling Capacity {m3/s-W}

designday, !- Heating Design Air Flow Method

0, !- heating design air flow rate {m3/s}

, !- Supply Air Flow Rate Per Floor Area During Heating Operation {m3/s-m2}

, !- Fraction of Autosized Design Heating Supply Air Flow Rate {-}

, !- Fraction of Autosized Design Cooling Supply Air Flow Rate {-}

, !- Design Supply Air Flow Rate Per Unit Heating Capacity {m3/s-W}

ZoneSum, !- System Outdoor Air Method

0.5, !- Zone Maximum Outdoor Air Fraction

CoolingDesignCapacity, !- Cooling Design Capacity Method

autosize, !- Cooling Design Capacity {W}

, !- Cooling Design Capacity Per Floor Area {W/m2}

, !- Fraction of Autosized Cooling Design Capacity {-}

HeatingDesignCapacity, !- Heating Design Capacity Method

autosize, !- Heating Design Capacity {W}

, !- Heating Design Capacity Per Floor Area {W/m2}

; !- Fraction of Autosized Cooling Design Capacity {-}

### System Sizing Outputs

The system design air flow rates and heating and cooling capacities are output onto the local file “eplusssz.<ext>” where <ext> is the extension from the sizing style object (default is csv – a comma separated file *eplusssz.csv)*. The columns are clearly labeled. It will easily import into Excel or other spreadsheet program that accepts delimited files. The results are calculated values and do not include any user input system flow rates.

The calculated system design air flow rates and the user input system design air flow rates are also reported on the *eplusout.eio* file. The values are printed out for each system as comma separated records beginning with *System Sizing*. An example is:

! <System Sizing Information>, System Name, Field Description, Value

System Sizing, VAV SYS 1, Calculated Cooling Design Air Flow Rate [m3/s], 1.3194

System Sizing, VAV SYS 1, User Cooling Design Air Flow Rate [m3/s], 1.5000

System Sizing, VAV SYS 1, Calculated Heating Design Air Flow Rate [m3/s], 0.90363

System Sizing, VAV SYS 1, User Heating Design Air Flow Rate [m3/s], 1.0000