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 referencencable identification for a data group and sequence of characters of any length using any (specified) character set.	string	AHU-01
`Null`	Indicator that no value is provided. Only used in combination with other data types, e.g., 'Number/Null'.	null	null

ConditioningType

Enumerator	Description	Notes
`HEATED_AND_COOLED`	Heated and cooled	
`HEATED_ONLY`	Heated only	
`SEMIHEATED`	Semiheated	
`UNCONDITIONED`	Unconditioned	

SpaceFunctionType

Enumerator	Description	Notes
`LABORATORY`	Laboratory	
`KITCHEN`	Kitchen	
`OTHER`	Other	

InfiltrationMethodType

Enumerator	Description	Notes
WEATHER_DRIVEN	Weather Driven. The amount of air leakage is determined by a correlation usually involving windspeed, height, and the difference between indoor and outdoor temperature.	
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 amount of air leakage is fixed.	

SurfaceClassificationType

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

SurfaceAdjacentTo

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 explicity modeled.	
IDENTICAL	Surface adjacent to a environment identical to the space. Sometimes this is described as adiabatic surface since no heat is transfered. The space on the other side of the surface is not explicity 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.	

SubsurfaceClassificationType

Enumerator	Description	Notes
WINDOW	Window	
SKYLIGHT	Skylight	
DOOR	Door	

MiscellaneousEquipmentType

Enumerator	Description	Notes
PLUG	Plug	
PROCESS	Process	
OTHER	Other	

TransformerType

Enumerator	Description	Notes
DRY_TYPE	Dry Type	
FLUID_FILLED	Fluid Filled	
OTHER	Other	

ElectricalPhase

Enumerator	Description	Notes
SINGLE_PHASE	Single Phase	
THREE_PHASE	Three Phase	

ScheduleSequenceTypeOptions

Enumerator	Description	Notes
HOURLY	Hourly	
EVENT	Event	

ScheduleTypeOptions

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

DayOfWeek

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

FluidLoopFlowControlOptions

Enumerator	Description	Notes
FIXED_FLOW	Fixed flow	
VARIABLE_FLOW	Variable flow	

FluidLoopTypeOptions

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

TemperatureResetTypeOptions

Enumerator	Description	Notes
NO_RESET	No Reset	
CONSTANT	Constant	
OUTSIDE_AIR_RESET	Outside air reste	
LOAD_RESET	Load Reset	
OTHER	Other	

FluidLoopOperationOptions

Enumerator	Description	Notes
CONTINUOUS	Continuous	
INTERMITTENT	Intermittent	

PumpSpeedControlOptions

Enumerator	Description	Notes
FIXED_SPEED	Fixed speed	
VARIABLE_SPEED	Variable speed	

PumpSpecificationMethodOptions

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

BoilerCombustionOptions

Enumerator	Description	Notes
NATURAL	Natural	
FORCED	Forced	

BoilerEfficiencyMetricTypeOptions

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

ChillerPartLoadEfficiencyMetricTypeOptions

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	

ChillerCompressorTypeOptions

Enumerator	Description	Notes
`SCREW`	Screw	
`CENTRIFUGAL`	Centrifugal	
`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	

HeatRejectionTypeOptions

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	

HeatRejectionFanTypeOptions

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	

HeatRejectionResetOptions

Enumerator	Description	Notes
CONSTANT	Constant	
LOAD_RESET	Load reset	
OTHER	Other	

HeatRejectionFanSpeedControlOptions

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

ExternalFluidSourceTypeOptions

Enumerator	Description	Notes
CHILLED_WATER	Chilled water	
HOT_WATER	Hot water	
STEAM	Steam	

ServiceWaterHeatingEnteringWaterTemperatureInputOptions

Enumerator	Description	Notes
ANNUAL_MAIN	Annual main entering water temperature option	
MONTHLY_MAIN	Monthly main entering water temperature option	
ANNUAL_GROUND	Annual ground entering water temperature option	
MONTHLY_GROUND	Monthly ground entering water temperature option	

FuelTypeOptions

Enumerator	Description	Notes
ELECTRICITY	Electricity	
NATURAL_GAS	Natural gas	
OTHER	Other	

ASHRAE229

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`				
`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).
`calendar`	Information on the calendar used with the simulation.	`{Calendar}`				
`schedules`	Schedules for internal loads, thermostats, equipment operation and control, and any other need.	`[{Schedule}]`				Contains a list of schedules used in model.
`weather`	Information on the local weather conditions used with the simulation.	`{Weather}`				
`infiltration_pressure_difference`	Differential pressure difference assumed for infiltration values.	`Numeric`	Pa	≥0		Often 50 Pa or 75 Pa and used as rating conditions for air leakage for a building.
`overall_simulation_outputs`	Outputs from the simluation summed for all buildings in the simulation.	`{OverallSimulationOutputs}`				
`category`	Indicates which category the current model represents for rulesets with multiple simulation models	`<CategoryType2019ASHRAE901>`				
`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	`<CompliancePathType2019ASHRAE901>`				
`building_rotation_angles`	A list of angles that building simulations are performed and results are provided.	`[Numeric]`	degrees			List of angles that the building has been rotated.
`fluid_loops`	Fluid loops on the site	`[{FluidLoop}]`				Contains a list of fluid loops on the site.

Name	Description	Data Type	Units	Range	Req	Notes
conditioning_components	Links to all conditioning components used on the site	[{Pump},{Boiler},{Chiller}, {HeatRejection}, {DistrictFluidMeter}]			✓	Contains a list of all components related to conditioning.

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				
notes	Supplementary information to provide context to the model reviewer	String				
number_of_floors	Number of floors	Numeric		≥0		
building_segments	Large portions of a building that share a building area type	[{BuildingSegment}]				Contains a list of building segments in the building.
is_all_new	Indicates whether building is completely new construction (true) or existing (false).	Boolean				Projects that include additions should be False. Projects with additional instead may be modeled as two buildings - one new and one existing, as curtain rules such as baseline fenestration area will apply differently to each portion.
elevators	Elevators	[{Elevator}]				Contains a list of elevators in the building.
refrigeration_components	Refrigeration	[{Refrigeration}]				Contains a list of refrigeration components in the building.
building_open_schedule	Reference to the schedule containing indicating when the building is open	$ID			✓	One represent when the building is open and zero when closed.

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`				
`notes`	Supplementary information to provide context to the model reviewer	`String`				
`thermal_blocks`	Thermal blocks in the building	`[{ThermalBlock}]`				Contains a list of thermal blocks in the building.
`heating_ventilation_air_conditioning_systems`	HVAC systems in the building	`[{HeatingVentilationAirConditioningSystem}]`				Contains a list of HVAC systems in the building.
`service_water_heating_systems`	Service water heating systems in the building	`[{ServiceWaterHeatingSystem}]`				Contains a list of service water heating systems in the building.
`area_type_vertical_fenestration`	Building area classification used for vertical fenestration	`<VerticalFenestrationBuildingAreaType2019ASHRAE901>`				The enumeration is based on the standard used.
`lighting_building_area_type`	Building area lighting area type	`<LightingSpaceType2019ASHRAE901T951TG38>`				

ThermalBlock

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`				
`zones`	Zones in the building	`[{Zone}]`				Contains a list of zones in the building.
`served_by_heating_ventilation_air_conditioning_systems`	HVAC systems serving the thermal block	`[String]`				Contains a list of IDs of the HVAC systems serving the thermal block - from Unique Identification Number in HeatingVentilationAirConditioningSystem.
`served_by_service_water_heating_system`	A service water heating system serving the thermal block	`String`				Contains a single ID of the service water heating system serving the thermal block - from Unique Identification Number in ServiceWaterHeatingSystem.

Zone

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`				
`spaces`	Spaces in the building	`[{Space}]`				Contains a list of spaces in the building.
`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	`<ConditioningType>`				
`infiltration`	Airleakage into the zone.	`{Infiltration}`				References a single infiltration data group.

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				
interior_lighting	Internal lighting that produce internal gains for a space.	[{InteriorLighting}]				
miscellaneous_equipment	Miscellaneous equipment loads that produce internal gains for a space.	[{MiscellaneousEquipment}]				
floor_area	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.	Numeric	m2	≥0		
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	$ID			✓	
status_type	Choice of new, existing, addition, or alteration.	<SpaceStatusType2019ASHRAE901>				
space_function	Generic function for the space.	<SpaceFunctionType>				The enumeration is based on the standard used.
lighting_space_type	Lighting space type classification	<LightingSpaceType2019ASHRAE901TG37>				The enumeration is based on the standard used.
ventilations_space_type	Ventilation space type classification	<VentilationSpaceType2019ASHRAE901>				The enumeration is based on the standard used.
service_water_heating_space_type	Service water heating space type classification	<ServiceWaterHeatingSpaceType2019ASHRAE901>				The enumeration is based on the standard used.

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`				
`modeling_method`	The software methodology chosen for modeling infiltration	`<InfiltrationMethodType>`				
`air_leakage_rate`	Air leakage rate from infiltration of outside air	`Numeric`	m3/s	≥0		Based on the pressure described in ASHRAE229.infiltration_pressure_difference.
`multiplier_schedule`	Referenced to the schedule containing the multiplier for the infiltration	`$ID`				

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				
subsurfaces	Suburfaces that are on the surface	[{Subsurface}]				Contains a list of surfaces that define the space.
classification	Classification for the surface.	<SurfaceClassificationType>				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
adjacent_to	Used to classify the conditions on the surface.	(<SurfaceAdjacentTo>, <AdditionalSurfaceAdjacentToRESNET>, <AdditionalSurfaceAdjacentTo2019ASHRAE901>)				Determines whether the other side of the surface is modeled and if not what assumptions should be used.
adjacent_zone	ID of the adjacent zone for interior surface. Only required when adjacent zone is explicity modeled when adjacent_to is set to INTERIOR.	$ID				
does_cast_shade	Determines whether the surface is modeled as casting shade on other exterior surfaces	Boolean				
construction	Construction description of surface.	{Construction}				
surface_optical_properties	Optical properties of the surface.	{SurfaceOpticalProperties}				

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				
surface_construction_input_option	Identifies whether construction is entered layer-by-layer or simplified (R-value)	<SurfaceConstructionInputOptions>				
fraction_framing	Fraction of the construction that is framing.	Numeric		≥0,≤1		Fraction of the construction using framing_layers, the remaining portion uses the primary_layers. If blank, assume zero framing.
primary_layers	List of names of layer descriptions starting from the outside surface for primary heat path	[{Material}]				For constructions with framing and cavity heat transfer paths, use this for the cavity. For homogeneous constructions, use this element only. Air films should not be included in the list of layers.
framing_layers	List of names of layer descriptions starting from the outside surface for the framing heat path	[{Material}]				For constructions with framing and cavity heat transfer paths, use this for the framing. For homogeneous constructions, do not use this element. Air films should not be included in the list of layers.
insulation_location	The location of the insulation related to the surface	String				
u_factor	suface U-factor	Numeric	W/m2-K	≥0		Includes interior and exterior air films as specified by the referenced standard.
c_factor	surface C-factor	Numeric	W/m2-K	≥0		
f_factor	surface F-factor	Numeric	W/m-K	≥0		
r_value	r-value of the insulation for the surface	Numeric	K-m2/W	≥0		
has_radiant_heating	Includes embedded radiant heating elements	Boolean				
has_radiant_cooling	Includes embedded radiant cooling elements	Boolean				

Material

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`				
`thickness`	The thickness of the material layer	`Numeric`	m	>0		
`thermal_conductivity`	The thermal conductivity of the material layer	`Numeric`	W/m-K	≥0		When thermal_conductivity is specified, r_value should not be provided.
`density`	The density of the material layer	`Numeric`	kg/m3	≥0		
`specific_heat`	The specific heat of the material layer	`Numeric`	J/kg-K	≥0		
`r_value`	r-value of the insulation for the material layer	`Numeric`	K-m2/W	≥0		When r_value is specified, thermal_conductivity should not be provided. Typically used for insulation or air gaps.

SurfaceOpticalProperties

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`				
`absorptance_thermal_exterior`	Thermal absorptance of long wavelength radiation on the exterior surface.	`Numeric`		≥0		
`absorptance_solar_exterior`	Thermal absorptance of short wavelength radiation on the exterior surface.	`Numeric`		≥0		
`absorptance_visible_exterior`	Thermal absorptance of visible radiation on the exterior surface.	`Numeric`		≥0		
`absorptance_thermal_interior`	Thermal absorptance of long wavelength radiation on the interior surface.	`Numeric`		≥0		
`absorptance_solar_interior`	Thermal absorptance of short wavelength radiation on the interior surface.	`Numeric`		≥0		
`absorptance_visible_interior`	Thermal absorptance of visible radiation on the interior surface.	`Numeric`		≥0		

Subsurface

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`				
`classification`	Classification for the subsurface being window, skylight, door.	`<SubsurfaceClassificationType>`				
`subclassification`	Standard specific subclassification for subsurfaces	`<SubsurfaceSubclassificationType2019ASHRAE901>`				
`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.	`<SubsurfaceFrameType2019ASHRAE901>`				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.
`is_dynamic_glazing`	Identifies whether the window subsurface can change it's performance properties	`Boolean`				
`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

Name	Description	Data Type	Units	Range	Req	Notes
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				

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				
purpose_type	Lighting space type classification	<LightingPurposeType2019ASHRAE901>				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	$ID			✓	
has_occupancy_control	Indicates that the lighting has occupancy controls	Boolean				
has_daylighting_control	Includes daylighting controls	Boolean				

MiscellaneousEquipment

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`				
`energy_type`	Source of energy for the miscelleous equipment in the space	`<FuelTypeOptions>`				
`peak_usage`	Peak energy usage per hour by the miscelleous equipment in the space.	`Numeric`	W			
`multiplier_schedule`	Referenced to the schedule containing the multiplier for the miscellenous equipment	`$ID`			✓	
`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.
`miscellaneous_equipment_type`	Type of miscellaneous equipment	`<MiscellaneousEquipmentType>`				
`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`				
`type`	The type of transformer	`<TransformerType>`				
`phase`	The number of electrical phases	`<ElectricalPhase>`				
`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 transfomer 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`				
`notes`	Supplementary information to provide context to the model reviewer	`String`				
`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 RMRs. Examples include thermostat, multiplier for lighting, availability for equipment.
`schedule_sequence_type`	Schedule sequence type	`<ScheduleSequenceTypeOptions>`				
`hourly_values`	Hourly Values of Schedule	`[Numeric][8760]`				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.
`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.
`type`	The type of schedule	`<ScheduleTypeOptions>`				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_schedule`	True if any schedule values have changed from what appears in the schedule library	`<PrescribedSchedules2019ASHRAE901>`				
`is_schedule_modified_for_workaround`	True if any schedule has been modified for a workaround	`Boolean`				

Calendar

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				
day_of_week_for_january_1	Day of the week for January 1	<DayOfWeek>				
is_leap_year	The schedules assume it is a leap year	Boolean				
is_daylight_savings_time	The schedules adjust for daylight Savings Time	Boolean				

Weather

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				
monthly_ground_temperature	Modeled monthly ground temperatures	[Numeric][1..12]	C			
climate_zone	The designation of the climate zone where the building is located	<ClimateZone2019ASHRAE901>			✓	The enumeration is based on the standard used.

Elevator

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				
motor_power	Elevator peak motor power	Numeric	W			
cab_counterweight	Elevator car counterweight	Numeric	kg			
cab_weight	Weight of elevator car	Numeric	kg			
design_elevator_load	Elevator load at which to operate	Numeric	kg			
speed	Design speed of the elevator	Numeric	m/s			
cab_area	Floor area of elevator cab	Numeric	m2			
cab_lighting_power	Lighitng power of cab	Numeric	W			
cab_ventilation_fan_power	Ventilation fan power of cab	Numeric	W			
cab_ventilation_fan_flow	Airflow of cab ventfan	Numeric	L/s			
cab_motor_multiplier_schedule	Elevator motor operation multiplier schedule name	String				
cab_ventilation_fan_multiplier_schedule	Elevator ventilation fan operation mulitplier schedule name	String				
cab_lighting_multiplier_schedule	Elevator lighting multiplier schedule name	String				

HeatingVentilationAirConditioningSystem

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`				
`zones_served`	List of the zones served by the HVAC system	`[{Zone}]`				
`hot_water_loop`	Referenced to the hot water fluid loop	`$ID`				
`chilled_water_loop`	Referenced to the Chilled water fluid loop	`$ID`				
`condenser_water_loop`	Referenced to the Condenser water fluid loop	`$ID`				
`preheat_loop`	Referenced to the Preheat fluid loop	`$ID`				
`reheat_loop`	Referenced to the reheat fluid loop	`$ID`				
`sensible_cool_capacity`	Sensible cooling capacity	`[Numeric]`	W/m2	≥0		May be design value or result from the simulation. If multiple values are provided, they correspond to rotated building orientations

Name	Description	Data Type	Units	Range	Req	Notes
`heat_capacity`	Heating capacity	`[Numeric]`	W/m2	≥0		May be design value or result from the simulation. If multiple values are provided, they correspond to rotated building orientations

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`				
`type`	Type of loop	`<FluidLoopTypeOptions>`				
`child_loops`	Other fluid loops connected to this one as children.	`[{FluidLoop}]`				
`cooling_or_condensing_design_and_control`		`{FluidLoopDesignAndControl}`				
`heating_design_and_control`		`{FluidLoopDesignAndControl}`				

FluidLoopDesignAndControl

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`				
`design_supply_temperature`	Design Supply Temperature	`Numeric`	C			
`design_return_temperature`	Design Return Temperature	`Numeric`	C			
`pump_power_per_flow_rate`	Total design pump power divided by the loop design flow rate	`Numeric`	W/s-L			
`is_sized_using_coincident_load`	True if the loop is sized based on coincident load	`Boolean`				
`minimum_flow_fraction`	Minimum fraction of full flow allowed	`Numeric`				
`operation`	Type of operation used by loop	`<FluidLoopOperationOptions>`				
`flow_control`	Flow control options	`<FluidLoopFlowControlOptions>`				
`temperature_reset_type`	Type of temperature reset used by loop	`<TemperatureResetTypeOptions>`				
`outdoor_high_for_loop_supply_temperature_reset`	Outdoor high for loop supply temp reset	`Numeric`	C			
`outdoor_low_for_loop_supply_temperature_reset`	Outdoor low for loop supply temp reset	`Numeric`	C			
`loop_supply_temperature_at_outdoor_high`	Loop supply temperature at outdoor high temperature	`Numeric`	C			
`loop_supply_temperature_at_outdoor_low`	Loop supply temperature at outdoor low temperature	`Numeric`	C			

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				
loop	Referenced to the fluid loop	$ID			✓	
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>				
design_flow	Design Pump Flowrate	Numeric	L/s			
is_flow_autosized	True if the design_flow is autosized	Boolean				
is_variable_speed	True if variable speed drive such a VFD	Boolean				

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`				
loop	Referenced to the fluid loop	`$ID`			✓	
design_capacity	Heating capacity	`Numeric`	W			
rated_capacity	Heating capacity	`Numeric`	W			At rating conditions.
minimum_load_ratio	Minimum fraction of full load allowed	`Numeric`				
draft_type	Combustion option	`<BoilerCombustionOptions>`				
efficiency_metric	The type of efficiency metric used	`<BoilerEfficiencyMetricTypeOptions>`				
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			
operation_upper_limit	Heating load range operation, upper limit	`Numeric`	W			

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.
result	Result	`Numeric`	W			

Chiller

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`				
`cooling_loop`	Referenced to the cooling fluid loop	`$ID`			✓	
`condensing_loop`	Referenced to the condensing fluid loop	`$ID`				No condensing loop name implies air-cooled chiller.
`compressor_type`	Compressor Type	`<ChillerCompressorTypeOptions>`				
`design_capacity`	Chiller Design Cooling Capacity	`Numeric`	W			
`rated_capacity`	Chiller Design Cooling Capacity	`Numeric`	W			At rating conditions.
`minimum_load_ratio`	Minimum fraction of full load allowed	`Numeric`				
`design_flow_evaporator`	Chiller evaporator design flow	`Numeric`	L/s			
`design_flow_condenser`	Chiller condenser design flow	`Numeric`	L/s			
`full_load_efficiency`	Full Low Efficiency expressed as a coefficient of performance (COP)	`Numeric`	W/W			
`part_load_efficiency`	Efficiency value based on the selected part_load_efficiency_metric	`Numeric`		≥0, ≤1		
`part_load_efficiency_metric`	The type of part load efficiency metric used	`<ChillerPartLoadEfficiencyMetricTypeOptions>`				
`capacity_validation_points`	Capacity validation points	`[{ChillerPerformanceValidationPoint}]`				
`power_validation_points`	Energy validation points	`[{ChillerPerformanceValidationPoint}]`				

ChillerPerformanceValidationPoint

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.
`second_temperature`	Second temperature	`Numeric`	C			Outside air dry-bulb temperature for air cooled chillers and condenser water temperature for water cooled chillers
`load`	Load	`Numeric`	W			
`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`				
`loop`	Referenced to the fluid loop	`$ID`			✓	
`type`	Heat Rejection Type	`<HeatRejectionTypeOptions>`				
`fan_type`	Heat Rejection Fan Type	`<HeatRejectionFanTypeOptions>`				
`fluid`	Fluid Cooled by Heat Rejection	`<HeatRejectionFluidOptions>`				
`range`	Heat rejection Range	`Numeric`	C			
`approach`	Heat rejection Approach	`Numeric`	C			
`reset_type`	Leaving Temperature reset strategy	`<HeatRejectionResetOptions>`				
`minimum_reset_temperature`	Minimum leaving temperature setpoint	`Numeric`	C			
`fan_power`	Fan Power	`Numeric`	W			
`fan_speed_control`	Fan Speed Control Type	`<HeatRejectionFanSpeedControlOptions>`				
`design_supply_temperature`	Design leaving water temperature	`Numeric`	C			
`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.

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`				
`loop`	Referenced to the fluid loop	`$ID`			✓	
`type`	Type of external fluid source	`<ExternalFluidSourceTypeOptions>`				

ServiceWaterHeatingSystem

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				
area_type	Service Water Heating Loop Area Type	<ServiceWaterHeatingSpaceType2019ASHRAE901>				The enumeration is based on the standard used.
design_flow	Design Flowrate of service water heating loop	Numeric	L/s			
supply_temperature	Design supply temperature setpoint of service water heating loop	Numeric	C			
flow_multiplier_schedule	service water heating Loop flow muliplier schedule name	String				
annual_entering_water_temperature	Annual service main or annual ground temperature used for service water heating calculations entering water temperature degrees	Numeric	C			
monthly_entering_water_temperature	Monthly service main or ground temperatures used for service water heating entering water temperature degrees	[Numeric][1..12]	C			Arrayed variable with 12 values for monthly entering water temperature
entering_water_temperature_type	Method of determining service water heating entering water temperature	<ServiceWaterHeatingEnteringWaterTemperatureInputOptions>				
heater	Referenced to the service water heater	$ID			✓	
heater_fuel_type	Service water heating heater fuel type	<FuelTypeOptions>				
heater_efficiency	Service water heating heater efficiency	Numeric		≥0		

ExteriorLighting

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`				
`type`	The type of exterior lighting fixture none	`<ExteriorLightingAreas2019ASHRAE901TableG36>`				
`area`	Area of the exterior functional space.	`Numeric`	m2	>0		
`norminal_wattage`	Nominal capacity of exterior lighting fixtures	`Numeric`	W	>0		
`fixture_height`	Installation height of exterior fixture	`Numeric`	m	>0		
`power`	Total exterior lighting power of all fixtures in a specific functional area	`Numeric`	W	>0		
`designed_power`	Total designed exterior lighting power of all fixtures in a specific functional area	`Numeric`	W	>0		
`trade_light_power`	Exterior Lighting power for tradable surface	`Numeric`	W	≥0		
`non_trade_light_power`	Exterior Lighting power for non-tradable surface	`Numeric`	W	≥0		
`site_zone_type`	Site zone type for Sec 9.4.2	`<ExteriorLightingZones2019ASHRAE901>`				
`parking_area`	Area of exterior parking space	`Numeric`	m2	≥0		
`tradable_surface_type`	Type of tradable surfaces for exterior lighting	`<ExteriorLightingAreas2019ASHRAE901TableG36>`				
`tradable_surface_area`	Area of tradable surface	`Numeric`	m2	≥0		
`tradable_surface_linear_footage`	Linear feet of tradable surface	`Numeric`	m	≥0		
`has_walkway`	If the building has an exterior walkway	`Boolean`				
`tradable_walkway_width_footage`	Width of the exterior walkway	`Numeric`	m	≥0		
`tradable_opening_width_footage`	Width of an exterior opening	`Numeric`	m	≥0		
`multiplier`	Multiplier for exterior lighting specifications	`Numeric`		>0		

Refrigeration

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`				
type	Refrigeration equipment type	`<RefrigerationType2019ASHRAE901>`				
equipment_class	Equipment Class from referenced standard	`<RefrigerationClass2019ASHRAE901>`				
energy_per_day	Rated electrical energy use per day	`Numeric`	kWh			
case_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			

OverallSimulationOutputs

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`				
refrigeration_energy_enduse	Annual refrigeration energy end use from simulation output	`Numeric`	kWh			
service_water_heating_annual_enduse_electricity	Annual electricity energy end_use for SWH loops	`Numeric`	kWh	≥0		
service_water_heating_annual_enduse_fossilfuel	Annual fossil fuel energy end_use for SWH loops	`Numeric`	J	≥0		