

# 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
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	
PLENUM	Plenum	

# SpaceFunctionType

Enumerator	Description	Notes
LABORATORY	Laboratory	
KITCHEN	Kitchen	
OTHER	Other	

# SpaceStatusType

Enumerator	Description	Notes
NEW	New	
EXISTING	Existing	
ADDITION	Addition	
ALTERATION	Alteration	

## SurfaceClassificationType

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

## SurfaceAdjacentTo

Enumerator	Description	Notes
AMBIENT	Exterior wall or roof which is adjacent to the exterior ambient environments.	
GROUND	Slab-on-grad or below grade surface if adjacent to ground.	
INTERIOR	Interior surface if adjacent to another thermal block.	
IDENTICAL	Surface adjacent to a environment identical to the zone.	
UNHEATED	Surface adjacent to a environment that is not heated but enclosed.	

## SurfaceConstructionInputOptions

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

## FenestrationClassificationType

Enumerator	Description	Notes
WINDOW	Window	
SKYLIGHT	Skylight	
DOOR	Door	

## FenestrationFramingType

Enumerator	Description	Notes
METAL_WITHOUT_THERMAL_BREAK	Metal without thermal break	
METAL_WITH_THERMAL_BREAK	Metal with thermal break	
WOOD	Wood	
VINYL	Vinyl	
FIBERGLASS	Fiberglass	

## 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	

## DayOfWeek

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

## 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	

## ASHRAE229

Name	Description	Data Type	Units	Range	Req	Notes
<code>transformers</code>	Electrical transformers at the building site	<code>[{Transformer}]</code>				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.
<code>buildings</code>	Buildings on the site	<code>[{Building}]</code>				Contains a list of buildings on the site (often just one).
<code>calendar</code>	Information on the calendar used with the simulation.	<code>{Calendar}</code>				
<code>schedules</code>	Schedules for internal loads, thermostats, equipment operation and control, and any other need.	<code>[{Schedule}]</code>				Contains a list of schedules used in model.
<code>weather</code>	Information on the local weather conditions used with the simulation.	<code>{Weather}</code>				
<code>overall_simulation_outputs</code>	Outputs from the simulation summed for all buildings in the simulation.	<code>{OverallSimulationOutputs}</code>				
<code>building_rotation_angles</code>	A list of angles that building simulations are performed and results are provided.	<code>[Numeric]</code>	degrees			List of angles that the building has been rotated.

# Building

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Name	Description	Data Type	Units	Range	Req	Notes
id	Unique Identification Number	Numeric			✓	
name	Name of the Building	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 certain rules such as baseline fenestration area will apply differently to each portion.
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>				
elevators	Elevators	[{Elevator}]				Contains a list of elevators in the building.
refrigeration_components	Refrigeration	[{Refrigeration}]				Contains a list of refrigeration components in the building.
open_time	Time that the building opens.	Numeric		≥1, ≤24		The general time that the building is first opened during normal weekdays from 1 to 24

Name	Description	Data Type	Units	Range	Req	Notes
close_time	Time that the building closes.	Numeric		≥1, ≤24		The general time that the building is closed during normal weekdays from 1 to 24

## BuildingSegment

Name	Description	Data Type	Units	Range	Req	Notes
id	Unique Identification Number	Numeric			✓	
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	<LightingSpaceType2019ASHRAE901T961>				

## ThermalBlock

Name	Description	Data Type	Units	Range	Req	Notes
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.

## Zone

Name	Description	Data Type	Units	Range	Req	Notes
spaces	Spaces in the building	[{Space}]				Contains a list of spaces in the building.

## Space

Name	Description	Data Type	Units	Range	Req	Notes
<code>id</code>	Unique Identification Number	<code>Numeric</code>			✓	
<code>name</code>	Name fo the Space	<code>String</code>			✓	
<code>surfaces</code>	Surfaces surrounding the space	<code>[{Surface}]</code>				Contains a list of surfaces that define the space.
<code>floor_area</code>	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.	<code>Numeric</code>	m2	≥0		
<code>floor_to_ceiling_height</code>	The height from the floor of the space to the ceiling	<code>Numeric</code>	m	≥0		
<code>conditioning_type</code>	Space conditioning category	<code>&lt;ConditioningType&gt;</code>				
<code>status_type</code>	Choice of new, existing, addition, or alteration.	<code>&lt;SpaceStatusType&gt;</code>				
<code>space_function</code>	Generic function for the space.	<code>&lt;SpaceFunctionType&gt;</code>				The enumeration is based on the standard used.
<code>lighting_space_type</code>	Lighting space type classification	<code>&lt;LightingSpaceType2019ASHRAE90IT951&gt;</code>				The enumeration is based on the standard used.
<code>lighting_power</code>	Total power for lights in the spac.	<code>Numeric</code>	W			
<code>has_primary_daylighting_control</code>	Includes daylighting controls for primary daylit areas	<code>Boolean</code>				
<code>has_secondary_daylighting_control</code>	Includes daylighting controls for secondary daylit areas	<code>Boolean</code>				
<code>has_toplighting_control</code>	Includes daylighting controls for toplit areas	<code>Boolean</code>				
<code>primary_daylit_area</code>	Primary daylit area of the space.	<code>Numeric</code>	m2	≥0		



Name	Description	Data Type	Units	Range	Req	Notes
secondary_daylit_area	Secondary daylit area of the space.	Numeric	m2	≥0		
toplit_area	Toplit area of the space.	Numeric	m2	≥0		
has_additional_occupancy_sensor_control_credit	Includes credit for occupancy sensor controls.	Boolean				
has_additional_programmable_lighting_control_credit	Includes credit for programmable lighting controls.	Boolean				
lighting_schedule_name	Lighting schedule name	String				
lighting_equivalent_full_load_hours	Annual sum of hourly fractions of lighting schedule	Numeric	hr	≥0		
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_modeling_method	The software methodology chosen for modeling infiltration	String				
infiltration_equivalent_full_load_hours	Annual sum of hourly fractions of infiltration schedule	Numeric	hr	≥0		
receptacle_control_credit_taken	The receptacle control credit was taken	Boolean				
receptacle_baseline_exception_taken	The exception that receptacle power or schedule can be different in the baseline has been taken.	Boolean				
receptacle_power	Peak power consumed by the receptacles.	Numeric	W			
receptacle_schedule_name	Receptacle schedule name	String				
receptacle_control_credit	A multiplier for the fraction of space plug load power applied to the receptacle controlled credit.	Numeric		≥0		

## Surface

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Name	Description	Data Type	Units	Range	Req	Notes
id	Unique Identification Number	Numeric			✓	
name	Name fo the Space	String			✓	
fenestration_subsurfaces	Fenestration subsurfaces that are on the surface	[{Fenestration}]				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>)				Determines whether this is an (a) exterior surface if adjacent to ambient, (b) slab-on-grade or below grade surface if adjacent to ground, or (c) interior surface if adjacent to another thermal block.
adjacent_space_id	ID of the adjacent space for interior surface	String				
does_cast_shade	Determines whether the surface is modeled as casting shade on other exterior surfaces	Boolean				
construction	Construction description of surface.	{Construction}				
surface_optics	Optical properties of the surface.	{Optical}				

## Construction

Name	Description	Data Type	Units	Range	Req	Notes
surface_construction_input_option	Identifies whether construction is entered layer-by-layer or simplified (R-value)	<SurfaceConstructionInputOptions>				
layers	List of names of layer descriptions starting from the outside surface	[String]				
insulation_location	The location of the insulation related to the surface	String				
u_factor	surface U-factor	Numeric	W/m2-K	$\geq 0$		Includes interior and exterior air films as specified by the referenced standard.
c_factor	surface C-factor	Numeric	W/m2-K	$\geq 0$		
f_factor	surface F-factor	Numeric	W/m-K	$\geq 0$		
r_value	r-value of the insulation for the surface	Numeric	K-m2/W	$\geq 0$		
has_radiant_heating	Includes embedded radiant heating elements	Boolean				
has_radiant_cooling	Includes embedded radiant cooling elements	Boolean				

# SurfaceOptics

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Name	Description	Data Type	Units	Range	Req	Notes
absorptance_thermal_exterior	Thermal absorptance of long wavelength radiation on the exterior surface.	Numeric		$\geq 0$		
absorptance_solar_exterior	Thermal absorptance of short wavelength radiation on the exterior surface.	Numeric		$\geq 0$		
absorptance_visible_exterior	Thermal absorptance of visible radiation on the exterior surface.	Numeric		$\geq 0$		
absorptance_thermal_interior	Thermal absorptance of long wavelength radiation on the interior surface.	Numeric		$\geq 0$		
absorptance_solar_interior	Thermal absorptance of short wavelength radiation on the interior surface.	Numeric		$\geq 0$		
absorptance_visible_interior	Thermal absorptance of visible radiation on the interior surface.	Numeric		$\geq 0$		

## Fenestration

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Name	Description	Data Type	Units	Range	Req	Notes
id	Unique Identification Number	Numeric			✓	
name	Name of the fenestration subsurface	String			✓	
classification	Classification for the fenestration being window, skylight, door.	<FenestrationClassificationType>				
is_operable	Identifies whether fenestration can be opened and closed including by pivoting or sliding.	Boolean				
framing_type	The material of the framing.	<FenestrationFramingType>				
area	Area of fenestration including glass and framing	Numeric	m2	≥0		
u_factor	Fenestration U-factor	Numeric	W/m2-K	≥0		Includes interior and exterior air films as specified by the referenced standard.
solar_heat_gain_coefficient	Fenestration SHGC	Numeric		≥0		
visible_transmittance	Fenestration VT	Numeric		≥0		
depth_of_overhang	Distance from the edge of the overhang to the fenestration surface.	Numeric	m	≥0		
has_shading_overhang	Identifies whether fenestration has overhangs	Boolean				
has_shading_sidefins	Identifies whether fenestration 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				

# Transformer

Name	Description	Data Type	Units	Range	Req	Notes
name	Transformer Name	String			✓	
type	The type of transformer	<TransformerType>				
phase	The number of electrical phases	<ElectricalPhase>				
efficiency	Transformer efficiency	Numeric		$\geq 0$ , $\leq 1$		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	$\geq 0$		
peak_load	Annual Peak electric load on the transformer	Numeric	W	$\geq 0$		Peak electric load on the transformer based on an annual simulation with typical weather file.

## Schedule

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Name	Description	Data Type	Units	Range	Req	Notes
<code>id</code>	Unique Identification Number	<code>Numeric</code>			✓	
<code>name</code>	Name of the Schedule	<code>String</code>			✓	
<code>purpose</code>	The purpose of schedule	<code>String</code>				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.
<code>values</code>	Hourly Values of Schedule	<code>[Numeric][8760]</code>				Can also use functions like EFLH(), MAX(), MIN() to determine overall characteristics for the list of schedule values.
<code>units_of_values</code>	The units associated with the values of the schedule	<code>String</code>				For certain schedule purposes, the values may be represented by units such as C for temperature or W for power.
<code>prescribed_schedule</code>	True if any schedule values have changed from what appears in the schedule library	<code>&lt;PrescribedSchedules2019ASHRAE901&gt;</code>				

## Calendar

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Name	Description	Data Type	Units	Range	Req	Notes
id	Unique Identification Number	Numeric			✓	
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
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	Unique Identification Number	Numeric			✓	
name	Name of the elevator	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	Lighting 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_schedule	Elevator motor operation schedule name	String				
cab_ventilation_fan_schedule	Elevator ventilation fan operation schedule name	String				
cab_lighting_schedule	Elevator lighting schedule name	String				
cab_motor_schedule_equivalent_full_load_hours	Elevator motor operation schedule equivalent full load hours	Numeric	hr	$\geq 0$ , $\leq 8760$		
cab_ventilation_fan_schedule_equivalent_full_load_hours	Elevator ventfan operation schedule equivalent full load hours	Numeric	hr	$\geq 0$ , $\leq 8760$		
cab_lighting_schedule_equivalent_full_load_hours	Elevator lighting schedule equivalent full load hours	Numeric	hr	$\geq 0$ , $\leq 8760$		

# HeatingVentilationAirConditioningSystem

Name	Description	Data Type	Units	Range	Req	Notes
id	Unique Identification Number	Numeric			✓	
sensible_cool_output_capacity	Result from the simulation of the sensible cooling capacity	[Numeric]	W/m2	≥0		If multiple values are provided, they correspond to rotated building orientations
heat_output_capacity	Result from the simulation of the heating capacity	[Numeric]	W/m2	≥0		If multiple values are provided, they correspond to rotated building orientations

## ServiceWaterHeatingSystem

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Name	Description	Data Type	Units	Range	Req	Notes
loop_name	Name of service water heating system loop	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_schedule	service water heating Loop flow 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_name	Service water heating heater name	String				
heater_fuel_type	Service water heating heater fuel type	<FuelTypeOptions>				
heater_efficiency	Service water heating heater efficiency	Numeric		≥0		

## ExteriorLighting

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Name	Description	Data Type	Units	Range	Req	Notes
id	Unique ID assigned to each exterior lighting fixture(s) reported in an RMR	Numeric		>0		
name	Exterior lighting fixture name	String				
type	The type of exterior lighting fixture none	<ExteriorLightingAreas2019ASHRAE901TableG36>				
area	Area of the exterior functional space.	Numeric	m2	>0		
nominal_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	Unique Identification Number	Numeric			✓	
name	Name of the refrigeration component	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
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		