

# 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
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 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.	
CONSTANT_SCHEDULED	Constant multiplied by the schedule.	
OTHER	Other infiltration methods.	

# 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 explicitly modeled.	
IDENTICAL	Surface adjacent to a environment identical to the space. Sometimes this is described as 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.	

## SubsurfaceClassificationType

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

## SubsurfaceDynamicGlazingType

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

## LightingDaylightingControlType

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

## LightingOccupancyControlType

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

## 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	

## CoolingDesignDayTypeOptions

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	

## HeatingDesignDayTypeOptions

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	

## HeatingSystemType

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

## HeatpumpAuxilliaryHeatType

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

## HumidificationType

Enumerator	Description	Notes
ADIABATIC	Adiabatic	
NONE	None	
OTHER	Other	

## CoolingSystemType

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

## DehumidificationType

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

## FanSystemTemperatureControlType

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	

## FanSystemSupplyFanControlType

Enumerator	Description	Notes
CONSTANT	Constant	
VARIABLE_SPEED_DRIVE	Variable speed drive	
MULTISPEED	Multispeed	
INLET_VANE	Inlet vane	
DISCHARGE_DAMPER	Discharge damper	
OTHER	Other	

## FanSystemOperationType

Enumerator	Description	Notes
CYCLING	Cycling	
CONTINUOUS	Continuous	
KEEP_OFF	Off	
OTHER	Other	

## FanSystemSupplyFanVolumeResetType

Enumerator	Description	Notes
CONSTANT	Constant	
LOAD_RESET	Load Reset	
OTHER	Other	

## AirEconomizerType

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	

## EnergyRecoveryType

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	



# EnergyRecoveryOperation

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

# EnergyRecoverySupplyAirTemperatureControl

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

# DemandControlVentilationControlType

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

# TerminalType

Enumerator	Description	Notes
VARIABLE_AIR_VOLUME	Variable air volume	
CONSTANT_AIR_VOLUME	Constant air volume	
RADIANT	Radiant	
FOUR_PIPE_FAN_COIL_UNIT	Four pipe fan coil unit	
TWO_PIPE_FAN_COIL_UNIT	Two pipe fan coil unit	
BASEBOARD	Baseboard	
OTHER	Other	

## TerminalFanConfiguration

Enumerator	Description	Notes
PARALLEL	Parallel	
SERIES	Series	
OTHER	Other	

## ReheatSourceType

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

## 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 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	
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, impellor 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	

## ServiceWaterHeatingConfigurationType

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	
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	

## ServiceWaterHeatingHeatRecoveryType

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

## ServiceWaterHeaterType

Enumerator	Description	Notes
CONVENTIONAL	Conventional	
HEAT_PUMP_PACKAGED	Heat pump packaged	
HEAT_PUMP_SPLIT	Heat pump split	
OTHER	Other	

## ComponentLocation

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	

## ServiceWaterHeaterTankType



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	

## ServiceWaterHeatingFixtureType

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	
OTHER	Other	

## ServiceWaterHeatingUseUnits

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	

## EnergySourceTypeOptions

Enumerator	Description	Notes
ELECTRICITY	Electricity	
NATURAL_GAS	Natural gas	
PROPANE	Propane	
FUEL_OIL	Fuel oil	
OTHER	Other	

## RefrigerationType

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

# RefrigerationCategory

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	

# ApplicationTemperatureType

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)
ICE_CREAM	Ice cream	-26.1 C +/- 1.1 C (-15 F +/- 2 F)
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}				
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.
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				
overall_simulation_outputs	Outputs from the simulation summed for all buildings in the simulation.	{OverallSimulationOutputs}				
ruleset_model_type	Describes the current model for rulesets with multiple simulation models	<RulesetModelType2019ASHRAE901>, <RulesetModelTypeRESNET, <RulesetModelType2019T24Com>, <RulesetModelType2019T24Res>>				
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.

Name	Description	Data Type	Units	Range	Req	Notes
fluid_loops	Fluid loops on the site	{{FluidLoop}}				Contains a list of fluid loops on the site.
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.
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_source	ExternalFluidSources used on the site	{{ExternalFluidSource}}				
site_zone_type	Site zone type for Sec 9.4.2	<ExteriorLightingZones2019ASHRAE901>				

# Building

---

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>				
<code>building_segments</code>	Large portions of a building that share a building area type	<code>[{BuildingSegment}]</code>				Contains a list of building segments in the building.
<code>elevators</code>	Elevators	<code>[{Elevator}]</code>				Contains a list of elevators in the building.
<code>exterior_lighting</code>	Exterior lighting systems	<code>[{ExteriorLighting}]</code>				Contains a list of exterior lighting systems for the building.
<code>refrigeration_components</code>	Refrigeration	<code>[{Refrigeration}]</code>				Contains a list of refrigeration components in the building.
<code>building_open_schedule</code>	Reference to the schedule containing indicating when the building is open	<code>\$ID</code>			✓	One represent when the building is open and zero when closed. Constraint to use when implemented :Schedule:
<code>has_site_shading</code>	Indicates whether the site has features that cast shadows on the building	<code>Boolean</code>				

## 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				
number_of_floors_above_grade	Number of floors above grade	Numeric		≥0		JG to verify if used in test case description.
number_of_floors_below_grade	Number of floors below grade	Numeric		≥0		JG to verify if used in test case description.
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	[{Zone}]				Contains a list of zones in the building.
heating_ventilation_air_conditioning_systems	HVAC systems in the building	[{HeatingVentilationAirConditioningSystem}]				Contains a list of HVAC systems in the building.
area_type_vertical_fenestration	Building area classification used for vertical fenestration	<verticalFenestrationBuildingAreaType2019ASHRAE90I>				The enumeration is based on the standard used.
lighting_building_area_type	Building area lighting area type	<LightingSpaceType2019ASHRAE90IT951TG38>				
area_type_heating_ventilation_air_conditioning_system	Classification used for HVAC	<HeatingVentilationAirConditioningBuildingAreaType2019ASHRAE90I>				The enumeration is based on the standard used. JG to verify if used in test case description.

# Zone

Name	Description	Data Type	Units	Range	Req	Notes
<code>id</code>	Scope-unique reference identifier for instances of this data group	<code>ID</code>			✓	No multipliers or floor multipliers are used with the Zone data group so each zone should be individually identified.
<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>				
<code>spaces</code>	Spaces in the zone	<code>[{Space}]</code>				Contains a list of spaces in the building.
<code>floor_number</code>	Floor number	<code>Numeric</code>				Used to group zones on a floor so the number indicates that different zones share a floor. The number should increase for increasing heights and be negative values for stories generally below ground and should generally correspond to numbering of floors on the plans. JG to verify if used in test case description.
<code>volume</code>	Volume of the space	<code>Numeric</code>	m3	≥0		
<code>surfaces</code>	Surfaces surrounding the zone	<code>[{Surface}]</code>				Contains a list of surfaces that define the zone.
<code>conditioning_type</code>	Space conditioning category	<code>&lt;ConditioningType&gt;</code>				
<code>infiltration</code>	Airleakage into the zone.	<code>{Infiltration}</code>				References a single infiltration data group.
<code>design_thermostat_cooling_setpoint</code>	Setpoint temperature for cooling during occupied hours	<code>Numeric</code>	C			JG to verify if used in test case description.
<code>thermostat_cooling_setpoint_schedule</code>	Reference to the schedule containing the cooling setpoint temperatures	<code>\$ID</code>			✓	Constraint to use when implemented :Schedule:
<code>design_thermostat_heating_setpoint</code>	Setpoint temperature for heating during occupied hours	<code>Numeric</code>	C			JG to verify if used in test case description.
<code>thermostat_heating_setpoint_schedule</code>	Reference to the schedule containing the heating setpoint temperatures	<code>\$ID</code>			✓	Constraint to use when implemented :Schedule:
<code>terminals</code>	List of terminals	<code>[{Terminal}]</code>				Multiple terminals may be used such as from a VAV system, a DOAS, and a baseboard. JG to verify if used in test case description.
<code>served_by_service_water_heating_system</code>	A service water heating system serving the zone	<code>\$ID</code>				Contains a single ID of the service water heating system serving the zone - from Unique Identification Number in ServiceWaterHeatingSystem. Constraint to use when implemented :ServiceWaterHeatingDistributionSystem:
<code>transfer_airflow_rate</code>	Airflow rate for transfer air	<code>Numeric</code>	L/s			Net transfer air. Positive values indicate transfer air in to the zone and negative values show transfer out of the zone. JG to verify if used in test case description.
<code>exhaust_airflow_rate</code>	Airflow rate for exhaust air	<code>Numeric</code>	L/s	≥0		JG to verify if used in test case description.
<code>makeup_airflow_rate</code>	Airflow rate for makeup air	<code>Numeric</code>	L/s	≥0		JG to verify if used in test case description.
<code>non_mechanical_cooling_fan_power</code>	Non-mechanical cooling fan power	<code>Numeric</code>	W	≥0		JG to verify if used in test case description.
<code>non_mechanical_cooling_fan_airflow</code>	Non-mechanical cooling fan airflow	<code>Numeric</code>	L/s	≥0		JG to verify if used in test case description.
<code>air_distribution_effectiveness</code>	Air distribution effectiveness	<code>Numeric</code>		≥0		JG to verify if used in test case description.

# 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 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.
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			✓	Constraint to use when implemented :Schedule:
occupant_sensible_heat_gain	Sensible heat gain of each occupant.	Numeric	W	≥0		JG to verify if used in test case description.
status_type	Choice of new, existing, addition, alteration, etc. for each ruleset.	(<SpaceStatusType2019ASHRAE901> , <GeneralStatusType2019T24>)				
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.

Name	Description	Data Type	Units	Range	Req	Notes
<code>service_water_heating_space_type</code>	Service water heating space type classification	<code>&lt;ServiceWaterHeatingSpaceType2019ASHRAE901&gt;</code>				The enumeration is based on the standard used.
<code>service_water_heating_uses</code>	List of service water heating uses	<code>[{ServiceWaterHeatingUse}]</code>				

# Infiltration

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>				
<code>modeling_method</code>	The software methodology chosen for modeling infiltration	<code>&lt;InfiltrationMethodType&gt;</code>				
<code>algorithm_name</code>	Name of the algorithm used for modeling infiltration in the specific simulation engine.	<code>String</code>				
<code>measured_air_leakage_rate</code>	Measured air leakage rate from infiltration of outside air	<code>Numeric</code>	m3/s	<code>≥0</code>		Based on the pressure described in ASHRAE229.measured_infiltration_pressure_difference.
<code>infiltration_flow_rate</code>	Design infiltration flow rate	<code>Numeric</code>	m3/s	<code>≥0</code>		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.
<code>multiplier_schedule</code>	Referenced to the schedule containing the multiplier for the infiltration	<code>\$ID</code>				Constraint to use when implemented :Schedule:

# Surface

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>				
<code>subsurfaces</code>	Subsurfaces that are on the surface	<code>[{Subsurface}]</code>				Contains a list of surfaces that define the space.
<code>classification</code>	Classification for the surface.	<code>&lt;SurfaceClassificationType&gt;</code>				Options for surface being interior or exterior wall, floor, or ceiling.
<code>area</code>	area of the surface	<code>Numeric</code>	m2	$\geq 0$		Measured from interior face area. It is the gross area of the wall and includes the area of all subsurfaces.
<code>tilt</code>	Angle between vertical and the surface outward normal	<code>Numeric</code>	degrees			Example value would be 0 = roof, 90 = wall, 180 = downward facing surface (exterior floor)
<code>azimuth</code>	Clockwise angle between North and the horizontal projection of the wall's outward normal.	<code>Numeric</code>	degrees	$\geq 0$		Example values would be 0 = north, 90 = East, 180 = South, 270 = West
<code>adjacent_to</code>	Used to classify the conditions on the surface.	<code>(&lt;SurfaceAdjacentTo&gt;, &lt;AdditionalSurfaceAdjacentToRESNET&gt;, &lt;AdditionalSurfaceAdjacentTo2019ASHRAE901&gt;)</code>				Determines whether the other side of the surface is modeled and if not what assumptions should be used.
<code>adjacent_zone</code>	ID of the adjacent zone for interior surface. Only required when adjacent zone is explicitly modeled when adjacent_to is set to INTERIOR.	<code>\$ID</code>				Constraint to use when implemented :Zone:
<code>does_cast_shade</code>	Determines whether the surface is modeled as casting shade on other exterior surfaces	<code>Boolean</code>				
<code>construction</code>	Construction description of surface.	<code>{Construction}</code>				
<code>surface_optical_properties</code>	Optical properties of the surface.	<code>{SurfaceOpticalProperties}</code>				
<code>status_type</code>	Choice of new, existing, addition, alteration, etc. for each ruleset.	<code>&lt;GeneralStatusType2019T24&gt;</code>				

# 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 constructions with homogeneous layer, 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 otherwise leave blank. 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	surface 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		$\geq 0$		May also be called thermal emittance, emittance or emissivity and represents the fraction of incident long wavelength radiation that is absorbed by the material
absorptance_solar_exterior	Thermal absorptance of short wavelength radiation on the exterior surface.	Numeric		$\geq 0$		Equals one minus the solar reflectance (for opaque materials) and represents the fraction of incident solar radiation that is absorbed by the material
absorptance_visible_exterior	Thermal absorptance of visible radiation on the exterior surface.	Numeric		$\geq 0$		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
absorptance_thermal_interior	Thermal absorptance of long wavelength radiation on the interior surface.	Numeric		$\geq 0$		May also be called thermal emittance, emittance or emissivity and represents the fraction of incident long wavelength radiation that is absorbed by the material
absorptance_solar_interior	Thermal absorptance of short wavelength radiation on the interior surface.	Numeric		$\geq 0$		Equals one minus the solar reflectance (for opaque materials) and represents the fraction of incident solar radiation that is absorbed by the material
absorptance_visible_interior	Thermal absorptance of visible radiation on the interior surface.	Numeric		$\geq 0$		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	<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>				
<code>classification</code>	Classification for the subsurface being window, skylight, door.	<code>&lt;SubsurfaceClassificationType&gt;</code>				
<code>subclassification</code>	Standard specific subclassification for subsurfaces	<code>&lt;SubsurfaceSubclassificationType2019ASHRAE901&gt;</code>				
<code>is_operable</code>	Identifies whether window subsurface can be opened and closed including by pivoting or sliding.	<code>Boolean</code>				This applies to windows and skylights but not to doors.
<code>has_open_sensor</code>	Has sensor and reports to building control system when the window or door is open.	<code>Boolean</code>				
<code>framing_type</code>	The material of the framing.	<code>&lt;SubsurfaceFrameType2019ASHRAE901&gt;</code>				This applies to windows and skylights but not to doors.
<code>glazed_area</code>	Area of subsurface including glass and transparent surfaces	<code>Numeric</code>	m2	≥0		
<code>opaque_area</code>	Area of subsurface framing for a window or skylight or opaque portion for a door.	<code>Numeric</code>	m2	≥0		
<code>u_factor</code>	Overall Subsurface U-factor	<code>Numeric</code>	W/m2-K	≥0		Includes interior and exterior air films as specified by the referenced standard.
<code>dynamic_glazing_type</code>	Type of dynamic glazing for the window subsurface	<code>&lt;SubsurfaceDynamicGlazingType&gt;</code>				Indicates if the glazed subsurface can change it's performance properties and if it is automatic or not.
<code>solar_heat_gain_coefficient</code>	Subsurface SHGC	<code>Numeric</code>		≥0		For dynamic glazing represents the minimum SHGC
<code>maximum_solar_heat_gain_coefficient</code>	Maximum Subsurface SHGC for Dynamic Glazing	<code>Numeric</code>		≥0		Only used for dynamic glazing
<code>visible_transmittance</code>	Subsurface VT	<code>Numeric</code>		≥0		For dynamic glazing represents the maximum visible transmittance
<code>minimum_visible_transmittance</code>	Minimum Subsurface VT for Dynamic Glazing	<code>Numeric</code>		≥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				
status_type	Choice of new, existing, addition, alteration, etc. for each ruleset.	<GeneralStatusType2019T24>				

# InteriorLighting

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>				
<code>purpose_type</code>	Lighting space type classification	<code>&lt;LightingPurposeType2019ASHRAE901&gt;</code>				The enumeration is based on the standard used.
<code>power_per_area</code>	Total power for lights divided by the area of the space.	<code>Numeric</code>	W/m2			When computing the power per area use the area of the entire space.
<code>lighting_multiplier_schedule</code>	Reference to the schedule containing the multiplier for lighting	<code>\$ID</code>			✓	Constraint to use when implemented :Schedule:
<code>occupancy_control_type</code>	Indicates the type of occupancy controls	<code>&lt;LightingOccupancyControlType&gt;</code>				
<code>daylighting_control_type</code>	Indicates the type of daylighting controls	<code>&lt;LightingDaylightingControlType&gt;</code>				
<code>are_schedules_used_for_modeling_occupancy_control</code>	Indicates that schedule values are used for modeling the impacts of occupancy controls on lighting.	<code>Boolean</code>				
<code>are_schedules_used_for_modeling_daylighting_control</code>	Indicates that schedule values are used for modeling the impacts of daylighting controls on lighting.	<code>Boolean</code>				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			✓	
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 miscellaneous equipment in the space	<EnergySourceTypeOptions>				
peak_usage	Peak energy usage per hour by the miscellaneous equipment in the space.	Numeric	W			
multiplier_schedule	Referenced to the schedule containing the multiplier for the miscellaneous equipment	\$ID			✓	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.
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 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				
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] [0..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
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				
has_daylight_saving_time	The schedules adjust for Daylight Saving Time	Boolean				

## Weather

Name	Description	Data Type	Units	Range	Req	Notes
notes	Supplementary information to provide context to the model reviewer	String				
ground_temperature_schedule	Ground temperature schedule name	\$ID				Constraint to use when implemented :Schedule:
weather_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, CWEC, CTZ, WYEC or other sources.
climate_zone	The designation of the climate zone where the building is located	<ClimateZone2019ASHRAE901>			✓	The enumeration is based on the standard used.
cooling_design_day_type	The frequency of occurrence type for cooling design day	<CoolingDesignDayTypeOptions>				
heating_design_day_type	The frequency of occurrence type for heating design day	<HeatingDesignDayTypeOptions>				

## 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>				
<code>motor_power</code>	Elevator 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_elevator_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>\$ID</code>				Constraint to use when implemented :Schedule:
<code>cab_ventilation_fan_multiplier_schedule</code>	Elevator ventilation fan operation multiplier schedule name	<code>\$ID</code>				Constraint to use when implemented :Schedule:
<code>cab_lighting_multiplier_schedule</code>	Elevator lighting multiplier schedule name	<code>\$ID</code>				Constraint to use when implemented :Schedule:

# 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				
fan_systems	Fan systems	[{FanSystem}]				Normally one fan system is used but second fan systems may be used when a direct outdoor air system is used. JG to verify if used in test case description.
heating_system	Heating system	{HeatingSystem}				JG to verify if used in test case description.
cooling_system	Cooling system	{CoolingSystem}				JG to verify if used in test case description.
preheat_system	Pre-heating system	{HeatingSystem}				JG to verify if used in test case description.
status_type	Choice of new, existing, addition, alteration, etc. for each ruleset.	<GeneralStatusType2019T24>				

## 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				
heating_system_type	Heating system type	<HeatingSystemType>				JG to verify if used in test case description.
energy_source_type	Source of energy for the chiller	<EnergySourceTypeOptions>				
hot_water_loop	Referenced to the hot water fluid loop	\$ID				Constraint to use when implemented :FluidLoop:
heat_capacity	Heating capacity	Numeric	W	≥0		The design heat capacity.
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. JG to verify if used in test case description.
is_autosized	True if the component is automatically sized by the simulation software	Boolean				JG to verify if used in test case description.
heating_coil_setpoint	Setpoint of the air leaving the heating coil	Numeric	C			JG to verify if used in test case description.
full_load_efficiency	Full Low Efficiency expressed as a coefficient of performance or thermal efficiency	Numeric	W/W			Used for furnace or heat pump. JG to verify if used in test case description.
part_load_efficiency	Efficiency value based on the selected part_load_efficiency_metric	Numeric		≥0, ≤1		Used for furnace or heat pump. JG to verify if used in test case description.
heatpump_auxilliary_heat_type	Heatpump auxilliary heat type used for backup	<HeatpumpAuxilliaryHeatType>				JG to verify if used in test case description.
heatpump_auxilliary_heat_high_temperature_shutoff	Heatpump auxilliary heat high temperature shutoff	Numeric	C			JG to verify if used in test case description.
heatpump_low_temperature_shutoff	Heatpump low temperature shutoff	Numeric	C			JG to verify if used in test case description.
humidification_type	Humidification type	<HumidificationType>				JG to verify if used in test case description.

# 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				
cooling_system_type	Cooling system type	<CoolingSystemType>				JG to verify if used in test case description.
total_cool_capacity	Total cooling capacity	Numeric	W	≥0		Designed total cooling capacity. JG to verify if used in test case description.
sensible_cool_capacity	Sensible cooling capacity	Numeric	W	≥0		Designed sensible cooling capacity
oversizing_factor	The oversizing factor applied to the peak load that results in the heat capacity. Zero indicates no oversizing.	Numeric		≥0		JG to verify if used in test case description.
is_autosized	True if the component is automatically sized by the simulation software	Boolean				JG to verify if used in test case description.
chilled_water_loop	Referenced to the Chilled water fluid loop	\$ID				Constraint to use when implemented :FluidLoop:
condenser_water_loop	Referenced to the Condenser water fluid loop	\$ID				Constraint to use when implemented :FluidLoop:
full_load_efficiency	Full Load Efficiency expressed as a coefficient of performance (COP)	Numeric	W/W			Used for direct expansion. JG to verify if used in test case description.
part_load_efficiency	Efficiency value based on the selected part_load_efficiency_metric	Numeric		≥0, ≤1		Used for direct expansion. JG to verify if used in test case description.
dehumidification_type	Dehumidification type	<DehumidificationType>				JG to verify if used in test case description.
cooling_turndown_ratio	Cooling turndown ratio	Numeric				Cooling capacity turndown before simultaneous heating and cooling occurs. JG to verify if used in test case description.

# FanSystem

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				
supply_fans	List of supply fans	[{Fan}]				JG to verify if used in test case description.
return_fans	List of return fans	[{Fan}]				JG to verify if used in test case description.
exhaust_fans	List of exhaust fans	[{Fan}]				JG to verify if used in test case description.
relief_fans	List of relief fans	[{Fan}]				JG to verify if used in test case description.
air_economizer	Air side economizer related to the fan system	{AirEconomizer}				
air_energy_recovery	Air side energy recovery related to the fan system	{AirEnergyRecovery}				
is_variable_air_volume	If the fan system is variable air volume.	Boolean				JG to verify if used in test case description.
temperature_control	Supply air temperature control type	<FanSystemTemperatureControlType>				JG to verify if used in test case description.
operation_during_occupied	Operation during occupied times type	<FanSystemOperationType>				JG to verify if used in test case description.
operation_during_unoccupied	Operation during unoccupied times type	<FanSystemOperationType>				JG to verify if used in test case description.
fan_control	Supply fan control type	<FanSystemSupplyFanControlType>				JG to verify if used in test case description.
supply_air_temperature_setpoint	Supply air temperature setpoint temperarue	Numeric	C			JG to verify if used in test case description.
reset_differential_temperature	Supply air temperature reset differential temperature at minimum cooling load	Numeric	K			When temperature_control is LOAD_RESET_TO_SPACE_TEMPERATURE this temperate is added to the supply air temperature at minimum cooling load conditions. When temperature_control is LOAD_RESET_DIFFERENTIAL_TEMPERATURE this temperate is the temperate below space tempature when no cooling load. JG to verify if used in test case description.
supply_air_temperature_reset_load_fraction	Supply air temperature reset load fraction	Numeric				When temperature_control is a reset option this is the threshold fraction to use below which supply air temperature reset begins and ramps down to zero. JG to verify if used in test case description.
supply_air_temperature_reset_schedule	Supply air temperature reset schedule	\$ID				JG to verify if used in test case description. Constraint to use when implemented :Schedule:
fan_volume_reset_type	Fan volume reset control type	<FanSystemSupplyFanVolumeResetType>				JG to verify if used in test case description.
fan_volume_reset_load_fraction	Fan volume reset load fraction	Numeric				When fan_volume_reset_type is LOAD_RESET this is the fraction of the load for minimum air flow. JG to verify if used in test case description.
operating_schedule	Operating schedule name	\$ID				Zero when fan is off. JG to verify if used in test case description. Constraint to use when implemented :Schedule:
exhaust_schedule	Exhaust fan schedule name	\$ID				Zero when fan is off. JG to verify if used in test case description. Constraint to use when implemented :Schedule:
minimum_airFlow	Minimum volume airflow	Numeric	L/s			JG to verify if used in test case description.
minimum_outdoor_airFlow	Minimum outdoor air volume airflow	Numeric	L/s			JG to verify if used in test case description.
maximum_outdoor_airFlow	Maximum outdoor air volume airflow	Numeric	L/s			JG to verify if used in test case description.
air_filter_merv_rating	The MERV rating of the air filter	Numeric		≥1, ≤20		JG to verify if used in test case description.
has_fully_ducted_return	If the fan system has fully ducted return.	Boolean				JG to verify if used in test case description.
demand_control_ventilation_control	Demand control ventilation control type	<DemandControlVentilationControlType>				JG to verify if used in test case description.

# 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				
type	Type	<AirEconomizerType>				JG to verify if used in test case description.
high_limit_temperature_shutoff	High limit temperature shutoff	Numeric	C			JG to verify if used in test case description.
design_sensible_effectiveness	Design sensible effectiveness	Numeric				JG to verify if used in test case description.
design_latent_effectiveness	Design sensible effectiveness	Numeric				JG to verify if used in test case description.

## AirEnergyRecovery

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_recovery_type	Energy recovery type	<EnergyRecoveryType>				JG to verify if used in test case description.
enthalpy_recovery_ratio	Enthalpy recovery ratio	Numeric				JG to verify if used in test case description.
energy_recovery_operation	Energy recovery operation	<EnergyRecoveryOperation>				JG to verify if used in test case description.
energy_recovery_supply_air_temperature_control	Energy recovery supply air temperature control	<EnergyRecoverySupplyAirTemperatureControl>				JG to verify if used in test case description.

## 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				
design_airflow	Design airflow	Numeric	L/s			JG to verify if used in test case description.
specification_method	Options for how the fan is specified	<FanSpecificationMethodOptions>				
design_electric_power	Design electric fan power	Numeric	W			Only used when specification_method is set to Simple. JG to verify if used in test case description.
design_pressure_rise	Pressure rise through fan at design flow conditions	Numeric	m			Only used when specification_method is set to Detailed
nameplate_power	nameplate power of fan	Numeric	W			Only used when specification_method is set to Detailed. JG to verify if used in test case description.
input_power	input power of fan	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. Only used when specification_method is set to Detailed. JG to verify if used in test case description.
total_efficiency	Total fan efficiency	Numeric		≥0, ≤1		Only used when specification_method is set to Detailed.
motor_efficiency	Fan motor efficiency	Numeric		≥0, ≤1		Only used when specification_method is set to Detailed.
status_type	Choice of new, existing, addition, alteration, etc. for each ruleset.	<GeneralStatusType2019T24>				
output_validation_points	Energy validation points	[{FanOutputValidationPoint}]				Airflow is input to each validation point and energy output is the result. A minimum number of four points is recommended.

## FanOutputValidationPoint

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

## Terminal

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 terminal	<TerminalType>				JG to verify if used in test case description.
served_by_heating_ventilation_air_conditioning_systems	HVAC systems serving the terminal	\$ID				Contains ID of the HVAC system serving the terminal - from Unique Identification Number in HeatingVentilationAirConditioningSystem. Constraint to use when implemented :HeatingVentilationAirConditioningSystem:
reheat_source	Source of reheat	<ReheatSourceType>				JG to verify if used in test case description.
reheat_from_loop	Referenced to the fluid loop used for reheat	\$ID				Only used when reheat_source is hot water. Constraint to use when implemented :FluidLoop:
fan	Terminal fan	{Fan}				JG to verify if used in test case description.
fan_configuration	Fan configuration	<TerminalFanConfiguration>				JG to verify if used in test case description.
primary_airflow	Zone terminal primary airflow	Numeric	L/s			JG to verify if used in test case description.
secondary_airflow	Zone terminal secondary airflow	Numeric	L/s			JG to verify if used in test case description.
supply_temperature_setpoint	Zone terminal supply temperature setpoint	Numeric	C			JG to verify if used in test case description.
minimum_airflow	Zone terminal minimum volume airflow	Numeric	L/s			JG to verify if used in test case description.
minimum_outdoor_airflow	Zone terminal minimum outdoor air volume airflow	Numeric	L/s			JG to verify if used in test case description.
minimum_outdoor_airflow_multiplier_schedule	Zone terminal minimum outdoor air volume airflow multiplier schedule name	\$ID				JG to verify if used in test case description. Constraint to use when implemented :Schedule:
heat_capacity	Heat capacity for baseboard or radiant system	Numeric	W			JG to verify if used in test case description.
is_supply_ducted	True if the the supply is ducted.	Boolean				
is_fan_first_stage_heat	True if the the fan is run as the first stage of heating before reheat coil.	Boolean				

# 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>				
pump_power_per_flow_rate	Total design pump power divided by the loop design flow rate	Numeric	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.
child_loops	Other fluid loops connected to this one as children.	[[{FluidLoop}]]				Secondary loops should be described as child loops.
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			
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>				
operation_schedule	Operation schedule	\$ID				One represents when the fluid loop is operating and zero when not operating. Only used when operation equals SCHEDULED. Constraint to use when implemented :Schedule:
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			Used when temperature_reset_type = OUTSIDE_AIR_RESET
outdoor_low_for_loop_supply_temperature_reset	Outdoor low for loop supply temp reset	Numeric	C			Used when temperature_reset_type = OUTSIDE_AIR_RESET
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

# 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_or_piping	Referenced to the fluid loop or service water heating piping	\$ID			✓	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>				
design_flow	Design Pump Flowrate	Numeric	L/s			
minium_flow	Minimum Pump Flowrate	Numeric	L/s			
is_flow_autosized	True if the design_flow is autosized	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			✓	Constraint to use when implemented :FluidLoop:
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>				
energy_source_type	Source of energy for the boiler	<EnergySourceTypeOptions>				
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			✓	Constraint to use when implemented :FluidLoop:
condensing_loop	Referenced to the condensing fluid loop	\$ID				No condensing loop name implies air-cooled chiller. Constraint to use when implemented :FluidLoop:
compressor_type	Compressor Type	<ChillerCompressorTypeOptions>				
energy_source_type	Source of energy for the chiller	<EnergySourceTypeOptions>				
design_capacity	Chiller Design Cooling Capacity	Numeric	W			
rated_capacity	Chiller Rated 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	[[ChillerCapacityValidationPoint]]				
power_validation_points	Energy validation points	[[ChillerPowerValidationPoint]]				

## 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.
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 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 the temperature of the ambient air.
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			✓	Constraint to use when implemented :FluidLoop:
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			✓	Constraint to use when implemented :FluidLoop:
type	Type of external fluid source	<ExternalFluidSourceTypeOptions>				
energy_source_type	Source of energy for the external fluid source	<EnergySourceTypeOptions>				

# 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				
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.
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	Other service water piping connected to this one as children.	[[ServiceWaterPiping]]				
distribution_compactness	Type of compact distribution system	<ServiceWaterHeatingDistributionCompactness2019T24Com>				From CBECC-Com.
control_type	Type of distribution system	<ServiceWaterHeatingControlType2019T24Com>				From CBECC-Com.
configuration_type	Type of configuration	<ServiceWaterHeatingConfigurationType>				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		$\geq 0$ , $\leq 1$		From CBECC-Com. May use the Canadian Standards Association Rated Recovery Efficiency.
drain_heat_recovery_type	Drain heat recovery type	<ServiceWaterHeatingHeatRecoveryType>				From CBECC-Res.
flow_multiplier_schedule	service water heating Loop flow multiplier schedule name	\$ID				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.	\$ID				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
<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>				
<code>is_recirculation_loop</code>	Indicates if service water heating piping is a loop and recirculates	<code>Boolean</code>				
<code>insulation_thickness</code>	Pipe insulation thickness	<code>Numeric</code>	m	$\geq 0$		From CBECC-Com.
<code>loop_pipe_location</code>	Loop pipe location	<code>&lt;ComponentLocation&gt;</code>				From CBECC-Com.
<code>zone_location</code>	Zone reference of where the component is located when IN_ZONE is selected from ComponentLocation	<code>\$ID</code>				From CBECC-Com. Constraint to use when implemented :Zone:
<code>length</code>	Pipe length	<code>Numeric</code>	m	$\geq 0$		From RESNET
<code>diameter</code>	Pipe section diameter	<code>Numeric</code>	m	$\geq 0$		From CBECC-Res.
<code>child_service_water_piping</code>	Other service water piping connected to this one as children.	<code>[[ServiceWaterPiping]]</code>				

# 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				
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				
heater_fuel_type	Service water heating heater fuel type	<EnergySourceTypeOptions>				
service_water_heating_distribution_system	Referenced to the service water heating distribution system	\$ID			✓	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.
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	\$ID				From CBECC-Com. Constraint to use when implemented :Zone:
compressor_heat_rejection_source	Heat pump heat rejection source	<ComponentLocation>				From CBECC-Res.
compressor_heat_rejection_zone	Heat pump heat rejection zone	\$ID				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	<ServiceWaterHeaterType>				
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.	<GeneralStatusType2019T24>				
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.

# 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				
storage_capacity	Storage capacity of tank in distribution system	Numeric	L	≥0		From CBECC-Com.
type	Service water heater tank type	<ServiceWaterHeaterTankType>				
height	Tank height	Numeric	m	≥0		From CBECC-Com.
interior_insulation	Tank interior insulation R-value	Numeric	K-m2/W	≥0		Insulation that is part of the tank and is inside of the housing. From CBECC-Res.
exterior_insulation	Tank interior insulation R-value	Numeric	K-m2/W	≥0		A blanket of insulation that surrounds the exterior of the tank. From CBECC-Res.
location	Location	<ComponentLocation>				From CBECC-Res.
location_zone	Tank zone location	\$ID				Only used when tank_location 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
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.
water_serves_type	The use of the water serves the type	<ServiceWaterHeatingFixtureType>				
served_by_distribution_system	ID fo the ServiceWaterHeatingDistributionSystem that serves this end use	ID				From CBECC-Res. Constraint to use when implemented :ServiceWaterHeatingDistributionSystem:
use	Usage of service hot water	Numeric				
use_units	Type of units for use of service hot water	<ServiceWaterHeatingUseunits>				
use_multiplier_schedule	Reference to the schedule containing the multiplier for the use of service hot water	ID			✓	Constraint to use when implemented :Schedule:
temperature_at_fixture	Reference to the schedule containing the multiplier for the use of service hot water	Numeric	C			From RESNET
is_heat_recovered_by_drain	Indicates if heat is being recovered from the drain	Boolean				From CBECC-Res.
is_recovered_heat_used_by_cold_side_feed	Indicates if heat is being recovered from the drain is used on the cold side feed	Boolean				From CBECC-Res.

## 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		
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		

## 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	<RefrigerationType>				
equipment_category	Equipment Class from referenced standard	<RefrigerationCategory>				
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	<ApplicationTemperatureType>				Based on AHRI 1200
power	Nominal power of refrigeration	Numeric	W	>0		
power_multiplier_schedule	Refrigeration power multiplier schedule name	\$ID				Constraint to use when implemented :Schedule:
sensible_fraction	Fraction of energy that is a sensible load on the space.	Numeric		≥-1, ≤1		
heat_gain_fraction	Fraction of energy that is a heat gain to the space.	Numeric		≥-1, ≤1		
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			
zone_case_location	Zone where case is located	\$ID				

## OverallSimulationOutputs

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>				
<code>refrigeration_energy_enduse</code>	Annual refrigeration energy end use from simulation output	<code>Numeric</code>	kWh			
<code>service_water_heating_annual_enduse_electricity</code>	Annual electricity energy end_use for SWH loops	<code>Numeric</code>	kWh	≥0		
<code>service_water_heating_annual_enduse_fossilfuel</code>	Annual fossil fuel energy end_use for SWH loops	<code>Numeric</code>	J	≥0		
<code>unmet_heating_load_hours</code>	total hours any HVAC Zone heating temperature setpoint not met	<code>Numeric</code>	J	≥0		JG to verify if used in test case description.
<code>unmet_cooling_load_hours</code>	total hours any HVAC Zone cooling temperature setpoint not met	<code>Numeric</code>	J	≥0		JG to verify if used in test case description.