

Data Types

Data Type	Description	JSON Schema Type	Examples
Integer	A positive or negative whole number (i.e., a number that can be written without a fractional part).	integer	3, 19, -4
Numeric	A number that may include a fractional part with optional leading sign and optional exponent (engineering notation).	number	3.43, 0, -4, 1.03e4
Boolean	True or false.	boolean	true, false
String	A sequence of characters of any length using any (specified) character set.	string	Indirect evaporative cooler
ID	A referencable identification for a data group and sequence of characters of any length using any (specified) character set.	string	AHU-01
Reference	A reference to an ID of a data group.	string	AHU-01
Null	Indicator that no value is provided. Only used in combination with other data types, e.g., 'Number/Null'.	null	null

String Types

String Type	Description	JSON Schema Pattern	Examples
Timestamp	Date with UTC time formatted per ISO 8601 (ISO 2004)	[0-9]{4}-[0-9]{2}-[0-9]{2}T[0-9]{2}:[0-9]{2}Z	2016-06-29T14:35Z

ConditioningOptions

Enumerator	Description	Notes
HEATED_AND_COOLED	Heated and cooled	
HEATED_ONLY	Heated only	
SEMIHEATED	Semiheated	

Enumerator	Description	Notes
UNCONDITIONED	Unconditioned	

SpaceFunctionOptions

Enumerator	Description	Notes
LABORATORY	Laboratory	
KITCHEN	Kitchen	
OTHER	Other	

StatusOptions

Enumerator	Description	Notes
NEW	New	
EXISTING	Existing	
EXISTING_PLUS_NEW	Existing plus new	
FUTURE	Future	
ALTERED	Altered	
ALTERED_ROOF_SURFACE	Altered roof surface	
OTHER	Other	

InfiltrationMethodOptions

Enumerator	Description	Notes
WEATHER_DRIVEN	Weather Driven. The amount of air leakage is determined by using the infiltration_flow_rate with a correlation usually involving windspeed, height, and the difference between indoor and outdoor temperature and is then multiplied by the schedule.	
PRESSURE_BASED	Pressure Based. The amount of air leakage is determined by induced airflows from pressure differences between zones, air distribution system components, the outside due to wind speed and direction.	
CONSTANT	Constant. The schedule is ignored.	

Enumerator	Description	Notes
CONSTANT_SCHEDULED	Constant multiplied by the schedule.	
OTHER	Other infiltration methods.	

InsulationLocationOptions

Enumerator	Description	Notes
ABOVE_GROUND_WALL_EXTERIOR_CONTINUOUS	Continuous insulation on exterior of an above ground wall	
ABOVE_GROUND_WALL_INTERIOR_CONTINUOUS	Continuous insulation on interior of an above ground wall	
ABOVE_GROUND_WALL_FULL_CAVITY	Insulation within the cavity of an above ground wall that fills the entire cavity	
ABOVE_GROUND_WALL_PARTIAL_CAVITY	Insulation within the cavity of an above ground wall that fills only part of the cavity	
SLAB_HORIZONTAL_PERIMETER	Insulation on underside of the slab covering the perimeter	
SLAB_HORIZONTAL_FULL	Insulation fully covering the underside of the slab	
SLAB_VERTICAL	Insulation applied vertically next to edge of slab	
NONE	None	
OTHER	Other	

SurfaceClassificationOptions

Enumerator	Description	Notes
WALL	Vertical or nearly vertical wall	
FLOOR	Floor	
CEILING	Ceiling	

SurfaceAdjacencyOptions

Enumerator	Description	Notes
EXTERIOR	Exterior wall or roof which is adjacent to the exterior environment.	
GROUND	Slab-on-grad or below grade surface if adjacent to ground.	
INTERIOR	Interior surface if adjacent to another space which is explicitly modeled.	
IDENTICAL	Surface adjacent to an environment identical to the space. Sometimes this is described as an adiabatic surface since no heat is transferred. The space on the other side of the surface is not explicitly modeled.	
UNDEFINED	The surface adjacency cannot be determined by the software.	

SurfaceConstructionInputOptions

Enumerator	Description	Notes
LAYERS	Construction is entered layer-by-layer.	
SIMPLIFIED	Construction is entered by R-value only.	

SubsurfaceClassificationOptions

Enumerator	Description	Notes
WINDOW	Window	
SKYLIGHT	Skylight	
DOOR	Door	
OTHER	Other types of subsurfaces that allow light to pass	

SubsurfaceDynamicGlazingOptions

Enumerator	Description	Notes
NOT_DYNAMIC	Not dynamic	
MANUAL_DYNAMIC	Manual dynamic	
AUTOMATIC_DYNAMIC	Automatic dynamic	

LightingDaylightingControlOptions

Enumerator	Description	Notes
STEPPED	Stepped	
CONTINUOUS_DIMMING	Continuous Dimming	
OTHER	Other types of daylighting control	
NONE	None	No daylighting is used.

LightingOccupancyControlOptions

Enumerator	Description	Notes
FULL_AUTO_ON	Full auto on	
PARTIAL_AUTO_ON	Partial auto on	
MANUAL_ON	Manual on	
OTHER	Other types of occupancy control	
NONE	None	No occupancy controls is used.

MiscellaneousEquipmentOptions

Enumerator	Description	Notes
PLUG	Plug	
PROCESS	Process	
INFORMATION_TECHNOLOGY_EQUIPMENT	Information technology equipment	
OTHER	Other	

TransformerOptions

Enumerator	Description	Notes
DRY_TYPE	Dry Type	
FLUID_FILLED	Fluid Filled	
OTHER	Other	

ElectricalPhaseOptions

Enumerator	Description	Notes
SINGLE_PHASE	Single Phase	
THREE_PHASE	Three Phase	

ScheduleSequenceOptions

Enumerator	Description	Notes
HOURLY	Hourly	
EVENT	Event	

ScheduleOptions

Enumerator	Description	Notes
MULTIPLIER_DIMENSIONLESS	Multiplier dimensionless	
TEMPERATURE	Temperature	
POWER	Power	
FLOW_RATE	Flow rate	

DayOfWeekOptions

Enumerator	Description	Notes
SUNDAY	Sunday	
MONDAY	Monday	
TUESDAY	Tuesday	
WEDNESDAY	Wednesday	
THURSDAY	Thursday	
FRIDAY	Friday	
SATURDAY	Saturday	

WeatherFileDataSourceOptions

Enumerator	Description	Notes
HISTORIC_AGGREGATION	Historic data aggregated to represent typical weather	
HISTORIC_ACTUAL	Specific weather data for time period based on monitoring	
FUTURE	Weather data projected to represent future conditions	
OTHER	Other	

CoolingDesignDayOptions

Enumerator	Description	Notes
COOLING_0_4	Cooling design day 0.4% annual cumulative frequency of occurrence	
COOLING_1_0	Cooling design day 1.0% annual cumulative frequency of occurrence	
COOLING_2_0	Cooling design day 2.0% annual cumulative frequency of occurrence	

HeatingDesignDayOptions

Enumerator	Description	Notes
HEATING_99_6	Heating design day 99.6% annual cumulative frequency of occurrence	
HEATING_99_0	Heating design day 99.0% annual cumulative frequency of occurrence	

ElevatorOptions

Enumerator	Description	Notes
HYDRAULIC	Hydraulic	
TRACTION	Traction	
OTHER	Other	

HeatingSystemOptions

Enumerator	Description	Notes
HEAT_PUMP	Heat Pump	
FURNACE	Furnace	
ELECTRIC_RESISTANCE	Electric resistance	
FLUID_LOOP	Fluid loop	
NONE	None	
OTHER	Other	

HeatpumpAuxilliaryHeatOptions

Enumerator	Description	Notes
ELECTRIC_RESISTANCE	Electric resistance	
FURNACE	Furnace	
NONE	None	
OTHER	Other	

HumidificationOptions

Enumerator	Description	Notes
ADIABATIC	Adiabatic	
NONE	None	
OTHER	Other	

HeatingMetricOptions

Enumerator	Description	Notes
HEAT_PUMP_COEFFICIENT_OF_PERFORMANCE_HIGH_TEMPERATURE	Efficiency at 8.3C/47F dry bulb and 6.1C/43F wet bulb	

Enumerator	Description	Notes
HEAT_PUMP_COEFFICIENT_OF_PERFORMANCE_LOW_TEMPERATURE	Efficiency at -8.3C/17F dry bulb and -9.4C/15F wet bulb	
HEAT_PUMP_COEFFICIENT_OF_PERFORMANCE_HIGH_TEMPERATURE_NO_FAN	Efficiency at 8.3C/47F dry bulb and 6.1C/43F wet bulb not including fan	Used for heat pump and describes the efficiency not including the indoor supply fan. The outdoor evaporator fan power is generally included.
HEAT_PUMP_COEFFICIENT_OF_PERFORMANCE_LOW_TEMPERATURE_NO_FAN	Efficiency at -8.3C/17F dry bulb and -9.4C/15F wet bulb not including fan	Used for heat pump and describes the efficiency not including the indoor supply fan. The outdoor evaporator fan power is generally included.
THERMAL_EFFICIENCY	Et - thermal efficiency	
COMBUSTION_EFFICIENCY	Ec - combustion` efficiency	
ANNUAL_FUEL_UTILIZATION_EFFICIENCY	AFUE - annual fuel utilization efficiency	
HEATING_SEASONAL_PERFORMANCE_FACTOR	HSPF - heating seasonal performance factor	
HEATING_SEASONAL_PERFORMANCE_FACTOR_2	HSPF2 - heating seasonal performance factor 2	
COEFFICIENT_OF_PERFORMANCE_WATER_TO_AIR_WATER_LOOP	Coefficient of performance at entering temperature of 20C/68F rated conditions for water loops per ISO 13256-1	

Enumerator	Description	Notes
COEFFICIENT_OF_PERFORMANCE_WATER_TO_AIR_GROUND_WATER	Coefficient of performance at entering temperature of 10C/50F rated conditions for ground water per ISO 13256-1	
COEFFICIENT_OF_PERFORMANCE_BRINE_TO_AIR_GROUND_LOOP	Coefficient of performance at entering temperature of 0C/32F rated conditions for ground water per ISO 13256-1	
COEFFICIENT_OF_PERFORMANCE_WATER_TO_WATER_WATER_LOOP	Coefficient of performance at entering temperature of 20C/68F rated conditions for water loops per ISO 13256-2	
COEFFICIENT_OF_PERFORMANCE_WATER_TO_WATER_GROUND_WATER	Coefficient of performance at entering temperature of 10C/50F rated conditions for ground water per ISO 13256-2	
COEFFICIENT_OF_PERFORMANCE_BRINE_TO_WATER_GROUND_LOOP	Coefficient of performance at entering temperature of 0C/32F rated conditions for ground water per ISO 13256-2	
NONE	None	
OTHER	Other	

CoolingSystemOptions

Enumerator	Description	Notes
DIRECT_EXPANSION	Direct expansion	

Enumerator	Description	Notes
FLUID_LOOP	Fluid loop	
NON_MECHANICAL	Non-mechanical	
NONE	None	
OTHER	Other	

DehumidificationOptions

Enumerator	Description	Notes
MECHANICAL_COOLING	Mechanical cooling	
DESICCANT	Desiccant	
SERIES_HEAT_RECOVERY	Series heat recovery	
NONE	None	
OTHER	Other	

CoolingMetricOptions

Enumerator	Description	Notes
FULL_LOAD_COEFFICIENT_OF_PERFORMANCE	Full load efficiency expressed as a coefficient of performance at 35C/95F rated conditions	
FULL_LOAD_COEFFICIENT_OF_PERFORMANCE_NO_FAN	Full load efficiency expressed as a coefficient of performance at 35C/95F rated conditions not including indoor fan power	Describes the efficiency not including the indoor supply fan. The outdoor evaporator fan power is generally included.
ENERGY_EFFICIENCY_RATIO	EER - Energy efficiency ratio	
SEASONAL_ENERGY_EFFICIENCY_RATIO	SEER - Seasonal energy efficiency ratio	

Enumerator	Description	Notes
SEASONAL_ENERGY_EFFICIENCY_RATIO_2	SEER2 - Seasonal energy efficiency ratio 2	
INTEGRATED_ENERGY_EFFICIENCY_RATIO	IEER - Integrated energy efficiency ratio	
INTEGRATED_PART_LOAD_VALUE	IPLV - Integrated part load value	
COMBINED_ENERGY_EFFICIENCY_RATIO	CEER - Combined energy efficiency ratio	
COEFFICIENT_OF_PERFORMANCE_WATER_TO_AIR_WATER_LOOP	Coefficient of performance at entering temperature of 30C/86F rated conditions for water loops per ISO 13256-1	
COEFFICIENT_OF_PERFORMANCE_WATER_TO_AIR_GROUND_WATER	Coefficient of performance at entering temperature of 15C/59F rated conditions for ground water per ISO 13256-1	
COEFFICIENT_OF_PERFORMANCE_BRINE_TO_AIR_GROUND_LOOP	Coefficient of performance at entering temperature of 25C/77F rated conditions for ground water per ISO 13256-1	
COEFFICIENT_OF_PERFORMANCE_WATER_TO_WATER_WATER_LOOP	Coefficient of performance at entering temperature of 30C/86F rated conditions for water loops per ISO 13256-2	

Enumerator	Description	Notes
COEFFICIENT_OF_PERFORMANCE_WATER_TO_WATER_GROUND_WATER	Coefficient of performance at entering temperature of 15C/59F rated conditions for ground water per ISO 13256-2	
COEFFICIENT_OF_PERFORMANCE_BRINE_TO_WATER_GROUND_LOOP	Coefficient of performance at entering temperature of 25C/77F rated conditions for ground water per ISO 13256-2	
NONE	None	
OTHER	Other	

FanSystemTemperatureControlOptions

Enumerator	Description	Notes
CONSTANT	Constant	
OUTDOOR_AIR_RESET	Outdoor air reset	
ZONE_RESET	Zone reset	
LOAD_RESET_TO_SPACE_TEMPERATURE	Load Reset To Space Temperature	
LOAD_RESET_DIFFERENTIAL_TEMPERATURE	Load Reset Differential Temperature	
SCHEDULED	Scheduled	
OTHER	Other	

FanSystemSupplyFanControlOptions

Enumerator	Description	Notes
CONSTANT	Constant	
VARIABLE_SPEED_DRIVE	Variable speed drive	
MULTISPEED	Multispeed	

Enumerator	Description	Notes
INLET_VANE	Inlet vane	
DISCHARGE_DAMPER	Discharge damper	
OTHER	Other	

FanSystemOperationOptions

Enumerator	Description	Notes
CYCLING	Cycling	
CONTINUOUS	Continuous	
KEEP_OFF	Off	
OTHER	Other	

FanSystemSupplyFanVolumeResetOptions

Enumerator	Description	Notes
CONSTANT	Constant	
DESIGN_LOAD_RESET	Design Load Reset	
OPERATING_CAPACITY_RESET	Operating Capacity Reset	
OTHER	Other	

AirEconomizerOptions

Enumerator	Description	Notes
FIXED_FRACTION	Fixed Fraction	
TEMPERATURE	Dry-bulb temperature	
ENTHALPY	Enthalpy	
DIFFERENTIAL_TEMPERATURE	Differential dry-bulb temperature	
DIFFERENTIAL_ENTHALPY	Differential enthalpy	
OTHER	Other	

EnergyRecoveryOptions

Enumerator	Description	Notes
SENSIBLE_HEAT_EXCHANGE	Sensible heat exchange	
ENTHALPY_HEAT_EXCHANGE	Enthalpy heat exchange	
SENSIBLE_HEAT_WHEEL	Sensible heat wheel	
ENTHALPY_HEAT_WHEEL	Enthalpy heat wheel	
HEAT_PIPE	Heat pipe	
OTHER	Other	
NONE	None	

EnergyRecoveryOperationOptions

Enumerator	Description	Notes
WHEN_FANS_ON	When fans on	
WHEN_MINIMUM_OUTSIDE_AIR	When minimum outside air	
SCHEDULED	Scheduled	
OTHER	Other	
NONE	None	

EnergyRecoverySupplyAirTemperatureControlOptions

Enumerator	Description	Notes
FIXED_SETPOINT	Fixed setpoint	
MIXED_AIR_RESET	Mixed air reset	
OTHER	Other	
NONE	None	

DemandControlVentilationControlOptions

Enumerator	Description	Notes
CO2_RETURN_AIR	CO2 return air	
CO2_ZONE	CO2 zone	
OTHER	Other	
NONE	None	

FanSpecificationMethodOptions

Enumerator	Description	Notes
SIMPLE	Simple	Specify the electric power input of fan
DETAILED	Detailed	Specify the brake horse power, design pressure rise through, total efficiency, motor efficiency

TerminalOptions

Enumerator	Description	Notes
VARIABLE_AIR_VOLUME	Variable air volume	
CONSTANT_AIR_VOLUME	Constant air volume	
RADIANT	Radiant	
BASEBOARD	Baseboard	
OTHER	Other	

TerminalFanConfigurationOptions

Enumerator	Description	Notes
PARALLEL	Parallel	
SERIES	Series	
OTHER	Other	

TerminalTemperatureControlOptions

Enumerator	Description	Notes
CONSTANT	Constant	
LOAD_RESET_DIFFERENTIAL_TEMPERATURE	Load Reset Differential Temperature	
SCHEDULED	Scheduled	
OTHER	Other	

HeatingSourceOptions

Enumerator	Description	Notes
ELECTRIC	Electric	
HOT_WATER	Hot water	
NONE	None	
OTHER	Other	

CoolingSourceOptions

Enumerator	Description	Notes
CHILLED_WATER	Chilled water	
NONE	None	
OTHER	Other	

FluidLoopFlowControlOptions

Enumerator	Description	Notes
FIXED_FLOW	Fixed flow	
VARIABLE_FLOW	Variable flow	

FluidLoopOptions

Enumerator	Description	Notes
HEATING	Heating	

Enumerator	Description	Notes
COOLING	Cooling	
HEATING_AND_COOLING	Heating and cooling	
CONDENSER	Condenser	
OTHER	Other	

TemperatureResetOptions

Enumerator	Description	Notes
NO_RESET	No Reset	
OUTSIDE_AIR_RESET	Outside air reset	
LOAD_RESET	Load Reset	
OTHER	Other	

FluidLoopOperationOptions

Enumerator	Description	Notes
CONTINUOUS	Continuous	
INTERMITTENT	Intermittent/on-demand	
SCHEDULED	Scheduled	

PumpSpeedControlOptions

Enumerator	Description	Notes
FIXED_SPEED	Fixed speed	
TWO_SPEED	Two Speed	
VARIABLE_SPEED	Variable speed	
OTHER	Other	

PumpSpecificationMethodOptions

Enumerator	Description	Notes
SIMPLE	Simple	Specify the electric power input of pump
DETAILED	Detailed	Specify the motor nameplate power, design head, impellor efficiency, motor efficiency

BoilerCombustionOptions

Enumerator	Description	Notes
NATURAL	Natural	
FORCED	Forced	

BoilerEfficiencyMetricOptions

Enumerator	Description	Notes
ANNUAL_FUEL_UTILIZATION	Annual fuel utilization efficiency	
THERMAL	Thermal efficiency	
COMBUSTION	Combustion efficiency	

ChillerPartLoadEfficiencyMetricOptions

Enumerator	Description	Notes
INTEGRATED_PART_LOAD_VALUE	Integrated part load value efficiency expressed as a coefficient of performance (COP)	
NONSTANDARD_PART_LOAD_VALUE	Nonstandard part load value efficiency expressed as a coefficient of performance (COP)	
OTHER	Other part load efficiency metric	

ChillerCompressorOptions

Enumerator	Description	Notes
SCREW	Screw	
CENTRIFUGAL	Centrifugal	

Enumerator	Description	Notes
RECIPROCATING	Reciprocating	
SCROLL	Scroll	
POSITIVE_DISPLACEMENT	Positive displacement	
SINGLE_EFFECT_INDIRECT_FIRED_ABSORPTION	Single-effect indirect-fired absorption	
DOUBLE_EFFECT_INDIRECT_FIRED_ABSORPTION	Double-effect indirect-fired absorption	
SINGLE_EFFECT_DIRECT_FIRED_ABSORPTION	Single-effect direct-fired absorption	
DOUBLE_EFFECT_DIRECT_FIRED_ABSORPTION	Double-effect direct-fired absorption	
OTHER	Other	

HeatRejectionOptions

Enumerator	Description	Notes
OPEN_CIRCUIT_COOLING_TOWER	Open-circuit cooling tower	
CLOSED_CIRCUIT_COOLING_TOWER	Closed-circuit cooling tower or fluid cooler	
DRY_COOLER	Dry-cooler or air-cooled fluid cooler	
EVAPORATIVE_CONDENSER	Evaporative condenser	
AIR_COOLED_CONDENSER	Air cooled condenser	
OTHER	Other	

HeatRejectionFanOptions

Enumerator	Description	Notes
AXIAL	Axial or Propellor	
CENTRIFUGAL	Centrifugal	
OTHER	Other	

HeatRejectionFluidOptions

Enumerator	Description	Notes
WATER	Water	
REFRIGERANT	Refrigerant	Including R-448A
AMMONIA	Ammonia	
OTHER	Other	

HeatRejectionFanSpeedControlOptions

Enumerator	Description	Notes
CONSTANT	Constant	
TWO_SPEED	Two Speed	
VARIABLE_SPEED	Variable Speed	
OTHER	Other	

ExternalFluidSourceOptions

Enumerator	Description	Notes
CHILLED_WATER	Chilled water	
HOT_WATER	Hot water	
STEAM	Steam	

ServiceWaterHeatingConfigurationOptions

Enumerator	Description	Notes
HERS_PARALLEL_PIPING	HERS parallel piping	
HERS_PIPE_INSULATION_ALL_LINES	HERS pipe insulation of all lines	
HERS_RECIRCULATION_DEMAND_CONTROL_OCCUPANCY_SENSOR	HERS recirculation demand control occupancy sensor	

Enumerator	Description	Notes
HERS_RECIRCULATION_DEMAND_CONTROL_BUTTON	HERS recirculation demand control pull botton	
HERS_RECIRCULATION_NON_DEMAND_CONTROL	HERS recirculation non-demand control	
INSULATED_AND_PROTECTED_PIPE_BELOW_GRADE	Insulated and protected pipe below grade	
PARALLEL_PIPING	Parallel piping	
PIPE_INSULATION_ALL_LINES	Pipe insulation of all lines	
POINT_OF_USE	Point of use	
RECIRCULATION_DEMAND_CONTROL_OCCUPANCY_SENSOR	Recirculation demand control occupancy sensor	
RECIRCULATION_DEMAND_CONTROL_BUTTON	Recirculation demand control pull botton	
RECIRCULATION_NON_DEMAND_CONTROL	Recirculation non-demand control	
STANDARD	Standard	
OTHER	Other	

ServiceWaterHeatingHeatRecoveryOptions

Enumerator	Description	Notes
NOT_APPLICABLE	Not applicable	
VERTICAL	Vertical	
HORIZONTAL	Horizontal	
OTHER	Other	

ServiceWaterHeaterOptions

Enumerator	Description	Notes
CONVENTIONAL	Conventional	
HEAT_PUMP_PACKAGED	Heat pump packaged	
HEAT_PUMP_SPLIT	Heat pump split	
HEAT_FROM_HOT_WATER_LOOP	Heat from hot water loop	Should also specify hot water loop when this is used
COMBINATION_SERVICE_AND_SPACE	Combination space and service water heater.	Should also specify hot water loop when this is used
OTHER	Other	

ComponentLocationOptions

Enumerator	Description	Notes
IN_ZONE	In a zone	
CONDITIONED	Conditioned	
SEMICONDITIONED	Semiconditioned	
OUTSIDE	Outside	
GARAGE	Garage	
ATTIC	Attic	
CRAWL_SPACE	Crawl space	
UNDERGROUND	Underground	
UNCONDITIONED	Unconditioned	
OTHER	Other	

DrawPatternOptions

Enumerator	Description	Notes
VERY_SMALL	Very small	

Enumerator	Description	Notes
LOW	Low	
MEDIUM	Medium	
HIGH	High	
OTHER	Other	

ServiceWaterHeaterTankOptions

Enumerator	Description	Notes
CONSUMER_INSTANTANEOUS	Consumer instantaneous	Uses UEF
COMMERCIAL_INSTANTANEOUS	Commercial instantaneous	Uses TE
CONSUMER_STORAGE	Consumer storage	Uses UEF
COMMERCIAL_STORAGE	Consumer storage	Uses TE and SBL
RESIDENTIAL_DUTY_COMMERCIAL_INSTANTANEOUS	Residential-Duty Commercial Instantaneous	Uses UEF
INDIRECT	Indirect	
BOILER	Boiler	
COMMERCIAL_PACKAGED_BOILER	Commercial Packaged Boiler	
OTHER	Other	

ServiceWaterHeatingFixtureOptions

Enumerator	Description	Notes
SHOWER	Shower	
BATH	Bath	
RESTROOM_SINK	Restroom Sink	
DISHWASHER	Dishwasher	
KITCHEN_SINK	Kitchen sink	
WASH_SINK	Wash sink	
CLOTHES_WASHER	Clothes washing machine	

Enumerator	Description	Notes
OTHER	Other	

ServiceWaterHeatingUseUnitOptions

Enumerator	Description	Notes
POWER_PER_PERSON	Power per person	
POWER_PER_AREA	Power per area	
POWER	Power	
VOLUME_PER_PERSON	Volume per person	
VOLUME_PER_AREA	Volume per area	
VOLUME	Volume	
OTHER	Other	

EnergySourceOptions

Enumerator	Description	Notes
ELECTRICITY	Electricity	
NATURAL_GAS	Natural gas	
PROPANE	Propane	
FUEL_OIL	Fuel oil	
NONE	None	No energy consumption by a utility supplied source occurs
OTHER	Other	

RefrigeratedCaseOptions

Enumerator	Description	Notes
COMMERCIAL_REFRIGERATION	Commercial refrigeration	
COMMERCIAL_REFRIGERATOR_SOLID_DOOR	Commercial refrigerator solid door	
COMMERCIAL_REFRIGERATOR_TRANSPARENT_DOOR	Commercial refrigerator transparent door	

Enumerator	Description	Notes
COMMERCIAL_FREEZER_SOLID_DOOR	Commercial freezer solid door	
COMMERCIAL_FREEZER_TRANSPARENT_DOOR	Commercial freezer transparent door	
COMMERCIAL_PULLDOWN_REFRIGERATOR	Commercial pulldown refrigerator	
COMMERCIAL_REFRIGERATOR_FREEZER_SOLID_DOOR	Commercial refrigerator freezer solid door	
OTHER	Other	

RefrigeratedCaseEquipmentCategoryOptions

Enumerator	Description	Notes
HORIZONTAL_OPEN	Horizontal open	
HORIZONTAL_SOLID_DOOR	Horizontal solid door	
HORIZONTAL_TRANSPARENT_DOOR	Horizontal transparent door	
SEMIVERTICAL_OPEN	Semivertical open	
SERVICE_OVER_COUNTER	Service over counter	
VERTICAL_OPEN	Vertical open	
VERTICAL_SOLID_DOOR	Vertical solid door	
VERTICAL_TRANSPARENT_DOOR	Vertical transparent door	
OTHER	Other	

ApplicationTemperatureOptions

Enumerator	Description	Notes
MEDIUM	Medium temperature	3.3 C +/- 1.1 C (38 F +/- 2 F)
LOW	Low temperature	-17.8 C +/- 1.1 C (0 F +/- 2 F)
VERY_LOW	Very low	-26.1 C +/- 1.1 C (-15 F +/- 2 F). This corresponds to the ice cream category in AHRI 1200

Enumerator	Description	Notes
OTHER	Other	

RulesetProjectDescription

Name	Description	Data Type	Units	Range	Req	Notes
id	Scope-unique reference identifier for instances of this data group.	ID			✓	All id data elements are shown as required so that that every data group can be explicitly identified. Almost no other data elements are shown as required but they may be required by specific rulesets.
reporting_name	Descriptive name used in RCT reports if id is not already a descriptive name	String				
notes	Supplementary information to provide context to the model reviewer	String				Notes are not used by the RCT, but may be included in RCT reports to give the reviewer additional information or context
data_timestamp	Date and time of data publication	Timestamp			✓	Date and time of publication of the data
data_version	Integer version identifier for the data	Integer		≥1		Used by data publisher to track revisions of the data and shall be incremented for each data revision

Name	Description	Data Type	Units	Range	Req	Notes
ruleset_model_descriptions	A list of the ruleset model descriptions within the project each with a unique ruleset_model_type.	[[RulesetModelDescription]]			✓	For submissions with ruleset model descriptions (i.e., user, proposed, baseline,...) generated as separate files, only one model description would be defined for each ASHRAE229 ruleset project description json file. For submissions where the software always produces all ruleset model descriptions together, multiple model descriptions would appear in the same ASHRAE229 ruleset project description json file. Some rulesets may restrict the submission process including the number of files and number of model descriptions per file. Multiple model descriptions may be required by rulesets that require models at various tiers or levels of performance. Model descriptions may also be used by References between data groups and are restricted to be within the same ruleset model description. For 90.1-2019 appendix G model descriptions would be created for the following models: user, proposed, baseline at 0 degrees, baseline at 90 degrees, baseline at 180 degrees, and baseline at 270 degrees. All IDs within a ruleset model description should be unique for each type of data group. Between ruleset model descriptions, IDs should be the same for the same component. For example, a Surface with an ID of LobbyFrontSurface is very likely to have the same geometry for all ruleset model descriptions except perhaps the azimuth so that surface should have the ID LobbyFrontSurface for all ruleset model descriptions.
calendar	Information on the calendar used with the simulation.	{Calendar}				
weather	Information on the local weather conditions used with the simulation.	{weather}				
compliance_path	Indicates the chosen compliance path if the ruleset has multiple compliance paths such as 90.1 Appendix G has code compliance and beyond code	<CompliancePathOptions2019ASHRAE901>				
output_format_type	Indicates the chosen format for output	(<OutputSchemaOptions2019ASHRAE901>, <OutputSchemaOptions2019T24>, OutputSchemaOptionsRESNET)				

RulesetModelDescription

Name	Description	Data Type	Units	Range	Req	Notes
id	Scope-unique reference identifier for instances of this data group	ID			✓	
reporting_name	Descriptive name used in RCT reports if id is not already a descriptive name	String				

Name	Description	Data Type	Units	Range	Req	Notes
notes	Supplementary information to provide context to the model reviewer	String				Notes are not used by the RCT, but may be included in RCT reports to give the reviewer additional information or context
type	Describes the current ruleset model description for rulesets with multiple simulation models	<RulesetModelOptions2019ASHRAE901>,<RulesetModelOptionsRESNET>,<RulesetModelOptions2019T24Com>,<RulesetModelOptions2019T24Res>			✓	Will usually designate which simulation this RulesetModelDescription refers to such as: PROPOSED, BASELINE_0, USER, RATED, REFERENCE
transformers	Electrical transformers at the building site	[[Transformer]]				Contains a list of transformers that convert electricity from a higher voltage to one used by the building, exterior lighting, and other services at the site.
buildings	Buildings on the site	[[Building]]				Contains a list of buildings on the site (often just one).
schedules	Schedules for internal loads, thermostats, equipment operation and control, and any other need.	[[Schedule]]				Contains a list of schedules used in model.
measured_infiltration_pressure_difference	Differential pressure difference used during measurement for infiltration values.	Numeric	Pa	≥0		Used as rating conditions for air leakage for a building. The most common values used are 50 Pa or 75 Pa since they correspond to common rating conditions. For the model of actual building value this value would be measured but for created baseline or reference model this could be an assumed value.
is_measured_infiltration_based_on_test	Indicates whether the differential pressure difference used during measurement for infiltration values is based on pressure testing of the building.	Boolean				
fluid_loops	Fluid loops on the site	[[FluidLoop]]				Contains a list of fluid loops on the site that are not child loops. In primary/secondary piping systems or more complicated piping systems, this data element should include a list of the primary loops. Child loops should appear in FluidLoop.child_loops.
service_water_heating_distribution_systems	Service water heating systems on the site	[[ServiceWaterHeatingDistributionSystem]]				Contains a list of service water heating distribution systems at the site.
service_water_heating_equipment	Service water heating equipment on the site	[[ServiceWaterHeatingEquipment]]				Contains a list of service water heating equipment at the site.
pumps	Pumps used on the site	[[Pump]]				
boilers	Boilers used on the site	[[Boiler]]				
chillers	Chillers used on the site	[[Chiller]]				
heat_rejections	HeatRejections used on the site	[[HeatRejection]]				
external_fluid_sources	ExternalFluidSources used on the site	[[ExternalFluidSource]]				The sources of energy, such as district chilled water, district hot water, and district steam.
site_zone_type	Site zone type for Sec 9.4.2	<ExteriorLightingZoneOptions2019ASHRAE901>				The site designation type for exterior lighting classification.
output	Output	((Output2019ASHRAE901))				

Building

Name	Description	Data Type	Units	Range	Req	Notes
id	Scope-unique reference identifier for instances of this data group	ID			✓	
reporting_name	Descriptive name used in RCT reports if id is not already a descriptive name	String				

Name	Description	Data Type	Units	Range	Req	Notes
notes	Supplementary information to provide context to the model reviewer	String				Notes are not used by the RCT, but may be included in RCT reports to give the reviewer additional information or context
building_segments	Large portions of a building that share a building area type	[{BuildingSegment}]				Contains a list of building segments in the building.
elevators	Elevators	[{Elevator}]				Contains a list of elevators in the building.
exterior_lighting	Exterior lighting systems	[{ExteriorLighting}]				Contains a list of exterior lighting systems for the building.
refrigerated_cases	Refrigerated cases	[{RefrigeratedCase}]				Contains a list of refrigerated cases in the building.
building_open_schedule	Reference to the schedule indicating when the building is open	Reference				One represent when the building is open and zero when closed. If the schedule is not present, 24 hour operation is assumed. Constraint to use when implemented :Schedule:
has_site_shading	Indicates whether the site has features that cast shadows on the building	Boolean				
number_of_floors_above_grade	Number of floors above grade	Numeric		≥0		For the entire building including all building segments. Includes only floors that are not devoted solely to parking or unconditioned space.
number_of_floors_below_grade	Number of floors below grade	Numeric		≥0		For the entire building including all building segments. Includes only floors that are not devoted solely to parking or unconditioned space.

BuildingSegment

Name	Description	Data Type	Units	Range	Req	Notes
id	Scope-unique reference identifier for instances of this data group	ID			✓	
reporting_name	Descriptive name used in RCT reports if id is not already a descriptive name	String				

Name	Description	Data Type	Units	Range	Req	Notes
notes	Supplementary information to provide context to the model reviewer	String				Notes are not used by the RCT, but may be included in RCT reports to give the reviewer additional information or context
number_of_floors_above_grade	Number of floors above grade	Numeric		≥0		For the portion of the building represented by the BuildingSegment.
number_of_floors_below_grade	Number of floors below grade	Numeric		≥0		For the portion of the building represented by the BuildingSegment.
is_all_new	Indicates whether the building segment is completely new construction (true) or existing (false).	Boolean				Projects that include additions should have a building segments that are existing (false) and for the addition (true). Curtain rules such as baseline fenestration area will apply differently to each portion.
zones	Zones in the building segment	[[{Zone}]]				Contains a list of zones in the building.
heating_ventilating_air_conditioning_systems	HVAC systems in the building segment	[{HeatingVentilatingAirConditioningSystem}]				Contains a list of HVAC systems in the building.
area_type_vertical_fenestration	Building area classification used for vertical fenestration	<VerticalFenestrationBuildingAreaOptions2019ASHRAE90L>				The enumeration is based on the standard used.
lighting_building_area_type	Building area lighting area type	<LightingBuildingAreaOptions2019ASHRAE90LT951TG38>				The lighting building area type for the building segment. If used, options are provided in the ruleset specific enumerations. This data element may also be used for determining the building area type for other purposes such as target setting targets (like 90.1 building performanc factors) so it should be completed even when the lighting building area method is not used.
area_type_heating_ventilating_air_conditioning_system	Classification used for HVAC	<HeatingVentilatingAirConditioningBuildingAreaOptions2019ASHRAE90L>				The enumeration is based on the standard used.
service_water_heating_area_type	Service water heating area type classification	<ServiceWaterHeatingAreaOptions2019ASHRAE90L>				The enumeration is based on the standard used.

Zone

Name	Description	Data Type	Units	Range	Req	Notes
id	Scope-unique reference identifier for instances of this data group	ID			✓	No multipliers or floor multipliers are used with the Zone data group so each zone should be individually identified.
reporting_name	Descriptive name used in RCT reports if id is not already a descriptive name	String				
notes	Supplementary information to provide context to the model reviewer	String				Notes are not used by the RCT, but may be included in RCT reports to give the reviewer additional information or context
spaces	Spaces in the zone	[[{Space}]]				Contains a list of spaces in the building.
floor_name	Floor name	String				Used to group zones on a floor. Zones with the same floor name are on the same floor. Numbers may be used as part of the floor name such as Level 1. If a number is used it should increase for increasing heights and use negative values for stories generally below ground. The floor name should generally correspond to numbering of floors on the plans.
volume	Volume of the space	Numeric	m3	≥0		
surfaces	Surfaces surrounding the zone	[[{Surface}]]				Contains a list of surfaces that define the zone.
conditioning_type	Space conditioning category	<ConditioningOptions>				
infiltration	Airleakage into the zone.	{Infiltration}				References a single infiltration data group. If a zone includes multiple spaces and infiltration is specified at the space level the rates and schedules should be aggregated to the zone.

Name	Description	Data Type	Units	Range	Req	Notes
design_thermostat_cooling_setpoint	Setpoint temperature for cooling during occupied hours	Numeric	C			The cooling setpoint temperature for the zone at design conditions.
thermostat_cooling_setpoint_schedule	Reference to the schedule containing the cooling setpoint temperatures	Reference				If the schedule is not present, the design thermostat cooling setpoint is assumed to be constant. Constraint to use when implemented :Schedule:
design_thermostat_heating_setpoint	Setpoint temperature for heating during occupied hours	Numeric	C			The heating setpoint temperature for the zone at design conditions.
thermostat_heating_setpoint_schedule	Reference to the schedule containing the heating setpoint temperatures	Reference				If the schedule is not present, the design thermostat heating setpoint is assumed to be constant. Constraint to use when implemented :Schedule:
minimum_humidity_setpoint_schedule	Reference to the schedule containing the minimum relative humidity setpoint	Reference		≥ 0 , ≤ 1		For schedule values use relative humidity expressed on a 0 to 1 scale. Constraint to use when implemented :Schedule:
maximum_humidity_setpoint_schedule	Reference to the schedule containing the maximum relative humidity setpoint	Reference		≥ 0 , ≤ 1		For schedule values use relative humidity expressed on a 0 to 1 scale. Constraint to use when implemented :Schedule:
terminals	List of terminals	[[Terminal]]				Multiple terminals may be used such as from a VAV system, a DOAS, and a baseboard.
served_by_service_water_heating_system	A service water heating system distribution serving the zone	Reference				Contains the ID of the service water heating distribution system serving the zone. The ID is a unique identification for a specific ServiceWaterHeatingSystem data group. Constraint to use when implemented :ServiceWaterHeatingDistributionSystem:
transfer_airflow_rate	Airflow rate for transfer air	Numeric	L/s			Net transfer air. Positive values indicate transfer air in to the zone and negative values show transfer out of the zone.
transfer_airflow_source_zone	ID of the source zone for transfer air.	Reference				Constraint to use when implemented :Zone:
zonal_exhaust_fan	Zonal exhaust fan	{Fan}				References a fan that is used to exhaust air from the zone. The fan should be configured to not be connected from any other HVAC data group.
exhaust_airflow_rate_multiplier_schedule	Reference to the schedule containing the multiplier for the exhaust airflow rate	Reference				If the schedule is not present, the multiplier is always one. Constraint to use when implemented :Schedule:
makeup_airflow_rate	Airflow rate for makeup air	Numeric	L/s	≥ 0		
non_mechanical_cooling_fan_power	Non-mechanical cooling fan power	Numeric	W	≥ 0		The power consumed by a fan used in a non-mechanical cooling device such as a ceiling fan.
non_mechanical_cooling_fan_airflow	Non-mechanical cooling fan airflow	Numeric	L/s	≥ 0		The airflow of a fan used in a non-mechanical cooling device such as a ceiling fan.
air_distribution_effectiveness	Air distribution effectiveness	Numeric		≥ 0		

Name	Description	Data Type	Units	Range	Req	Notes
aggregation_factor	Aggregation factor	Numeric		≥ 1		A factor that has already been applied when modeling a zone that represents an aggregation of several individual zones shown on design documents. For example, if five dwelling units facing the same orientation are modeled as a single zone, the total volume of the zone and the total surface area of the zone should be five times the values of a single dwelling unit shown on the design documents and aggregation_factor should be set to 5. Another example, when three identical floors are modeled, the zones modeled for these floors should represent the volume of the zone on three floors, and the aggregation_factor should be set to 3. A final example would be a big box retail store with eight units serving the core zone, the total floor area of the spaces in the core zone should already account for the total area, and the aggregation_factor should be set to 8. The factor is chiefly used to determine the size range for heating and cooling equipment serving that zone. Used only to confirm the individual size of heating or cooling units serving the zone so that the efficiency for that size range can be looked up in tables of equipment efficiency by size range. By dividing the heating and cooling capacity of the zone by the aggregation_factor, the result would indicate the capacity of the individual units represented by equipment. For zones not representing any type of aggregation, this value should be one. The aggregation_factor is typically an integer but occasionally may include a fractional value. The total area of the spaces and the volume of the zone should already be multiplied by the factor.

Space

Name	Description	Data Type	Units	Range	Req	Notes
id	Scope-unique reference identifier for instances of this data group	ID			✓	
reporting_name	Descriptive name used in RCT reports if id is not already a descriptive name	String				
notes	Supplementary information to provide context to the model reviewer	String				Notes are not used by the RCT, but may be included in RCT reports to give the reviewer additional information or context
interior_lighting	Internal lighting that produce internal gains for a space.	[{InteriorLighting}]				References one or more InteriorLighting data groups that collectively define all interior lighting within the space.
miscellaneous_equipment	Miscellaneous equipment loads that produce internal gains for a space.	[{MiscellaneousEquipment}]				References one or more MiscellaneousEquipment that collectively describe all of the miscellaneous equipment in the space.
floor_area	The floor area of the space.	Numeric	m2	≥ 0		The floor area of a space within the building, including basements, mezzanine and intermediate-floored tiers, and penthouses with a headroom height of 7.5 ft or greater. It is measured from the exterior faces of walls or from the center-line of walls separating buildings, but excluding covered walkways, open roofed-over areas, porches and similar spaces, pipe trenches, exterior terraces or steps, chimneys, roof overhangs, and similar features. This is the floor area that is modeled.

Name	Description	Data Type	Units	Range	Req	Notes
number_of_occupants	Number of occupants in the space	Numeric		≥0		
occupant_multiplier_schedule	Reference to the schedule containing the multiplier for the number of occupants	Reference				If the schedule is not present, the multiplier is always one. Constraint to use when implemented :Schedule:
occupant_sensible_heat_gain	Sensible heat gain of each occupant.	Numeric	W	≥0		
occupant_latent_heat_gain	Latent heat gain of each occupant.	Numeric	W	≥0		
status_type	Choice of new, existing, addition, alteration, etc.	<StatusOptions>				
function	Generic function for the space.	<SpaceFunctionOptions>				The enumeration is based on the standard used.
envelope_space_type	Envelope space type classification	<EnvelopeSpaceOptions2019ASHRAE901>				The enumeration is based on the standard used. Often referred to as occupancy type.
lighting_space_type	Lighting space type classification	<LightingSpaceOptions2019ASHRAE901TG37>				The enumeration is based on the standard used.
ventilation_space_type	Ventilation space type classification	<VentilationSpaceOptions2019ASHRAE901>				The enumeration is based on the standard used.
service_water_heating_area_type	Service water heating area type classification	<ServiceWaterHeatingAreaOptions2019ASHRAE901>				The enumeration is based on the standard used.
service_water_heating_uses	List of service water heating uses	[[ServiceWaterHeatingUse]]				

Infiltration

Name	Description	Data Type	Units	Range	Req	Notes
id	Scope-unique reference identifier for instances of this data group	ID			✓	
reporting_name	Descriptive name used in RCT reports if id is not already a descriptive name	String				
notes	Supplementary information to provide context to the model reviewer	String				Notes are not used by the RCT, but may be included in RCT reports to give the reviewer additional information or context
modeling_method	The software methodology chosen for modeling infiltration	<InfiltrationMethodOptions>				
algorithm_name	Name of the algorithm used for modeling infiltration in the specific simulation engine.	String				
measured_air_leakage_rate	Measured air leakage rate from infiltration of outside air	Numeric	m3/s	≥0		Based on the pressure described in ASHRAE229.measured_infiltration_pressure_difference. If a zone includes multiple spaces and infiltration is specified at the space level the rates should be aggregated to the zone.

Name	Description	Data Type	Units	Range	Req	Notes
flow_rate	Design infiltration flow rate	Numeric	m3/s	≥0		Infiltration flow rate for simulation infiltration models unadjusted for temperature difference or windspeed or schedule often with a windspeed at 10 mph (4.5 m/s). This may vary in meaning between simulation engines. If a zone includes multiple spaces and infiltration is specified at the space level the rates should be aggregated to the zone.
multiplier_schedule	Referenced to the schedule containing the multiplier for the infiltration	Reference				If the schedule is not present, the multiplier is always one. If a zone includes multiple spaces and infiltration is specified at the space level the rates and schedules should be aggregated to the zone. Constraint to use when implemented :Schedule:

Surface

Name	Description	Data Type	Units	Range	Req	Notes
id	Scope-unique reference identifier for instances of this data group	ID			✓	
reporting_name	Descriptive name used in RCT reports if id is not already a descriptive name	String				
notes	Supplementary information to provide context to the model reviewer	String				Notes are not used by the RCT, but may be included in RCT reports to give the reviewer additional information or context
subsurfaces	Subsurfaces that are on the surface	[{Subsurface}]				Contains a list of surfaces that define the space.
classification	Classification for the surface.	<SurfaceClassificationOptions>				Options for surface being interior or exterior wall, floor, or ceiling.
area	area of the surface	Numeric	m2	≥0		Measured from interior face area. It is the gross area of the wall and includes the area of all subsurfaces.
tilt	Angle between vertical and the surface outward normal	Numeric	degrees			Example value would be 0 = roof, 90 = wall, 180 = downward facing surface (exterior floor)
azimuth	Clockwise angle between North and the horizontal projection of the wall's outward normal.	Numeric	degrees	≥0		Example values would be 0 = north, 90 = East, 180 = South, 270 = West. For rulesets with baseline rotations, the angle of the azimuth should be different for each baseline rotation.

Name	Description	Data Type	Units	Range	Req	Notes
adjacent_to	Used to classify the conditions on the surface.	(<SurfaceAdjacencyOptions>, <AdditionalSurfaceAdjacencyOptionsRESNET>, <AdditionalSurfaceAdjacencyOptions2019ASHRAE901>)				Determines whether the other side of the surface is modeled and if not what assumptions should be used. Commonly, plenums do not need to be explicitly described for many rulesets and instead when a plenum is present in the simulation model, this field should be set to the what is adjacent to the other side of the plenum. For example, on the top floor with a plenum, EXTERIOR would be entered.
adjacent_zone	ID of the adjacent zone for interior surface. Only required when adjacent zone is explicitly modeled when adjacent_to is set to INTERIOR.	Reference				Constraint to use when implemented :Zone:
does_cast_shade	Determines whether the surface is modeled as casting shade on other exterior surfaces	Boolean				
construction	Construction description of surface.	{Construction}				
optical_properties	Optical properties of the surface.	{SurfaceOpticalProperties}				
status_type	Choice of new, existing, addition, alteration, etc. for each ruleset.	<StatusOptions>				

Construction

Name	Description	Data Type	Units	Range	Req	Notes
id	Scope-unique reference identifier for instances of this data group	ID			✓	
reporting_name	Descriptive name used in RCT reports if id is not already a descriptive name	String				
notes	Supplementary information to provide context to the model reviewer	String				Notes are not used by the RCT, but may be included in RCT reports to give the reviewer additional information or context
classification	Classification for the subsurface being window, skylight, door.	(<ConstructionClassificationOptions2019ASHRAE901>, <ConstructionClassificationOptions2019T24>)				
surface_construction_input_option	Identifies whether construction is entered layer-by-layer or simplified (R-value)	<SurfaceConstructionInputOptions>				

Name	Description	Data Type	Units	Range	Req	Notes
<code>fraction_framing</code>	Fraction of the construction that is framing.	<code>Numeric</code>		$\geq 0, \leq 1$		Fraction of the construction using <code>framing_layers</code> , the remaining portion uses the <code>primary_layers</code> . If blank, assume zero framing.
<code>primary_layers</code>	List of names of layer descriptions starting from the outside surface for primary heat path	<code>[{Material}]</code>				For constructions with framing and cavity heat transfer paths, use this for the cavity. For constructions with homogeneous layer, use this element only. Air films should not be included in the list of layers.
<code>framing_layers</code>	List of names of layer descriptions starting from the outside surface for the framing heat path	<code>[{Material}]</code>				For constructions with framing and cavity heat transfer paths, use this for the framing otherwise leave blank. Air films should not be included in the list of layers.
<code>insulation_locations</code>	List of locations for the insulation related to the surface that correspond to the values in the <code>r_values</code> list	<code>[<InsulationLocationOptions>]</code>				
<code>u_factor</code>	surface U-factor	<code>Numeric</code>	W/m2-K	≥ 0		Includes interior and exterior air films as specified by the referenced standard.
<code>c_factor</code>	surface C-factor	<code>Numeric</code>	W/m2-K	≥ 0		Typically used to describe the thermal performance of constructions used in below grade walls. It is the time rate of steady-state heat flow through unit area of a material or construction, induced by a unit temperature difference between the body surfaces. Note that the C-factor does not include soil or air films.
<code>f_factor</code>	surface F-factor	<code>Numeric</code>	W/m-K	≥ 0		Typically used to describe the thermal performance of constructions used in slab-on-grade floors. It is the heat transfer through the floor, induced by a unit temperature difference between the outside and inside air temperature, on the per linear length of the exposed perimeter of the floor.

Name	Description	Data Type	Units	Range	Req	Notes
<code>r_values</code>	List of r-value of the insulation for the surface that correspond to values in the <code>insulation_locations</code> list	<code>[Numeric]</code>	K-m ² /W	≥0		
<code>has_radiant_heating</code>	Includes embedded radiant heating elements	<code>Boolean</code>				
<code>has_radiant_cooling</code>	Includes embedded radiant cooling elements	<code>Boolean</code>				

Material

Name	Description	Data Type	Units	Range	Req	Notes
<code>id</code>	Scope-unique reference identifier for instances of this data group	<code>ID</code>			✓	
<code>reporting_name</code>	Descriptive name used in RCT reports if <code>id</code> is not already a descriptive name	<code>String</code>				
<code>notes</code>	Supplementary information to provide context to the model reviewer	<code>String</code>				Notes are not used by the RCT, but may be included in RCT reports to give the reviewer additional information or context
<code>thickness</code>	The thickness of the material layer	<code>Numeric</code>	m	>0		
<code>thermal_conductivity</code>	The thermal conductivity of the material layer	<code>Numeric</code>	W/m-K	≥0		When <code>thermal_conductivity</code> is specified, <code>r_value</code> should not be provided.
<code>density</code>	The density of the material layer	<code>Numeric</code>	kg/m ³	≥0		
<code>specific_heat</code>	The specific heat of the material layer	<code>Numeric</code>	J/kg-K	≥0		
<code>r_value</code>	r-value of the insulation for the material layer	<code>Numeric</code>	K-m ² /W	≥0		When <code>r_value</code> is specified, <code>thermal_conductivity</code> should not be provided. Typically used for insulation or air gaps.

SurfaceOpticalProperties

Name	Description	Data Type	Units	Range	Req	Notes
<code>id</code>	Scope-unique reference identifier for instances of this data group	<code>ID</code>			✓	
<code>reporting_name</code>	Descriptive name used in RCT reports if id is not already a descriptive name	<code>String</code>				
<code>notes</code>	Supplementary information to provide context to the model reviewer	<code>String</code>				Notes are not used by the RCT, but may be included in RCT reports to give the reviewer additional information or context
<code>absorptance_thermal_exterior</code>	Thermal absorptance of long wavelength radiation on the exterior surface.	<code>Numeric</code>		≥ 0		May also be called thermal emittance, emittance or emissivity and represents the fraction of incident long wavelength radiation that is absorbed by the material
<code>absorptance_solar_exterior</code>	Thermal absorptance of short wavelength radiation on the exterior surface.	<code>Numeric</code>		≥ 0		Equals one minus the solar reflectance (for opaque materials) and represents the fraction of incident solar radiation that is absorbed by the material
<code>absorptance_visible_exterior</code>	Thermal absorptance of visible radiation on the exterior surface.	<code>Numeric</code>		≥ 0		Equals one minus the visible reflectance (for opaque materials) and represents the fraction of incident visible wavelength radiation that is absorbed by the material

Name	Description	Data Type	Units	Range	Req	Notes
<code>absorptance_thermal_interior</code>	Thermal absorptance of long wavelength radiation on the interior surface.	Numeric		≥ 0		May also be called thermal emittance, emittance or emissivity and represents the fraction of incident long wavelength radiation that is absorbed by the material
<code>absorptance_solar_interior</code>	Thermal absorptance of short wavelength radiation on the interior surface.	Numeric		≥ 0		Equals one minus the solar reflectance (for opaque materials) and represents the fraction of incident solar radiation that is absorbed by the material
<code>absorptance_visible_interior</code>	Thermal absorptance of visible radiation on the interior surface.	Numeric		≥ 0		Equals one minus the visible reflectance (for opaque materials) and represents the fraction of incident visible wavelength radiation that is absorbed by the material

Subsurface

Name	Description	Data Type	Units	Range	Req	Notes
<code>id</code>	Scope-unique reference identifier for instances of this data group	ID			✓	
<code>reporting_name</code>	Descriptive name used in RCT reports if id is not already a descriptive name	String				
<code>notes</code>	Supplementary information to provide context to the model reviewer	String				Notes are not used by the RCT, but may be included in RCT reports to give the reviewer additional information or context
<code>classification</code>	Classification for the subsurface being window, skylight, door.	<SubsurfaceClassificationOptions>				
<code>subclassification</code>	Standard specific subclassification for subsurfaces	<SubsurfaceSubclassificationOptions2019ASHRAE901>				

Name	Description	Data Type	Units	Range	Req	Notes
is_operable	Identifies whether window subsurface can be opened and closed including by pivoting or sliding.	Boolean				This applies to windows and skylights but not to doors.
has_open_sensor	Has sensor and reports to building control system when the window or door is open.	Boolean				
framing_type	The material of the framing.	<SubsurfaceFrameOptions2019ASHRAE901>				This applies to windows and skylights but not to doors.
glazed_area	Area of subsurface including glass and transparent surfaces	Numeric	m2	≥0		
opaque_area	Area of subsurface framing for a window or skylight or opaque portion for a door.	Numeric	m2	≥0		
u_factor	Overall Subsurface U-factor	Numeric	W/m2-K	≥0		Includes interior and exterior air films as specified by the referenced standard.
dynamic_glazing_type	Type of dynamic glazing for the window subsurface	<SubsurfaceDynamicGlazingOptions>				Indicates if the glazed subsurface can change it's performance properties and if it is automatic or not.
solar_heat_gain_coefficient	Subsurface SHGC	Numeric		≥0		For dynamic glazing represents the minimum SHGC
maximum_solar_heat_gain_coefficient	Maximum Subsurface SHGC for Dynamic Glazing	Numeric		≥0		Only used for dynamic glazing
visible_transmittance	Subsurface VT	Numeric		≥0		For dynamic glazing represents the maximum visible transmittance
minimum_visible_transmittance	Minimum Subsurface VT for Dynamic Glazing	Numeric		≥0		Only used for dynamic glazing
depth_of_overhang	Distance from the edge of the overhang to the subsurface.	Numeric	m	≥0		
has_shading_overhang	Identifies whether subsurface has overhangs	Boolean				
has_shading_sidefins	Identifies whether subsurface has sidefins	Boolean				
has_manual_interior_shades	Are there manually-operated interior shading such as blinds, curtains or shades	Boolean				
solar_transmittance_multiplier_summer	Solar transmittance multiplier for summer	Numeric		≥0		Often used to account for interior shading such as drapes.
solar_transmittance_multiplier_winter	Solar transmittance multiplier for summer	Numeric		≥0		Often used to account for interior shading such as drapes.
has_automatic_shades	Are there automatic interior shading such as blinds, curtains or shades	Boolean				

Name	Description	Data Type	Units	Range	Req	Notes
status_type	Choice of new, existing, addition, alteration, etc. for each ruleset.	<StatusOptions>				

InteriorLighting

Name	Description	Data Type	Units	Range	Req	Notes
id	Scope-unique reference identifier for instances of this data group	ID			✓	
reporting_name	Descriptive name used in RCT reports if id is not already a descriptive name	String				
notes	Supplementary information to provide context to the model reviewer	String				Notes are not used by the RCT, but may be included in RCT reports to give the reviewer additional information or context
purpose_type	Lighting purpose type classification	<LightingPurposeOptions2019ASHRAE901>				The enumeration is based on the standard used.
power_per_area	Total power for lights divided by the area of the space.	Numeric	W/m2			When computing the power per area use the area of the entire space.
lighting_multiplier_schedule	Reference to the schedule containing the multiplier for lighting	Reference				If the schedule is not present, the multiplier is always one. Constraint to use when implemented :Schedule:
occupancy_control_type	Indicates the type of occupancy controls	<LightingOccupancyControlOptions>				
daylighting_control_type	Indicates the type of daylighting controls	<LightingDaylightingControlOptions>				
are_schedules_used_for_modeling_occupancy_control	Indicates that schedule values are used for modeling the impacts of occupancy controls on lighting.	Boolean				
are_schedules_used_for_modeling_daylighting_control	Indicates that schedule values are used for modeling the impacts of daylighting controls on lighting.	Boolean				For simulations that are modeling daylighting by computing the illuminance this should be false.

MiscellaneousEquipment

Name	Description	Data Type	Units	Range	Req	Notes
id	Scope-unique reference identifier for instances of this data group	ID			✓	

Name	Description	Data Type	Units	Range	Req	Notes
reporting_name	Descriptive name used in RCT reports if id is not already a descriptive name	String				
notes	Supplementary information to provide context to the model reviewer	String				Notes are not used by the RCT, but may be included in RCT reports to give the reviewer additional information or context
energy_type	Source of energy for the miscellaneous equipment in the space	<EnergySourceOptions>				To indicate that the energy is not accounted for by any utility supplied source, choose NONE. To indicate equipment with a energy source from a Loop choose OTHER
power	Power for miscellaneous equipment in the space	Numeric	W			The value of power for the miscellaneous equipment in the space that when multiplied by the schedule is the consumption of power (for electricity or other energy_type's) for each period in the schedule.
multiplier_schedule	Reference to the schedule containing the multiplier for miscellaneous equipment power in the space.	Reference				If the schedule is not present, the multiplier is always one. Constraint to use when implemented :Schedule:
sensible_fraction	Fraction of energy that is a sensible load on the space.	Numeric		≥ 0 , ≤ 1		Sensible plus latent do not necessarily add up to 1.0.
latent_fraction	Fraction of energy that is a latent load on the space.	Numeric		≥ 0 , ≤ 1		Sensible plus latent do not necessarily add up to 1.0.
remaining_fraction_to_loop	Referenced to the water fluid loop for the remaining fraction	Reference				If sensible_fraction and latent_fraction add up to less than 1.0 and this field is specified then the chilled water or condenser water loop specified gets the remaining fraction of the miscellaneous load. Constraint to use when implemented :FluidLoop:
energy_from_loop	Referenced to the loop serving as the source of energy	Reference				References the loop that is the source of energy for the miscellaneous equipment. Example would be hot water that is used for laundry in the zone. When this is used the energy_type should be set to OTHER. Constraint to use when implemented :FluidLoop:
type	Type of miscellaneous equipment	<MiscellaneousEquipmentOptions>				
has_automatic_control	Indicates that the receptacles have automatic controls	Boolean				

Transformer

Name	Description	Data Type	Units	Range	Req	Notes
id	Scope-unique reference identifier for instances of this data group	ID			✓	
reporting_name	Descriptive name used in RCT reports if id is not already a descriptive name	String				
notes	Supplementary information to provide context to the model reviewer	String				Notes are not used by the RCT, but may be included in RCT reports to give the reviewer additional information or context
type	The type of transformer	<TransformerOptions>				
phase	The number of electrical phases	<ElectricalPhaseOptions>				
efficiency	Transformer efficiency	Numeric		≥0, ≤1		Expresses the efficiency of the transformer as a fraction from 0 to 1, where 1 would represent 100% efficiency.
capacity	Rated Capacity of the Transformer	Numeric	V-A	≥0		
peak_load	Annual Peak electric load on the transformer	Numeric	W	≥0		Peak electric load on the transformer based on an annual simulation with typical weather file.

Schedule

Name	Description	Data Type	Units	Range	Req	Notes
id	Scope-unique reference identifier for instances of this data group	ID			✓	
reporting_name	Descriptive name used in RCT reports if id is not already a descriptive name	String				

Name	Description	Data Type	Units	Range	Req	Notes
notes	Supplementary information to provide context to the model reviewer	String				Notes are not used by the RCT, but may be included in RCT reports to give the reviewer additional information or context
purpose	The purpose of schedule	String				Describe the purpose of the schedule and how it can be used. Not an enumerations. The purpose assigned by BEM tool should match across RMDs. Examples include thermostat, multiplier for lighting, availability for equipment.
sequence_type	Schedule sequence type	<ScheduleSequenceOptions>				
hourly_values	Hourly Values of Schedule	[Numeric] [0..8784]				Used when schedule_sequence_type is HOURLY. Can also use functions like EFLH(), MAX(), MIN() to determine overall characteristics for the list of schedule values.
hourly_heating_design_day	Hourly values for heating design day	[Numeric] [0..24]				Used when schedule_sequence_type is HOURLY.
hourly_cooling_design_day	Hourly values for cooling design day	[Numeric] [0..24]				Used when schedule_sequence_type is HOURLY.
event_times	Event times when the schedule changes	[Numeric]	s			Used when schedule_sequence_type is EVENT to describe the time of the year in seconds that the schedule changes value.
event_values	Event value at corresponding event time.	[Numeric]				Used when schedule_sequence_type is EVENT. New values starting at corresponding to the event time until following event time minus one second. Can also use functions like EFLH(), MAX(), MIN() to determine overall characteristics for the list of schedule values.
event_times_heating_design_day	Event times when the schedule changes for heating design day	[Numeric]	s			Used when schedule_sequence_type is EVENT.
event_values_heating_design_day	Event value at corresponding event time for heating design day	[Numeric]				Used when schedule_sequence_type is EVENT. New values starting at corresponding to the event time until following event time minus one second.
event_times_cooling_design_day	Event times when the schedule changes for cooling design day	[Numeric]	s			Used when schedule_sequence_type is EVENT.
event_values_cooling_design_day	Event value at corresponding event time for cooling design day	[Numeric]				Used when schedule_sequence_type is EVENT. New values starting at corresponding to the event time until following event time minus one second.
type	The type of schedule	<ScheduleOptions>				Primarily indicates if the values may be represented by units such as C for temperature or W for power or m3/s for flow rate or are dimensionless multipliers.
prescribed_type	Options when any schedule values have changed from what appears in the schedule library	<PrescribedScheduleOptions2019ASHRAE901>				Some rule sets prescribe which schedules to use for modeling purposes. This option indicates if the schedule is as prescribed or has been modified.

Name	Description	Data Type	Units	Range	Req	Notes
is_modified_for_workaround	True if any schedule has been modified for a workaround	Boolean				Not all technologies can be modeled directly in the simulation program. Modifying schedules is a common workaround for modeling some technologies. This flag is used to indicate when a schedule has been modified for this purpose.

Calendar

Name	Description	Data Type	Units	Range	Req	Notes
notes	Supplementary information to provide context to the model reviewer	String				Notes are not used by the RCT, but may be included in RCT reports to give the reviewer additional information or context
day_of_week_for_january_1	Day of the week for January 1	<DayOfWeekOptions>				
is_leap_year	The schedules assume it is a leap year	Boolean				This value is true if the calendar and schedules include February 29.
has_daylight_saving_time	The schedules adjust for Daylight Saving Time	Boolean				This value should be true if the modeled calendar includes daylight saving time.

Weather

Name	Description	Data Type	Units	Range	Req	Notes
notes	Supplementary information to provide context to the model reviewer	String				Notes are not used by the RCT, but may be included in RCT reports to give the reviewer additional information or context
ground_temperature_schedule	Ground temperature schedule name	Reference				Constraint to use when implemented :Schedule:
file_name	The file name for the weather file including extension.	String				The file name for the annual weather file such as from TMY, TRY, CWC, CTZ, WYEC or other sources.
data_source_type	Data source use for the weather file.	<WeatherFileDataSourceOptions>				
climate_zone	The designation of the climate zone where the building is located	<ClimateZoneOptions2019ASHRAE90I>				The enumeration is based on the standard used.
cooling_design_day_type	The frequency of occurrence type for cooling design day	<CoolingDesignDayOptions>				
heating_design_day_type	The frequency of occurrence type for heating design day	<HeatingDesignDayOptions>				

Elevator

Name	Description	Data Type	Units	Range	Req	Notes
<code>id</code>	Scope-unique reference identifier for instances of this data group	<code>ID</code>			✓	
<code>reporting_name</code>	Descriptive name used in RCT reports if id is not already a descriptive name	<code>String</code>				
<code>notes</code>	Supplementary information to provide context to the model reviewer	<code>String</code>				Notes are not used by the RCT, but may be included in RCT reports to give the reviewer additional information or context
<code>type</code>	The type of elevator	<code><ElevatorOptions></code>				
<code>motor_location_zone</code>	Zone where the heat from the motor goes	<code>Reference</code>				When specified, it is the zone the heat from the elevator motor get added to. Constraint to use when implemented :Zone:
<code>motor_heat_fraction</code>	Fraction of heat from the motor that is added as a sensible load zone.	<code>Numeric</code>		≥ 0 , ≤ 1		
<code>cab_location_zone</code>	Zone where the heat from the cab goes	<code>Reference</code>				When specified, it is the zone the heat from the cab get added to to the zone including lighting heat, fan heat, and accessory heat. Constraint to use when implemented :Zone:
<code>cab_heat_fraction</code>	Fraction of heat from the cab that is added as a sensible load zone.	<code>Numeric</code>		≥ 0 , ≤ 1		When specified, it is the fraction of the heat from the cab that gets added to the zone including lighting heat, fan heat, and accessory heat
<code>is_variable_speed_motor</code>	If the elevator uses a variable speed motor drive	<code>Boolean</code>				

Name	Description	Data Type	Units	Range	Req	Notes
<code>motor_power</code>	Elevator average hourly peak motor power	<code>Numeric</code>	W			The motor power can be provided either together with or, instead of, the detailed elements used to calculate it.
<code>cab_counterweight</code>	Elevator car counterweight	<code>Numeric</code>	kg			
<code>cab_weight</code>	Weight of elevator car	<code>Numeric</code>	kg			
<code>design_load</code>	Elevator load at which to operate	<code>Numeric</code>	kg			
<code>speed</code>	Design speed of the elevator	<code>Numeric</code>	m/s			
<code>cab_area</code>	Floor area of elevator cab	<code>Numeric</code>	m2			
<code>cab_lighting_power</code>	Lighting power of cab	<code>Numeric</code>	W			
<code>cab_ventilation_fan_power</code>	Ventilation fan power of cab	<code>Numeric</code>	W			
<code>cab_ventilation_fan_flow</code>	Airflow of cab ventfan	<code>Numeric</code>	L/s			
<code>cab_motor_multiplier_schedule</code>	Elevator motor operation multiplier schedule name	<code>Reference</code>				If the schedule is not present, the multiplier is always one. Constraint to use when implemented :Schedule:
<code>cab_ventilation_fan_multiplier_schedule</code>	Elevator ventilation fan operation multiplier schedule name	<code>Reference</code>				If the schedule is not present, the multiplier is always one. Constraint to use when implemented :Schedule:
<code>cab_lighting_multiplier_schedule</code>	Elevator lighting multiplier schedule name	<code>Reference</code>				If the schedule is not present, the multiplier is always one. Constraint to use when implemented :Schedule:

HeatingVentilatingAirConditioningSystem

Name	Description	Data Type	Units	Range	Req	Notes
<code>id</code>	Scope-unique reference identifier for instances of this data group	<code>ID</code>			✓	

Name	Description	Data Type	Units	Range	Req	Notes
reporting_name	Descriptive name used in RCT reports if id is not already a descriptive name	String				
notes	Supplementary information to provide context to the model reviewer	String				Notes are not used by the RCT, but may be included in RCT reports to give the reviewer additional information or context
fan_system	Fan system	{FanSystem}				One FanSystem for each HeatingVentilatingAirConditioningSystem so if a direct outdoor air system is used a second Zone Terminal should be specified with a separate HeatingVentilatingAirConditioningSystem.
heating_system	Heating system	{HeatingSystem}				References the HeatingSystem data group that acts as the main heating system or coil for this HVAC System. If the HVAC system does not have a heating system, this entry can be left blank, or the HeatingSystem HeatingSystemOptions can be set to equal NONE.
cooling_system	Cooling system	{CoolingSystem}				References the CoolingSystem data group associated with this HVAC System. If the HVAC system does not have a cooling system, this entry can be left blank, or the CoolingSystem CoolingSystemOptions can be set to equal NONE.
preheat_system	Pre-heating system	{HeatingSystem}				References a HeatingSystem data group that provides preheat to this HVAC System. Preheat is typically a coil used to temper cold air entering an HVAC system often when high quantities of outdoor air is expected. If the HVAC system does not have a preheat system, this entry can be left blank, or the HeatingSystem HeatingSystemOptions can be set to equal NONE in the referenced data group.
status_type	Choice of new, existing, addition, alteration, etc. for each ruleset.	<StatusOptions>				

HeatingSystem

Name	Description	Data Type	Units	Range	Req	Notes
id	Scope-unique reference identifier for instances of this data group	ID			✓	
reporting_name	Descriptive name used in RCT reports if id is not already a descriptive name	String				
notes	Supplementary information to provide context to the model reviewer	String				Notes are not used by the RCT, but may be included in RCT reports to give the reviewer additional information or context

Name	Description	Data Type	Units	Range	Req	Notes
type	Heating system type	<HeatingSystemOptions>				System configurations that typically are at the zone and include a compressor (such as packaged terminal air conditioning, packaged terminal heat pumps, window air conditioning units, and water loop heat pumps) should be reported in the schema using HeatingSystem and CoolingSystem. Systems that include gas or electric furnaces should be reported in the schema using HeatingSystem. System configurations that are at the zone and only include fans and coils (such as four-pipe fan coil, two-pipe fan coil, radiant systems, baseboards, and chilled beams) should be reported in the schema using Terminal with the chilled water and hot water systems described in the cooling_source and heating_source data elements (and any other relevant Terminal Data elements). Evaporative cooling systems should be described in CoolingSystem. Passive diffusers with no coil or fan should be described in Terminal.
energy_source_type	Source of energy for the heating system	<EnergySourceOptions>				
hot_water_loop	Referenced to the hot water fluid loop	Reference				Constraint to use when implemented :FluidLoop:
water_source_heat_pump_loop	Referenced to the water fluid loop to support water source heat pumps	Reference				Constraint to use when implemented :FluidLoop:
design_capacity	Design heating capacity	Numeric	W	≥0		Design capacity may be determined by sizing performed by the software. This value should be provided if sized by the simulation software as an output or explicitly provided as a simulation input.
rated_capacity	Rated heating capacity	Numeric	W	≥0		At rating conditions. The rated capacity is generally used to determine efficiency level when efficiency level is based on size. It is net heating capacity taking into account the heat from the indoor fan.
oversizing_factor	The oversizing factor applied to the peak load that results in the heat capacity. Zero indicates no oversizing.	Numeric		≥0		Used for furnace or heat pump.
is_sized_based_on_design_day	True if the component is sized by the simulation software for the design day	Boolean				
heating_coil_setpoint	Setpoint of the air leaving the heating coil	Numeric	C			The setpoint of the air leaving the heating coil at design conditions.
efficiency_metric_values	List of efficiency metric values that correspond to the descriptors in efficiency_metric_types list	[Numeric]	W/W			Used for furnace or heat pump.
efficiency_metric_types	List of efficiency metrics that correspond to the values in efficiency_metric_values list	<HeatingMetricOptions>				Used for furnace or heat pump.
heatpump_auxilliary_heat_type	Heatpump auxilliary heat type used for backup	<HeatpumpAuxilliaryHeatOptions>				
heatpump_auxilliary_heat_high_shutoff_temperature	Heatpump auxilliary heat high temperature shutoff	Numeric	C			The auxiliary heat is available at or below this outside temperature to satisfy the load. If this temperature is higher than heatpump_low_shutoff_temperature then between the two temperatures, the heat pump is energized first and if any load remains, then the auxiliary heat is energized.
heatpump_low_shutoff_temperature	Heatpump low temperature shutoff	Numeric	C			The heat pump is available at above this outdoor temperature to satisfy the load. The heat pump is always energized first to meet any heating load prior to the use of auxillar heat.
humidification_type	Humidification type	<HumidificationOptions>				

CoolingSystem

Name	Description	Data Type	Units	Range	Req	Notes
id	Scope-unique reference identifier for instances of this data group	ID			✓	
reporting_name	Descriptive name used in RCT reports if id is not already a descriptive name	String				
notes	Supplementary information to provide context to the model reviewer	String				Notes are not used by the RCT, but may be included in RCT reports to give the reviewer additional information or context

Name	Description	Data Type	Units	Range	Req	Notes
type	Cooling system type	<CoolingSystemOptions>				System configurations that typically are at the zone and include a compressor (such as packaged terminal air conditioning, packaged terminal heat pumps, window air conditioning units, and water loop heat pumps) should be reported in the schema using HeatingSystem and CoolingSystem. Systems that include gas or electric furnaces should be reported in the schema using HeatingSystem. System configurations that are at the zone and only include fans and coils (such as four-pipe fan coil, two-pipe fan coil, radiant systems, baseboards, and chilled beams) should be reported in the schema using Terminal with the chilled water and hot water systems described in the cooling_source and heating_source data elements (and any other relevant Terminal Data elements). Evaporative cooling systems should be described in CoolingSystem. Passive diffusers with no coil or fan should be described in Terminal.
design_total_cool_capacity	Design total cooling capacity	Numeric	W	≥0		Designed total cooling capacity. Design capacity may be determined by sizing performed by the software. This value should be provided if sized by the simulation software as an output or explicitly provided as a simulation input.
design_sensible_cool_capacity	Design sensible cooling capacity	Numeric	W	≥0		Designed sensible cooling capacity. Design sensible capacity may be determined by sizing performed by the software. This value should be provided if sized by the simulation as an output or explicitly provided as a simulation input.
rated_total_cool_capacity	Rated total cooling capacity	Numeric	W	≥0		At rating conditions. The rated capacity is generally used to determine efficiency level when efficiency level is based on size. It is net cooling capacity taking into account the heat from the indoor fan.
rated_sensible_cool_capacity	Rated sensible cooling capacity	Numeric	W	≥0		At rating conditions. The rated capacity is generally used to determine efficiency level when efficiency level is based on size. It is net sensible cooling capacity taking into account the heat from the indoor fan.
oversizing_factor	The oversizing factor applied to the peak load that results in the cool capacity. Zero indicates no oversizing.	Numeric		≥0		
is_sized_based_on_design_day	True if the component is sized by the simulation software for the design day	Boolean				

Name	Description	Data Type	Units	Range	Req	Notes
<code>chilled_water_loop</code>	Referenced to the Chilled water fluid loop	<code>Reference</code>				Constraint to use when implemented :FluidLoop:
<code>condenser_water_loop</code>	Referenced to the Condenser water fluid loop	<code>Reference</code>				Constraint to use when implemented :FluidLoop:
<code>efficiency_metric_values</code>	List of efficiency metric values that correspond to the descriptors in <code>efficiency_metric_types</code> list	<code>[Numeric]</code>	W/W			Used for direct expansion.
<code>efficiency_metric_types</code>	List of efficiency metrics that correspond to the values in <code>efficiency_metric_values</code> list	<code>[<CoolingMetricOptions>]</code>				Used for direct expansion.
<code>dehumidification_type</code>	Dehumidification type	<code><DehumidificationOptions></code>				
<code>cooling_turndown_ratio</code>	Cooling turndown ratio	<code>Numeric</code>				Cooling capacity turndown before simultaneous heating and cooling occurs.

FanSystem

Name	Description	Data Type	Units	Range	Req	Notes
<code>id</code>	Scope-unique reference identifier for instances of this data group	<code>ID</code>			✓	
<code>reporting_name</code>	Descriptive name used in RCT reports if id is not already a descriptive name	<code>String</code>				
<code>notes</code>	Supplementary information to provide context to the model reviewer	<code>String</code>				Notes are not used by the RCT, but may be included in RCT reports to give the reviewer additional information or context
<code>supply_fans</code>	List of supply fans	<code>[{Fan}]</code>				List of fans that supply air by the HVAC system and are located in the building.
<code>return_fans</code>	List of return fans	<code>[{Fan}]</code>				List of fans that return air to the HVAC system and are located in the building.
<code>exhaust_fans</code>	List of exhaust fans	<code>[{Fan}]</code>				List of fans that exhaust air from the building either at the air handler or located in various spaces. The fans are located in the building.
<code>relief_fans</code>	List of relief fans	<code>[{Fan}]</code>				List of fans that exhaust air from the building at the air handler to maintain proper pressurization. The fans are located in the building.
<code>air_economizer</code>	Air side economizer related to the fan system	<code>{AirEconomizer}</code>				
<code>air_energy_recovery</code>	Air side energy recovery related to the fan system	<code>{AirEnergyRecovery}</code>				
<code>temperature_control</code>	Supply air temperature control type	<code><FanSystemTemperatureControlOptions></code>				
<code>operation_during_occupied</code>	Operation during occupied times type	<code><FanSystemOperationOptions></code>				
<code>operation_during_unoccupied</code>	Operation during unoccupied times type	<code><FanSystemOperationOptions></code>				
<code>has_lock_out_central_heat_during_unoccupied</code>	Locks out the use of central heating during unoccupied hours	<code>Boolean</code>				Typically used when zone has heating coil available that can serve unoccupied heating load.
<code>fan_control</code>	Supply fan control type	<code><FanSystemSupplyFanControlOptions></code>				
<code>reset_differential_temperature</code>	Supply air temperature reset differential temperature at minimum cooling load	<code>Numeric</code>	K			When <code>temperature_control</code> is <code>LOAD_RESET_TO_SPACE_TEMPERATURE</code> this temperate is added to the supply air temperature at minimum cooling load conditions. When <code>temperature_control</code> is <code>LOAD_RESET_DIFFERENTIAL_TEMPERATURE</code> this temperate is the temperate below space temperature when no cooling load. The supply air temperature is specified in Terminal.
<code>supply_air_temperature_reset_load_fraction</code>	Supply air temperature reset load fraction	<code>Numeric</code>				When <code>temperature_control</code> is <code>LOAD_RESET_TO_SPACE_TEMPERATURE</code> , this is the threshold fraction below which supply air temperature reset begins. Between the stated load fraction and 0% load the supply air temperature is ramped linearly until the supply air temperature reaches the zone. The supply air temperature is specified in Terminal.

Name	Description	Data Type	Units	Range	Req	Notes
supply_air_temperature_reset_schedule	Supply air temperature reset schedule	Reference				The supply air temperature is specified in Terminal. Constraint to use when implemented :Schedule:
fan_volume_reset_type	Fan volume reset control type	<FanSystemSupplyFanVolumeResetOptions>				
fan_volume_reset_fraction	Fan volume reset load fraction	Numeric				When fan_volume_reset_type is DESIGN_LOAD_RESET this is the fraction of the design load that corresponds to minimum air flow. When fan_volume_reset_type is OPERATING_CAPACITY_RESET this is the fraction of the instantaneous operating capacity that corresponds to minimum air flow.
operating_schedule	Operating schedule name	Reference				If the schedule is not present, the fansystem is always operating. Zero when fan is off. Constraint to use when implemented :Schedule:
minimum_airflow	Minimum volume airflow	Numeric	L/s			The minimum airflow may be determined by sizing performed by the software. This value should be provided if sized by the simulation software as an output or explicitly provided as a simulation input.
minimum_outdoor_airflow	Minimum outdoor air volume airflow	Numeric	L/s			If the minimum_outdoor_airflow is equal to the maximum_outdoor_airflow and equal to the total supply fan volume that indicates a constant volume dedicated outdoor air system. If only the maximum_outdoor_airflow and equal to the total supply fan volume but the minimum_outdoor_airflow is lower that indicates an air side economizer.
maximum_outdoor_airflow	Maximum outdoor air volume airflow	Numeric	L/s			If the minimum_outdoor_airflow is equal to the maximum_outdoor_airflow and equal to the total supply fan volume that indicates a constant volume dedicated outdoor air system. If only the maximum_outdoor_airflow and equal to the total supply fan volume but the minimum_outdoor_airflow is lower that indicates an air side economizer.
air_filter_merv_rating	The MERV rating of the air filter	Numeric		≥1, ≤20		
has_fully_ducted_return	If the fan system has fully ducted return.	Boolean				
demand_control_ventilation_control	Demand control ventilation control type	<DemandControlVentilationControlOptions>				

AirEconomizer

Name	Description	Data Type	Units	Range	Req	Notes
id	Scope-unique reference identifier for instances of this data group	ID			✓	
reporting_name	Descriptive name used in RCT reports if id is not already a descriptive name	String				
notes	Supplementary information to provide context to the model reviewer	String				Notes are not used by the RCT, but may be included in RCT reports to give the reviewer additional information or context
type	Type	<AirEconomizerOptions>				
high_limit_shutoff_temperature	High limit temperature shutoff	Numeric	C			

Name	Description	Data Type	Units	Range	Req	Notes
<code>is_integrated</code>	True if the economizer and mechanical cooling system can work together	<code>Boolean</code>				When the economizer is integrated with the mechanical cooling system it is capable of providing partial cooling even when additional mechanical cooling is required to meet the remainder of the cooling load.

AirEnergyRecovery

Name	Description	Data Type	Units	Range	Req	Notes
<code>id</code>	Scope-unique reference identifier for instances of this data group	<code>ID</code>			✓	
<code>reporting_name</code>	Descriptive name used in RCT reports if id is not already a descriptive name	<code>String</code>				
<code>notes</code>	Supplementary information to provide context to the model reviewer	<code>String</code>				Notes are not used by the RCT, but may be included in RCT reports to give the reviewer additional information or context
<code>type</code>	Energy recovery type	<code><EnergyRecoveryOptions></code>				
<code>enthalpy_recovery_ratio</code>	Enthalpy recovery ratio	<code>Numeric</code>				The change in the enthalpy of the outdoor air supply divided by the difference between the outdoor air and entering exhaust air enthalpy, expressed as a percentage.
<code>energy_recovery_operation</code>	Energy recovery operation	<code><EnergyRecoveryOperationOptions></code>				
<code>energy_recovery_supply_air_temperature_control</code>	Energy recovery supply air temperature control	<code><EnergyRecoverySupplyAirTemperatureControlOptions></code>				
<code>design_sensible_effectiveness</code>	Design sensible effectiveness	<code>Numeric</code>				
<code>design_latent_effectiveness</code>	Design latent effectiveness	<code>Numeric</code>				
<code>outdoor_airflow</code>	Outdoor airflow	<code>Numeric</code>	L/s			
<code>exhaust_airflow</code>	Exhaust airflow	<code>Numeric</code>	L/s			

Fan

Name	Description	Data Type	Units	Range	Req	Notes
id	Scope-unique reference identifier for instances of this data group	ID			✓	
reporting_name	Descriptive name used in RCT reports if id is not already a descriptive name	String				
notes	Supplementary information to provide context to the model reviewer	String				Notes are not used by the RCT, but may be included in RCT reports to give the reviewer additional information or context
design_airflow	Design airflow	Numeric	L/s			The design airflow may be determined by sizing performed by the software. This value should be provided if sized by the simulation software as an output or explicitly provided as a simulation input.
is_airflow_sized_based_on_design_day	True if the airflow is sized by the simulation software for the design day	Boolean				
specification_method	Options for how the fan is specified	<FanSpecificationMethodOptions>				Indicates if the fan is specified using the SIMPLE method of just the design electric power or using the DETAILED method of using pressure rise, nameplate power, shaft power, total efficiency, and motor efficiency.
design_electric_power	Design electric fan power	Numeric	W			Only used when specification_method is set to Simple.
design_pressure_rise	Pressure rise through fan at design flow conditions	Numeric	Pa			Only used when specification_method is set to Detailed
motor_nameplate_power	nameplate power of fan motor	Numeric	W			Only used when specification_method is set to Detailed.
shaft_power	fan shaft power	Numeric	W			Power delivered to the fans shaft and does not include the mechanical drive losses. Equivalent to fan brake horsepower for inch-pound units. Only used when specification_method is set to Detailed.
total_efficiency	Total fan efficiency	Numeric		≥0, ≤1		Only used when specification_method is set to Detailed. It includes the overall efficiency of the combination of the fan, drive, and motor.
motor_efficiency	Fan motor efficiency	Numeric		≥0, ≤1		Only used when specification_method is set to Detailed.
motor_heat_to_airflow_fraction	Fraction of motor heat added to the airflow.	Numeric		≥0, ≤1		Fraction to airflow plus fraction to zone do not necessarily add up to 1.0.
motor_heat_to_zone_fraction	Fraction of motor heat added to the zone.	Numeric		≥0, ≤1		Fraction to airflow plus fraction to zone do not necessarily add up to 1.0.

Name	Description	Data Type	Units	Range	Req	Notes
<code>motor_location_zone</code>	Zone where the heat from the motor goes	<code>Reference</code>				When specified, it is the zone the heat from the fan motor get added to. Constraint to use when implemented :Zone:
<code>status_type</code>	Choice of new, existing, addition, alteration, etc. for each ruleset.	<code><StatusOptions></code>				
<code>output_validation_points</code>	Energy validation points	<code>[{FanOutputValidationPoint}]</code>				Airflow is input to each validation point and energy output is the result. A minimum number of four points is recommended. Certain rulesets may have a different minimum number of points. For example, 90.1 Appendix G expects 11 data points.

FanOutputValidationPoint

Name	Description	Data Type	Units	Range	Req	Notes
<code>airflow</code>	Load	<code>Numeric</code>	L/s			No name and id is needed since typically used as one of a series.
<code>result</code>	Result	<code>Numeric</code>	W			The rate of energy used by the fan at the given airflow.

Terminal

Name	Description	Data Type	Units	Range	Req	Notes
<code>id</code>	Scope-unique reference identifier for instances of this data group	<code>ID</code>			✓	
<code>reporting_name</code>	Descriptive name used in RCT reports if id is not already a descriptive name	<code>String</code>				
<code>notes</code>	Supplementary information to provide context to the model reviewer	<code>String</code>				Notes are not used by the RCT, but may be included in RCT reports to give the reviewer additional information or context
<code>type</code>	Type of terminal	<code><TerminalOptions></code>				System configurations that typically are at the zone and include a compressor (such as packaged terminal air conditioning, packaged terminal heat pumps, window air conditioning units, and water loop heat pumps) should be reported in the schema using HeatingSystem and CoolingSystem. Systems that include gas or electric furnaces should be reported in the schema using HeatingSystem. System configurations that are at the zone and only include fans and coils (such as four-pipe fan coil, two-pipe fan coil, radiant systems, baseboards, and chilled beams) should be reported in the schema using Terminal with the chilled water and hot water systems described in the cooling_source and heating_source data elements (and any other relevant Terminal Data elements). Evaporative cooling systems should be described in CoolingSystem. Passive diffusers with no coil or fan should be described in Terminal.
<code>served_by_heating_ventilating_air_conditioning_system</code>	HVAC system serving the terminal	<code>Reference</code>				Contains ID of the HVAC system serving the terminal - from Unique Identification Number in HeatingVentilatingAirConditioningSystem. Constraint to use when implemented :HeatingVentilatingAirConditioningSystem:
<code>heating_source</code>	Source of heating	<code><HeatingSourceOptions></code>				Used for terminal heating including reheat.
<code>heating_from_loop</code>	References the fluid loop used to provide heating	<code>Reference</code>				Only used when heating_source is hot water. Used for terminal Heating including reheat. Constraint to use when implemented :FluidLoop:

Name	Description	Data Type	Units	Range	Req	Notes
cooling_source	Source of cooling	<CoolingSourceOptions>				Used for terminal cooling.
cooling_from_loop	Referenced the fluid loop used to provide cooling	Reference				Only used when cooling_source is chilled water. Used for terminal cooling including radiant and fan coils. Constraint to use when implemented :FluidLoop:
fan	Terminal fan	{Fan}				The fan data group associated with the terminal. If no fan is modeled for this terminal, this field should be left blank.
fan_configuration	Fan configuration	<TerminalFanConfigurationOptions>				
primary_airflow	Zone terminal primary airflow	Numeric	L/s			Zone terminal primary airflow at design conditions.
secondary_airflow	Zone terminal secondary airflow	Numeric	L/s			
maximum_heating_airflow	Zone terminal maximum heating airflow	Numeric	L/s			Entry only needed if maximum heating airflow is different than the primary airflow such as when describing a dual maximum VAV box control.
supply_design_heating_setpoint_temperature	Zone terminal supply design heating temperature setpoint	Numeric	C			
supply_design_cooling_setpoint_temperature	Zone terminal supply design cooling temperature setpoint	Numeric	C			
temperature_control	Temperature control type	<TerminalTemperatureControlOptions>				
minimum_airflow	Zone terminal minimum volume airflow	Numeric	L/s			
minimum_outdoor_airflow	Zone terminal minimum outdoor air volume airflow	Numeric	L/s			This value should be provided if fan airflow determined by sizing performed by the software or explicitly provided.
minimum_outdoor_airflow_multiplier_schedule	Zone terminal minimum outdoor air volume airflow multiplier schedule name	Reference				If the schedule is not present, the multiplier is always one. Constraint to use when implemented :Schedule:
heating_capacity	Heating capacity for baseboard or radiant system or reheat	Numeric	W			Only includes the heating capacity of the terminal for hot water or electric coil. This value should be provided if determined by sizing performed by the software or explicitly provided.
cooling_capacity	Cooling capacity for the radiant system or cooling coil	Numeric	W			Only includes the cooling capacity of the terminal for chilled water coil for radiant or fan coil. This value should be provided if determined by sizing performed by the software or explicitly provided.
is_supply_ducted	True if the the supply is ducted.	Boolean				Packaged terminal air conditioners (PTAC), packaged terminal heat pumps (PTHP), and window or through the wall air conditioners should be False and other DX systems including rooftop units should be True
has_demand_control_ventilation	True if the zone has demand control ventilation	Boolean				The zone is either served by an air handler that responds to demand control ventilation signals from that zone or is served by a DOAS that specifically provides air to that zone on demand.
is_fan_first_stage_heat	True if the the only source of first stage heating is the heat from the fan itself	Boolean				Only appropriate with variable volume boxes that are fan powered

FluidLoop

Name	Description	Data Type	Units	Range	Req	Notes
id	Scope-unique reference identifier for instances of this data group	ID			✓	
reporting_name	Descriptive name used in RCT reports if id is not already a descriptive name	String				
notes	Supplementary information to provide context to the model reviewer	String				Notes are not used by the RCT, but may be included in RCT reports to give the reviewer additional information or context
type	Type of loop	<FluidLoopOptions>				

Name	Description	Data Type	Units	Range	Req	Notes
<code>pump_power_per_flow_rate</code>	Total design pump power divided by the loop design flow rate	<code>Numeric</code>	W-s/L			This is the pump power per flow rate for the entire pumping system on the current FluidLoop. The power and flow rate should be for the current FluidLoop only and does not include power and flow rate in any child loops.
<code>child_loops</code>	Other fluid loops connected to this one as children.	<code>[{FluidLoop}]</code>				Secondary loops should be described as child loops.
<code>cooling_or_condensing_design_and_control</code>	Fluid loop design and control used for cooling or condensing loops	<code>{FluidLoopDesignAndControl}</code>				References a FluidLoopDesignAndControl data group which describes how this FluidLoop is sized and controlled in cooling or condensing mode.
<code>heating_design_and_control</code>	Fluid loop design and control used for heating loops	<code>{FluidLoopDesignAndControl}</code>				References a FluidLoopDesignAndControl data group which describes how this FluidLoop is sized and controlled in heating mode.

FluidLoopDesignAndControl

Name	Description	Data Type	Units	Range	Req	Notes
<code>id</code>	Scope-unique reference identifier for instances of this data group	<code>ID</code>			✓	
<code>reporting_name</code>	Descriptive name used in RCT reports if id is not already a descriptive name	<code>String</code>				
<code>notes</code>	Supplementary information to provide context to the model reviewer	<code>String</code>				Notes are not used by the RCT, but may be included in RCT reports to give the reviewer additional information or context
<code>design_supply_temperature</code>	Design Supply Temperature	<code>Numeric</code>	C			
<code>design_return_temperature</code>	Design Return Temperature	<code>Numeric</code>	C			
<code>is_sized_using_coincident_load</code>	True if the loop is sized based on coincident load	<code>Boolean</code>				
<code>minimum_flow_fraction</code>	Minimum fraction of full flow allowed	<code>Numeric</code>				The minimum flow rate expressed as a fraction of the loop design flow rate.
<code>operation</code>	Type of operation used by loop	<code><FluidLoopOperationOptions></code>				
<code>operation_schedule</code>	Operation schedule	<code>Reference</code>				One represents when the fluid loop is available to be operating and zero when not available to be operating. Only used when operation equals SCHEDULED. Constraint to use when implemented :Schedule:
<code>flow_control</code>	Flow control options	<code><FluidLoopFlowControlOptions></code>				
<code>temperature_reset_type</code>	Type of temperature reset used by loop	<code><TemperatureResetOptions></code>				
<code>outdoor_high_for_loop_supply_reset_temperature</code>	Outdoor high for loop supply temp reset	<code>Numeric</code>	C			Used when temperature_reset_type = OUTSIDE_AIR_RESET
<code>outdoor_low_for_loop_supply_reset_temperature</code>	Outdoor low for loop supply temp reset	<code>Numeric</code>	C			Used when temperature_reset_type = OUTSIDE_AIR_RESET

Name	Description	Data Type	Units	Range	Req	Notes
loop_supply_temperature_at_outdoor_high	Loop supply temperature at outdoor high temperature	Numeric	C			Used when temperature_reset_type = OUTSIDE_AIR_RESET
loop_supply_temperature_at_outdoor_low	Loop supply temperature at outdoor low temperature	Numeric	C			Used when temperature_reset_type = OUTSIDE_AIR_RESET
loop_supply_temperature_at_low_load	Loop supply temperature at low load	Numeric	C			Used when temperature_reset_type = LOAD_RESET
has_integrated_waterside_economizer	True if chilled water loop described has an integrated waterside economizer	Boolean				

Pump

Name	Description	Data Type	Units	Range	Req	Notes
id	Scope-unique reference identifier for instances of this data group	ID			✓	
reporting_name	Descriptive name used in RCT reports if id is not already a descriptive name	String				
notes	Supplementary information to provide context to the model reviewer	String				Notes are not used by the RCT, but may be included in RCT reports to give the reviewer additional information or context
loop_or_piping	Referenced to the fluid loop or service water heating piping	Reference			✓	Data elements linking data groups by reference that don't make sense without the reference are shown as required. Few other data elements than this type and id data elements are shown as required. Other data elements may be required by specific rulesets. Constraint to use when implemented :FluidLoop; or :ServiceWaterPiping;
specification_method	Options for how the pump is specified	<PumpSpecificationMethodOptions>				
design_electric_power	Pump design electric power	Numeric	W			Pump electric power at design conditions. Only used when specification_method is set to Simple
motor_nameplate_power	Pump motor nameplate power	Numeric	W			Only used when specification_method is set to Detailed
design_head	Head of the pump at design flow conditions	Numeric	m			Only used when specification_method is set to Detailed
impeller_efficiency	Full load efficiency of the impeller	Numeric		≥0, ≤1		Only used when specification_method is set to Detailed
motor_efficiency	Full load efficiency of the pump motor	Numeric		≥0, ≤1		Only used when specification_method is set to Detailed
speed_control	Options for pump speed control	<PumpSpeedControlOptions>				

Name	Description	Data Type	Units	Range	Req	Notes
design_flow	Design Pump Flowrate	Numeric	L/s			This value should be provided if determined by sizing performed by the software or explicitly provided.
is_flow_sized_based_on_design_day	True if the design_flow is sized by the simulation software for the design day	Boolean				
output_validation_points	Energy validation points	[{PumpOutputValidationPoint}]				Pump flow is input to each validation point and energy output is the result. A minimum number of four points is recommended.

PumpOutputValidationPoint

Name	Description	Data Type	Units	Range	Req	Notes
flow	Flow rate	Numeric	L/s			No name and id is needed since typically used as one of a series.
result	Result	Numeric	W			The rate of energy used by the pump at the given flow rate.

Boiler

Name	Description	Data Type	Units	Range	Req	Notes
id	Scope-unique reference identifier for instances of this data group	ID			✓	
reporting_name	Descriptive name used in RCT reports if id is not already a descriptive name	String				
notes	Supplementary information to provide context to the model reviewer	String				Notes are not used by the RCT, but may be included in RCT reports to give the reviewer additional information or context
loop	Referenced to the fluid loop	Reference			✓	Data elements linking data groups by reference that don't make sense without the reference are shown as required. Few other data elements than this type and id data elements are shown as required. Other data elements may be required by specific rulesets. Constraint to use when implemented :FluidLoop:
design_capacity	Heating capacity	Numeric	W			
rated_capacity	Heating capacity	Numeric	W			At rating conditions.

Name	Description	Data Type	Units	Range	Req	Notes
minimum_load_ratio	Minimum fraction of full load allowed	Numeric				
draft_type	Combustion option	<BoilerCombustionOptions>				
energy_source_type	Source of energy for the boiler	<EnergySourceOptions>				
efficiency_metric	The type of efficiency metric used	<BoilerEfficiencyMetricOptions>				
efficiency	Efficiency value based on the selected efficiency_metric	Numeric		≥0, ≤1		
output_validation_points	Energy validation points	[[BoilerOutputValidationPoint]]				Load is input to each validation point and energy output is the result. A minimum number of four points is recommended.
auxiliary_power	Auxiliary power	Numeric	W			Power for boiler pump, combustion fan, or other auxiliary that operates when boiler operates.
operation_lower_limit	Heating load range operation, lower limit	Numeric	W			The heating rate below which the boiler will not operate. This is often used in plants that have multiple boilers to specify how they should be sequenced.
operation_upper_limit	Heating load range operation, upper limit	Numeric	W			The heating rate above which the boiler will not operate. This is often used in plants that have multiple boilers to specify how they should be sequenced.

BoilerOutputValidationPoint

Name	Description	Data Type	Units	Range	Req	Notes
load	Load	Numeric	W			No name and id is needed since typically used as one of a series.
entering_water_temperature	Entering water temperature	Numeric	C			Temperature of water entering the boiler which returned from the loop. This entry is optional since not all curves for boiler performance need this.
result	Result	Numeric	W			

Chiller

Name	Description	Data Type	Units	Range	Req	Notes
<code>id</code>	Scope-unique reference identifier for instances of this data group	<code>ID</code>			✓	
<code>reporting_name</code>	Descriptive name used in RCT reports if id is not already a descriptive name	<code>String</code>				
<code>notes</code>	Supplementary information to provide context to the model reviewer	<code>String</code>				Notes are not used by the RCT, but may be included in RCT reports to give the reviewer additional information or context
<code>cooling_loop</code>	Referenced to the cooling fluid loop	<code>Reference</code>			✓	Data elements linking data groups by reference that don't make sense without the reference are shown as required. Few other data elements than this type and id data elements are shown as required. Other data elements may be required by specific rulesets. Constraint to use when implemented :FluidLoop:
<code>condensing_loop</code>	Referenced to the condensing fluid loop	<code>Reference</code>				No condensing loop name implies air-cooled chiller. Constraint to use when implemented :FluidLoop:
<code>compressor_type</code>	Compressor Type	<code><ChillerCompressorOptions></code>				
<code>energy_source_type</code>	Source of energy for the chiller	<code><EnergySourceOptions></code>				
<code>design_capacity</code>	Chiller Design Cooling Capacity	<code>Numeric</code>	W			The capacity of the chiller at design conditions.
<code>rated_capacity</code>	Chiller Rated Cooling Capacity	<code>Numeric</code>	W			At rating conditions.
<code>rated_entering_condenser_temperature</code>	Rated entering condenser temperature	<code>Numeric</code>	C			The rated outside air dry-bulb temperature for air cooled chillers or design entering condenser water temperature for water cooled chillers. For AHRI conditions for inch-pound ratings for air cooled chillers are 35C/95F and water cooled are 29.4C/85F. The AHRI conditions for SI ratings are 35C for air cooled chillers and 30C for water cooled.
<code>rated_leaving_evaporator_temperature</code>	Rated leaving evaporator temperature	<code>Numeric</code>	C			For AHRI conditions for inch-pound ratings are 6.7C/44F. For AHRI conditions for SI ratings are 7C.
<code>minimum_load_ratio</code>	Minimum fraction of full load allowed	<code>Numeric</code>				
<code>design_flow_evaporator</code>	Chiller evaporator design flow	<code>Numeric</code>	L/s			
<code>design_flow_condenser</code>	Chiller condenser design flow	<code>Numeric</code>	L/s			

Name	Description	Data Type	Units	Range	Req	Notes
design_entering_condenser_temperature	Design entering condenser temperature	Numeric	C			The design outside air dry-bulb temperature for air cooled chillers or design entering condenser water temperature for water cooled chillers.
design_leaving_evaporator_temperature	Design leaving evaporator temperature	Numeric	C			The temperature leaving the evaporator portion of the chiller at design conditions.
full_load_efficiency	Full Load Efficiency expressed as a coefficient of performance (COP)	Numeric	W/W			The useful cooling energy supplied by the chiller divided by the electric energy into the chiller both in the same units when the chiller is supplying it's full capacity.
part_load_efficiency	Efficiency value based on the selected part_load_efficiency_metric	Numeric	W/W	≥0		The useful cooling energy supplied by the chiller divided by the electric energy into the chiller both in the same units when the chiller is supplying a predefined part of it's full capacity.
part_load_efficiency_metric	The type of part load efficiency metric used	<ChillerPartLoadEfficiencyMetricOptions>				
capacity_validation_points	Capacity validation points	[[ChillerCapacityValidationPoint]]				
power_validation_points	Energy validation points	[[ChillerPowerValidationPoint]]				
is_chilled_water_pump_interlocked	Indicates if the operation of the chilled water pump is interlocked with the operation of the chiller	Boolean				Should be set to true when the chiller and the chiller water pump are controlled to turn on an off at the same time.
is_condenser_water_pump_interlocked	Indicates if the operation of the condenser water pump is interlocked with the operation of the chiller	Boolean				Should be set to true when the chiller and the condenser water pump are controlled to turn on an off at the same time.
heat_recovery_loop	Recovered heat to fluid loop	Reference				Constraint to use when implemented :FluidLoop:
heat_recovery_fraction	Heat recovery fraction	Numeric		≥0, ≤1		Fraction of total rejected heat that can be recovered at full load

ChillerCapacityValidationPoint

Name	Description	Data Type	Units	Range	Req	Notes
chilled_water_supply_temperature	Chilled water supply temperature	Numeric	C			No name and id is needed since used as one of a series. The temperature is leaving the chiller.

Name	Description	Data Type	Units	Range	Req	Notes
condenser_temperature	Second temperature	Numeric	C			Outside air dry-bulb temperature for air cooled chillers and condenser water temperature for water cooled chillers. For water cooled chillers, this is the temperature as the water enters the chiller. For air cooled chillers this is the temperature of the ambient air.
result	Result	Numeric	W			

ChillerPowerValidationPoint

Name	Description	Data Type	Units	Range	Req	Notes
chilled_water_supply_temperature	Chilled water supply temperature	Numeric	C			No name and id is needed since used as one of a series. The temperature is leaving the chiller.
condenser_temperature	Second temperature	Numeric	C			Outside air dry-bulb temperature for air cooled chillers and condenser water temperature for water cooled chillers. For water cooled chillers, this is the temperature as the water enters the chiller. For air cooled chillers this is the temperature of the ambient air.
load	Load	Numeric	W			
is_at_full_capacity	True if chiller is at full capacity	Boolean	W			True if chiller is operating at full capacity for the given temperature conditions
result	Result	Numeric	W			

HeatRejection

Name	Description	Data Type	Units	Range	Req	Notes
id	Scope-unique reference identifier for instances of this data group	ID			✓	
reporting_name	Descriptive name used in RCT reports if id is not already a descriptive name	String				
notes	Supplementary information to provide context to the model reviewer	String				Notes are not used by the RCT, but may be included in RCT reports to give the reviewer additional information or context
loop	Referenced to the fluid loop	Reference			✓	Data elements linking data groups by reference that don't make sense without the reference are shown as required. Few other data elements than this type and id data elements are shown as required. Other data elements may be required by specific rulesets. Constraint to use when implemented :FluidLoop:
type	Heat Rejection Type	<HeatRejectionOptions>				
fan_type	Heat Rejection Fan Type	<HeatRejectionFanOptions>				
fluid	Fluid Cooled by Heat Rejection	<HeatRejectionFluidOptions>				
range	Heat rejection Range	Numeric	K			
approach	Heat rejection Approach	Numeric	K			
fan_shaft_power	Fan Shaft Power	Numeric	W			Power delivered to the fan’s shaft and does not include the mechanical drive losses. Equivalent to fan brake horsepower for inch-pound units.
fan_motor_efficiency	Efficiency of the fan motor at rating conditions	Numeric	W			From CBECC-Com.
fan_motor_nameplate_power	Fan Motor Nameplate Power	Numeric	W			The nameplate power at rating conditions. In inch-pound units is the fan motor horsepower.From CBECC-Com.
fan_speed_control	Fan Speed Control Type	<HeatRejectionFanSpeedControlOptions>				
design_wetbulb_temperature	Design wetbulb temperature	Numeric	C			0.4% ASHRAE MCWB
design_water_flowrate	Design condenser water flow rate	Numeric	L/s			
rated_water_flowrate	Rated condenser water flow rate	Numeric	L/s			At rating conditions.
leaving_water_setpoint_temperature	leaving water setpoint temperature	Numeric	C			

ExternalFluidSource

Name	Description	Data Type	Units	Range	Req	Notes
id	Scope-unique reference identifier for instances of this data group	ID			✓	
reporting_name	Descriptive name used in RCT reports if id is not already a descriptive name	String				
notes	Supplementary information to provide context to the model reviewer	String				Notes are not used by the RCT, but may be included in RCT reports to give the reviewer additional information or context
loop	Referenced to the fluid loop	Reference			✓	Data elements linking data groups by reference that don't make sense without the reference are shown as required. Few other data elements than this type and id data elements are shown as required. Other data elements may be required by specific rulesets. Constraint to use when implemented :FluidLoop:
type	Type of external fluid source	<ExternalFluidSourceOptions>				
energy_source_type	Source of energy for the external fluid source	<EnergySourceOptions>				

ServiceWaterHeatingDistributionSystem

Name	Description	Data Type	Units	Range	Req	Notes
id	Scope-unique reference identifier for instances of this data group	ID			✓	
reporting_name	Descriptive name used in RCT reports if id is not already a descriptive name	String				
notes	Supplementary information to provide context to the model reviewer	String				Notes are not used by the RCT, but may be included in RCT reports to give the reviewer additional information or context
design_supply_temperature	Design supply temperature setpoint of service water heating loop	Numeric	C			From CBECC-Com.
design_supply_temperature_difference	Design supply temperature difference (deltaT) of service water heating loop	Numeric	C			From CBECC-Com.

Name	Description	Data Type	Units	Range	Req	Notes
tanks	Tanks within service water heating distribution system	[{Tank}]				Contains a list of storage tanks that are part of this service water heating distribution system but not part of individual service water heaters.
is_central_system	Indicates whether it is a central service water heater distribution system	Boolean				From CBECC-Com.
service_water_piping	Connected service water piping	[{ServiceWaterPiping}]				Contains a list of service water piping that is associated with this service water heater distribution system.
distribution_compactness	Type of compact distribution system	<ServiceWaterHeatingDistributionCompactnessOptions2019T24Com>				From CBECC-Com.
control_type	Type of distribution system	<ServiceWaterHeatingControlOptions2019T24Com>				From CBECC-Com.
configuration_type	Type of configuration	<ServiceWaterHeatingConfigurationOptions>				From CBECC-Com.
is_recovered_heat_from_drain_used_by_water_heater	Indicates whether the recovered heat from the shower drain used by the service water heater	Boolean				From CBECC-Res.
drain_heat_recovery_efficiency	Shower heat drain recovery efficiency	Numeric		≥0, ≤1		From CBECC-Com. May use the Canadian Standards Association Rated Recovery Efficiency.
drain_heat_recovery_type	Drain heat recovery type	<ServiceWaterHeatingHeatRecoveryOptions>				From CBECC-Res.
flow_multiplier_schedule	service water heating Loop flow multiplier schedule name	Reference				If the schedule is not present, the multiplier is always one. Constraint to use when implemented :Schedule:
entering_water_mains_temperature_schedule	Temperature schedule for unheated entering water to the building site often referenced as mains temperature.	Reference				Constraint to use when implemented :Schedule:
is_ground_temperature_used_for_entering_water	Indicates whether ground temperature is the source of the entering water temperature	Boolean				

ServiceWaterPiping

Name	Description	Data Type	Units	Range	Req	Notes
id	Scope-unique reference identifier for instances of this data group	ID			✓	
reporting_name	Descriptive name used in RCT reports if id is not already a descriptive name	String				
notes	Supplementary information to provide context to the model reviewer	String				Notes are not used by the RCT, but may be included in RCT reports to give the reviewer additional information or context
is_recirculation_loop	Indicates if service water heating piping is a loop and recirculates	Boolean				
are_thermal_losses_modeled	Indicates if thermal losses from the service water heating piping are modeled	Boolean				
insulation_thickness	Pipe insulation thickness	Numeric	m	≥0		From CBECC-Com.
loop_pipe_location	Loop pipe location	<ComponentLocationOptions>				From CBECC-Com.
location_zone	Zone reference of where the component is located when IN_ZONE is selected from ComponentLocationOptions	Reference				From CBECC-Com. Constraint to use when implemented :Zone:
length	Pipe length	Numeric	m	≥0		From RESNET
diameter	Pipe section diameter	Numeric	m	≥0		From CBECC-Res.

Name	Description	Data Type	Units	Range	Req	Notes
child	Other service water piping connected to this one as children.	[[ServiceWaterPiping]]				

SolarThermal

Name	Description	Data Type	Units	Range	Req	Notes
id	Scope-unique reference identifier for instances of this data group	ID			✓	
reporting_name	Descriptive name used in RCT reports if id is not already a descriptive name	String				
notes	Supplementary information to provide context to the model reviewer	String				Notes are not used by the RCT, but may be included in RCT reports to give the reviewer additional information or context
angle_from_true_north	Solar heater angle from true north, clockwise	Numeric				From CBECC-Com.
solar_savings_fraction	Solar savings fraction	Numeric				Based on ICC-SRCC rating. From CBECC-Com.
collector_area	Solar collector area	Numeric				From CBECC-Com.
collector_type_description	Description of solar collector type	String				From CBECC-Com.
collector_slope	Solar slope from horizontal	Numeric				From CBECC-Com.
tank	Tank that is part of the solar thermal system	{Tank}				Contains a storage tank that is part of the solar thermal system.

ServiceWaterHeatingEquipment

Name	Description	Data Type	Units	Range	Req	Notes
id	Scope-unique reference identifier for instances of this data group	ID			✓	
reporting_name	Descriptive name used in RCT reports if id is not already a descriptive name	String				
notes	Supplementary information to provide context to the model reviewer	String				Notes are not used by the RCT, but may be included in RCT reports to give the reviewer additional information or context
heater_fuel_type	Service water heating heater fuel type	<EnergySourceOptions>				
distribution_system	Referenced to the service water heating distribution system	Reference			✓	Data elements linking data groups by reference that don't make sense without the reference are shown as required. Few other data elements than this type and id data elements are shown as required. Other data elements may be required by specific rulesets. Constraint to use when implemented :ServiceWaterHeatingDistributionSystem:
energy_factor	Energy factor	Numeric		≥0		From CBECC-Com.
thermal_efficiency	Service water heating heater thermal efficiency	Numeric		≥0		
standby_loss_fraction	Standby loss fraction	Numeric				From CBECC-Com.
uniform_energy_factor	Uniform energy factor	Numeric		≥0		From CBECC-Com.
draw_pattern	Draw pattern	<DrawPatternOptions>				Draw pattern refers to the water draw profile in the uniform energy factor test
first_hour_rating	First hour rating volume	Numeric	L	≥0		From CBECC-Com.
output_validation_points	Capacity validation points	[[ServiceWaterHeaterValidationPoint]]				
input_power	Input power	Numeric	W	≥0		From CBECC-Com.
rated_capacity	Rated capacity	Numeric	W			From CBECC-Com.
minimum_capacity	Minimum capacity	Numeric	W	≥0		From CBECC-Com.
recovery_efficiency	Recovery efficiency	Numeric				From CBECC-Com.
setpoint_temperature	Set point temperature	Numeric	C			
compressor_location	Description of where the heat pump for the water heater is located	String				Used when compressor is not located in a specific zone. From CBECC-Com.
compressor_zone	Zone reference of where the heat pump for the water heater is located	Reference				From CBECC-Com. Constraint to use when implemented :Zone:
compressor_heat_rejection_source	Heat pump heat rejection source	<ComponentLocationOptions>				From CBECC-Res.
compressor_heat_rejection_zone	Heat pump heat rejection zone	Reference				From CBECC-Res. Constraint to use when implemented :Zone:
compressor_capacity_validation_points	Capacity validation points	[[HeatPumpWaterHeaterCapacityValidationPoint]]				
compressor_power_validation_points	Coefficient of performance validation points	[[HeatPumpWaterHeaterPowerValidationPoint]]				
draft_fan_power	Power for the draft fan	Numeric	W	≥0		From CBECC-Com.
has_electrical_ignition	Indicates whether the water heater has electrical ignition	Boolean				From CBECC-Com.
heater_type	Service water heater type	<ServiceWaterHeaterOptions>				
tank	Tank that is part of the service water heating equipment	{Tank}				Contains a storage tank that is part of the service water heating equipment.
status_type	Choice of new, existing, addition, alteration, etc. for each ruleset.	<StatusOptions>				
solar_thermal_systems	Solar thermal systems used for heating service water	[[SolarThermal]]				Contains a list of Solar thermal systems that are part of this service water heating distribution system.

Name	Description	Data Type	Units	Range	Req	Notes
hot_water_loop	Referenced to the hot water fluid loop	Reference				Can be used when heat is supplied to service water heater from a hot water loop or when combination service water and space heating is used. Constraint to use when implemented :FluidLoop.

ServiceWaterHeaterValidationPoint

Name	Description	Data Type	Units	Range	Req	Notes
load	Load	Numeric	W			No name and id is needed since typically used as one of a series.
result	Result	Numeric	W			

HeatPumpWaterHeaterCapacityValidationPoint

Name	Description	Data Type	Units	Range	Req	Notes
evaporator_air_temperature	Outside dry bulb temperatures of air	Numeric	C			No name and id is needed since used as one of a series.
condenser_water_temperature	Entering condenser temperature of water	Numeric	C			
evaporator_air_flow	Air flow across evaporator	Numeric	L/s			
condenser_water_flow	Water flow across condenser	Numeric	L/s			
result	Result	Numeric	W			

HeatPumpWaterHeaterPowerValidationPoint

Name	Description	Data Type	Units	Range	Req	Notes
evaporator_air_temperature	Outside dry bulb temperatures of air	Numeric	C			No name and id is needed since used as one of a series.
condenser_water_temperature	Entering condenser temperature of water	Numeric	C			
evaporator_air_flow	Air flow across evaporator	Numeric	L/s			
condenser_water_flow	Water flow across condenser	Numeric	L/s			
load	Load	Numeric	W			
result	Result	Numeric	W			

Tank

Name	Description	Data Type	Units	Range	Req	Notes
id	Scope-unique reference identifier for instances of this data group	ID			✓	
reporting_name	Descriptive name used in RCT reports if id is not already a descriptive name	String				
notes	Supplementary information to provide context to the model reviewer	String				Notes are not used by the RCT, but may be included in RCT reports to give the reviewer additional information or context
storage_capacity	Storage capacity of tank in distribution system	Numeric	L	≥0		From CBECC-Com.
type	Service water heater tank type	<ServiceWaterHeaterTankOptions>				
height	Tank height	Numeric	m	≥0		From CBECC-Com.

Name	Description	Data Type	Units	Range	Req	Notes
<code>interior_insulation</code>	Tank interior insulation R-value	<code>Numeric</code>	K-m2/W	≥ 0		Insulation that is part of the tank and is inside of the housing. From CBECC-Res.
<code>exterior_insulation</code>	Tank exterior insulation R-value	<code>Numeric</code>	K-m2/W	≥ 0		A blanket of insulation that surrounds the exterior of the tank. From CBECC-Res.
<code>location</code>	Location	<code><ComponentLocationOptions></code>				From CBECC-Res.
<code>location_zone</code>	Tank zone location	<code>Reference</code>				Only used when <code>tank_location</code> indicates the tank is located in a zone. From CBECC-Res. Constraint to use when implemented :Zone:

ServiceWaterHeatingUse

Name	Description	Data Type	Units	Range	Req	Notes
<code>id</code>	Scope-unique reference identifier for instances of this data group	<code>ID</code>			✓	
<code>reporting_name</code>	Descriptive name used in RCT reports if id is not already a descriptive name	<code>String</code>				
<code>notes</code>	Supplementary information to provide context to the model reviewer	<code>String</code>				Notes are not used by the RCT, but may be included in RCT reports to give the reviewer additional information or context
<code>area_type</code>	Service Water Heating Loop Area Type	<code><ServiceWaterHeatingSpaceOptions2019ASHRAE90I></code>				The enumeration is based on the standard used.
<code>water_serves_type</code>	The use of the water serves the type	<code><ServiceWaterHeatingFixtureOptions></code>				
<code>served_by_distribution_system</code>	ID to the ServiceWaterHeatingDistributionSystem that serves this end use	<code>Reference</code>			✓	From CBECC-Res. Constraint to use when implemented :ServiceWaterHeatingDistributionSystem:
<code>use</code>	Usage of service hot water	<code>Numeric</code>				This field together with the <code>use_units</code> and <code>use_multiplier_schedule</code> fields allow detailed description of the ServiceWaterHeating use in the units selected in the <code>use_units</code> field.
<code>use_units</code>	Type of units for use of service hot water	<code><ServiceWaterHeatingUseUnitOptions></code>				
<code>use_multiplier_schedule</code>	Reference to the schedule containing the multiplier for the use of service hot water	<code>Reference</code>				If the schedule is not present, the multiplier is always one. Constraint to use when implemented :Schedule:
<code>temperature_at_fixture</code>	Reference to the schedule containing the multiplier for the use of service hot water	<code>Numeric</code>	C			From RESNET
<code>is_heat_recovered_by_drain</code>	Indicates if heat is being recovered from the drain	<code>Boolean</code>				From CBECC-Res.
<code>is_recovered_heat_used_by_cold_side_feed</code>	Indicates if heat is being recovered from the drain is used on the cold side feed	<code>Boolean</code>				From CBECC-Res.

ExteriorLighting

Name	Description	Data Type	Units	Range	Req	Notes
<code>id</code>	Scope-unique reference identifier for instances of this data group	<code>ID</code>			✓	
<code>reporting_name</code>	Descriptive name used in RCT reports if id is not already a descriptive name	<code>String</code>				
<code>notes</code>	Supplementary information to provide context to the model reviewer	<code>String</code>				Notes are not used by the RCT, but may be included in RCT reports to give the reviewer additional information or context

Name	Description	Data Type	Units	Range	Req	Notes
type	The type of exterior lighting fixture	<ExteriorLightingAreaOptions2019ASHRAE901TableG36>				
area	Area of the exterior functional space.	Numeric	m2	>0		The lit area, when the lighting allowance specified by the type is based on area.
length	Linear length measure for exterior functional space	Numeric	m	≥0		For example, used when expressing street frontage or door width
power	Nominal power of exterior lighting fixtures	Numeric	W	>0		
fixture_height	Installation height of exterior fixture	Numeric	m	>0		
is_exempt	Indicates whether the exterior lighting is exempted from requirements	Boolean				
multiplier_schedule	Reference to the schedule containing the multiplier for exterior lighting	Reference				If the schedule is not present, the multiplier is always one. Constraint to use when implemented :Schedule:

RefrigeratedCase

Name	Description	Data Type	Units	Range	Req	Notes
id	Scope-unique reference identifier for instances of this data group	ID			✓	
reporting_name	Descriptive name used in RCT reports if id is not already a descriptive name	String				
notes	Supplementary information to provide context to the model reviewer	String				Notes are not used by the RCT, but may be included in RCT reports to give the reviewer additional information or context
type	Refrigerated case type	<RefrigeratedCaseOptions>				
equipment_category	Equipment Class from referenced standard	<RefrigeratedCaseEquipmentCategoryOptions>				
is_self_contained	Indicates whether unit is self-contained	Boolean				If not self-contained, show as false, and indicates that it has remote condenser
application_temperature	Equipment application temperature	<ApplicationTemperatureOptions>				Based on AHRI 1200
power	Nominal power of refrigerated case	Numeric	W	>0		
power_multiplier_schedule	Refrigerated case power multiplier schedule name	Reference				If the schedule is not present, the multiplier is always one. Constraint to use when implemented :Schedule:
sensible_fraction	Fraction of energy that is a sensible load on the space.	Numeric		≥-1, ≤1		

Name	Description	Data Type	Units	Range	Req	Notes
heat_gain_fraction	Fraction of energy that is a heat gain to the space.	Numeric		≥ -1 , ≤ 1		
volume	volume of a refrigerated case in cubic meters	Numeric	m3			
total_display_area	display area of a refrigerated case in square meters	Numeric	m2			
zone	Zone where case is located	Reference				Constraint to use when implemented :Zone: