Mitigating Peak Load and Heat Stress under Heat Waves by Scheduling Cooling and Energy Storage Systems

by

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Abstract

As the climate changes, heat waves are becoming more frequent and severe. Exposure to heat waves could lead to heat stress. Heat waves intensify cooling demand and reduce air conditioner efficiencies. It causes peaks in electricity demand that pose operational challenges to the power grid. This thesis provides simulation-based methods to mitigate peak load and heat stress under heat waves by adjusting the schedules of the cooling and energy storage systems in buildings. This thesis demonstrates three scheduling methods: (1) cooling system scheduling, (2) energy storage system scheduling, and (3) combined cooling and energy storage system scheduling. The cooling system scheduling methods involve (1) generating baseline and training data with EnergyPlus (EP) simulations, (2) fitting surrogate models that relate cooling system adjustments to the perturbations in purchased power and Standard Effective Temperature (SET^*, a comprehensive measure of thermal comfort, which is found to be a useful measurement of heat stress), and (3) embedding the EP data and trained models in an optimizer to schedule cooling system adjustments. The methods provide closely predicted optimized solutions with less computation cost than solving the problem by brute-force EP simulations. The energy storage system scheduling method relocates the power discharging from the energy storage system based on EP simulated baseline grid purchased power and its average value. The scheduling of the cooling and energy storage systems combines the two methods above. Case studies of these methods on a single building and a six-building neighborhood in the climate of Miami and Kuwait are offered. In these case studies, the methods reduce peak load significantly while maintaining SET^* within comfortable ranges. Among the three methods, the combined scheduling of cooling and energy storage systems is able to reduce peak power the most.

Thesis Supervisor: Leslie K. Norford
Title: Professor of Building Technology

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Finally, on a personal note,

Mingming and Meimei, meow.

à Yijiang, merci.

Thesis Supervisor

Leslie K. Norford, PhD

Professor of Building Technology

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Chapter 1

Introduction

Heat waves are extended periods of high temperature that affect lifestyle and lead to health consequences [65]. Under the trend of climate change and global warming, heat waves will become longer, more frequent, and stronger [12]. It is found that exposure to heat waves could lead to heat stress [46]. In quantifying heat stress, degree of thermal discomfort is shown to be useful measurement of heat stress [55]. Intensified heat stress would increase health risks[13], such as cardiovascular mortality and respiratory illnesses[61] or even cause heat-related deaths [44].

Research has shown for the indoor environment, under heat waves, the presence of air conditioning would significantly reduce the mortality rate [60] [70]. However, as the outdoor temperature rises, the increased energy consumption due to efficiency degradation of the air conditioner and growing demand would increase peak load, which poses great challenges to the grid and could even possibly lead to grid shutdown and power outrage [7] [78]. Under heat waves the peak electric demand [79] and the reliability of the grid [71] have become particular problems. To respond to the peak load, extending the existing capacity or building new power plants is a conventional approach, which is costly and practically not efficient considering the small percentage of time peak load occurs in the time span of general usage [57]. The power loss during transmission is in a nonlinear relationship between the current; during the peak load, an increase of the supplied current would result in less efficiency in power transmission [64].

Studies on building adaptation have developed strategies to mitigate the impacts of heat waves. In particular, Porritt et al. [63] ranks building-level interventions for reducing overheating under heat waves. Simson et al. [67] identifies intervention guidance for building parameters, including orientation, window-to-wall ratios, and overhang dimensions that prevent summer overheating. In addition, published papers [22] [18], show that thermal mass of a building enables reductions in the peak air conditioning load. Given weather variability, the case study in [45] shows that a highly efficient building envelope not only leads to greater peak demand reduction but also improves thermal comfort. Although building adaptations show benefits in mitigating the impacts of heat waves, the cost and time associated with the construction are a factor that can not be neglected.

As an alternative to building renovations, optimizing the operation of air conditioning systems can reduce peak load [20] [41]. Scheduling, a form of energy management, can reduce renovation costs and efforts, but generally requires some investment in sensing, communication, and controls. Corbin et al. [23] describe a model predictive control method that generates hourly cooling setpoints to minimize the daily energy cost of a commercial building. Price-based energy management can reduce peak load [75] [69]. However, these approaches often under-emphasizes the thermal comfort of building occupants, a critical metric under heat waves.

As a complement to air-conditioning, ceiling-mounted or other fans can improve energy efficiency [77] by providing more comfortable air movement to occupants [31] [35][10]. The study of [39] optimizes ceiling fan airspeed to enhance thermal comfort and reduce electricity cost. At a group level, a coordinated optimization on a system of fans is able to incorporate the thermal comfort of multiple occupants in one room [53].

However, there is limited research on jointly optimizing the control of air conditioners and fans to mitigate both peak load and heat stress. In [54], Luo et al. evaluate thermal comfort under various constant room temperatures with different fan operating modes and find that a higher setpoint with fan-assisted cooling can achieve similar thermal comfort to a lower setpoint. In [68], Taylor et al. run large

iterations of EnergyPlus simulations to find optimal air conditioner and fan schedules that reduce total energy usage and ensure thermal comfort. Although the studies of Luo et al.[54] and Taylor et al. [68] considered both the air conditioner and fan, Luo et al. [54] only presents analytical results under defined constant settings without means for adjustment, and the optimization strategy by Taylor et al. [68] is limited by extensive computing required by EnergyPlus simulations. Moreover, in neither of the studies is peak load considered, which is critical under heat waves.

This thesis proposes simulation-based methods to jointly optimize the air conditioner and fan schedules that mitigate peak load and heat stress under heat waves in Section 2.1. In addition, the sustainable energy generated by the photovoltaic (PV) systems and stored by smart home batteries (SHB) is found to be effective in reducing peak load [5][34]. Extreme hot days generally are associated with extensive solar energy, which are able to be converted to electric energy by PV systems[48]. The SHB is capable of charging and discharging electric energy in a programmable way [9] [6]. In Section 2.2, strategies of scheduling the discharge of the energy storage system are presented. A combined scheduling of the air conditioner, fan, and battery are demonstrated in Section 2.3.

In the demonstration of the proposed strategies, this thesis uses the Standard Effective Temperature (SET^*), one of the comprehensive measures of thermal comfort that describes the feels like temperature [32] [11], as the measurement of thermal comfort. Data are obtained from simulation with a commonly used physics-based building energy simulation tool, EnergyPlus (EP) [2]. This study involves energy storage and cooling systems scheduling. The discharge power from the energy storage systems corresponds well with the discharge scheduling. The efficiency associated with converting battery discharge power to demand supporting power through the inverter fluctuates in a quite small range around 5%. As for the cooling systems, special attention needs to be paid to the efficiency due to its variation under the change of the outside temperature. Optimizing the cooling schedules by brute-force running the physics-based simulation would lead to large computational efforts and possibilities for the optimizer to become stuck at local minima in this high-dimensional problem.

This thesis fits two types of surrogate models, a linear regression model, proposed by Kircher et al. [43] and a neural network model, to replace the physics-based simulation during the optimization. In data generation, a python based package, eppy [3] is used to parametrically modify the schedules of the systems and generate perturbation data for the surrogate training. In optimization, for the linear regression model, a convex optimization package CVXpy [25] is used to solve the optimization problems; for the neural network model, a SciPy minimize optimizer with Sequential Least Squares Programming is used. This thesis demonstrate three scheduling methods:1) cooling systems scheduling, 2) energy storage system scheduling, and 3) cooling and energy storage systems scheduling. Detailed explanation of the methods will be shown in Section 2.1, Section 2.2, and Section 2.3.

The proposed methods are demonstrated through case studies of a single building and a six-building neighborhood in Miami and Kuwait during a heat wave. Section 3.1 and Section 4.1 demonstrate the case studies set up in Miami and Kuwait. The cooling system scheduling results are shown in Section 3.2 and Section 4.2; the energy storage systems scheduling results are presented in Section 3.3 and Section 4.3; the results for applying cooling and energy storage system scheduling are demonstrated in Section 3.4 and Section 4.4. The case studies show that by jointly scheduling cooling and energy storage systems, the proposed methods are able to achieve most peak load reduction while maintaining thermal comfort within a comfortable range.

Chapter 2

Methods

This chapter proposes three methods: cooling systems scheduling, energy storage system scheduling, and cooling + energy storage system scheduling. They will be demonstrated in details in Section 2.1, Section 2.2 and Section 2.3.

2.1 Cooling Systems Scheduling

The methods include three phases: data generation (Section 2.1.1), surrogate model training (Section 2.1.2), and optimization (Section 2.1.3). Figure 2-7 demonstrates the workflow of the proposed methodology. The generated data is simulated by a physics-based building energy simulation tool, EnergyPlus (EP) [2]. A python-based package, eppy [3], is used to parametrically modify the schedules in the EP file and generate perturbed target values with simulation. The data consists of the perturbation of the schedules and the perturbation of the target values. Two types of surrogate models, linear regression models proposed by Kircher et al. [43] and a neural network model, are implemented as a surrogate for EP in this proposed framework for different test cases, and they are trained with generated data. To solve the optimization problem with two different surrogate models, two types of optimizers are adopted. The CVXPY package [25] is used to solve the optimization problem with a linear regression model. Example code of the cooling systems scheduling python workflow is provided in Appendix A.

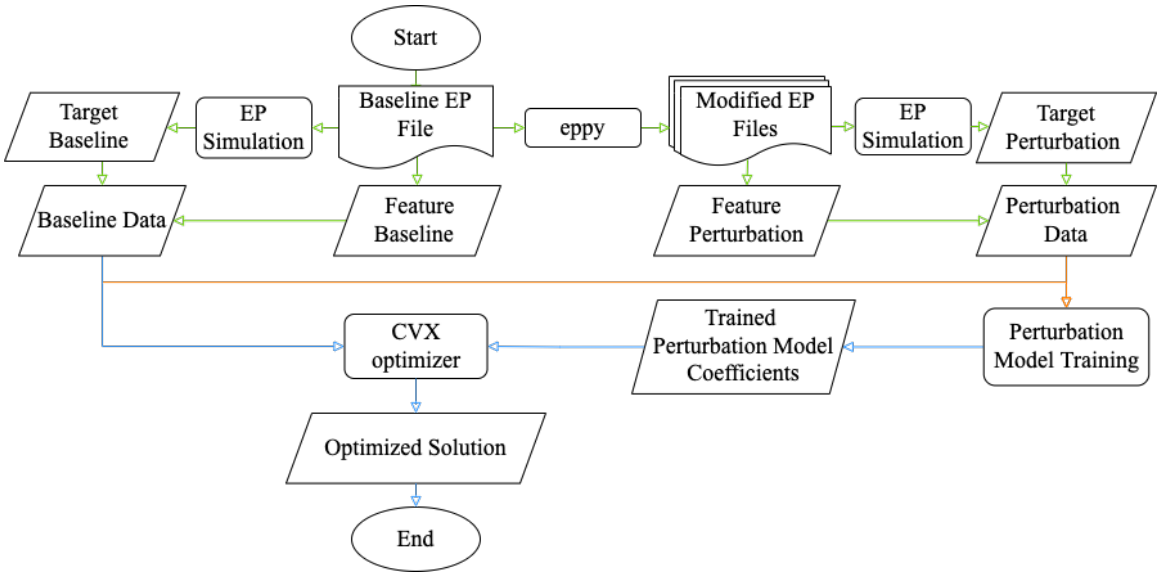


Figure 2-1: Workflow: cooling systems scheduling

2.1.1 Data Generation

In the first step, a baseline EP model is set up. This thesis uses the single-family prototype model in the ASHRAE 1A climate zone (very hot-humid) published by the Building Energy Codes Program [1] as the baseline. The baseline setpoint keeps is set as 23.9 °C for Miami case studies and 28 °C for Kuwait case studies. In addition to the air conditioning system, raising air speed by ceiling fans is an energy-efficient strategy that consumes less energy than the air conditioning system and [77] could benefit thermal comfort [10] [35]. The values of average air speed and power consumption of the ceiling fan refer to the data published by Liu et al. [52]. A baseline air speed of 0.35 m/s is implemented in this test with an average power consumption of 0.48 W/m^2. An hourly baseline power $\hat{P}(t)$ and Standard Effective Temperature $S\hat{E}T(t)$ is generated as the baseline target. Certain days are defined as simulation days. Under the heat wave context in this thesis, the hottest day and four weeks around the hottest day are simulated. Eppy [3] is used to parametrically modify the schedules of cooling systems. The perturbation range for temperature setpoint is ±3 °C and for air speed is ±0.35 m/s. For the target perturbation, at time k, the perturbation of power is calculated as $P(t) - \hat{P}(t)$; the perturbation of SET^* is calculated as $SET(t) - S\hat{E}T(t)$. A defined set of randomly generated perturbations

of the setpoint and air speed is used to simulate the perturbation of power and SET^*.

2.1.2 Linear Regression Model Training

In the second step, perturbation data, which includes the perturbation of temperature setpoint and air speed for input and the perturbation of power and SET^* for output, is used to train a perturbation model. The first three weeks of the perturbation data are used for training the perturbation model; the last week is used for validating the prediction of the trained perturbation model. Given the perturbation of setpoint and air speed as an input, the surrogate model predicts the perturbation of power and SET^* as output. This thesis implements the linear regression proposed by Kircher et al. [43] as the surrogate. Equation (2.1) is a standard form of linear regression, in which y is the output target vector, X is the input feature matrix, a is the coefficient vector, and e is the error vector. The coefficient vector a is fit by least squares as shown in equation (2.2):

$$y = Xa + e. \tag{2.1}$$

$$a = (X^T X)^{-1} X^T y. \tag{2.2}$$

Consider the power perturbation models with only setpoint perturbation as an example. The perturbation of power is restricted to be linear in the setpoint perturbations:

$$\delta_P(t) = a_1 \delta_T(t) + \cdots + a_m \delta_T(t - m + 1) + e_t. \tag{2.3}$$

In equation (2.3), m is a tunable memory parameter, $\delta_P(t)$ and $\delta_T(t)$ are power and temperature perturbations, e_t is the error at time t, and the parameter vector a is fit by least squares. In the standard linear regression form, $y = Xa + e$, the power perturbation can be written as

$$\begin{bmatrix} \delta_P(1) \\ \vdots \\ \delta_P(m) \\ \vdots \\ \delta_P(t) \end{bmatrix} = \begin{bmatrix} \delta_T(1) & & \\ \vdots & \ddots & \\ \delta_T(m) & \dots & \delta_T(1) \\ \vdots & & \vdots \\ \delta_T(t) & \dots & \delta_T(t-m+1) \end{bmatrix} \begin{bmatrix} a_1 \\ \vdots \\ a_m \end{bmatrix} + \begin{bmatrix} e_1 \\ \vdots \\ e_m \\ \vdots \\ e_k \end{bmatrix}. \tag{2.4}$$

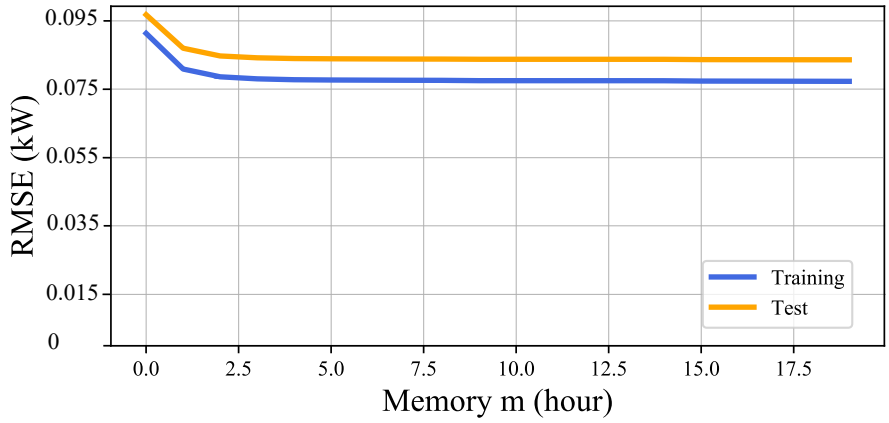
The coefficient vector a can be identified by least-squares estimation: $a = (X^T X)^{-1} X^T y$. In implementation of this thesis' proposed method, two perturbation models are trained in equations (2.5) and (2.6), where perturbations of power $\delta_P(t)$ and perturbation of SET^* $\delta_{SET}(t)$ are restricted to be linear in the setpoint perturbation $\delta_T(t)$ and air speed perturbations $\delta_{Airspeed}(t)$.

$$\begin{bmatrix} \delta_P(1) \\ \vdots \\ \delta_P(m) \\ \vdots \\ \delta_P(k) \end{bmatrix} = \begin{bmatrix} \delta_T(1) & & & \delta_{Air}(1) & & \\ \vdots & \ddots & & \vdots & \ddots & \\ \delta_T(m) & \dots & \delta_T(1) & \delta_{Air}(m) & \dots & \delta_{Air}(1) \\ \vdots & \ddots & \vdots & \vdots & \ddots & \vdots \\ \delta_T(k) & \dots & \delta_T(t-m+1) & \delta_{Air}(t) & \dots & \delta_{Air}(t-m+1) \end{bmatrix} \begin{bmatrix} a_1 \\ \vdots \\ a_m \\ a_{m+1} \\ \vdots \\ a_{2m} \end{bmatrix} + \begin{bmatrix} e_{1_P} \\ \vdots \\ e_{m_P} \\ \vdots \\ e_{t_P} \end{bmatrix} \tag{2.5}$$

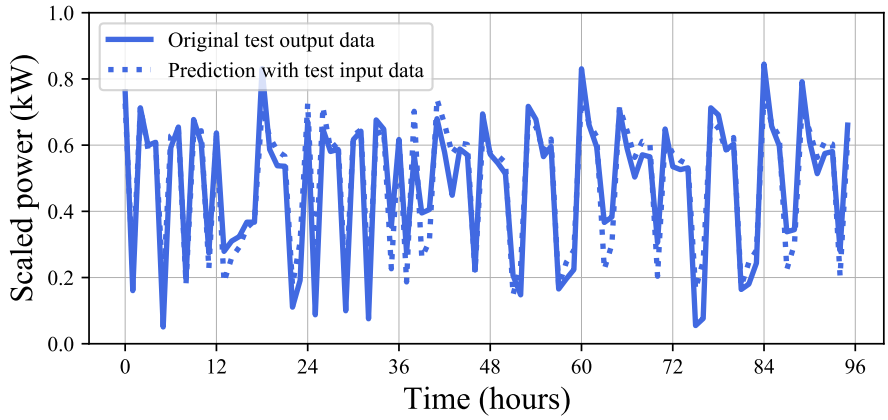
$$\begin{bmatrix} \delta_{SET}(1) \\ \vdots \\ \delta_{SET}(m) \\ \vdots \\ \delta_{SET}(k) \end{bmatrix} = \begin{bmatrix} \delta_T(1) & & & \delta_{Air}(1) & & \\ \vdots & \ddots & & \vdots & \ddots & \\ \delta_T(m) & \dots & \delta_T(1) & \delta_{Air}(m) & \dots & \delta_{Air}(1) \\ \vdots & \ddots & \vdots & \vdots & \ddots & \vdots \\ \delta_T(t) & \dots & \delta_T(t-m+1) & \delta_{Air}(t) & \dots & \delta_{Air}(t-m+1) \end{bmatrix} \begin{bmatrix} b_1 \\ \vdots \\ b_m \\ b_{m+1} \\ \vdots \\ b_{2m} \end{bmatrix} + \begin{bmatrix} e_{1_{SET}} \\ \vdots \\ e_{m_{SET}} \\ \vdots \\ e_{t_{SET}} \end{bmatrix} \tag{2.6}$$

The power perturbation model's RMSE convergence over the manually tuned memory number m is shown in Figure 2-2a. Figure 2-2b shows a comparison of the power prediction from the trained perturbation model (in dotted blue line) with the

power consumption data from the test data (in solid blue line) over 96 hours.



(a) RMSE for training electrical power surrogate model



(b) prediction with electrical power surrogate model

Figure 2-2: Surrogate model training

2.1.3 Optimization and Scheduling

In the third step, the baseline $\hat{P}(k)$ and $S\hat{E}T(k)$ and the trained power and SET^* perturbation models (2.5) and (2.6) are fed into the load-shifting optimization. The goal of the optimization is to determine setpoint and air speed perturbations that minimize the weighted sum of the peak power and SET^* over a day. The objective goal can be written as a weighted sum function,

$$P_{weight} \cdot \max(P_{base} + \delta_P) + S_{weight} \cdot \max(SET_{base} + \delta_{SET}), \tag{2.7}$$

where P_{weight} and S_{weight} are assigned weights of peak power reduction and SET^* reduction in the optimization goal. Since the proposed methods use a linear regression model as the surrogate, a convex solver, CVXPY [25], can be applied to solve the optimization problems. The surrogate and optimizer choices in the proposed methods result in very low computation cost in solving such multi-objective, high-dimension optimization problems. These choices also guarantee that the optimization problems can be solved to global optimality.

2.2 Energy Storage System Scheduling

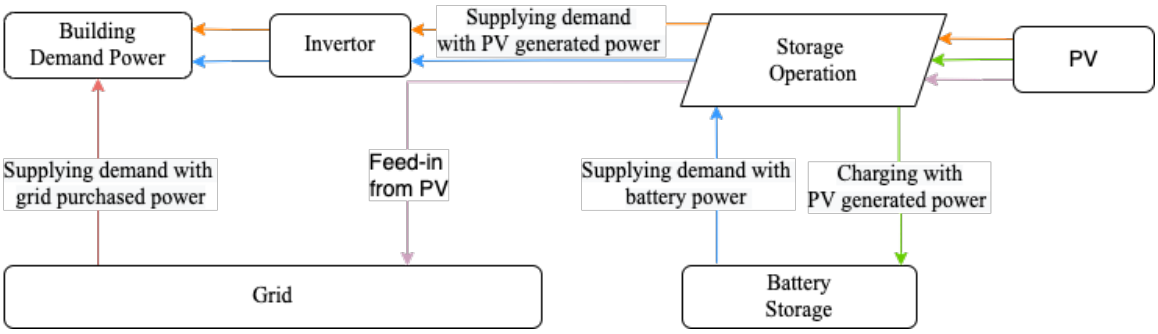


Figure 2-3: PV and Battery Power Outline

This section proposes a method to reduce the peak power purchased from the grid under heat waves by implementing and scheduling an energy storage system. Photovoltaic panels (PV) and battery provide and store sustainable energy. Studies have found PV and energy storage system effective for releasing the grid pressure in regions where solar power is resourceful [5]. Figure 2-3 shows the outline of power flow with PV and energy storage system. The demand is satisfied by PV-produced power, battery discharge power and the grid purchased power. The supply of the three power sources is coordinated by the storage operation center with specified operation schemes. As for the PV-produced power, in addition to supporting the demand, the remainder of the PV-produced power flows into battery storage and the grid. Figure 2-4 presents the composition of different types of power during a day in a building with an installed PV and energy storage system. Example code of the energy storage

system scheduling python workflow is provided in Appendix B.

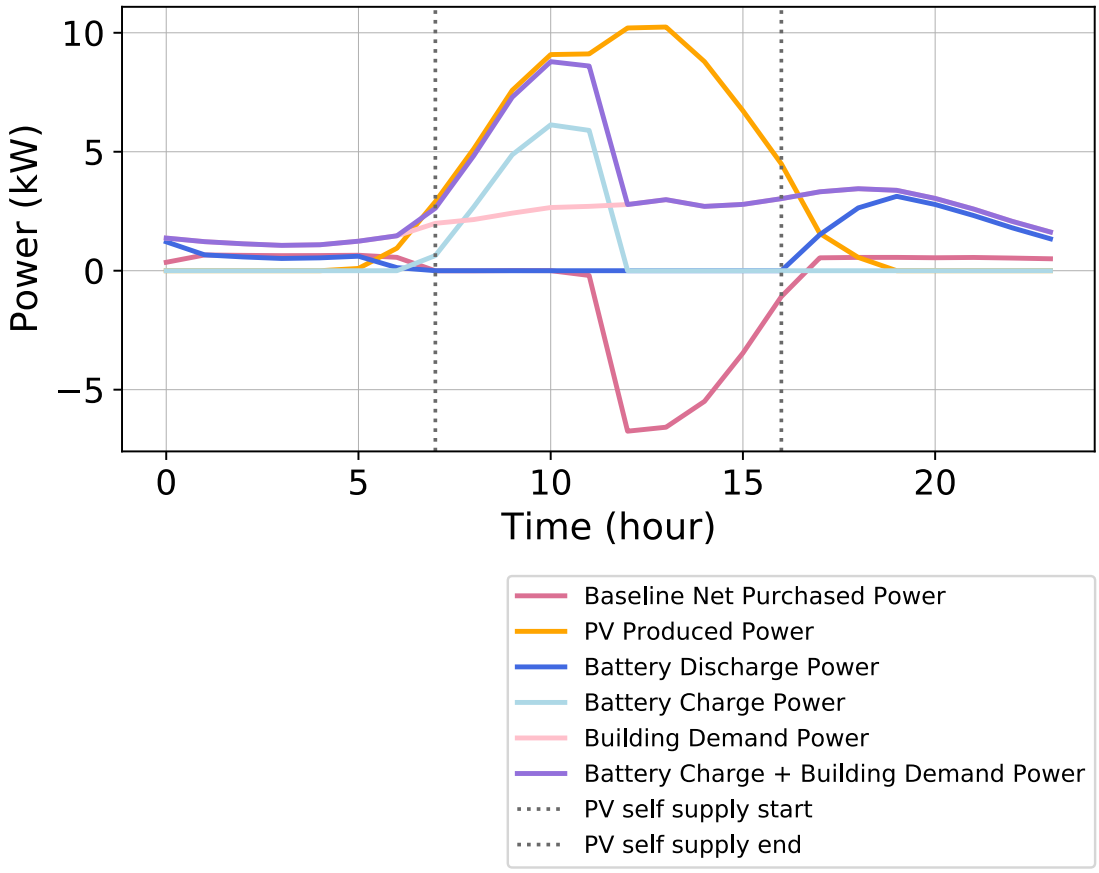


Figure 2-4: Power composition

2.2.1 Modeling, Sizing and Data Generation

This thesis implements the "simple PhotovoltaicPerformance" object as PV and the "LiIonNMCBattery" as a battery for the residential *EP* model. The sizing of the PV is specified with the percentage of the coverage of the roof area. The battery is sized with a number of parallel strings of battery [26]. The capacity of the PV (kWp/MWh) is the peak PV produced power in kWp, normalized by the annual demand in MWh. The capacity of the battery (kWh/MWh) is the amount of energy able to be stored in the battery in kWh normalized by the annual demand in MWh. The distribution of the PV and battery energy is coordinated with an EP object named "Electric Distribution Center: Distribution". The default operation scheme of the distribution

center is called "TrackFacilityElectricDemandStoreExcessOnSite", which prioritizes meeting the demand when distributing the PV and battery power. The output under this setting is used as the baseline for this study. Different from the previous sections, demand is considered equivalent to peak load; since PV and battery are implemented in this section, the peak load is the peak power purchased from the grid. The excess PV power fed back to the grid is output as a negative value in the net purchased power.

$$P_{Buy} = P_{Demand} - P_{Battery\ discharge} - P_{PV} \tag{2.8}$$

To schedule an energy storage system, an operation scheme named "TrackChargeDischargeSchedules" is implemented. It takes a charge, discharge schedule *designstoragecontrolchargepow* and *designstoragecontroldischargepower* as inputs. The charge and discharge schedules are fractions in the range of 0 to 1. The *designstoragecontrolchargepower* and *designstoragecontroldischargepower* are the maximum power under schedule value 1. The hourly charge and discharge power are presented in equation 2.9 and equation 2.10.

$$P_{Charge}(t) = Charge\ Schedule\ Value(t) \times Design\ Storage\ Control\ Charge\ Power \tag{2.9}$$

$$P_{Discharge}(t) = Discharge\ Schedule\ Value(t) \times Design\ Storage\ Control\ Discharge\ Power \tag{2.10}$$

2.2.2 Scheduling

In this section, a method of scheduling the energy storage system is demonstrated for reducing the peak purchased power. Figure 2-5 shows an outline of the workflow. First, the number of self-sufficient hours is identified. As defined in equation 2.11,

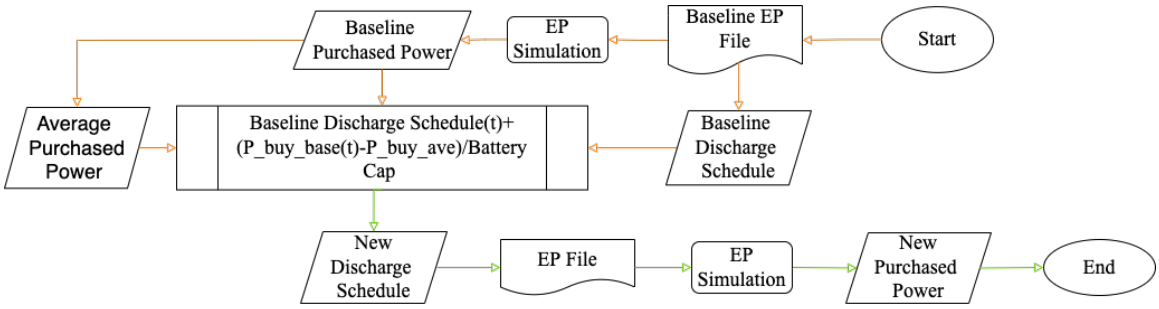


Figure 2-5: Battery discharge scheduling workflow

self-sufficient hours in this thesis are times where PV produced power is equal to or more than the demand power plus the power for charging the battery. During this time, the building does not need battery discharging or grid purchased power to satisfy the demand. Self-sufficient hours are concentrated in the middle of the day when solar energy is abundant. In the case studies, the start and end of the self-sufficient hours are marked as vertical dotted lines. Since during the self-sufficient hours PV produced power is sufficient to support the building demand, these hours are not considered in the energy system scheduling.

$$P(t)_{PV} \geqslant P(t)_{Battery\ Charge} + P(t)_{Demand} \tag{2.11}$$

To reduce the peak of the purchased power, the next step is to reschedule the discharging of the battery so that the curve of the purchased power could be flattened. An average of the baseline purchased power is calculated in equation 2.12, where t are hours that are not included in the PV self-sufficient hours.

$$P_{buy\ average} = \frac{\sum_{t=0}^{24} P_{buy}(t)}{24 - self\ sufficient\ hours} \tag{2.12}$$

A difference of each hour's purchased power compared to the average purchased power is taken with equation 2.13. The $\Delta P(t)_{discharge}$ would be positive if the purchased power is larger than the average value, and would be negative if the purchased power is smaller than the average value.

$$\Delta P(t)_{discharge} = P(t)_{buy} - P_{buy\ average} \tag{2.13}$$

As shown in equation 2.14, to convert the $\Delta P(t)_{discharge}$ to $\Delta Discharge\ Schedule$, the $\Delta P(t)_{discharge}$ is then divided by the value of design storage control discharge power specified in the EP model. This schedule fraction difference is added to the baseline discharge schedule value to get a new schedule for reducing the peak purchased power. The new discharge schedule would be applied to the EP model to generate a new output of purchased power.

$$New\ Discharge\ Schedule\ Value(t) = Baseline\ Discharge\ Schedule\ Value(t) + \frac{\Delta P(t)_{discharge}}{Storage\ Control\ Discharge\ Power} \tag{2.14}$$

2.2.3 Cost Analysis

A cost analysis of the PV and battery is conducted in this section. It considers the investment of the systems, installation, and maintenance, and income from grid feed-in. The unit cost of electricity in the short term to the long term is estimated. The calculation of the costs refers to the equation in the thesis by Weniger et al. on sizing the residential PV battery system [73]. Certain assumptions are made in this cost calculation, based on these assumptions, the unit cost of the electricity of various PV and battery capacities in the short and long terms is calculated in the steps below.

The short-term to long-term investment costs for PV and battery systems and the feed-in tariff refer to the data published in [72].

	$5 years$	$10 years$	$15 years$	$20 years$
PV system costs ($/kWp)	1800	1500	1200	1000
Battery system costs ($/kWh)	3000	1500	1000	600
Feed in tariff ($/ kWh)	0.15	0.11	0.06	0.02

Table 2.1: Cost in short to long terms

For the investment in PV and battery, the annuity factor is considered and it is calculated as in equation 2.15. The interest rate of 4% is referred from the value published in paper [72]. The number of years for short term and long term ranges from 5 to 20 years.

$$Annuity = \frac{Interest\ rate}{1 - (1 + Interest\ rate)^{-number\ of\ years}} \tag{2.15}$$

The PV cost is calculated as in equation 2.16, where $P_{PV\ peak}$ is the peak power, in kWp, the PV is able to produce. The operation cost is assumed to be 1.5 % of the cost of PV.

$$Investment_{PV} = Cost_{PV} \times P_{PV\ peak} \times (Annuity + Operation\ cost) \tag{2.16}$$

The battery cost is calculated as equation 2.17, where the $P_{Battery\ capacity}$ is the amount of energy that can be stored in the battery in kWh.

$$Investment_{Battery} = Cost_{Battery} \times P_{Battery\ capacity} \times (Annuity + Operation\ cost) \tag{2.17}$$

The income from feeding power to the grid is calculated in equation 2.18, where the $Energy_{pv}$ refers to the annual energy produced by the PV panel in kWh. As shown in equation 2.19, the self-consumption rate is the sum of PV produced power for direct use and charging the battery divided by the total PV produced power.

$$Income_{feed\ in} = Feed\ in\ tariff \times Energy_{pv} \times (1 - Self\ consumption\ rate\%) \tag{2.18}$$

$$Self\ consumption\ rate\ \% = \frac{E_{Direct\ Use} + E_{Battery\ charge}}{E_{PV}} \tag{2.19}$$

The cost for purchased power from the grid is calculated in equation 2.20. The

unit price for energy is assumed to be 0.34 \$/KWh.

$$\begin{aligned} Cost_{purchased} = Purchased\ power\ unit\ price\times \\ E_{demand} \times (1 - Degree\ of\ self\ sufficiency) \end{aligned} \tag{2.20}$$

The degree of self-sufficiency is demonstrated in equation 2.21. When the demand is more than the PV-produced energy, the direct use energy equals PV produced energy; when PV-produced energy is less than the demand, the direct use energy equals the demand.

$$Degree\ of\ self\ sufficiency = \frac{E_{directuse} + E_{Battery\ discharge}}{E_{demand}} \tag{2.21}$$

In all, taking in account the investment for PV and battery, cost of grid purchased power and the income from grid feed-in, the final unit price of electricity in \$/KWh is calculated in equation 2.22

$$\begin{aligned} Final\ electricity\ unit\ price = \\ \frac{Investment_{PV} + Investment_{Battery} + Cost_{Purchased} - Income_{Feed\ in}}{E_{Demand}} \end{aligned} \tag{2.22}$$

2.3 Cooling and Energy Storage Systems Scheduling

In this section, the schedules of the cooling systems and the battery are adjusted under heat waves. The methods are divided into two parts: cooling systems scheduling and energy storage system scheduling. The steps in the first part, cooling systems scheduling, include: part 1: (1) generating data including hourly setpoint, air speed, PV generated power, outside temperature, purchaseed power, and SET^*,in EP simulations, (2) fitting a deep neural network that relates cooling systems schedules, PV produced power and outside temperature to the hourly purchased power and SET^*, and (3) embedding the trained machine learning model in SciPy's minimize optimizer to schedule the cooling systems for the set optimization goal. Figure 2-6 presents an overview of the workflow for part 1. For part 2, energy storage scheduling, the meth-

ods demonstrated in section 2.2 are applied to flatten the peak of the purchased power under heat waves. The method is tested under two scenarios: minimizing the peak purchased power during heat waves and maximizing self-sufficient hours after grid shutdown. Example code of the cooling and energy storage systems scheduling python workflow is provided in Appendix C.

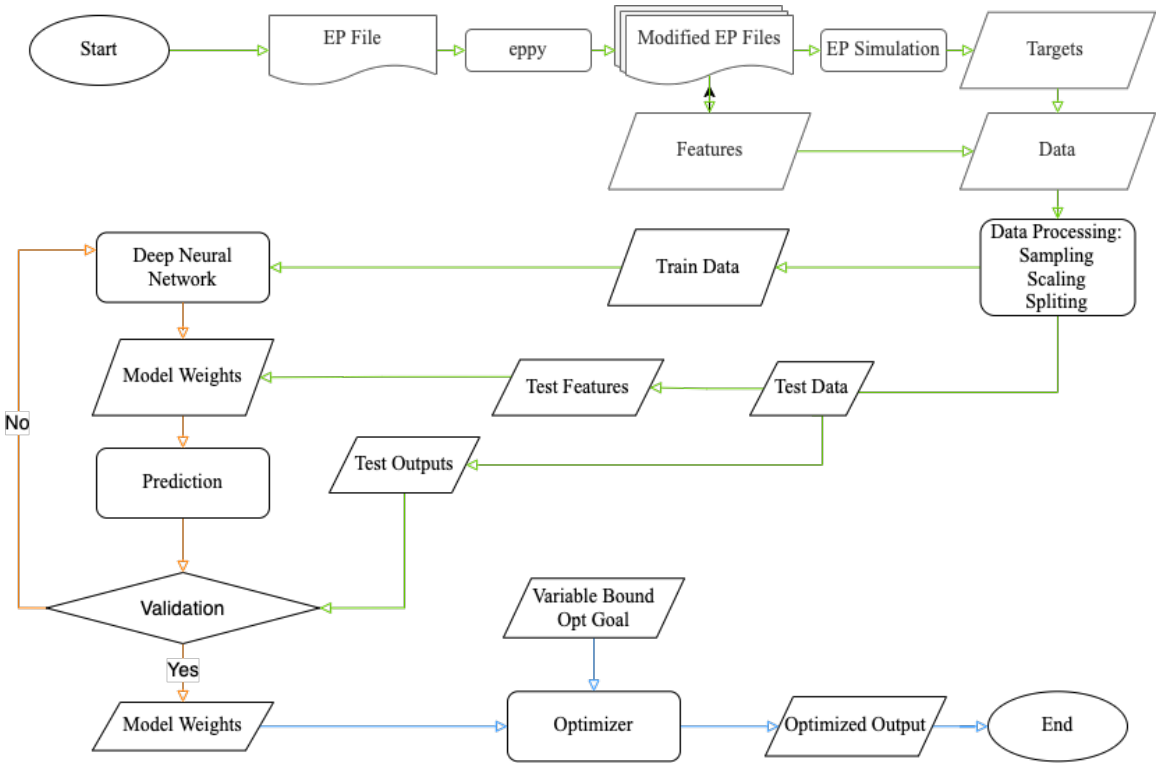


Figure 2-6: Workflow: machine learning and optimization

2.3.1 Part 1: Data Generation

The data are generated with EnergyPlus simulation. This study implements PV and battery systems in the same single-family prototype model mentioned in the previous sections. The baseline cooling systems schedule and perturbation range are kept the same as Section 2.1. Building on the improvement from energy discharge scheduling from the previous section, this section takes the battery discharge schedule from the previous section as the baseline. It is known from the previous section that during PV self-sufficient hours, there would be no need for discharge. Except for the PV

self-sufficient hours, the range for battery charge and discharge schedule variation is a fraction from 0 to 1.

The hottest day and four weeks around the hottest day are defined as simulation periods. The hourly setpoint, air speed, PV-generated power, and outside dry bulb temperature are generated as input data for the next step, neural network model training; the hourly purchased power and SET^* are produced as target data. Three-fourths of data are used as training data, in which 80% are used for training and 20% are used for validation. The remaining one-forth of the data are used as test data.

2.3.2 Part 1: Neural Network Model Training

This study uses a fully connected deep neural network with TensorFlow's Sequential model[24]. A deep neural network structure with five layers, in which the top and bottom layers consist of ten neurons, the middle layers consists of 50 neurons, is set up for this project. *Relu* is used as the activation function for each layer; *Softmax* is used in the last layer. The dropout rate of 0.05 is applied in each layer. *BatchNormalization* is used to reduce the risk of overfitting.

In the training process, the learning rate of 0.1 is set. The callback function is set up to monitor the loss of the validation training results and restore the best result. An epoch of 200 is applied in the training of the neural network model.

2.3.3 Part 1:Scheduling and Optimizing Cooling Systems

The trained neural network model is fed into an optimizer into a SciPy minimize optimizer. The Sequential Least SQuares Programming (SLSQP)[47] is used as an optimization method to minimize the objective function with variable bounds.

Since after the first part cooling systems scheduling, the output would be passed to the second part, energy storage systems scheduling, which could flatten the profile of the purchased power to its average value. The objective for the cooling systems

scheduling can be written as,

$$score_{opt} = P_{weight} \cdot P_{buy\ sum} + SET_{weight} \cdot SET_{max} \tag{2.23}$$

P_{weight} and SET_{weight} are weights assigned to the sum of the purchased power and maximum SET^*.

The variable to be optimized is the setpoint and air speed schedules. To smooth the perturbation of the optimized schedule, multi-control-point NURBS curves are applied to the setpoint and air speed schedules as initial values for the optimizer. After running the optimizer 100 times, the minimal optimization score calculated with function 2.23 is taken as the optimized result. The reduced sum of the purchased power would allow the second part, energy storage system scheduling, to achieve a lower peak purchased power.

2.3.4 Part 2: Scheduling Energy Storage System

After the cooling systems scheduling, this step takes the resulting purchased power profile as the baseline. The energy system scheduling methods demonstrated in Section 2.2 are repeated in this step to flatten the curve of the purchased power.

2.3.5 Minimizing the Peak Purchased Power during Heat Waves and Maximizing Self-sufficient Hours after Grid Shutdown

To mitigate grid stress during a heat wave, the goal is to minimize the peak purchased power. This study tries to achieve this goal by combining the adjustment of the cooling systems and the discharge of the battery.

In the scenario of a grid shut down after a major heat wave, the duration that the power from PV and battery can support the building demand is the self-sufficient hours. The goal of this study is to maximize the number of hours. The self-sufficient hours are composed of PV directly supported hours and energy storage supported

hours. The condition for identifying the PV self-sufficiency has been demonstrated in equation 2.11. The condition for energy system self-sufficiency can be described as:

$$E_{battery} \geqslant \sum_{t=0}^{24} P_{demand}(t) \tag{2.24}$$

2.4 Linear Regression Model vs Neural Network Model

In cooling systems scheduling, a linear regression model is utilized; in cooling and energy storage system scheduling, a neural network model is implemented. The selections of the two types of models are based on the characteristics of the training data. The cooling systems scheduling involves only the perturbation of the air conditioner and fan schedule, thus the linear regression model is used to train a perturbation model. In the cooling and energy storage system scheduling, in addition to the parameters of the cooling systems, the training data involves solar radiation and outdoor temperature, which are not perturbation adjustments to the building system, thus neural network model is implemented to include more types of the parameters. These two types of models have their own advantages and disadvantages. In general, neural network model obtains higher accuracy in prediction, however, the models are often complex. The linear regression model has more advantages in terms of ease of use but has lower accuracy [81].

Comparing the mean square error (MSE) and computing time of the two models implemented in this thesis, the results are shown in Table 2.2 and 2.3. If using only the cooling systems adjustments as input parameters to train the linear regression and neural network models, the highest MSE of the linear regression models is 0.96 and the MSE of the neural network model is 1.63. However, if the outside temperature is added to the input parameters to train the neural network model, the MSE improves significantly improved to 0.87. Computing time for making hourly predictions for one day from a 1000-day average, take the neural network model 3.2060 ms, and take the linear regression model only 0.0017ms. The neural network model with sufficient data could obtain higher accuracy than the linear regression model, but then it takes

a longer time for making predictions.

	MSE
Linear Regression Model	0.96
Neural Network Model (input: setpoint + fan speed)	1.63
Neural Network Model (input: setpoint + fan speed+ outside T)	0.87

Table 2.2: Surrogate models MSE comparisons

	Prediction Time [ms]
Linear Regression Model	0.0017
Neural Network Model	3.2060

Table 2.3: Surrogate models prediction time comparisons

The two types of models are compatible with different methods for solving optimization problems. The linear regression model works with linear optimization methods such as CVX, used in this thesis. The linear optimization solves the optimization problem with low computing power and ensures the optimality of the solutions [16]; however, the neural network model would need stochastic optimization such as the SLSQP method used in this thesis, which requires a longer time to converge and global optimally is not ensured [37]. The computational efficiency of the linear regression model prediction and optimization makes the method better suited for real building implementation with home-automation systems.

2.5 Implementing Cooling Systems Scheduling in Real Building

The workflow of cooling systems scheduling demonstrated in Section 2.1 which utilizes a linear regression model, is implementable in real buildings and has several practical advantages. No building or equipment modeling is required, which allows flexibility in the application; limited data is required, which protect users privacy; no expensive computing required to get the scheduling solutions, which ensures efficiency. Recent

rapid development and wide use of smart home devices make feedback and control of the cooling systems possible[49][76].

The workflow of the real building implementable follows the same structure with methodology demonstrated in Section 2.1. What is different is the source of perturbation model training data. It would be collected from real building environment with smart meters, controllers and sensors instead of simulation outputs. In addition, since the baseline condition can no longer be simulated by EP, a surrogate model would need to be trained to predict the baseline power and thermal comfort conditions. The steps of the real building implementation methods are demonstrated in Figure 2-7. The baseline model learning are explained in Section 2.5.1, the perturbation model training and optimization can refer to previous demonstrations in Section 2.1.2 and Section 2.1.3. The optimized schedules can be input to air conditioner smart thermostats and fan smart speed controls. Working with smart devices, the proposed method is able to record, predict and adjust the environmental conditions and power consumption, and promote users' thermal satisfaction.

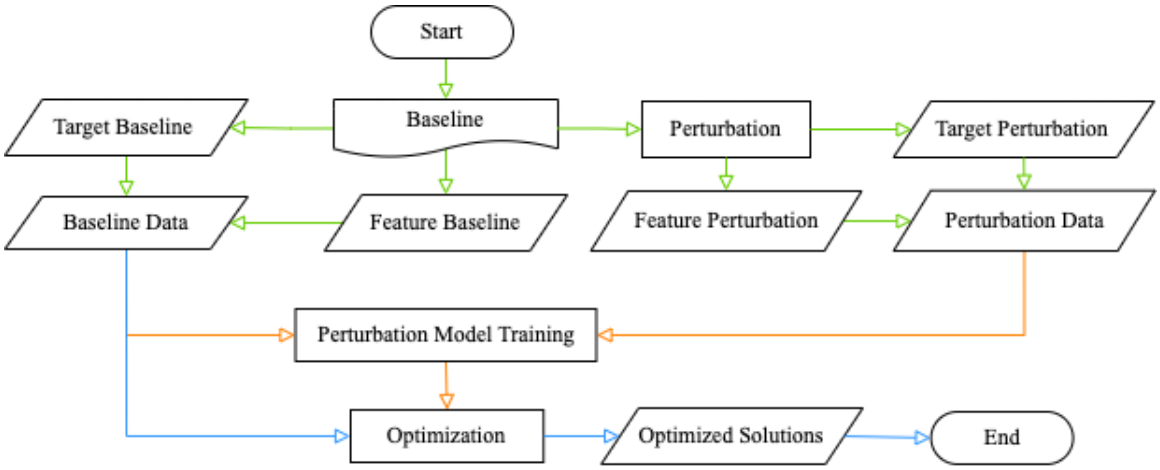


Figure 2-7: Workflow: implementing cooling systems scheduling in real building

2.5.1 Baseline Model Learning for Real Building Implementation

The goal of this section is to learn surrogate models that predict baseline load and heat stress conditions in the defined time interval. The data of load can be collected from electricity meters. For heat stress, the degree of thermal discomfort is often used as a measurement of heat stress [55]. There are two schools of thermal comfort models, the heat balance model, and the adaptive model. Heat balance models consider the human body as a thermodynamic system, which requires the human body to maintain an internal heat balance around 37±0.5 °C [19]. Predictive Mean Vote (PMV) model [28] and Standard Effective Temperature (SET^*) [32] [11] are representatives of heat balance models. For the adaptive models, the occupant is assumed to be able to adapt to the environment to improve personal thermal comfort. Research has shown that thermal comfort conditions can be quite personal and relate to many personal parameters such as culture[17], age[40], and gender[42]. Building on the knowledge from these thermal comfort models, the recent development of machine learning algorithms and smart sensors has enabled great progress in data-driven models for personalized thermal comfort [30] [15] [56] [62]. To mitigate heat stress, it is important to maintain thermal comfort in a comfortable range.

For the air conditioner and fan, the two devices that this thesis is scheduling, the baseline conditions of the air conditioner and fan are set up. Recent fast development and wide application of smart-home devices have opened up the potential for data collection and smart control of household devices. In paper [49], Lee et al. use the data of smart meters and smart thermostats of the air conditioners to predict and control the load in residential buildings; in the paper [76], Yammen et al. offer methods to control the speed of the fan through a mobile application. The baseline schedule of the air conditioner and fan and the building load collected from the smart meters would be used to train the baseline models. In addition, occupancy factors including the information of the type of the day, time of the day, and occupancy schedules are critical to power consumption [80]. The occupancy data could be collected through

sensor or user logs. For the choice of algorithm, there is a great amount of existing research work that predicts load. Review paper [81] compares the performance of various algorithms for load prediction. Artificial Neural Network (ANN)[33] [14] and Support Vector Machine (SVM) [38][51] are two types of models can be trained with historical data and obtain high accuracy in prediction, however, the models are often complex. The statistical regression model [36] has more advantages in terms of ease of use, but has less accuracy.

For thermal comfort prediction, the above-mentioned heat balance model, adaptive model, or data-driven personalized thermal comfort model could be used to describe the thermal perception of the occupant. Review paper [29] lists input factors for generating thermal comfort values. Normally environmental factors include air temperature, mean radiant temperature, relative humidity, and air speed, which could be measured through a set of sensors [82]. Human factors involve anthropometric data, physiological factors, and behavioral factors. The anthropometric data include age, gender, ethnicity, height, and weight, which are often not included in the thermal comfort predicting inputs since the input values would not vary much; the physiological factors often included heart rate, Electroencephalogram (EEG), and skin temperature, which can be collected directly or measured through physiological sensors and is the most used inputs for thermal comfort models; the behavioral factors involve lifestyle, clothing insulation, and activity levels, which can be hard to quantify thus often not used in the input data. For the machine learning algorithm, a wide range of models have been applied to predict thermal comfort, including Artificial Neural Network (ANN) [30]and [66], Fuzzy Logic[15], and Support Vector Machine (SVM) [56] [62][8][74] and [59]. Review paper [29] points out SVM model is the most used in the reviewed works and obtains one the best prediction accuracy.

The above-mentioned existing machine learning models for power and thermal comfort predictions have their advantages and disadvantages. It would be hard to determine the best model without comparing the performance of a few models for the specific problem with specific requirements for accuracy, computing time, and ease of use. Testing a few models with available types and amounts of data, the

algorithm of the baseline models could be chosen based on the specific requirements of the problem.

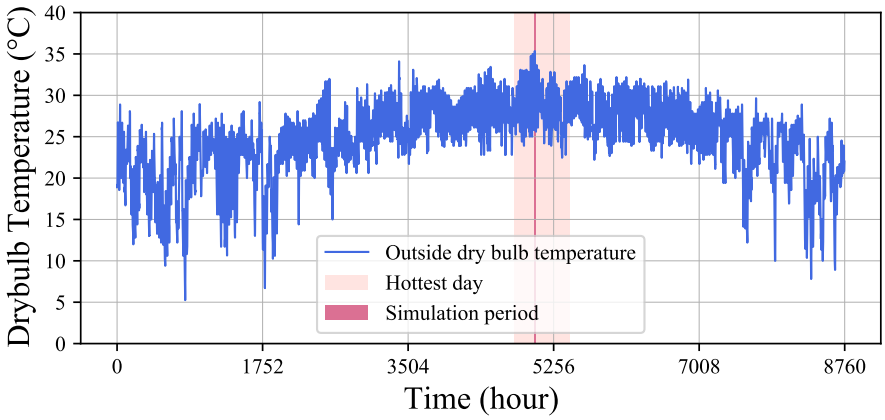
Chapter 3

Miami Case Studies & Results

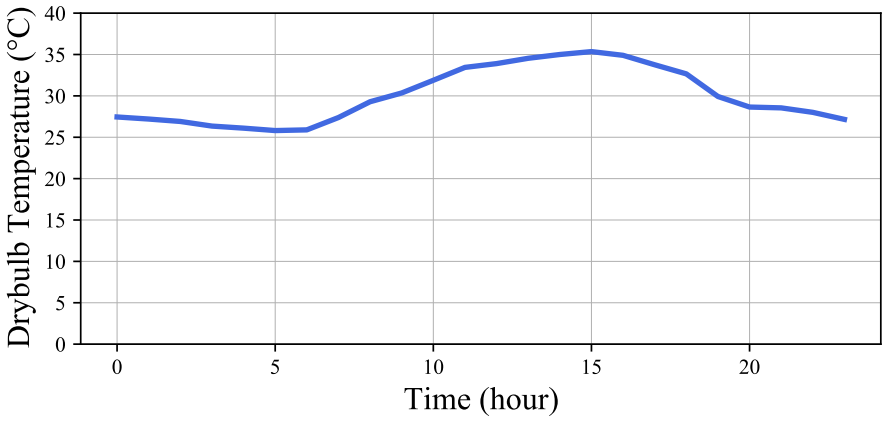
3.1 Miami Single Building and Six-Building Neighborhood Case Studies Setup

This section demonstrates the proposed methodology with a single building case study and a six-building neighborhood case study. The single-family residential prototype model of the ASHRAE 1A climate zone [1] is used as the baseline file for the case studies. The Miami TMY3 epw file is used as a weather file for the simulation. Figure 3-1a shows the outside temperature over a year of the chosen climate profile. The summer hottest day, shown in Figure 3-1b, is set as the optimization days.

With the constant default setpoint at 23.9 °C and air speed at 0.35 m/s, the baseline hourly power consumption and SET^* are shown as the pink line in Figure 3-2a and Figure 3-2b. The power demand and SET^* in the optimization day are used as the baseline for the case study. The pink line in Figure 3-2a shows, as the outside temperature rises in the afternoon, the power demand in the afternoon increases and reaches a peak, due to the increased thermal load and the decreased cooling system efficiency when the temperature difference between outdoor and indoor increases. To reduce the peak power, one easy solution would be raising the constant setpoint. If the setpoint is raised 3 °C, the resulting hourly power consumption is shown as the blue line in Figure 3-2a. Although the easy approach shifts the line of power consumption



(a) outside dry bulb temperature(whole year)

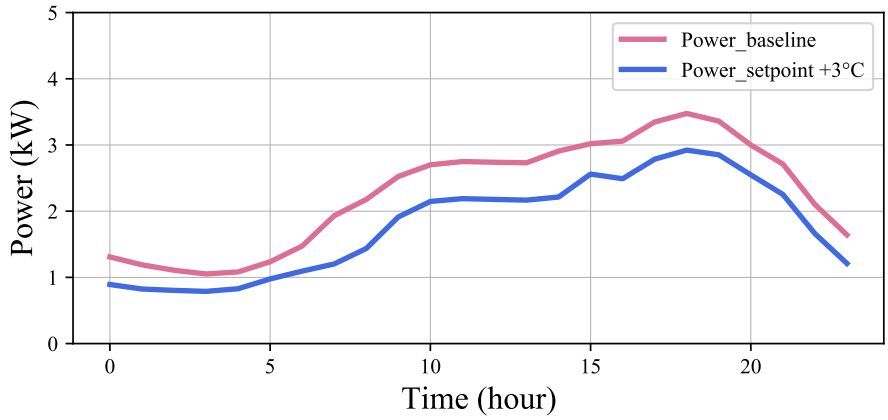


(b) outside dry bulb temperature(hottest day)

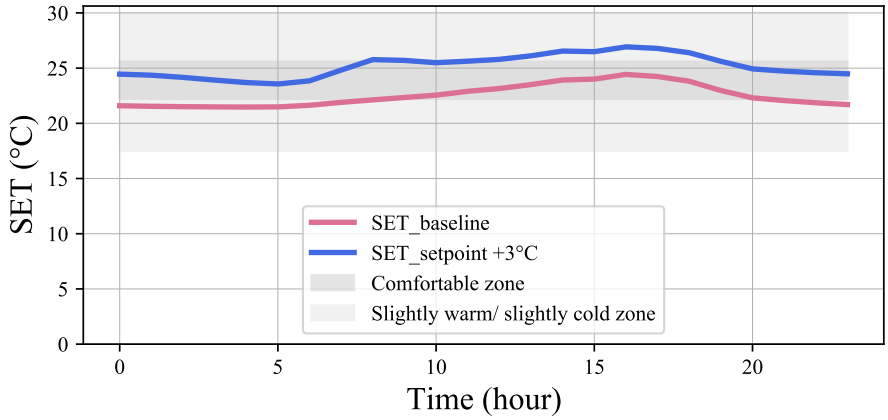
Figure 3-1: Miami case study outside dry bulb temperature

down, it compromises SET^* as shown in the blue line in Figure 3-2b. The darker gray and lighter gray shading boxes in Figure 3-2b indicate the thermally comfortable zone (22.2-25.6°C) and the lightly warm/cold zone (17.5-22.2°C, 25.6-30°C) of SET^* [11]. The goal for the optimization of the case studies below is to reduce the peak load and maintain a thermally comfortable condition.

As shown in Figure 3-3a, the single building case study uses the single-family residential prototype model of the 1A climate zone [1] as a baseline. The prototype is a two-story single-family house with a floor area of 110 m^2 for each floor, and a window-to-wall ratio of 0.15 on each side of the building. The two stories are set as one conditioned zone, and the attic is set as an unconditioned zone. The measurement of



(a) power consumption(hottest day)



(b) SET^*(hottest day)

Figure 3-2: Miami case study baseline conditions

(a) single building model (b) six-building neighborhood model

Figure 3-3: Miami case study models

power consumption and thermal performance are monitored in the conditioned zone. The air conditioner in the prototype is a Unitary Heat Pump Air to Air system with a direct expansion coil for cooling. The baseline setpoint keeps the default value at 23.9

°C. The implementation of average airspeed and power consumption of the ceiling fan is derived from data published by Liu et al. [52]. A baseline airspeed of 0.35 m/s is implemented in this test with an average power consumption of 0.48 W/m^2.

The hourly baseline power $\hat{P}(k)$ and Standard Effective Temperature $S\hat{E}T(k)$ of the prototype model are generated as baseline targets. The hottest day and four weeks around the hottest day are set as the run period. To generate perturbation data, eppy [3] is used to parametrically modify the schedules of the setpoint and air speed. The perturbation range for setpoint is ±3 °C and for air speed is ±0.35 m/s. One hundred fifty sets of schedule perturbations are generated.

One perturbation model for power and one perturbation model for SET^* are trained with linear regression functions in equations (2.5) and (2.6). The baseline power and SET^* and the trained power and SET^* perturbation models are fed into the convex linear solver, CVXPY [25] with goal function in equation (2.7). The proposed methods require low computation cost in solving the high-dimensional multi-objective optimization problems. A multi-objective sampling is applied with 1000 different combinations of randomly generated P_{weight}, and S_{weight} assigned to the optimization function (2.7).

The six-building neighborhood, as shown in Figure 3-3b, is composed of six single-family buildings with various footprints modified derived from the prototype single-family model. The geometry modification of the model is done with a python package, geomeppy [4], which can change dimension parameters in the models. The footprint of the buildings on each floor varies from 55 m^2 to 165 m^2. The window-to-wall ratio of the buildings keeps at 0.15 on each side of the buildings.

The process of baseline and perturbation data generation and perturbation model training is repeated six times. In the end, for each unit, one perturbation model for power and one perturbation model for SET^* are trained with their respective linear regression function (2.5) (2.6). The baseline power and SET^* and the trained power and SET^* perturbation models of the six units are fed into the convex linear solver, CVXpy [25]. The goal of the optimization for the six-unit neighborhood case study is to reduce the aggregate peak power and SET^* of the six units. Similarly, a multi-

objective sampling is applied with 1000 different combinations of randomly generated P_{weight}, and S_{weight} assigned to the optimization goal.

3.2 Cooling System Scheduling Results

3.2.1 Single Building Results

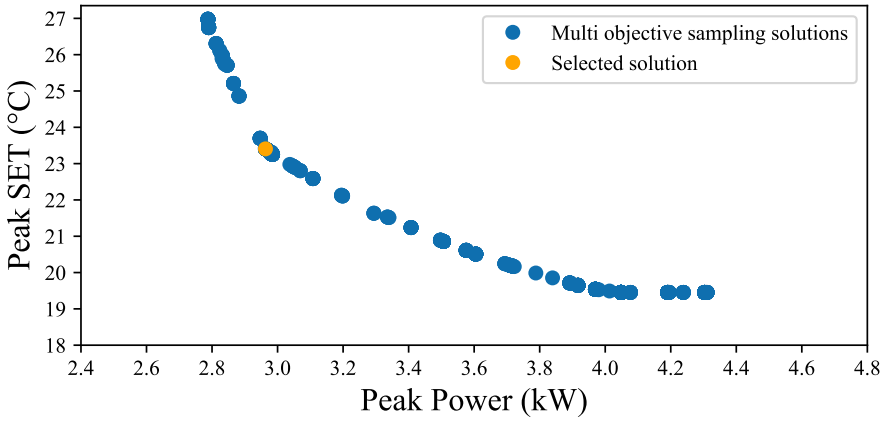
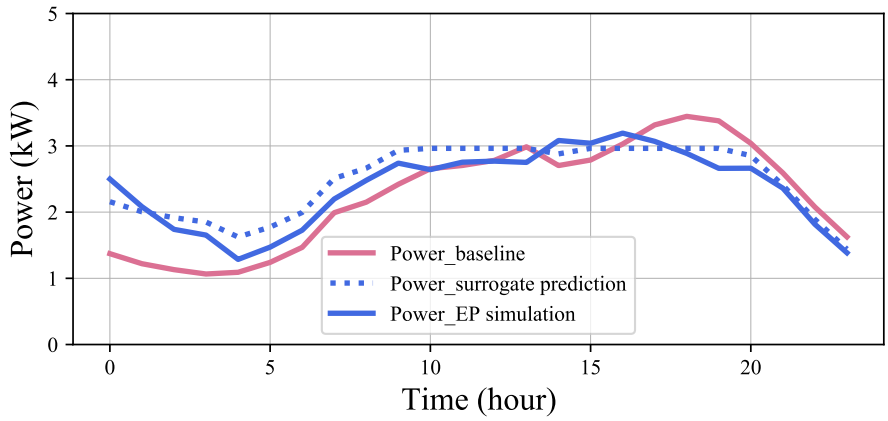


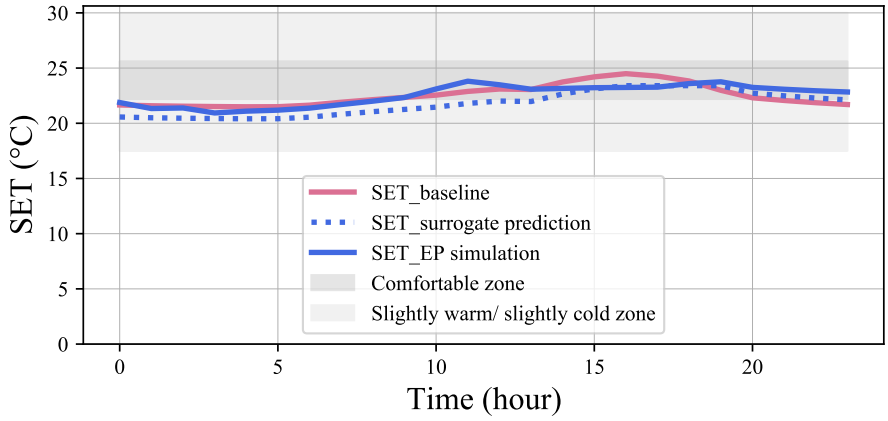
Figure 3-4: Miami single-building case study cooling g system scheduling multi-objective sampling

As shown in Figure 3-4, the multi-objective sampling method gives a range of optimized solutions to the case study problem. The solutions form a Pareto Front [50], in which each dot in the figure represents one unique optimal solution that cannot improve in one dimension without compromising the other. This section demonstrates the optimal solution of 75% P_{weight} to peak power optimization and 25% S_{weight} to peak SET^* optimization for the single building case study. In Figure 3-5a and Figure 3-5b, the pink line represents the baseline performance, the dotted blue line stands for surrogate prediction outputted from the optimizer, and the solid blue line is the building performance from EP simulation with the optimizer generated schedules. As indicated in both figures, the optimized power and SET^* in the solid blue lines were reduced by 7.8% and 2.8% compared to the baseline. Over the whole day, the total energy consumption of the optimized solution increases by 4.9%. The schedules of cooling system setpoint and ceiling fan air speed that result in the reduction are

shown in Figure 3-6a and Figure 3-6b. The optimized setpoint solution pre-cools the building earlier in the morning, then raises the setpoint temperature in the afternoon when the outside temperature increases. To maintain the indoor environment at a thermally comfortable level, the ceiling fan schedule raises the air speed in the afternoon.

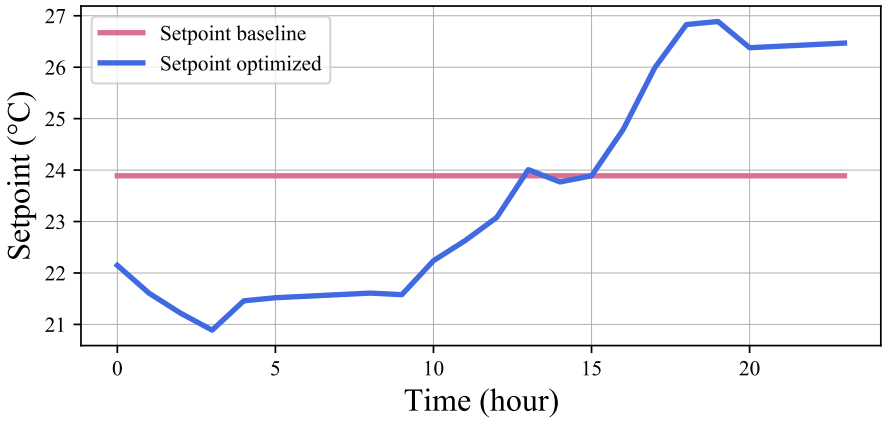


(a) demand power

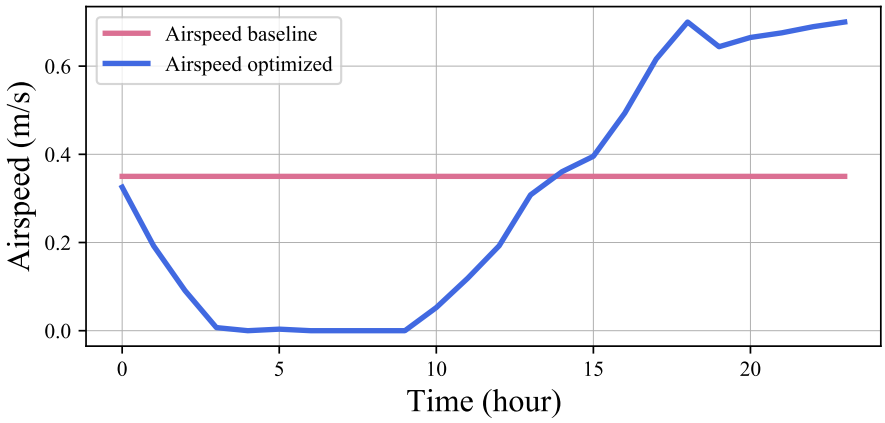


(b) SET^*

Figure 3-5: Miami single-building case study hourly demand power and SET^* after cooling system scheduling



(a) setpoint schedule

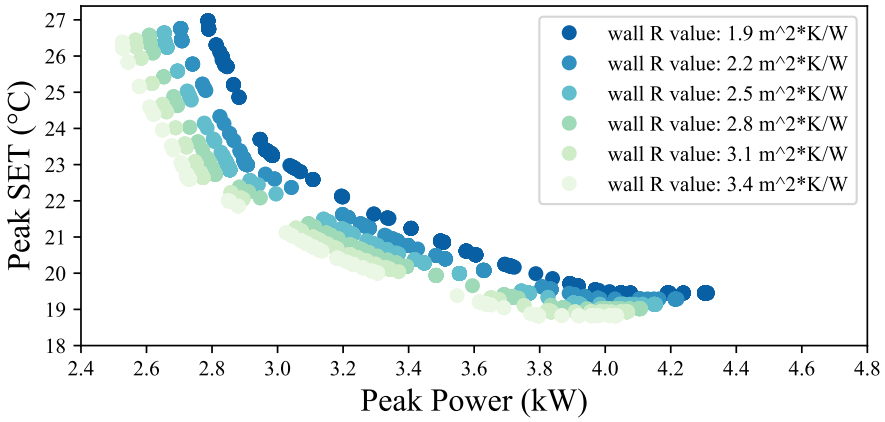


(b) air speed schedule

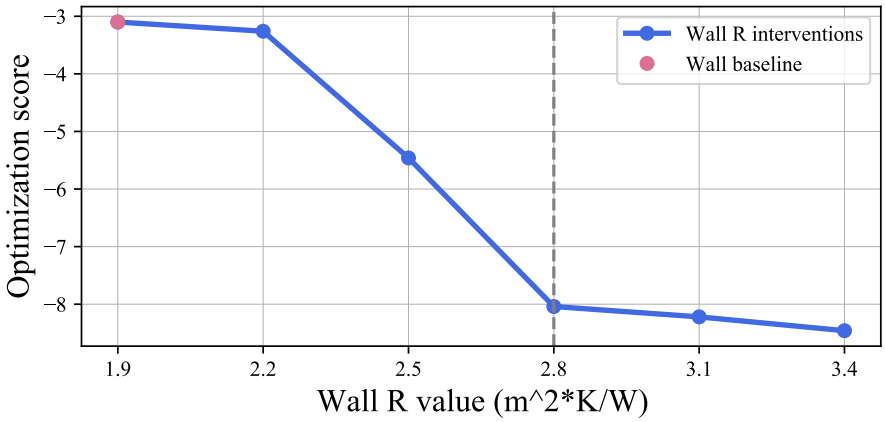
Figure 3-6: Miami single-building case study cooling system scheduling

3.2.2 Results with Wall R Value and Window U Value Variation

In addition to the schedule optimization, building-level interventions such as wall R-value and window U-value influence the power consumption. Building off the single unit case study, this section demonstrates the result of the single-building optimization with wall R-values varying from 1.9 m^2K/W to 3.4 m^2K/W, and window U-values varying from 1.1 W/m^2K to 4.5 W/m^2K. The proposed methodology is applied for each of the single buildings with wall R-values in 1.9, 2.2, 2.5, 2.8, 3.1, 3.4 m^2K/W. Similarly, the process is repeated for each of the buildings with window U-values of



(a) moo with wall R value variations

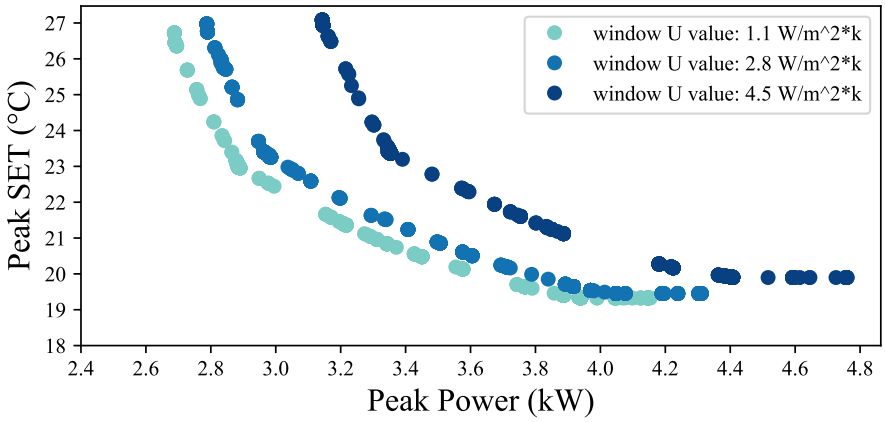


(b) score$_{opt}$ with wall R-value variations

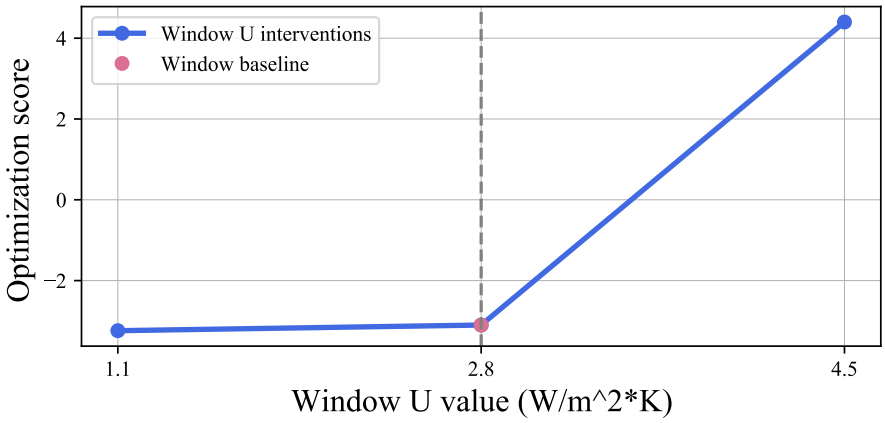
Figure 3-7: Miami single building case study multi-objective sampling (moo) and optimization score (score$_{opt}$) with wall R-value from 1.9 to 3.4 m^{2}K/W

1.1, 2.8, and 4.5 W/m^{2}K. Figures 3-7a and 3-8a present a wide range of solutions from the multi-objective sampling with wall R-value and window U-value variations. In both plots, the X-axis represents the optimized peak power and Y-axis represents the optimized peak SET^*. Lighter dots denote larger R and smaller U values.

Figures 3-7a and 3-8a show that as the wall R-value increases and the window U value decreases, the Pareto Front gets closer to the origin. The baseline peak power and SET^* of the prototype model with default wall R-value of 1.9 m^{2}K/W and window U value of 2.8 W/m^{2}K are used for comparison analysis. To cross-compare



(a) moo with window U value variations



(b) score$_{opt}$ with window U value variations

Figure 3-8: Miami single building case study multi-objective sampling (moo) and optimization score (score$_{opt}$) with window U-value from 1.1 to 4.5 W/m^{2}K

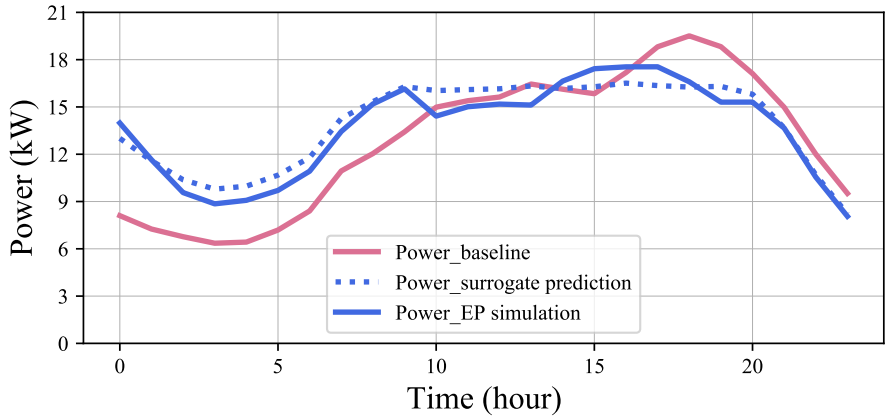
the results of the optimization, an optimization score is introduced here:

$$score_{opt} = P_{weight} \cdot P_{reduction}\% + SET_{weight} \cdot SET_{reduction}\% \tag{3.1}$$

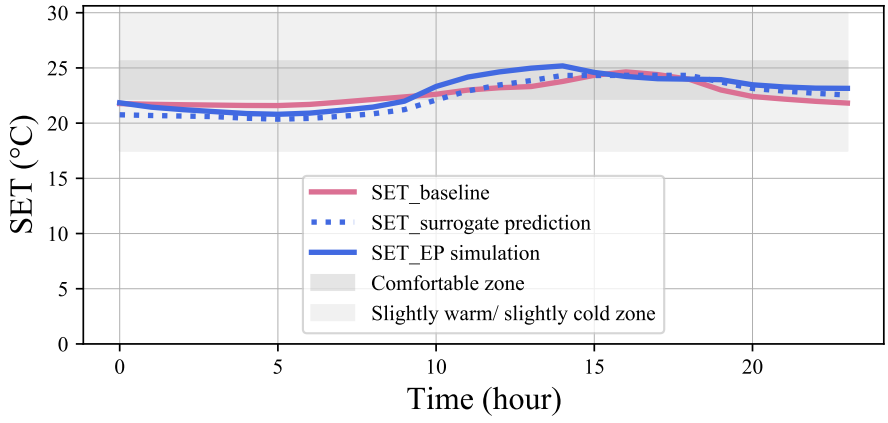
In equation (3.1), P_{weight} and S_{weight} are the assigned weights to peak power and peak SET^* optimization. The value of P_{weight} and S_{weight} are 60% and 40% in this result section. $P_{reduction}$ and $SET_{reduction}$ are peak power and SET^* reduction compared to the baseline peak power and SET^* of the prototype model. Smaller optimization scores indicate better optimization results. The optimization scores with wall R-value and window U value variation are shown in Figure 3-7b and Figure 3-8b. Figure 3-7b

shows that as the wall R-value changes from 1.9 m^2K/W to 2.8 m^2K/W, there is a significant improvement in the optimization score; after 2.8 m^2K/W, although the optimization score still improves as the R-value increases, the magnitude of improvement is smaller. For the window U value variation, Figure 3-8b shows the decline of the optimization score is sharper as the window U value changes from 4.5 to 2.8 W/m^2K than from 2.8 to 1.1 W/m^2K.

3.2.3 Six-Building Neighborhood Results



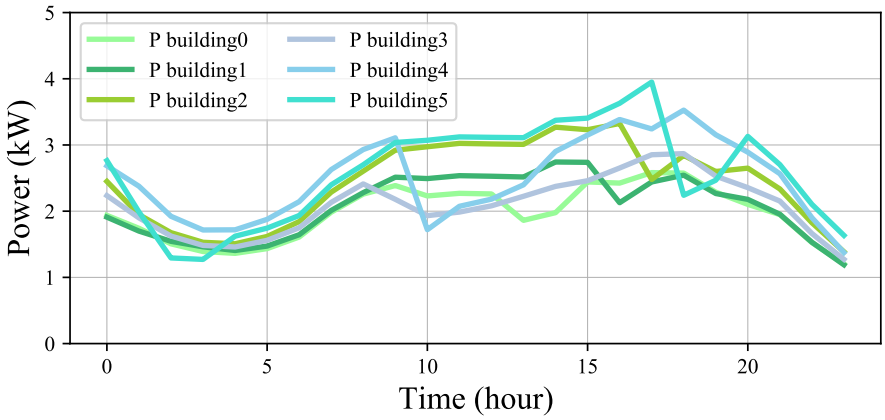
(a) aggregated demand power



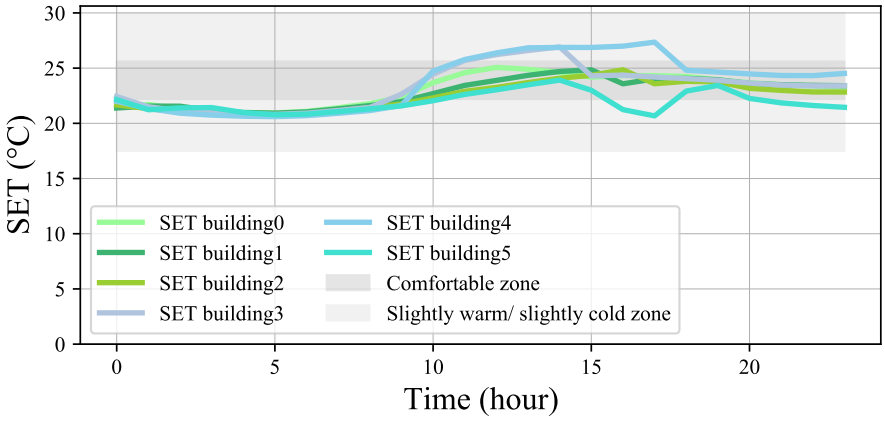
(b) average SET^*

Figure 3-9: Miami six-building neighborhood case study aggregated demand power and average SET^*

For the six-building neighborhood, to view varieties of solutions with this work-



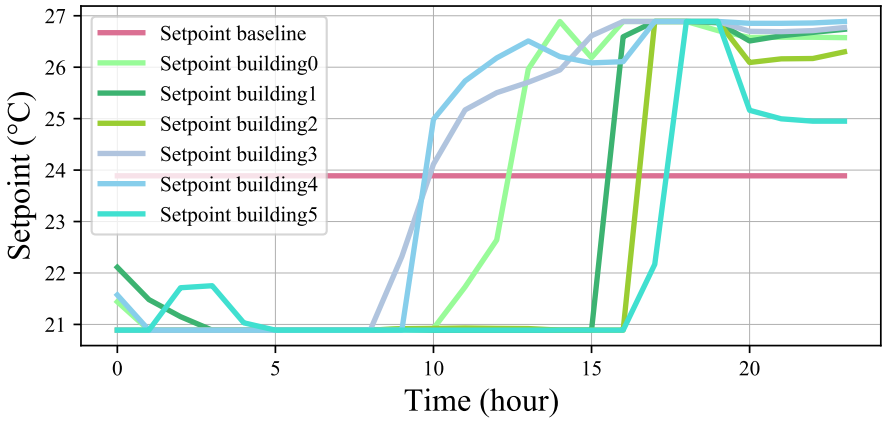
(a) demand power



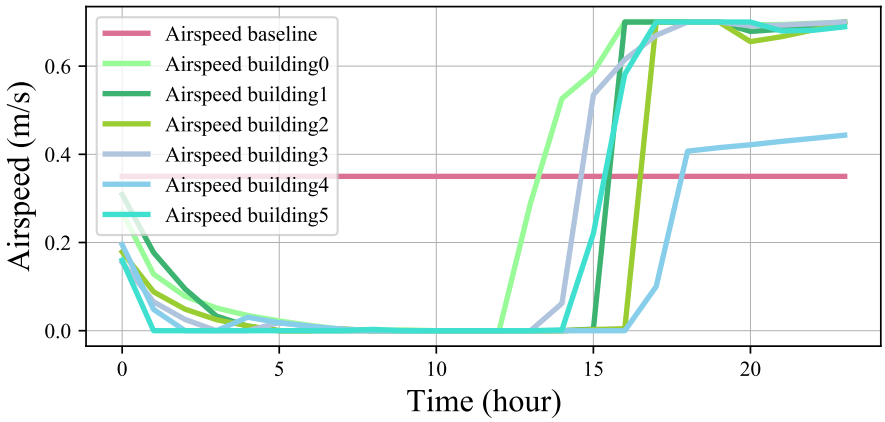
(b) SET^*

Figure 3-10: Miami six-building neighborhood case study individual demand power and SET^*

flow, a different set of weights, 65% P_{weight} to peak power and 35% S_{weight} to peak SET^*, is assigned to this optimization problem. Figure 3-9a and Figure 3-9b show the aggregate peak power is reduced 10.1% compared to the baseline and the average SET^* increases by only 2.2%. Over the whole day, the total energy of the optimized solution increases by 5.7%. Figure 3-10a and Figure 3-10b present the individual power and SET^* of the six buildings. As shown in Figure 3-11a and Figure 3-11b, the methodology is able to provide coordinated setpoint and air speed schedules for the small community.



(a) setpoint schedules

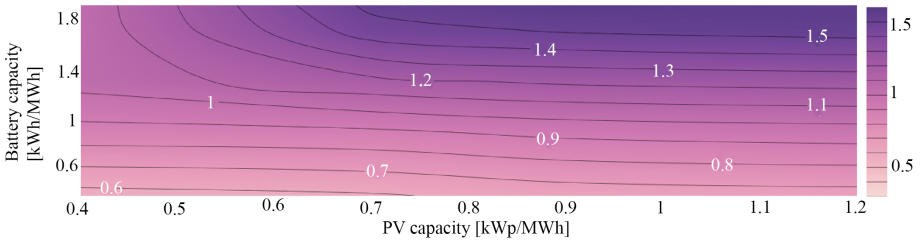


(b) air speed schedules

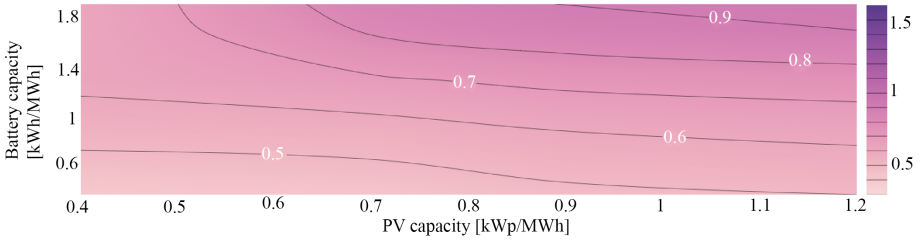
Figure 3-11: Miami six-building neighborhood case study cooling system scheduling

3.3 Energy System Scheduling Results

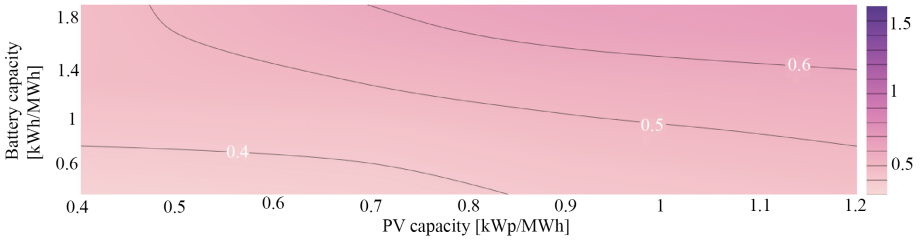
Figure 3-12 shows the cost of electricity unit price in 5 to 20 years with various PV and battery capacities. In the short term, within five years the unit cost of electricity for low PV and battery capacity is around 0.5 0.7 $/kWh, which increases to more than 1.5. $/kWh in high PV and battery capacities. The cost differences due to the PV and battery capacities tends to decrease in the long term.



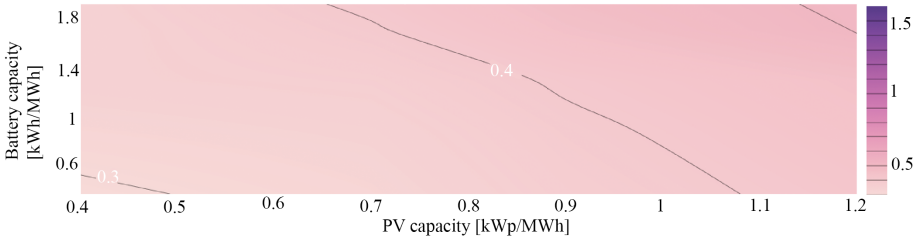
(a) Annual Total Electricity Cost 5-year



(b) Annual Total Electricity Cost 10-year



(c) Annual Total Electricity Cost 15-year



(d) Annual Total Electricity Cost 20-year

Figure 3-12: Miami single building case study electricity unit cost in short term and long term for PV and battery in various capacities

3.3.1 Single Building Results

The net purchased power presents both the power purchased from the grid, which is the positive value, and the power feeding to the grid, which is the negative value. The net purchased power of the unit with PV (0.7kWp/MWh) and battery (1.3 kWh/MWh) compared to the baseline demand of the same model without PV and battery is shown in Figure 3-13. The peak power needed from the grid reduces 65% from 3.6 kW to 1.2 kW. Figure3-14a and Figure 3-14b show further peak reduction

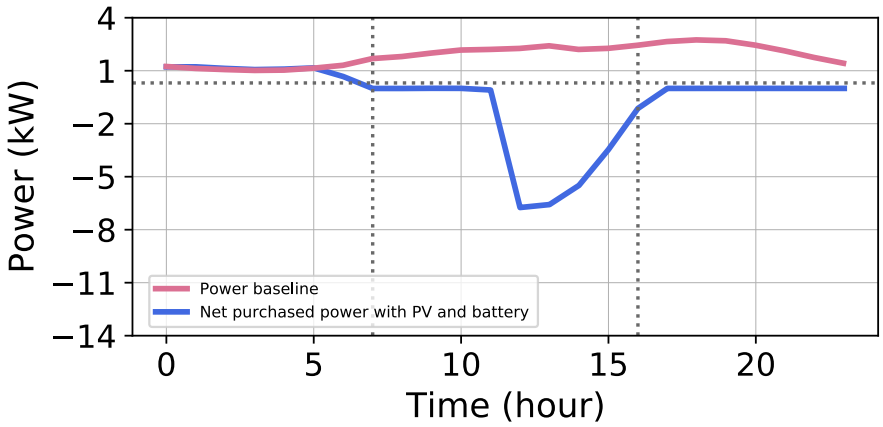


Figure 3-13: Miami single building case study net purchased power before and after installing PV and battery

with energy storage system scheduling. The peak purchased power was reduced to 0.66 (kW), which is about 45 % compared to the default PV and battery operation scheme, and about 81 % compared to no PV and battery. Since this section does not involve cooling system adjustment, there is no change in the thermal comfort of the building. Following the battery discharge scheduling method demonstrated in Section 2.2, as shown in Figure3-14c, the new battery discharge schedule relocates some of the power discharging from the battery from the late afternoon to the early morning, which helps reduce the peak power purchased from the grid.

The battery discharging methods are repeated for various models with PV capacities in the range of 0.4 to 1.2 kWp/MWh battery capacities in range of 0.4 to 1.9 kWh/ MWh. Figure 3-15 shows the net purchased power after the energy storage scheduling compared to the baseline for the various PV and battery capacities. If the capacity of the battery equals the amount of PV-produced power, excluding the power supplied by PV to directly meet the building's demand, further enlarging the battery would not further reduce the peak load. If the battery capacity with sufficient PV produced power is enough for supporting the entire building demand, further increasing the PV capacity would not help further reducing the peak load. In the case studies, purchased grid power for charging the battery is not considered.

Figure 3-16 shows the peak purchased power reduction that can be achieved with

the various PV and battery settings, before the energy storage scheduling (left), and after the energy storage scheduling(right). It shows the medium PV and battery capacities such as PV capacity at 0.7kWp/MWh and battery capacity at 1.3 kWh/MWh are able to achieve around 81% of peak purchased power reduction after rescheduling the battery. Taking the cost of the electricity in various PV and battery sizing as shown in Figure 3-12, the cost of electricity under medium PV and battery sizing is about half of the high PV battery capacity.

3.3.2 Six-Building Neighborhood Results

Figure 3-18 shows in the same PV and battery capacity as the section above, in a six-building neighborhood, the amount of accumulated peak purchased power is able to achieve through collectively scheduling the energy storage systems of the neighborhood. The energy storage scheduling method demonstrated in Section 2.2 is applied, and the average of the accumulated purchased power is set as the guidance for relocating the battery discharging power. After applying the new battery discharge schedule shown in Figure3-18b, the peak purchased power is able to reduce about 50% compared to the default energy storage schedule.

3.4 Cooling and Energy Storage System Scheduling Results

3.4.1 Single Building: Minimizing the Peak Grid Purchased Power during Heat Waves

Applying the cooling and energy system scheduling method demonstrated in Section 2.3, Figure 3-21 shows the case study on a single building with PV capacity of 0.7 kWp/MWh and battery capacity of 1.3 kWh/MWh. Figure 3-20a and 3-20b shows the net purchased power and purchased power with the optimized cooling system schedules shown in Figure 3-19a and 3-19a. The sum of the purchased power was

reduced by about 46 % compared to the constant value cooling system schedule. Figure3-20c shows that scheduling the cooling system achieved a 4% reduction in SET^*compared to the baseline. Based on the reduced total purchased power, the energy storage scheduling shown in Figure 3-21a is able to flatten the peak of the purchased power close to the average value, which is a 42 % reduction compared to the purchased power after cooling system scheduling, and 89% reduction comparing to the no PV and battery baseline power consumption.

In summary, Table 3.1 gathers the peak purchased power and SET^* of the case studies under each scheduling method. The cooling system scheduling is able to reduce the peak load by 7.8 % and reduce the SET^* max value by 2.8%; the energy storage system scheduling reduces the 81% of the peak purchased power; combining the two methods, the cooling, and energy storage systems scheduling reduces the peak purchased power by 89% and the SET^* by 4%.

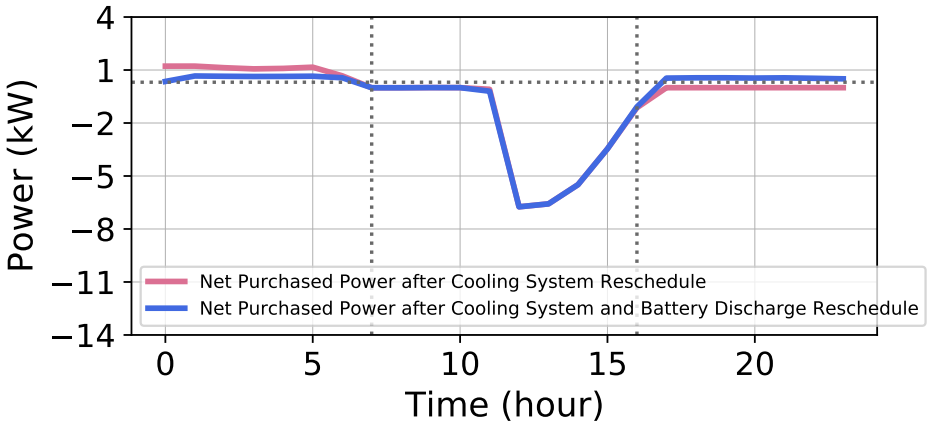
	$P_{max}(KW)$	$P_{difference}$	$SET_{max}(°C)$	$SET_{difference}$
Baseline	3.45	0 %	24.5	0 %
HVAC Scheduling	3.17	-8 %	24.9	+2 %
HVAC+Fan Scheduling	3.19	-8 %	23.8	-3 %
Energy Storage System Scheduling	0.66	-81 %	24.5	0 %
Cooling and Energy Storage Systems Scheduling	0.38	-89 %	23.4	-4 %

Table 3.1: Miami single building case study peak power and SET^* under various scheduling methods

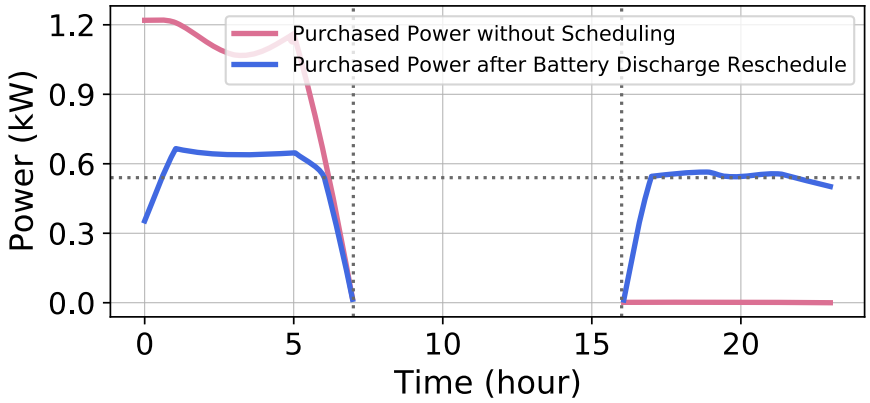
3.4.2 Single Building: Maximizing Self-sufficient Hours after Grid Shutdown

Self-sufficient hours are times during which the building's demand is supported by the PV-produced power or power from the energy storage system. Figure 3-22 shows the number of self-sufficient hours with various PV and battery capacity under default battery discharge by demand schedule. The number of hours varies from 10 to 24 depending on the capacity of the PV and battery.

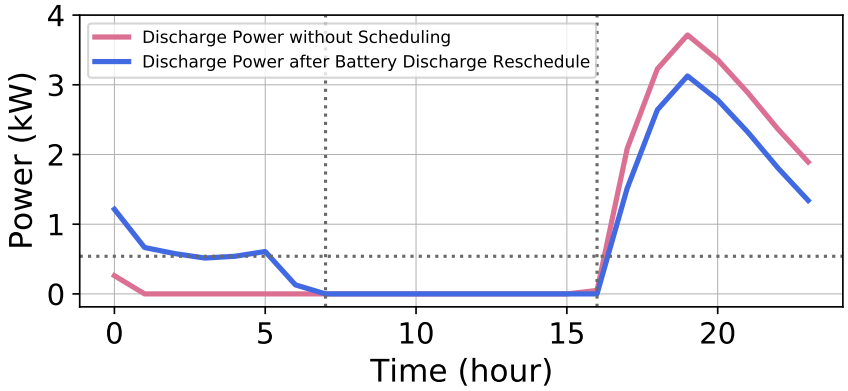
To maximize the number of self-sufficient hours in the scenario of a grid shut down after a heat wave,, the weight for reducing the demand power is raised to a higher value during the cooling system schedule optimization. After applying 90% weight to the sum of purchased power and 10% to the peak SET, the cooling system reschedule is able to reduce total purchased power by 75% compared to before the cooling reschedule, SET^* is compromised by 4%, 25.5 °C, and self-sufficiency extends to 24 hours. In the condition where the weather would be similar the following days, with cooling system scheduling the PV and battery would make the building self-sufficient.



(a) net purchased power



(b) purchased power



(c) battery discharge power

Figure 3-14: Miami single building case study net purchased power, purchased power and battery discharge power before and after applying the energy storage system scheduling method

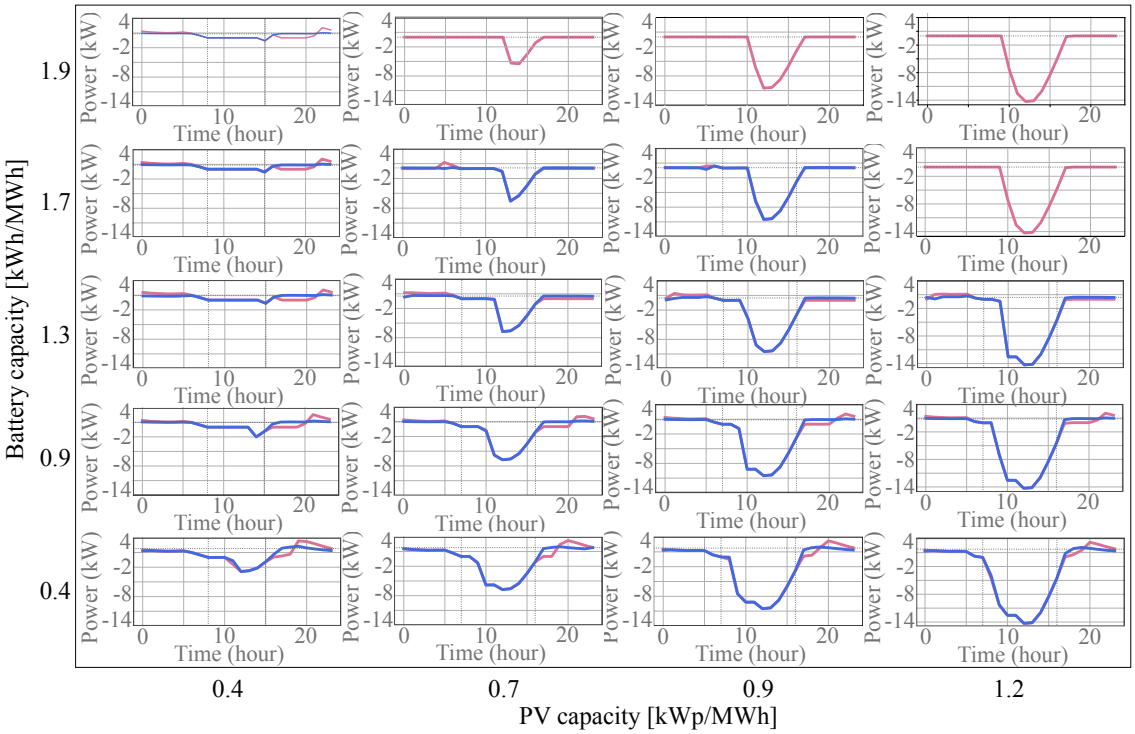
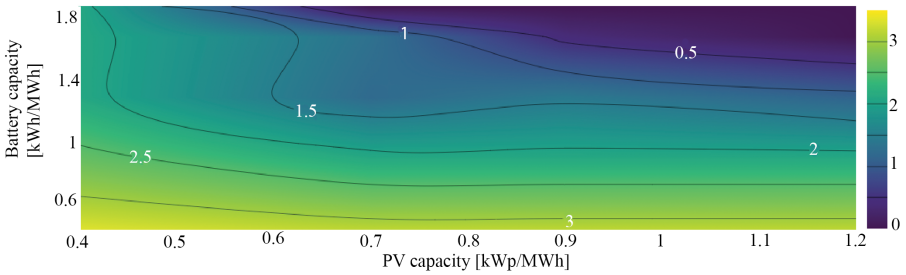
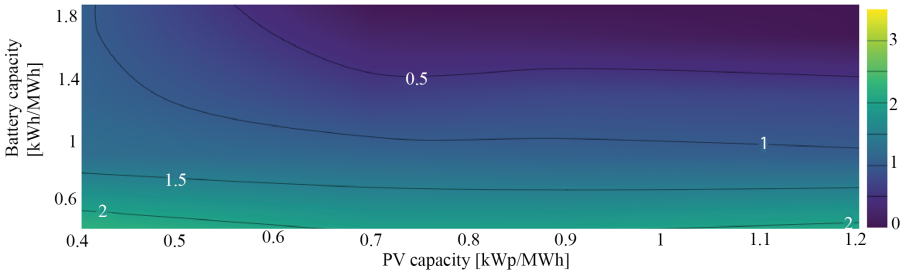


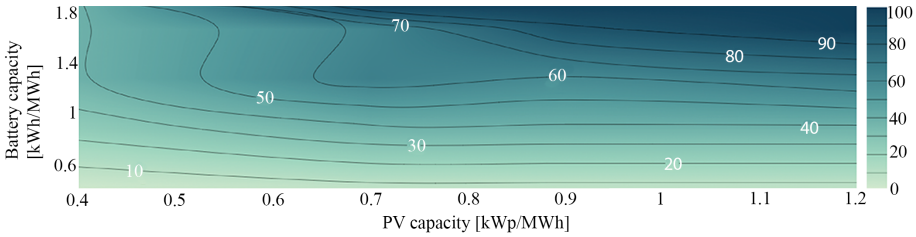
Figure 3-15: Miami single building case study net purchased power after discharge scheduling for PV and battery in various capacities



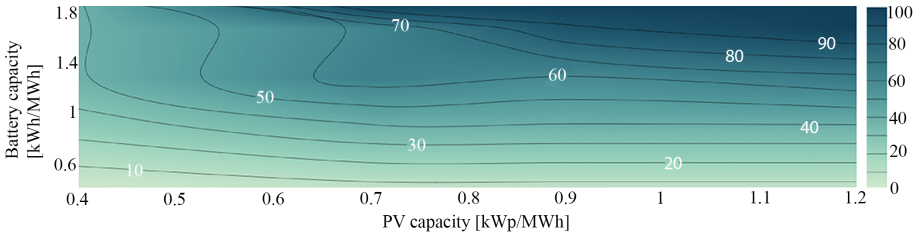
(a) Peak purchased power with default discharge schedule



(b) Peak purchased power with discharge scheduling methods

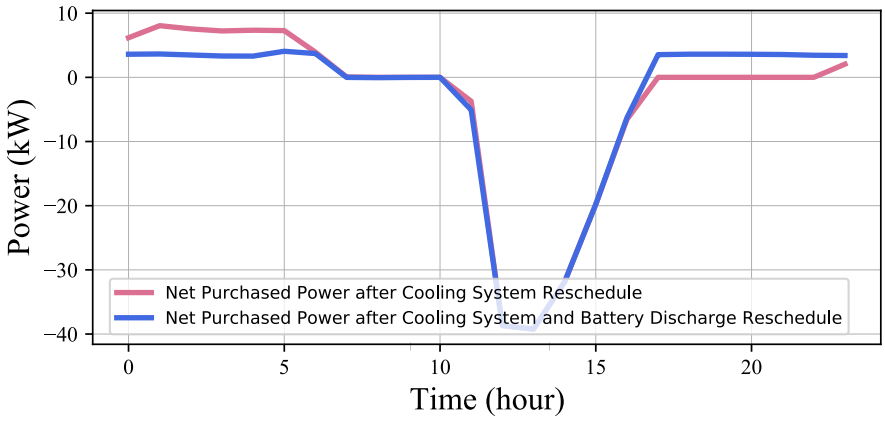


(c) Peak purchased power reduction percentage with default discharge schedule

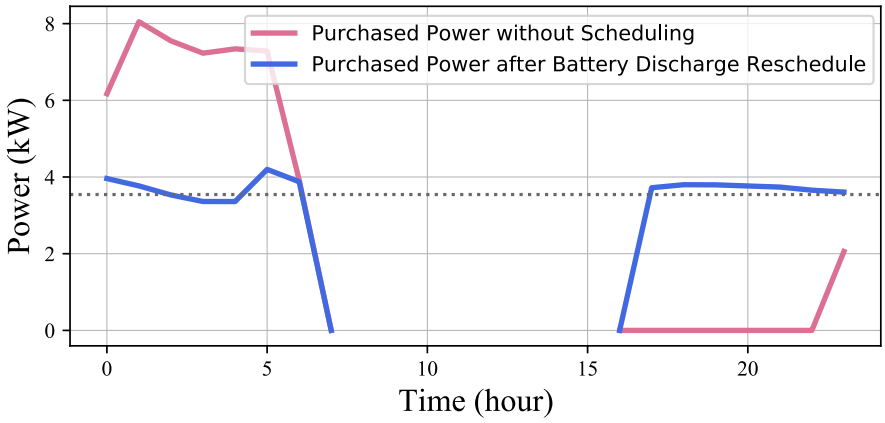


(d) Peak purchased power reduction percentage with discharge scheduling methods

Figure 3-16: Miami single building case study eak purchased power reduction before and after battery discharge scheduling for PV and battery in various capacities

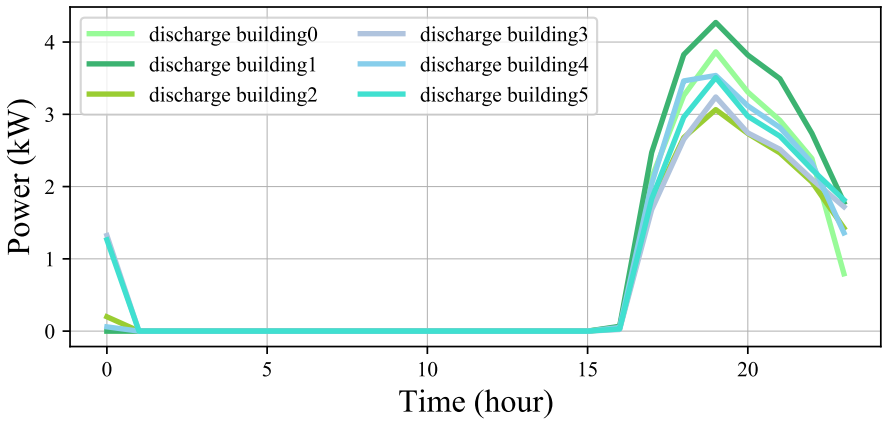


(a) net purchased power

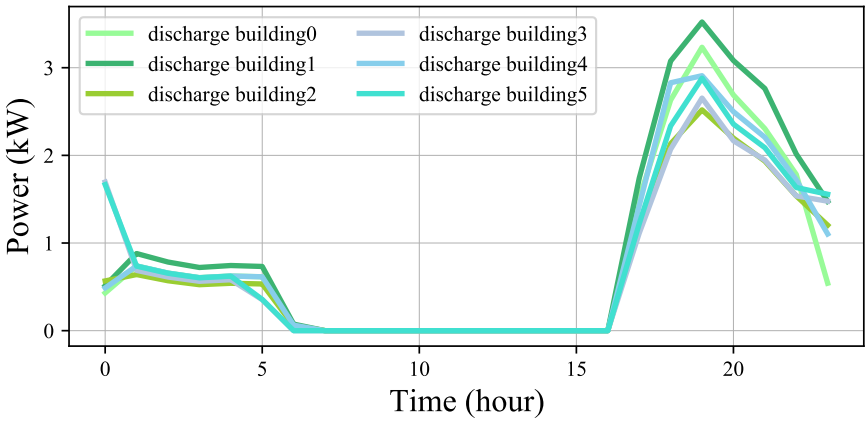


(b) purchased power

Figure 3-17: Miami six-building neighborhood case study net purchased power and purchased power before and after applying the energy storage system scheduling methods

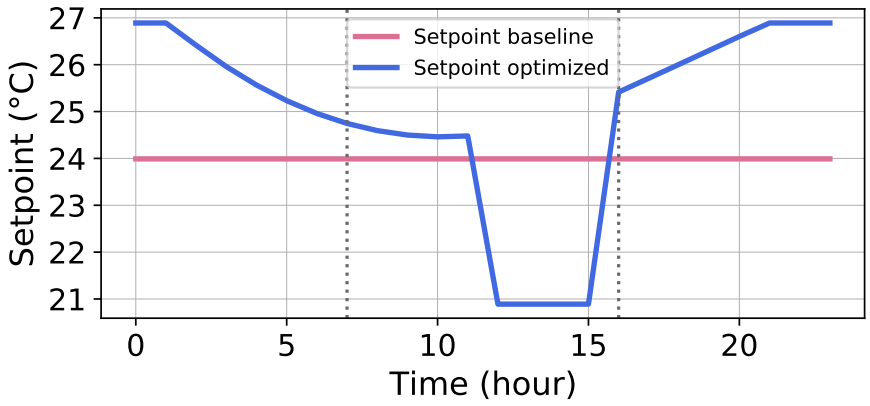


(a) battery discharge power default

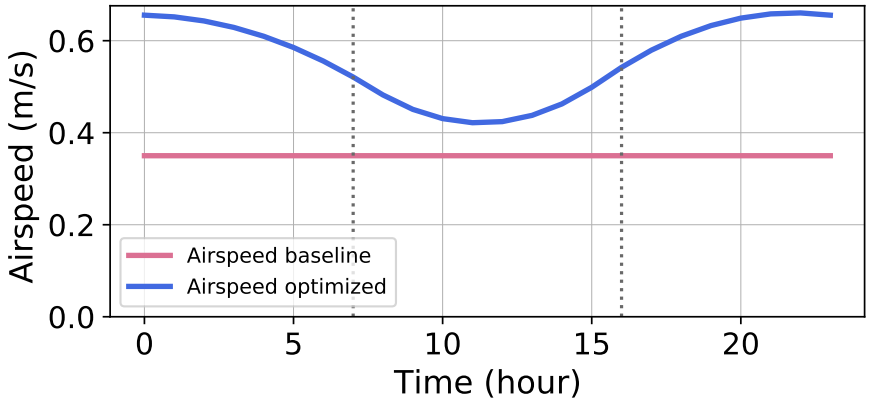


(b) battery discharge power scheduling

Figure 3-18: Miami six-building neighborhood case study individual discharge power before and after energy storage system scheduling method

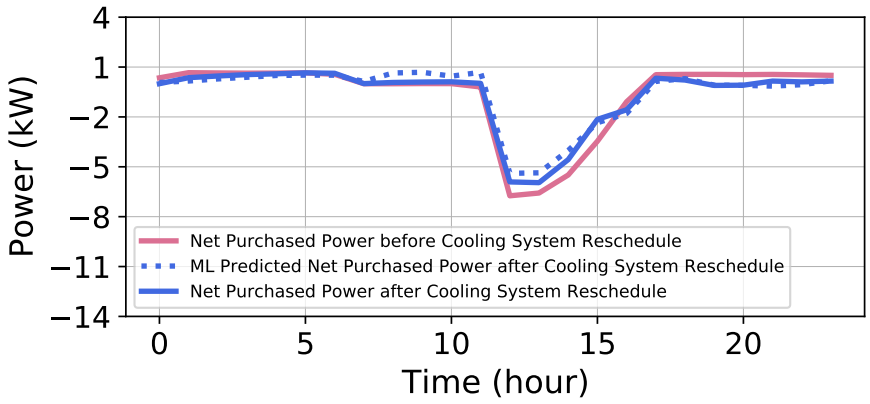


(a) setpoint schedule

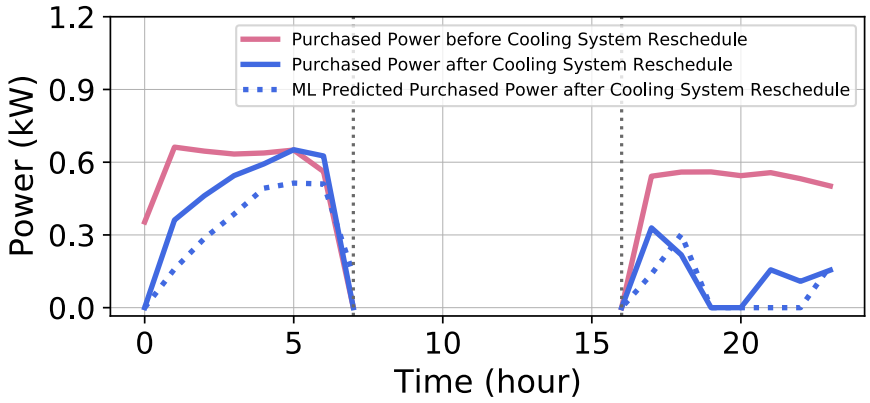


(b) air speed schedule

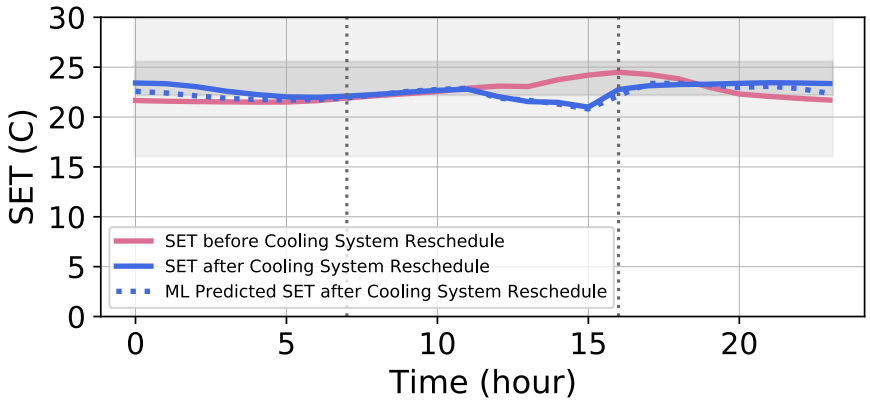
Figure 3-19: Peak Load Reduction, Miami single building case study cooling and energy storage systems scheduling, step1:cooling system scheduling



(a) net purchased power

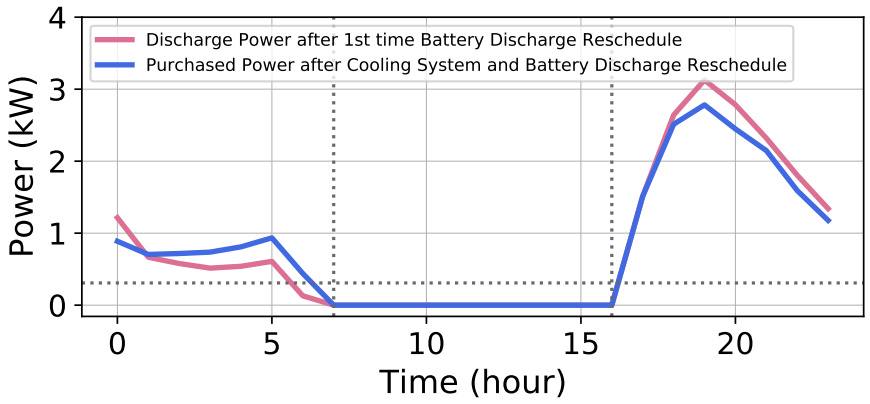


(b) purchased power

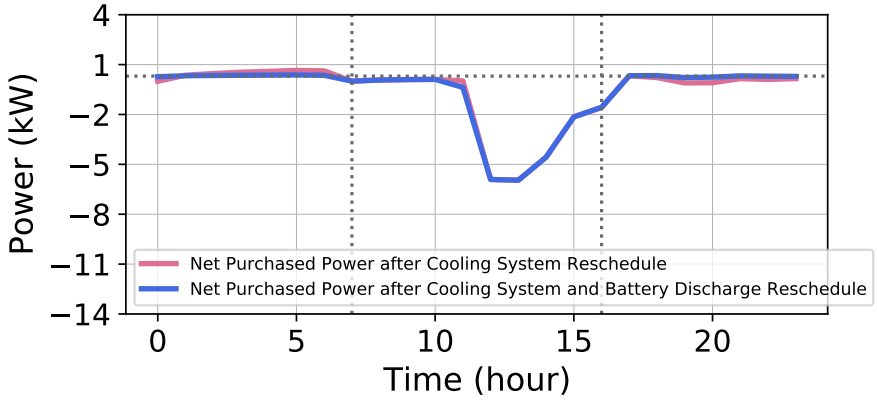


(c) SET^*

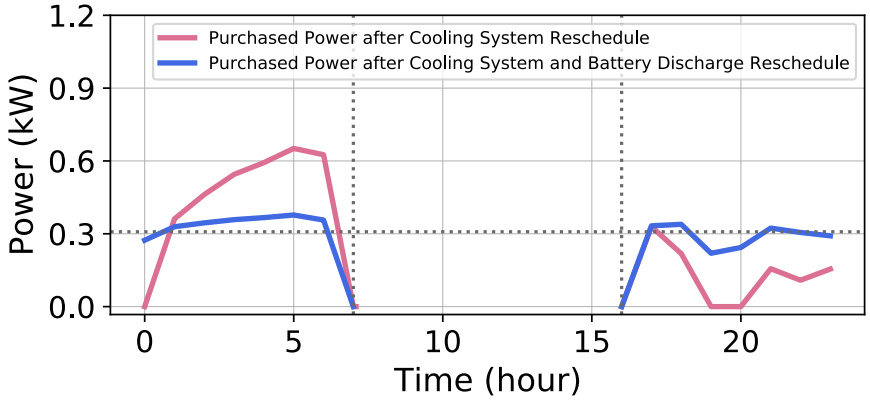
Figure 3-20: Peak Load Reduction, Miami single building case study net purchased power, purchased power and SET^* after step1: cooling system scheduling



(a) battery discharge power



(b) net purchased power



(c) purchased power

Figure 3-21: Peak Load Reduction, Miami single building case study cooling and energy storage systems scheduling, step2: energy storage system scheduling

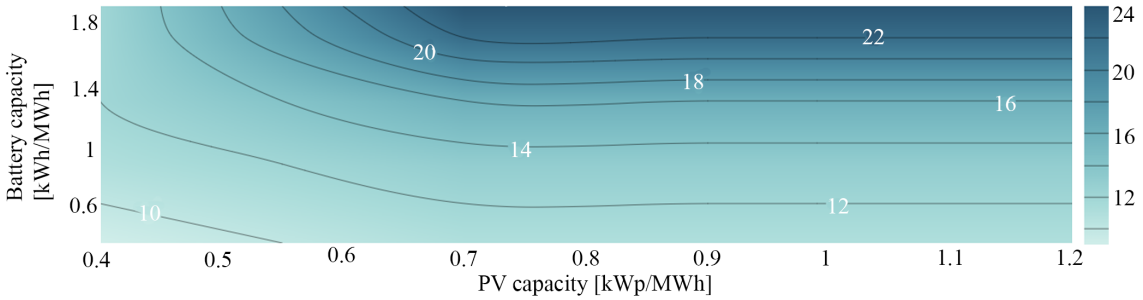
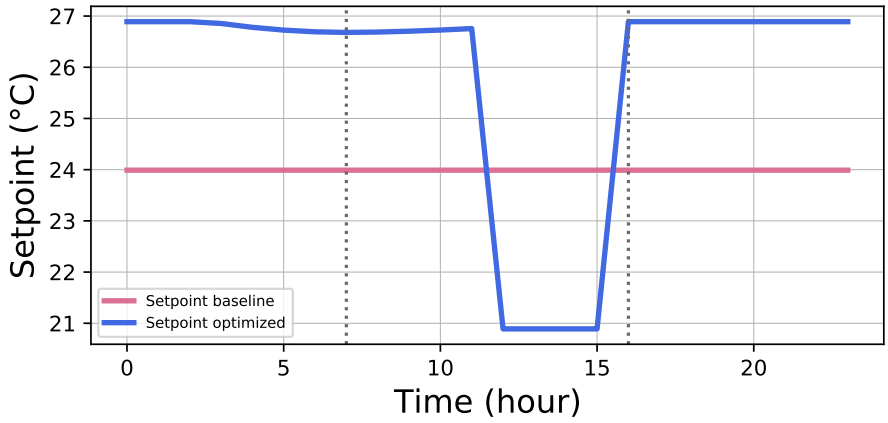
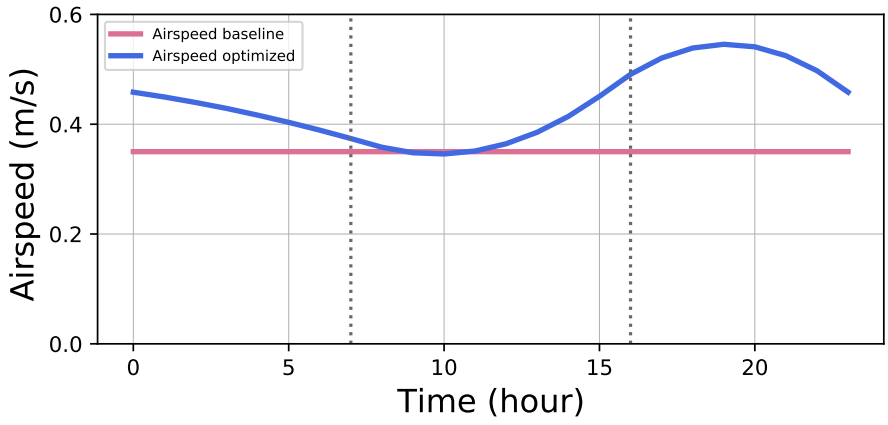


Figure 3-22: Self Sufficient Hours with PV and battery

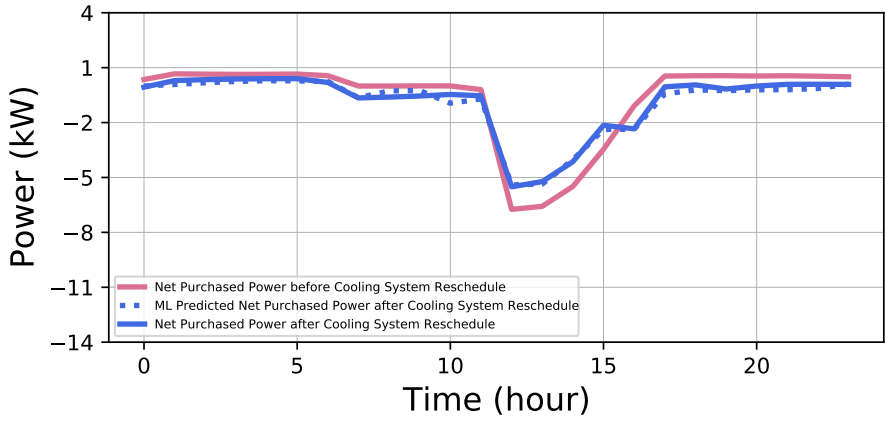


(a) setpoint schedule

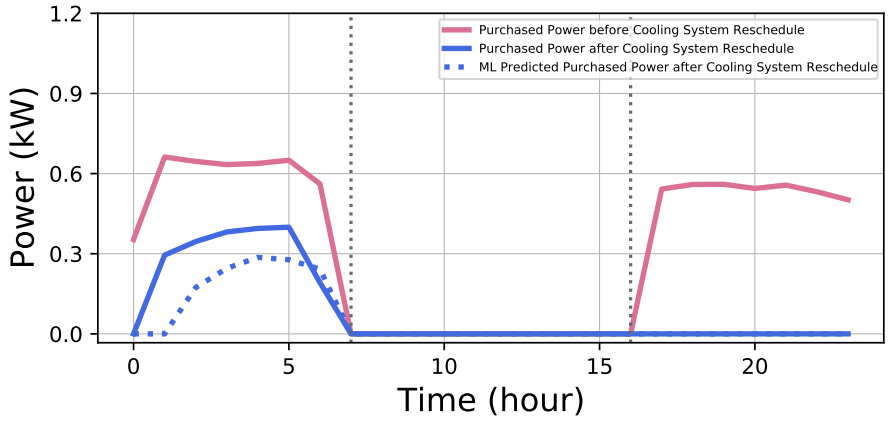


(b) air speed schedule

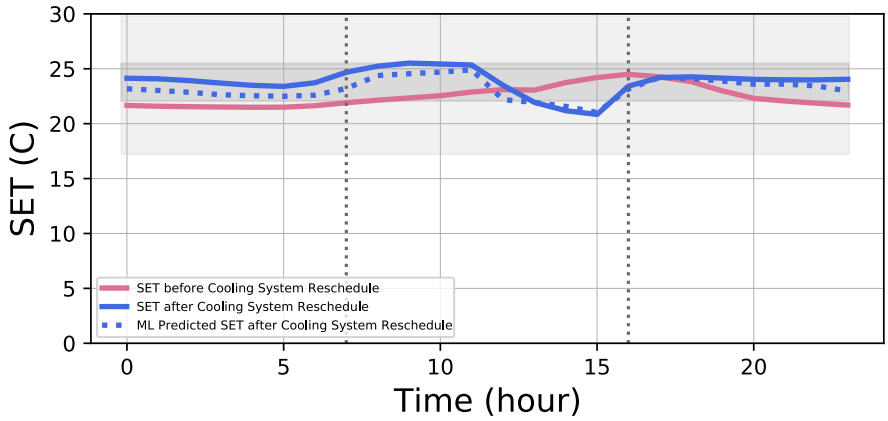
Figure 3-23: Self-sufficient hours maximization, Miami single building case study cooling and energy storage systems scheduling, step1: cooling system scheduling



(a) net purchased power



(b) purchased power



(c) SET^*

Figure 3-24: Self-sufficient hours maximization, Miami single building case study net purchased power, purchased power and SET^* after cooling system scheduling

Chapter 4

Kuwait Case Studies & Results

4.1 Kuwait Residential Case Studies Setup

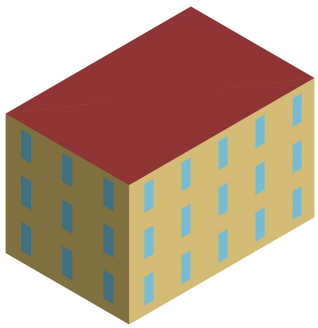
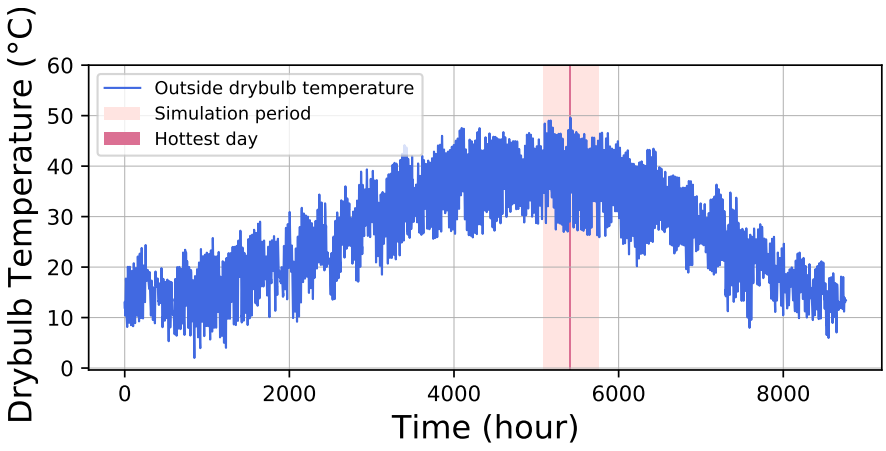
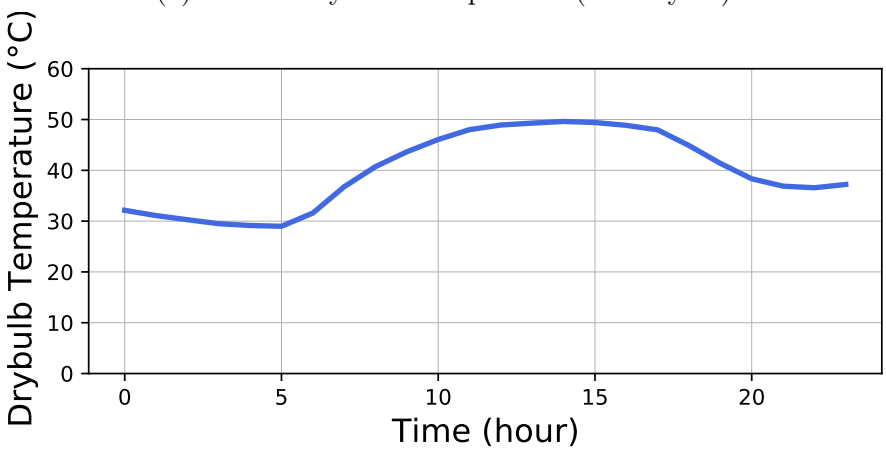


Figure 4-1: Kuwait residential case study building model

This section demonstrates the proposed methodology with a Kuwait residential building. As shown in Figure 4-1, this case study tests a multi-family residential model in Kuwait. The *EP* model is developed by the research team members, Jonathon Brearley and David Birge. The details of the model can be found in Appendix D.3.The prototype is a three-story multi-family house with a floor area of 150 m^2 on each floor, and a window-to-wall ratio of 0.15 on each side of the building. The whole building operates under one setpoint and airspeed value in this case study. The measurement of load takes the sum of the whole building, and thermal performance takes the average of all zones.



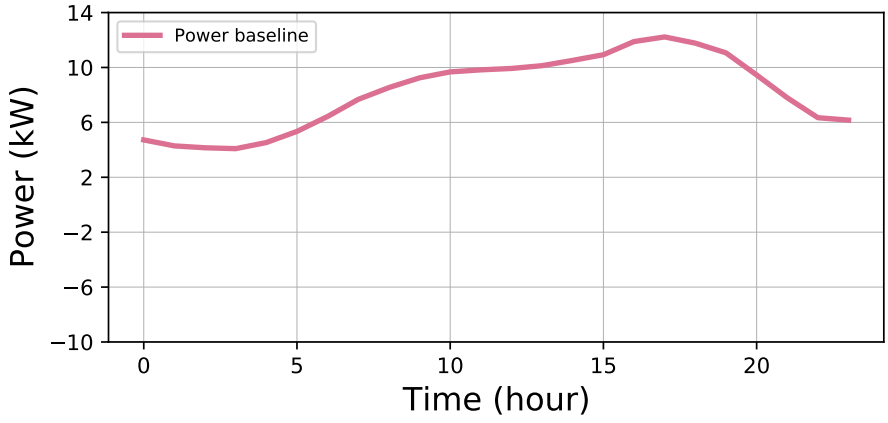
(a) outside dry bulb temperature(whole year)



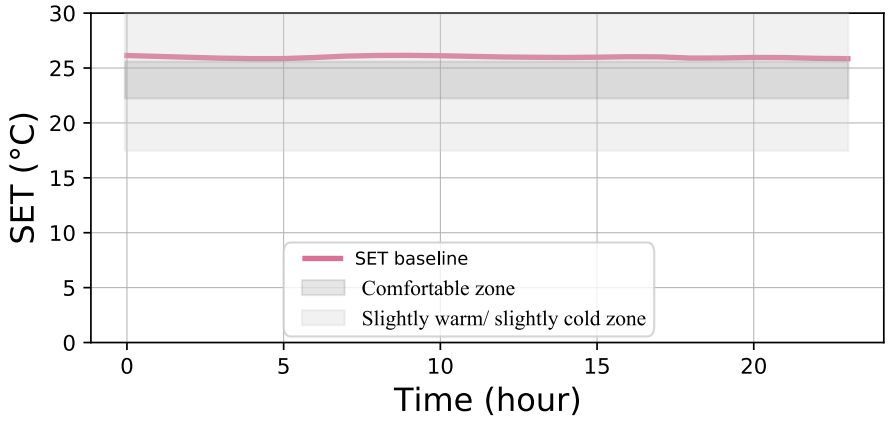
(b) outside dry bulb temperature(hottest day)

Figure 4-2: Kuwait case study outside dry bulb temperature

The Kuwait TMY3 epw file is used as the weather file for the simulation. Figure 4-2a shows the outside temperature over a year of the chosen climate profile. The summer hottest day, shown in Figure 4-2b, is set as the optimization day. A variable refrigerant flow (VRF) system is adopted for cooling. The baseline setpoint keeps the default value at 28 °C. The implementation of average airspeed and power consumption of the ceiling fan is derived from data published by Liu et al. [52]. A baseline air speed of 0.35 m/s is implemented in this test with an average power consumption of 0.48 W per floor area in m^2. The baseline hourly power consumption and SET^* are shown as a pink line in Figure 4-3a and Figure 4-3b. The darker gray and lighter gray shading boxes in Figure 4-3b indicate the thermally comfortable zone (22.2-25.6°C)



(a) power consumption(hottest day)



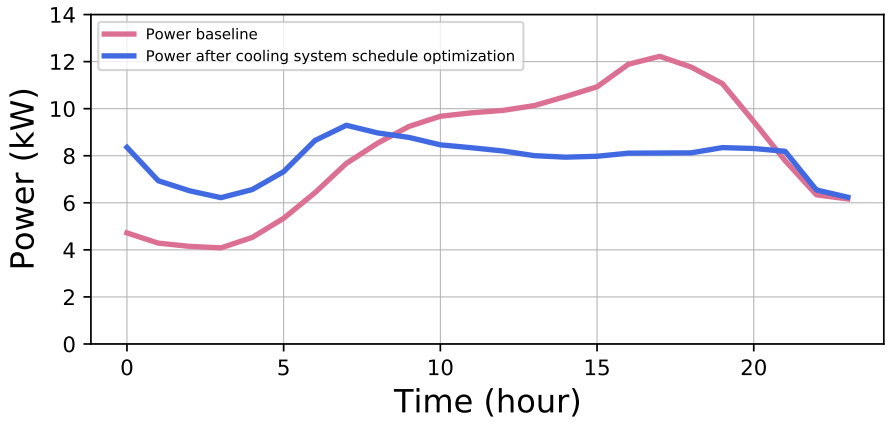
(b) SET^*(hottest day)

Figure 4-3: Kuwait residential case study baseline condition

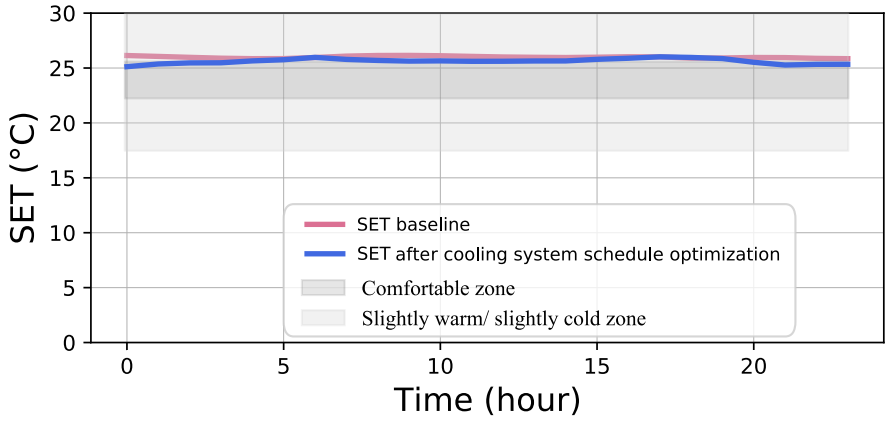
and the lightly warm/cold zone (17.5-22.2°C, 25.6-30°C) of SET^* [11]. The goal for the optimization of the case studies below is to reduce the peak load and maintain a thermally comfortable condition.

4.2 Cooling Systems Scheduling Results

Applying the cooling system scheduling methods demonstrated in Section 2.1, the optimized schedules of the cooling system setpoint and ceiling fan air speed are shown in Figure 4-5a and Figure 4-5b. The new setpoint schedule pre-cools the building earlier in the morning, then raises the setpoint temperature in the afternoon when



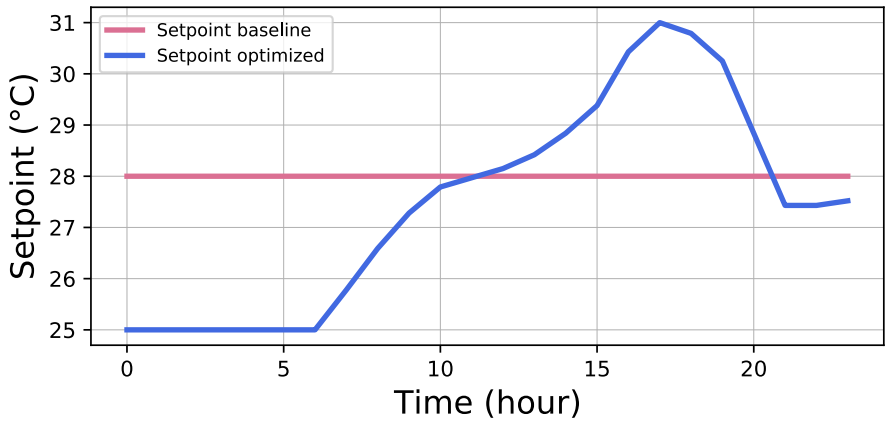
(a) demand power



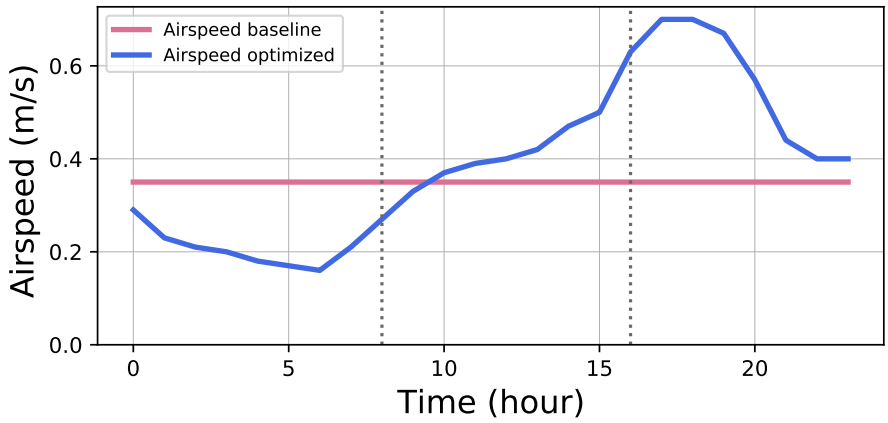
(b) SET^*

Figure 4-4: Kuwait residential case study demand power and SET^* after cooling system scheduling

the outside temperature reaches the highest. To maintain a thermally comfortable indoor environment, the ceiling fan schedule increases the air flow velocity in the afternoon. Figure 4-4a and Figure 4-4b show the power and SET before and after the scheduling. The peak load reduces from 12.2 kW to 9.3 kW, which is about a 24% reduction compared to the baseline. In the meantime, the max SET reduces 1%.



(a) setpoint schedule



(b) air speed schedule

Figure 4-5: Kuwait residential case study cooling system scheduling

4.3 Energy Storage Scheduling Results

This section adopts the energy storage scheduling method demonstrated in Section 2.2. Figure 4-7 shows the comparison of power needed from the grid between the no PV and battery and with PV and battery under baseline conditions. After applying the new energy storage discharging schedule, Figure 4-9a and Figure 4-9b show the peak net purchased power and purchased power reduction. The energy storage scheduling method reduces the peak purchased power to 2.4 kW and reaches 80% of reduction compared to the baseline. Since this section does not involve cooling system adjustment, there is no change in the thermal comfort of the building. As shown in Figure 4-9c, the new schedule relocates some of the battery discharging power from the late afternoon to early morning, which helps even out the power purchased from the grid.

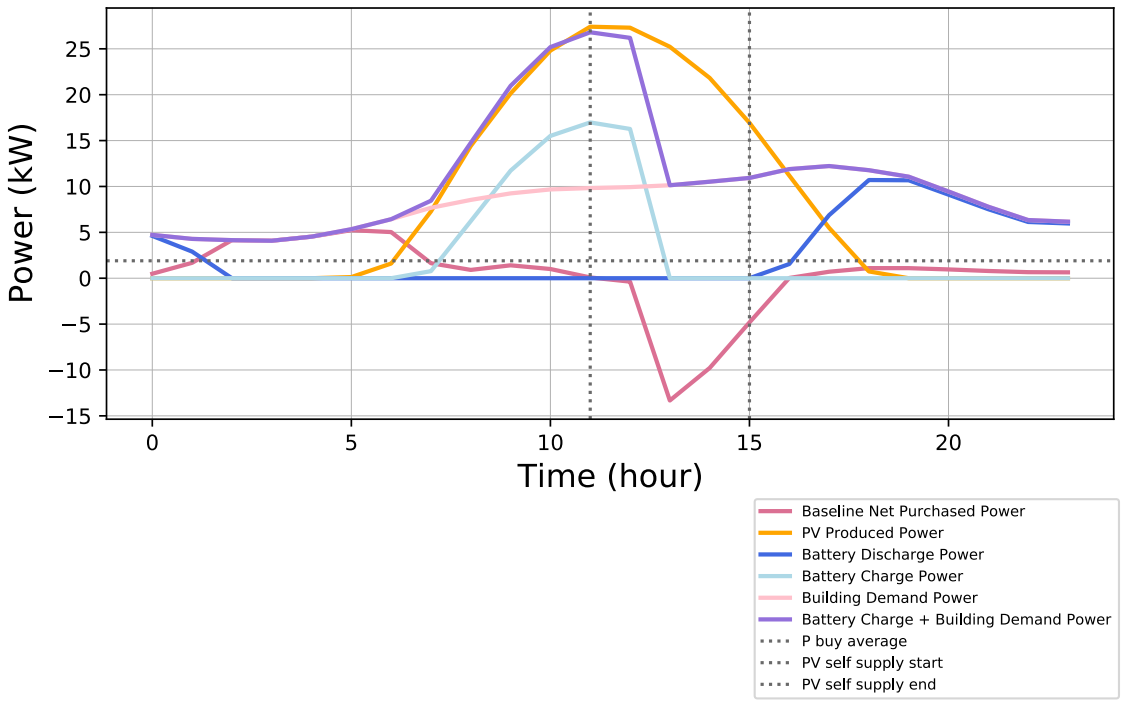


Figure 4-6: Kuwait residential building power composition

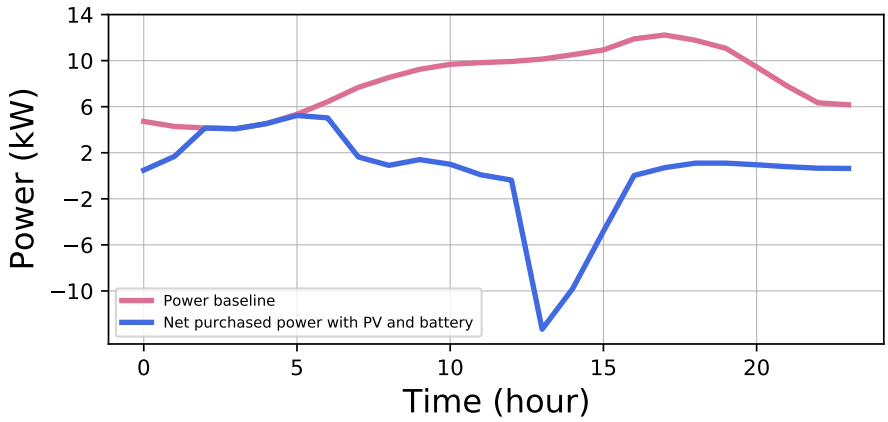


Figure 4-7: net purchased power

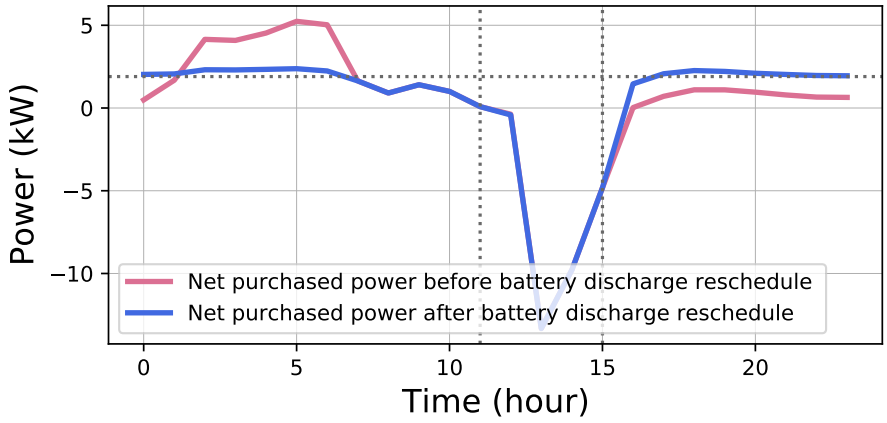
Figure 4-8: Kuwait residential case study net purchased power before and after installing PV and battery

4.4 Cooling and Energy Storage Systems Scheduling Results

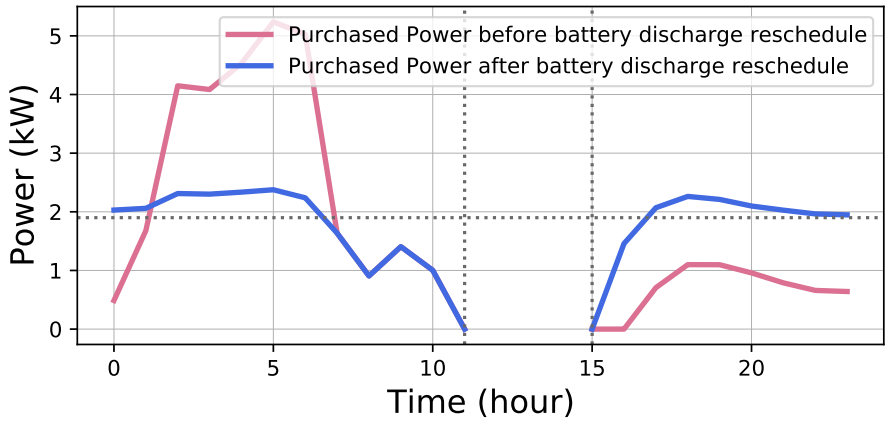
In this section, both cooling and energy storage systems are scheduled. The cooling system is scheduled first, and the energy storage scheduling would be applied after the cooling system scheduling. Following methods for optimizing the cooling system schedules in section 2.3.1 section 2.3.2 and section 2.3.3, the optimizer is set to reduce the weighted sum of the sum of purchased power and peak SET^* reduction.

4.4.1 Minimizing the Peak Purchased Power during Heat waves

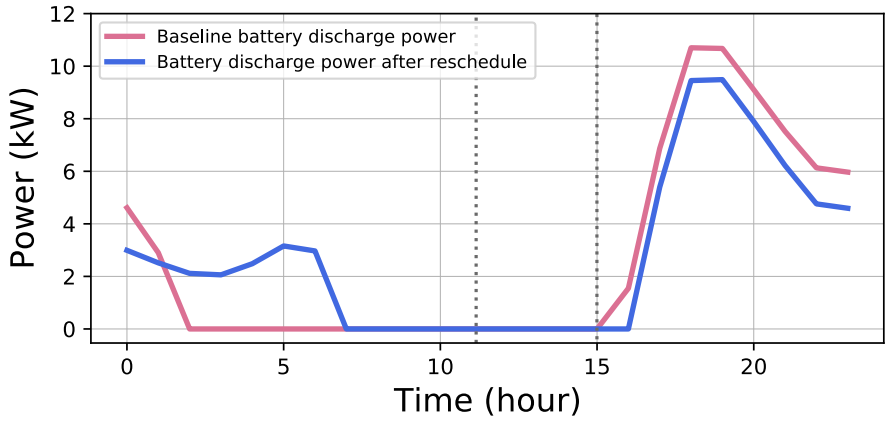
In order to minimize the peak purchased power while maintaining a thermally comfortable environment during a heat wave, with 80% weight is assigned to the sum of purchased power reduction and 20% weight assigned to the peak SET^* reduction, the optimizer created new cooling schedules as shown in Figure 4-10a and Figure 4-10b. As shown in Figure 4-11b and Figure 4-11b, the optimized cooling schedule reduced the total purchased power by 52% compared to purchased power with only energy storage system scheduled. The peak SET^* resulted from this cooling system scheduling compromised for about 6 %.



(a) net purchased power

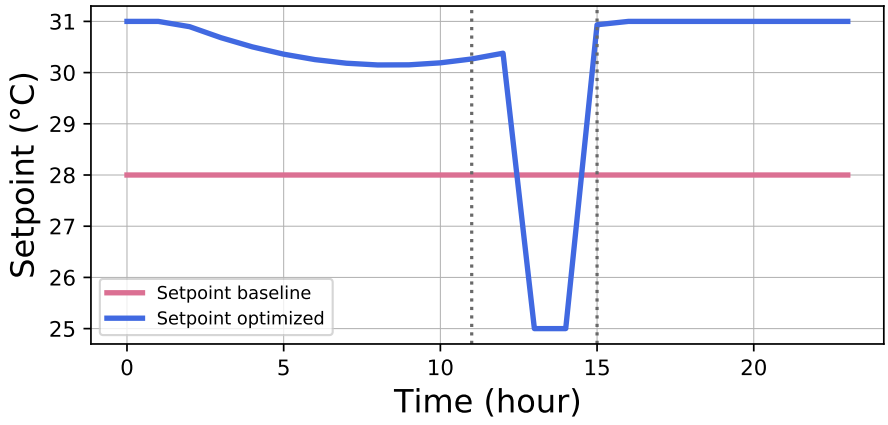


(b) purchased power

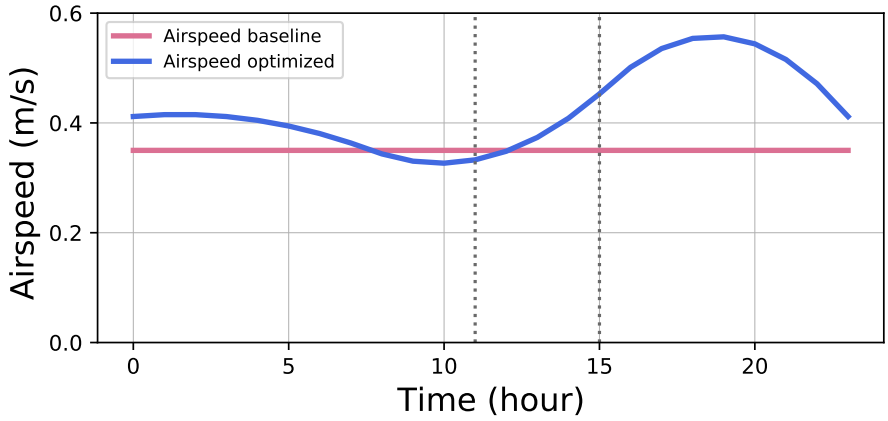


(c) battery discharge power

Figure 4-9: Kuwait residential case study net purchased power, purchased power and battery discharge power before and after applying the energy storage system scheduling method



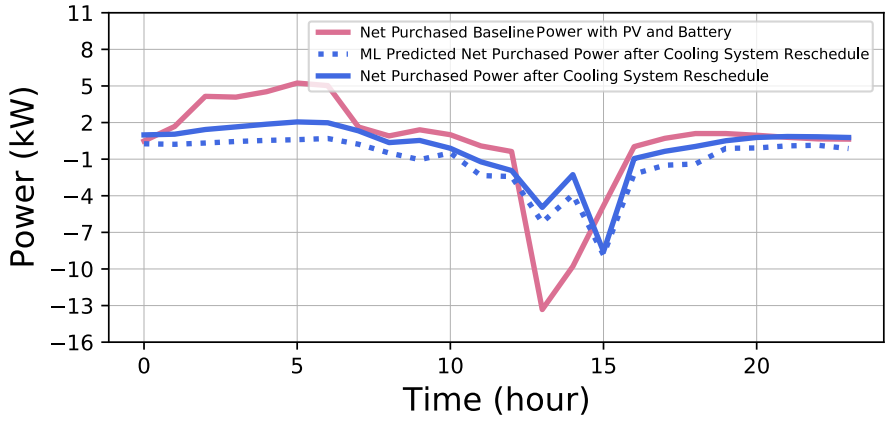
(a) setpoint schedule



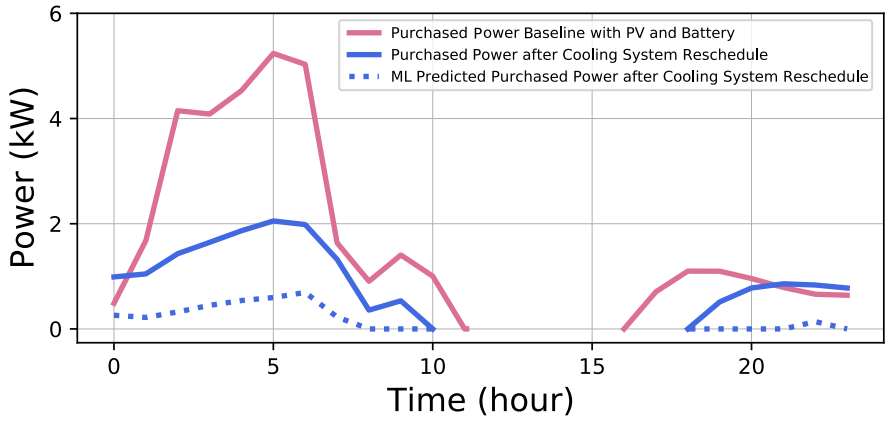
(b) air speed schedule

Figure 4-10: Peak Load Reduction, Kuwait residential case study cooling and energy storage systems scheduling, step1:cooling system scheduling

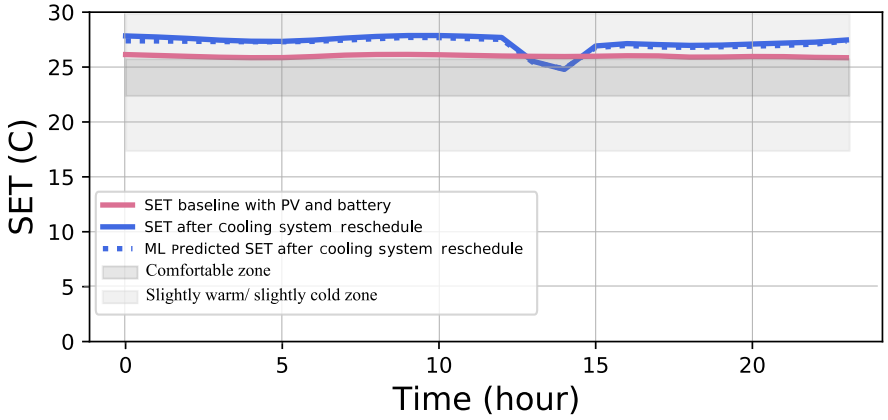
Based on the cooling system optimized results, the energy storage system scheduling methods are presented in section 2.3.4. The new battery discharge schedule shown in Figure 4-12a takes the average of the total purchased power from cooling system optimization, and relocates the discharge power to flatten the peak of the purchased power. The final net purchased power and purchased power after cooling and energy system schedules are shown in Figure 4-12b and Figure 4-12c. The peak purchased power is reduced to 1.3 kW, a decrease of about 38% compared to the purchased power of the last step, cooling system scheduling. Compared to the baseline, the peak purchased power was reduced by about 89 %, and the peak SET^* increased by



(a) net purchased power

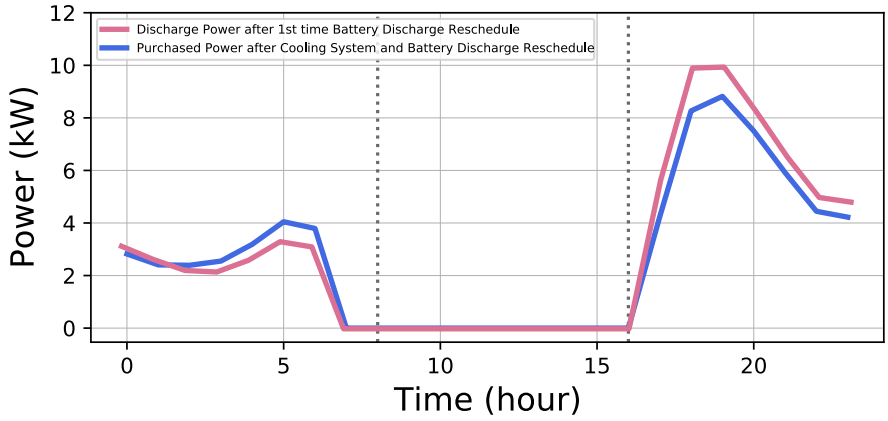


(b) purchased power

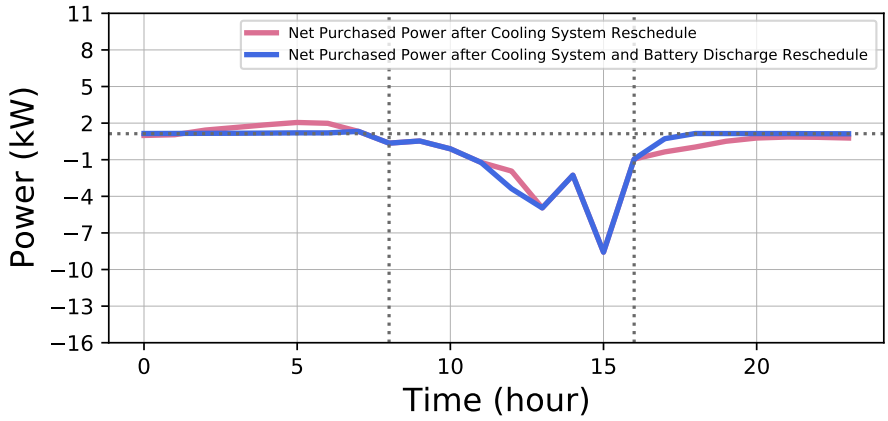


(c) SET^*

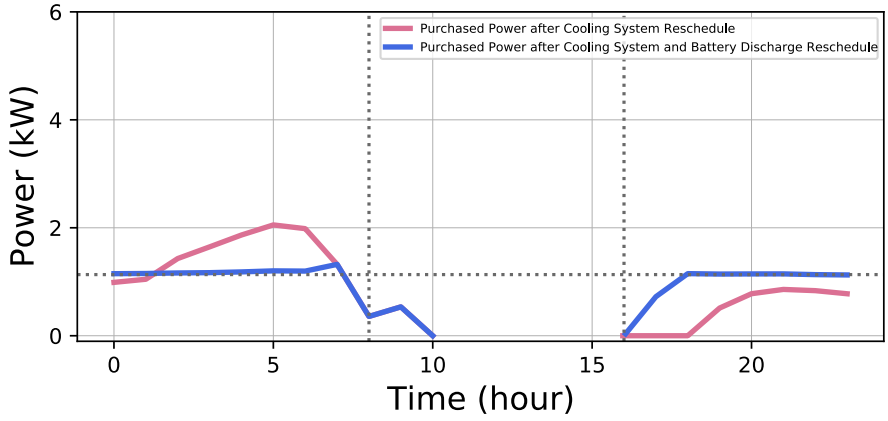
Figure 4-11: Peak Load Reduction, Kuwait residential case study net purchased power, purchased power and SET^* after step1: cooling system scheduling



(a) battery discharge power



(b) net purchased power



(c) purchased power

Figure 4-12: Peak Load Reduction, Kuwait residential case study cooling and energy storage systems scheduling, step2: energy storage system scheduling

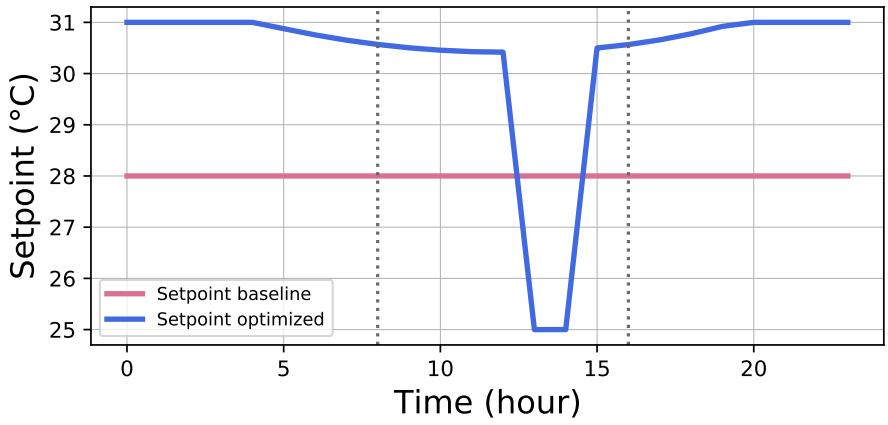
around 6%. In all, the peak load and SET^* after applying the three methods are presented in Figure 4-12a.

	$P_{max}(kW)$	$P_{reduction}$	$SET_{max}(°C)$	$SET_{reduction}$
Baseline	12.2	0 %	26.2	0 %
Cooling systems scheduling	9.3	24 %	26.0	1 %
Energy storage system scheduling	2.4	80 %	26.2	0 %
Cooling and energy storage systems scheduling	1.3	89 %	27.9	+6 %

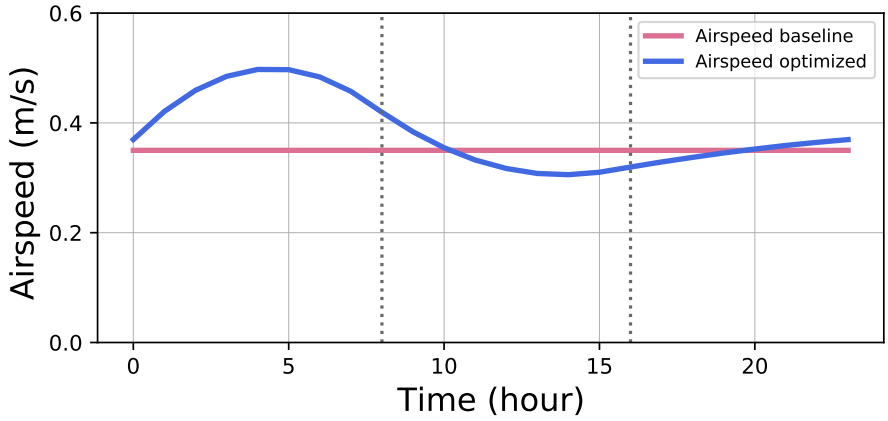
Table 4.1: Kuwait residential case study peak power and SET^* under various scheduling methods

4.4.2 Maximizing Self-sufficient Hours after Grid Shutdown

In the scenario after a grid shutdown, to maximize the number of hours that the building is able to be self-sufficient from PV produced power and the power stored in the energy storage system, this case study applied 95% weight to the total purchased power reduction and 5% to the peak SET^*. As shown in Figure 4-14b, the cooling system reschedule is able to reduce the sum of the purchased power to 14.9kWh, which is a 59 % reduction compared to the total purchased power with only battery discharge scheduling. As shown in Figure 4-14c, the peak SET^* increased 7%. Under this scenario, the resulting total power demand from the grid becomes the power needed to be supplied by the energy storage system. As result, self-sufficiency extends to 19 hours, which is 9 hours more before the cooling system scheduling. In the case study, the weather of post-grid shut down days is assumed to be similar.

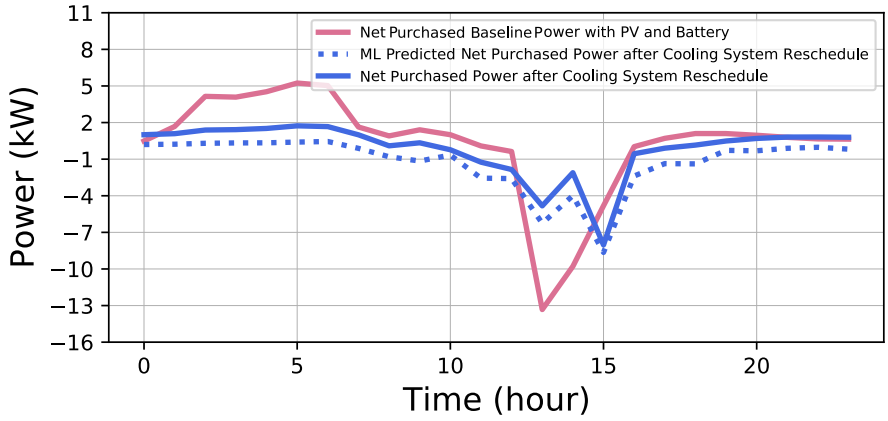


(a) setpoint schedule

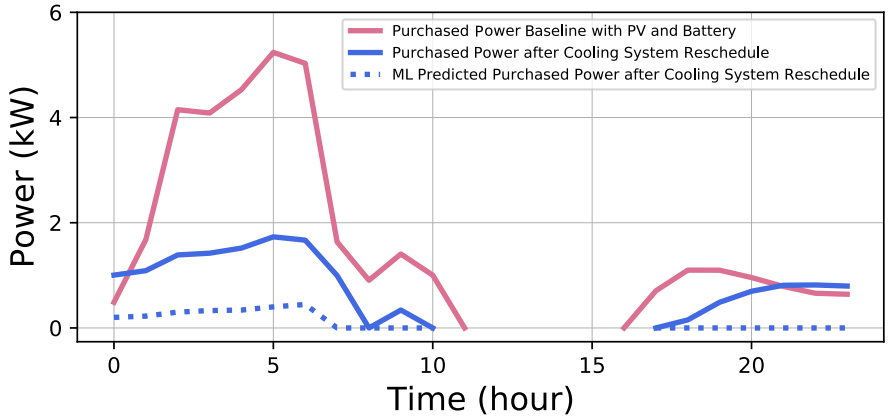


(b) air speed schedule

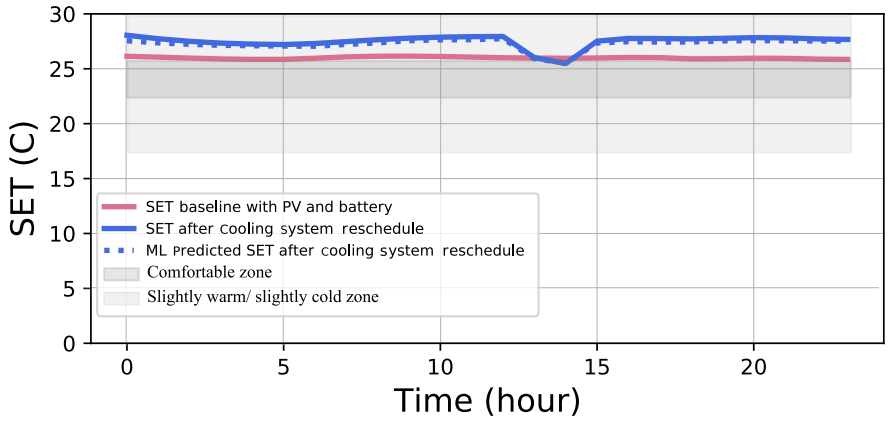
Figure 4-13: Self-sufficient hours maximization, Kuwait residential case study cooling and energy storage systems scheduling, step1: cooling system scheduling



(a) net purchased power



(b) purchased power



(c) SET^*

Figure 4-14: Self-sufficient hours maximization, Kuwait residential case study net purchased power, purchased power and SET^* after cooling system scheduling

Chapter 5

Discussion and Conclusion

This thesis proposes methods to adjust cooling and energy storage systems that mitigate demand peak and heat stress under heat waves. As shown in Table 3.1 and Table 4.1, the methods in this thesis are able to identify with low computing cost schedules that mitigate the peak power and heat stress. Ranking the scheduling results in descending order, the methods that lead to the most peak load reduction to the least are, cooling + energy systems scheduling, energy storage system scheduling, and cooling systems scheduling.

In neighborhood level, as shown in Section 3.3.2, coordinately optimizing the scheduling among the households shows more advantage in peak load reduction than separately scheduling individual households. For building level interventions such as wall R value and window U value demonstrated in Section 3.2.2, the results show that as the wall R-value increases and the window U value decreases, the scheduling methods in general is able to generate better solutions for peak load and heat stress mitigation. As a next step, the proposed methods have great potential to integrate with other heat resilient strategies such as improvements in insulation, solar shading, and thermal mass.

It is shown in Figure 3-16 that implementing PV and energy storage system with energy storage scheduling could significantly reduce the peak purchased power. The capacity of the PV and battery would influence the range of reduction. As shown in Figure 3-15, in sizing the PV and batteries, if the is capacity of the battery equals

the amount of PV produced power excluding the power supplies the demand by PV directly, further enlarging the battery would not benefit the peak load reduction; if the battery capacity with sufficient PV produced power is enough for supporting the entire building demand, further increasing the PV capacity would not further reduce the peak load. In the case studies, purchased grid power for charging the battery is not considered. A cost analysis on PV and battery capacities is conducted in Figure 3-12. Coupling the two analyses, the medium PV and battery in the studied capacities are able to achieve great peak load reduction and is much cheaper than the high PV and capacity settings.

The cooling system scheduling methods, implemented with linear regression model, are implementable in real buildings with no need for building energy models. The choice of the surrogate models and optimizer ensures computing speed and global optimality of the solutions. The implementation of the method is able to be achieved by inputting optimized schedules to air conditioner smart thermostats and fan smart speed controls such as the devices mentioned in papers [83] and [76]. Although the hardware of theses devices have been rapidly developed, the control complexity is still limited [49]. As the manufactures allows more complex control algorithms to be implemented with the smart devices, the smart-devices would be able to archive more customized goals such as reducing peak load and ensuring thermal comfort at meantime.

In order to reduce the computing cost in solving the high-dimensional multi-objective optimization problems for scheduling cooling systems, the proposed methods train linear regression models and neural network models as surrogate replacements for physics-based simulations. Due to the nature of the surrogate model, surrogate predictions of power and thermal comfort show slight differences from EP simulations, although the relative error is small.

The perturbation methods demonstrated in this thesis are based on a defined baseline model and perturbation range. If a new baseline condition or perturbation range needs to be applied, a new model would need to be trained. To offer large-scale solutions, a separate surrogate model that is able to predict the baseline and

perturbation values would be necessary.

The uncertainty observed in usage patterns in real buildings is not taken into account in the simulation based workflow. In building energy modeling, there is some research on modeling the uncertainty of use patterns in the built environment [21] [58]. In practice, model predictive control methods build off the prediction and control of the power usage based on knowledge of the previous period's energy usage [27]. The intent of the proposed simulation based workflow is to offer preliminary guidelines for power usage under heat waves, thus the uncertainty in usage patterns is not considered here.

The methods proposed in this thesis are useful for analyzing and optimizing peak building energy and thermal performance under historical or projected heat waves with adaptations in building operational schedules. The simulation-based methods offer flexible means to analyze existing buildings, building retrofits, or future construction. This thesis demonstrates the methods with air conditioner setpoint, fan speed, and battery discharging schedule optimization; the framework could extend the optimization features to other building operational schedules. In addition to the optimization target demonstrated here – peak load and heat stress mitigation – the methodology could be applied to an extended range of goals such as total energy usage, carbon emissions, and electricity costs.

Appendix A

Cooling Systems Scheduling

A.1 Baseline and Perturbation Data Generation

Set data path

```
import pandas as pd
import os
import numpy as np
from matplotlib import pyplot as plt
# get current code (ipynb) file path
ipynb_path = os.path.dirname(os.path.realpath("__file__"))
# ! REMEMBER TO CHANGE THIS EVERYTIME WE SET UP A NEW RUN!!!
current_run_tag = 'Testrun'

#".." move up one folder
# general_path is the general path where all the file relate to the
   test stored
general_path = os.path.abspath(os.path.join(ipynb_path, ".."))
# data_path where the current run data stores
data_path = os.path.join(general_path, current_run_tag)
# check whether this path exist, if not, build this path
if not os.path.exists(data_path):
    os.mkdir(data_path)
    print('Create new folder: ', data_path)
```

```
else:
    print('Folder already existed: ', data_path)
```

Set Eppy path

```
# build IDD file path for windows or mac systems
from sys import platform
if platform == "darwin":
    # Mac (IOS)
    energyplus_path = '/Applications/EnergyPlus-9-5-0'
elif "win" in platform:
    # Windows
    energyplus_path = 'C://EnergyPlusV9-5-0'
else:
    raise ValueError()
print(energyplus_path)

# set energyplus path, needs python reboot if changed
from eppy.modeleditor import IDF
IDF.setiddname(os.path.join(energyplus_path, 'Energy+.idd'))
```

Baseline data generation

```
# define weather file path
epw_name = 'USA_FL_Miami.Intl.AP.722020_TMY3.epw'
weather_filepath = os.path.join(general_path, 'weather', '
   USA_FL_Miami.Intl.AP.722020_TMY3', epw_name)
assert os.path.exists(weather_filepath)

base_fname='MIAMIPNNL' # input baseline idf file name
base_dir='{}_baserun'.format(base_fname)
perturb_dir='{}_perturb'.format(base_fname)

# establish idf file
fname= os.path.join(general_path, 'PNNLexamplefile','{}.idf'.format(
   base_fname))
assert os.path.exists(fname)
```

```
idf = IDF(fname, weather_filepath)

# identify cooling schedule in the idf file
allschedule=idf.idfobjects['Schedule:Compact']
ClgSetPSch=allschedule[-5]
VairSch=allschedule[-2]
fanSch=allschedule[0]

# build baseline output data folder first
base_output_path= os.path.join(data_path, base_dir)
if not os.path.exists(base_output_path):
    os.mkdir(base_output_path)
else:
    print('Folder already existed: ', base_output_path)

# run baseline idf file
idf.run(readvars=True, expandobjects=True, output_directory=
   base_output_path)

# read idf output csv file
Data = np.genfromtxt(os.path.join(base_output_path, "eplusout.csv"),
    delimiter=",", dtype=float, skip_header=217)
 _,c=Data.shape
Tout=Data[:,1:2] # Tout at collumn 1
MRT=Data[:,2:3]
Tair=Data[:,4:5]
RH=Data[:,5:6]
Setpt=Data[:,6:7]

SET=Data[:,c-1:c] #c
P_kw=Data[:,c-2:c-1]/1000 #kw
P_kw_cool=Data[:,c-3:c-2]/1000 #kw

# export baseline data
pd.DataFrame(P_kw).to_csv(os.path.join(base_output_path, 'p_base.csv
   '))
```

```
pd.DataFrame(SET).to_csv(os.path.join(base_output_path, "SET_base.
    csv"))
```

Listing A.1: Set Baseline Path and Generate Baseline Data

Perturbation data generation

```
# build perturbation data folder
perturb_output_path = os.path.join(data_path,perturb_dir)
if not os.path.exists(perturb_output_path):
    os.mkdir(perturb_output_path)
else:
    print('Folder already existed: ', perturb_output_path)

def perturbation(i):

    n=24 # simulation duration
    wk=4
#     smhr=240 #simulation start hr

    import random
    epw_name = 'USA_FL_Miami.Intl.AP.722020_TMY3.epw'
    weather_filepath = os.path.join(general_path, 'weather', '
    USA_FL_Miami.Intl.AP.722020_TMY3', epw_name)
    assert os.path.exists(weather_filepath)

    fname= os.path.join(general_path, 'PNNLexamplefile','{}.idf'.
    format(base_fname))
    assert os.path.exists(fname)
    idf = IDF(fname, weather_filepath)

    allschedule=idf.idfobjects['Schedule:Compact']
    ClgSetPSch=allschedule[-5]
    VairSch=allschedule[-2]
    fanSch=allschedule[0]
```

```
t_ref=23.888888888889 # celcius, baseline temperature
base_airspeed=0.35 # m/s, baseline air speed
T_range=3 # define setpoint perturbation range
W_range=0.35 # define airspeed perturbation range
W=[]

# index for field in idf schedule
i_str=3  # string field
i_num=4 # setpoint number field
i_hr=0 # field time start
time_ct=0 # count number of setpoint for a day
for time_ct in range(24):
    i_hr=i_hr+1
    fanSch['Field_{}'.format(i_str)] = 'Until: {}:00'.format(
i_hr)
    VairSch['Field_{}'.format(i_str)] = 'Until: {}:00'.format(
i_hr)
    ClgSetPSch['Field_{}'.format(i_str)] = 'Until: {}:00'.format
(i_hr)
    i_str=i_str+2

    b = [-T_range,T_range]
    choice=random.choice(b)
    ClgSetPSch['Field_{}'.format(i_num)] = t_ref+choice


    airspeed_choice=random.choice([-1,1])
    airspeed=base_airspeed+airspeed_choice*W_range
    VairSch['Field_{}'.format(i_num)] = airspeed
    W.append(airspeed_choice) # getting scaled perturbation of
airspped in 0-1 for the perturbation model training purpose
    fanSch['Field_{}'.format(i_num)] = airspeed* 10/7 # power
schedule =airspeed/0.7

    i_num=i_num+2
    time_ct=time_ct+1
```

```
    idf.run(readvars=True, expandobjects=True, output_directory=
    perturb_output_path)
    Data_1 = np.genfromtxt(os.path.join(perturb_output_path, "
    eplusout.csv"), delimiter=",", dtype=float, skip_header=217)

    _,n=Data_1.shape

    Setpt_1=Data_1[:,6:7]
    Delta_T=Setpt_1-t_ref

    SET_1=Data_1[:,n-1:n]
    Delta_SET=SET_1-SET

    P_kw_1=Data_1[:,n-2:n-1]/1000
    Delta_P=P_kw_1-P_kw

    W=np.reshape(W, (len(W), 1))
    W_nstack = np.vstack([W for i in range(7*wk)]) # 29 days:
    simulation period 7/7-8/4.
    # the perturbation data for training, we took scaled value of
    +-1

    results=np.hstack((Delta_P,Delta_SET,Delta_T,W_nstack))

    return results
```

Call perturbation function for defined number of times

```
num=50# sample size
# set up data structure for parsing training data in the next step
R=np.hstack((P_kw,SET,Setpt,Setpt)) # does not matter what content
    in it, we are just using the shape of the baseline data here,
    will be overwritten with the generated data
row,_=R.shape
t=R[0:row-7*24,:] # data start from 0_row, t matrix, training data 3
```

```
    week
t_row,_=t.shape
v=R[row-7*24:row,:] # data end in row_row, v matrix, validation data
   : last 1 week
v_row,_=v.shape

# empty matrix to be filled
train=np.zeros(t.shape)
valid=np.zeros(v.shape)

for i in range(num):
    r=perturbation(i) # result of one run of function: clg_setpoints
    ## START PARSING THE DATA
    r_t=r[0:t_row,:]
    r_v=r[t_row:row,:]
    train=np.vstack((train,r_t))
    valid=np.vstack((valid,r_v))

# take out zeros
T_row,_=train.shape
train_data=train[t_row:T_row,:]
V_row,_=valid.shape
valid_data=valid[v_row:V_row,:]

# build output path for perturbation data
data_perturb_output_path= os.path.join(perturb_output_path,"
   data_nozero")
if not os.path.exists(data_perturb_output_path):
    os.mkdir(data_perturb_output_path)

# save perturbation data
import pandas as pd
pd.DataFrame(train_data).to_csv(os.path.join(
   data_perturb_output_path,'train_data.csv'))
pd.DataFrame(valid_data).to_csv(os.path.join(
   data_perturb_output_path,'valid_data.csv'))
```

A.2 Linear Regression Model Training

Set perturbation path and import perturbation data

```
import os
import pandas as pd
import numpy as np
from matplotlib import pyplot as plt

base_fname='MIAMIPNNL'
base_dir='{}_baserun'.format(base_fname)
perturb_dir='{}_perturb'.format(base_fname)
T_range=3

# ! REMEMBER TO CHANGE THIS EVERYTIME WE SET UP A NEW RUN!!!
current_run_tag = 'Testrun'

# get current code file path
ipynb_path = os.path.dirname(os.path.realpath("__file__"))

# casestudy_path is the general path where all the file relate to
   the test stored
#".." move up one folder
general_path = os.path.abspath(os.path.join(ipynb_path, ".."))
general_path

# data_path where the current run data stores
data_path = os.path.join(general_path, "{}".format(current_run_tag))
# check whether this path exist, if not, build this path
if not os.path.exists(data_path):
    os.mkdir(data_path)
    print('Create new folder: ', data_path)
else:
    print('Folder already existed: ', data_path)
```

```
result_path = os.path.join(general_path, 'results',"{}".format(
    current_run_tag))
if not os.path.exists(result_path):
    os.mkdir(result_path)
    print('Create new folder: ', result_path)
else:
    print('Folder already existed: ', result_path)

# getting training and validation data shape
nt, _ = train_data.shape
nv, _ = val_data.shape

# getting number of iterations in perturbation data generation
samplesize=len(train_data)/24/(3*7)
samplesize=int(samplesize)
samplesize

SET_pert=train_data[:, 1]
# SET_pert
P_pert=train_data[:, 0]
# P_pert

# scaling data to 0-1
P_pert_scaled=(P_pert-P_pert.min())/(P_pert.max()-P_pert.min())
SET_pert_scaled=(SET_pert-SET_pert.min())/(SET_pert.max()-SET_pert.
    min())
```

Define memory size and train the SET perturbation model

```
m=20 # adjust memory size
# memory tuning # define memories to sweep

memories = list(range(0, m))
nm = len(memories)
```

```
# import and scale target data for training and validation
yt = (train_data[:, 1]-train_data[:, 1].min())/(train_data[:, 1].max
    ()-train_data[:, 1].min())
yv = (val_data[:, 1]-val_data[:, 1].min())/(val_data[:, 1].max()-
    val_data[:, 1].min())

# initialize error metric storage
rmset = np.zeros((nm, 1))
rmsev = np.zeros((nm, 1))
maet = np.zeros((nm, 1))
maev = np.zeros((nm, 1))

for m in memories:
    # define data matrices size with zeros
    Xt_T = np.zeros((nt, m+1)) # traindata: temperature perturbation
    Xt_W = np.zeros((nt, m+1)) # traindata: airspeed perturbation
    Xv_T = np.zeros((nv, m+1))
    Xv_W = np.zeros((nv, m+1))


    # feed info from traindata set to matrix
    for j in range(0, m+1):
        Xt_T[j:nt+1, j] = train_data[:nt-j, 2]/T_range # temperature
    # scale setpoint perturbation to 0-1
        Xt_W[j:nt+1, j] = train_data[:nt-j, 3] # airspeed scaled to
   0-1 in the data generation

        Xv_T[j:nv+1, j] = val_data[:nv-j, 2]/T_range
        Xv_W[j:nv+1, j] = val_data[:nv-j, 3]


    #2 variable, with shift
    Xt=np.hstack([np.ones((Xt_T.shape[0],1)), Xt_T,Xt_W]) # we add a
    colume of ones to shift the prediction results, so it matches
```

```
    better
     Xv=np.hstack([np.ones((Xv_T.shape[0],1)), Xv_T,Xv_W])

# no shift
#     Xt=np.hstack([Xt_T,Xt_W])
#     Xv=np.hstack([Xv_T,Xv_W])

    # least-squares model parameters, KW/C^2
    a = np.linalg.solve(np.dot(Xt.T, Xt), np.dot(Xt.T, yt))

    # compute error standard deviations
    rmset[m, 0] = np.sqrt(np.mean(np.square(yt - np.dot(Xt, a)))) #
    error
    rmsev[m, 0] = np.sqrt(np.mean(np.square(yv - np.dot(Xv, a))))

    # compute MAEs
    maet[m] = np.mean(np.abs(yt - np.dot(Xt, a)))
    maev[m] = np.mean(np.abs(yv - np.dot(Xv, a)))

# plot: error vs. memory
f, ax = plt.subplots(1)
#plt.figure()
plt.plot(memories, rmset, '-o',  memories, rmsev, '-o')
plt.xlabel('Memory m (hours)',fontsize=13)
plt.ylabel('RMSE (C)',fontsize=13)
plt.legend(['Training', 'Validation'])
plt.grid(True)
plt.title('SET Perturbation Model RMSE',fontsize=15)
ax.set_ylim(ymin=0)
# plt.xlim((0, 10))
plt.ylim((0, 0.2))
plt.savefig(os.path.join(result_path ,'SET_RMSE_scale_shift_m{}
    _sample{}_{}.png'.format(m+1,samplesize,base_fname)))
plt.show()
```

Visualize trained model prediction and save trained

model coefficients

```
Y=yv[0:96] # Power perturbation from data
Yc=np.dot(Xv,a)[0:96] # X*beta # c for calculate

plt.figure(figsize=(11.25, 7.875))
plt.plot(Y,'-'  ,Yc, '-')
plt.xlabel('Time (hours)',fontsize=13)
plt.ylabel('SET (C)',fontsize=13)
plt.legend(['Original Data', 'Perturbation Model Prediction'])
plt.grid(True)
plt.rcParams["figure.figsize"] = (10,6)
plt.title('SET Prediction Validation',fontsize=15)
plt.xticks(np.arange(0, 96, step=12))
plt.savefig(os.path.join(result_path ,'
   SETpredictioncomparison_scale_shift_m{}_sample{}_{}.png'.format(m
   +1,samplesize,base_fname)))
plt.show()

# compute error standard deviations
rmset = np.sqrt(np.mean(np.square(yt - np.dot(Xt, a))))
rmsev = np.sqrt(np.mean(np.square(yv - np.dot(Xv, a))))

# compute MAEs
maet = np.mean(np.abs(yt - np.dot(Xt, a)))
maev = np.mean(np.abs(yv - np.dot(Xv, a)))

# report
print('----------------------------')
print('Training RMSE:', round(rmset, 2))
print('Validation RMSE:', round(rmsev, 2))
print('Tuned Parameters')
print('Memories:', m+1)
#print('Temperature Threshold:', thetaMin+1)
print('Coefficients:', a)

t_rmse='Training RMSE', rmset
```

```
v_rmse='Validation RMSE', rmsev
rmse=[t_rmse,v_rmse]
pd.DataFrame(rmse).to_csv(os.path.join(result_path,'
    SET_rmse_scale_shift_m{}_sample{}_{}.csv'.format(m+1,samplesize,
    base_fname)))

# save coefficient
pd.DataFrame(a).to_csv(os.path.join(data_path,perturb_dir,'
    SET_a_scale_shift_m{}_sample{}.csv'.format(m+1,samplesize)))
```

Define memory size and train the power perturbation model

```
m=20 # define memory size
# memory tuning # define memories to sweep

memories = list(range(0, m))
nm = len(memories)

# import and scale target data for training and validation
yt = (train_data[:, 0]-train_data[:, 0].min())/(train_data[:, 0].max
    ()-train_data[:, 0].min())
yv = (val_data[:, 0]-val_data[:, 0].min())/(val_data[:, 0].max()-
    val_data[:, 0].min())

# initialize error metric storage
rmset = np.zeros((nm, 1))
rmsev = np.zeros((nm, 1))
maet = np.zeros((nm, 1))
maev = np.zeros((nm, 1))

for m in memories:
    # define data matrices size with zeros
    Xt_T = np.zeros((nt, m+1)) # traindata: temperature perturbation
    Xt_W = np.zeros((nt, m+1)) # traindata: airspeed perturbation
```

```
    Xv_T = np.zeros((nv, m+1))
    Xv_W = np.zeros((nv, m+1))


    # feed info from traindata set to matrix
    for j in range(0, m+1):
        Xt_T[j:nt+1, j] = train_data[:nt-j, 2]/T_range # temperature
        Xt_W[j:nt+1, j] = train_data[:nt-j, 3] # airspeed

        Xv_T[j:nv+1, j] = val_data[:nv-j, 2]/T_range
        Xv_W[j:nv+1, j] = val_data[:nv-j, 3]


    # 2 variables
    Xt=np.hstack([np.ones((Xt_T.shape[0],1)), Xt_T,Xt_W])
    Xv=np.hstack([np.ones((Xv_T.shape[0],1)), Xv_T,Xv_W])

    #shift with a constant 1
#     Xt=np.hstack([Xt_T,Xt_W])
#     Xv=np.hstack([Xv_T,Xv_W])

    # least-squares model parameters, KW/C^2
    a = np.linalg.solve(np.dot(Xt.T, Xt), np.dot(Xt.T, yt))

    # compute error standard deviations
    rmset[m, 0] = np.sqrt(np.mean(np.square(yt - np.dot(Xt, a)))) #
   error
    rmsev[m, 0] = np.sqrt(np.mean(np.square(yv - np.dot(Xv, a))))

    # compute MAEs
    maet[m] = np.mean(np.abs(yt - np.dot(Xt, a)))
    maev[m] = np.mean(np.abs(yv - np.dot(Xv, a)))

plt.figure(figsize=(11.25, 7.875))
f, ax = plt.subplots(1)
plt.plot(memories, rmset, '-o',  memories, rmsev, '-o')
```

```
plt.xlabel('Memory m (hours)',fontsize=13)
plt.ylabel('RMSE(kw)',fontsize=13)
plt.legend(['Training', 'Validation'])
plt.grid(True)
plt.title('Power perturbation Model RMSE',fontsize=15)
#ax.set_ylim(ymin=0)
#plt.xlim((0, 10))
#plt.ylim((0, 2.5))
plt.savefig(os.path.join(result_path,'Power_RMSE_scale_shift_m{}
    _sample{}_{}.png'.format(m+1,samplesize,base_fname)))
# plt.show()
```

Visualize trained model prediction and save trained model coefficients

```
Y=yv[0:96] # Power purterbation from data
Yc=np.dot(Xv,a)[0:96] # X*beta # c for calculate
plt.figure(figsize=(11.25, 7.875))
plt.plot(Y,'-'  ,Yc, '-')
plt.xlabel('Time (hours)',fontsize=13)
plt.ylabel('Power(kw)',fontsize=13)
plt.legend(['Original Data', 'Perturbation Model Prediction'])
plt.grid(True)
plt.rcParams["figure.figsize"] = (10,6)
plt.title('Power Prediction Validation',fontsize=15)
plt.xticks(np.arange(0, 96, step=12))
plt.savefig(os.path.join(result_path,'
    Powerpredictioncomparison_scale_shift_m{}_sample{}_{}.png'.format
    (m+1,samplesize,base_fname)))
plt.show()
# compute error standard deviations
rmset = np.sqrt(np.mean(np.square(yt - np.dot(Xt, a))))
rmsev = np.sqrt(np.mean(np.square(yv - np.dot(Xv, a))))

# compute MAEs
```

```
maet = np.mean(np.abs(yt - np.dot(Xt, a)))
maev = np.mean(np.abs(yv - np.dot(Xv, a)))

# report
print('----------------------------')
print('Training RMSE:', round(rmset, 2))
print('Validation RMSE:', round(rmsev, 2))
print('Tuned Parameters')
print('Memories:', m+1)
#print('Temperature Threshold:', thetaMin+1)
print('Coefficients:', a)
t_rmse='Training RMSE', rmset
v_rmse='Validation RMSE', rmsev
rmse=[t_rmse,v_rmse]
pd.DataFrame(rmse).to_csv(os.path.join(result_path,'
    Power_rmse_scale_shift_m{}_sample{}_{}.csv'.format(m+1,samplesize
    ,base_fname)))
# save coefficient
pd.DataFrame(a).to_csv(os.path.join(data_path,perturb_dir,'
    power_a_scale_shift_m{}_sample{}.csv'.format(m+1,samplesize)))
```

A.3 CVX Optimization and Cooling Systems Scheduling

Set data Path, import baseline data and trained models

```
import pandas as pd
import numpy as np
from matplotlib import pyplot as plt
import os
import cvxpy as cp
```

```
import math

# ! REMEMBER TO CHANGE THIS EVERYTIME WE SET UP A NEW RUN!!!
current_run_tag = 'Testrun'
base_fname='MIAMIPNNL'

base_dir='{}_baserun'.format(base_fname)
perturb_dir='{}_perturb'.format(base_fname)
cvx_dir='{}_cvx'.format(base_fname)
TPcvx_dir='{}_cvx_T&P'.format(base_fname)

m=20
T_range=3
W_range=0.35
smhr=240 # simulation hour is the 240th hour of the simulation
   period, since 240th hour is the start of the hottest day(7/29),
   we used this day as the optimization day
T_ref=23.888888888889
n= 24
perturbation_method='scale_shift'
sim_period=24
# get current code file path
ipynb_path = os.path.dirname(os.path.realpath("__file__"))

#".." move up one folder
# general_path is the general path where all the file relate to the
   test stored
general_path = os.path.abspath(os.path.join(ipynb_path, ".."))
# data_path where the current run data stores
data_path = os.path.join(general_path,"{}".format(current_run_tag))
# check whether this path exist, if not, build this path
if not os.path.exists(data_path):
    os.mkdir(data_path)
    print('Create new folder: ', data_path)
else:
    print('Folder already existed: ', data_path)
```

```
result_path= os.path.join(general_path, 'results',"{}".format(
    current_run_tag))
# check whether this path exist, if not, build this path
if not os.path.exists(result_path):
    os.mkdir(result_path)
    print('Create new folder: ', result_path)
else:
    print('Folder already existed: ', result_path)

base_output_path = os.path.join(data_path,base_dir)
if os.path.exists(base_output_path):
    print('Folder already existed: ',base_output_path)

perturb_output_path = os.path.join(data_path,perturb_dir)
if os.path.exists(perturb_output_path):
    print('Folder already existed: ',perturb_output_path)
cvx_output_path = os.path.join(data_path,cvx_dir)
if not os.path.exists(cvx_output_path):
    os.mkdir(cvx_output_path)
    print('Create new folder: ',cvx_output_path)
else:
    print('Folder already existed: ',cvx_output_path)

method_cvx_output_path = os.path.join(cvx_output_path,
    perturbation_method)
if not os.path.exists(method_cvx_output_path):
    os.mkdir(method_cvx_output_path)
    print('Create new folder: ',method_cvx_output_path)
else:
    print('Folder already existed: ',method_cvx_output_path)

train_data=pd.read_csv(os.path.join(data_path,perturb_dir,'
    data_nozero','train_data.csv'),header=0)
train_data= np.asarray(train_data).squeeze()
train_data=train_data[:,1:5]
```

```
val_data=pd.read_csv(os.path.join(data_path,perturb_dir,'data_nozero
    ','valid_data.csv'),header=0)
val_data= np.asarray(val_data).squeeze()
val_data=val_data[:,1:5]

samplesize=len(train_data)/24/21
samplesize=int(samplesize)

P_pert=train_data[:, 0]
SET_pert=train_data[:, 1]

P_perturbmax=P_pert.max()
P_perturbmin=P_pert.min()
SET_perturbmax=SET_pert.max()
SET_perturbmin=SET_pert.min()

# import perturbation model coefficient
a1= np.genfromtxt(os.path.join(perturb_output_path,"power_a_{}_m{}
    _sample{}.csv".format(perturbation_method,m,samplesize)),
    delimiter=",", dtype=float, skip_header=1)
a1=a1[:,1]
a1 # for dP

a2= np.genfromtxt(os.path.join(perturb_output_path,"SET_a_{}_m{}
    _sample{}.csv".format(perturbation_method,m,samplesize)),
    delimiter=",", dtype=float, skip_header=1)
a2=a2[:,1]
a2 #for SET

# import baseline load, Power consumption from energyplus simulation
     data base run
# for unitary file, baseline only take cooling power for now
# for david file, baseline = total power
pbase_all = pd.read_csv(os.path.join(base_output_path,'p_base.csv'),
    header=0)
```

```
pbase_all= np.asarray(pbase_all).squeeze()
pbase_all=pbase_all[:,1]

Pbasemax=pbase_all.max()
Pbasemin=pbase_all.min()

# import baseline SET, Power consumption from energyplus simulation
    data base run
# for unitary file, baseline only take cooling power for now
# for david file, baseline = total power
SETbase_all = pd.read_csv(os.path.join(base_output_path,'SET_base.
    csv'), header=0)
SETbase_all = np.asarray(SETbase_all).squeeze()
SETbase_all=SETbase_all[:,1]

SETbasemax=SETbase_all.max()
SETbasemin=SETbase_all.min()
```

Define CVX optimization function

```
#optimization function
def optimization_function_new(a, n, m, Pbase,a2,SETbase,p,s,sP,sS,
    scon,smul,pcon,pmul):
    # Input:
    #  a: (m+1, 1) np array, parameter vector beta,coefficient
    imported from perturbation model
    #  n: int, time duration (used to be called `K`), we simulate
    time `0` to time `n-1`
    #  m: int, number of coefficients (memory of trace back)
    #  Pbase: (n , 1) np array, baseline P values, value imported
    from data base run
    # Return:
    #  the optimized solution for the designated horizon (n=24, 24
    hours)
    # including both deltaP and deltaT
```

```
    # we assume that delta_T(0) = ... = delta_T()
    # make zero metrix as placeholder for matrix

    dTmem = np.zeros(m-1) # temperature
    dWmem = np.zeros(m-1) # airspeed

    # declare variable, x is the deltaT (dT) we are trying to solve
   for, x2 is the dW
    # index remapping: x(k) = dT(k-m+1) <=> dT(k) = x(k+m-1)
    #vector variable

    x = cp.Variable(n+m-1) # dT
    x2 = cp.Variable(n+m-1) # dW

    dP = cp.Variable(n) #objective
    dS= cp.Variable(n) # objective

    objective = cp.Minimize(s*((cp.max(SETbase + dS)-SETbasemin)/(
   SETbasemax-SETbasemin))+p*(1*((cp.max(Pbase + dP)-Pbasemin)/(
   Pbasemax-Pbasemin)))+sS*cp.sum(cp.abs(dS[1:n]-dS[:n-1]))+sP*cp.
   sum(cp.abs(dP[1:n]-dP[:n-1])))

    # 2 variable
    constraints = [x[0:m-1] == dTmem,x2[0:m-1] == dWmem] #,x3[0:1]
   == dRmem,x4[0:1] == dMmem]
    # 1 variable
#     constraints = [x[0:m-1] == dTmem]

    # if n>24 dTmem take previous last m-1 hr

    for k in range(n):
        # dP(k) = a(m)*dT(k-m+1) + ... + a(1)*dT(k)
        #       = a(m)*x(k+m-1)+ ... + a(1)*x(k)
        #       = a'*[x(k+m-1); ...; x(k)]
        #       = a'*flipped([x(k+m-1); ...; x(k)])
```

```
        # if a has a0 included
        #       = a'*flipped([x(k+m-1); ...x(k);1])

        # print(np.dot(a, x[k:k + m]))
        # Xt=np.hstack([np.ones((Xt.shape[0],1)), Xt])
        #print(len(a))

        # your perturbation model defined here, # coeffient * k

        # if statement make sure the for when shift perturbation is
    used, (there will be m+1 coeffients), the x matrix would have
    allones collumn
        if len(a) == m:
            constraints += [dP[k] == cp.sum(cp.multiply(a, x[k: k +
    m]))]
            constraints += [dS[k] == cp.sum(cp.multiply(a2, x[k: k +
     m]))]

        else:
            #scaled objective, 1 variable
            #dPscaled=(dP-dP.min())/(dP.max()-dP.min())-> dP=
    dPscaled*(dP.max()-dP.min())+dP.min()
#             constraints += [dP[k] == P_perturbmin+(P_perturbmax-
    P_perturbmin)*(cp.sum(cp.multiply(a,  cp.hstack([x[k: k + m],1]))
    ))]
#             constraints += [dS[k] == SET_perturbmin+(
    SET_perturbmax-SET_perturbmin)*(cp.sum(cp.multiply(a2,  cp.hstack
    ([x[k: k + m],1])))))]

#           # obj not scalled, 1variable
#             constraints += [dP[k] == cp.sum(cp.multiply(a, cp.
    hstack([x[k: k + m],1])))] # hstack 1 add to the end, to match
    the a_flip
#             constraints += [dS[k] == cp.sum(cp.multiply(a2, cp.
    hstack([x[k: k + m],1])))]
```

```
            # scaled obj, 2 variable
            constraints += [dP[k] == P_perturbmin+(P_perturbmax-
    P_perturbmin)*(cp.sum(cp.multiply(a, cp.hstack([x2[k: k + m],x[k:
     k + m],1])))))] # hstack 1 add to the end, to match the a_flip
            constraints += [dS[k] == SET_perturbmin+(SET_perturbmax-
    SET_perturbmin)*(cp.sum(cp.multiply(a2, cp.hstack([x2[k: k + m],x
    [k: k + m],1])))))]

            # obj not scaled, 2 variable
#             constraints += [dP[k] == cp.sum(cp.multiply(a, cp.
    hstack([x2[k: k + m],x[k: k + m],1])))] # hstack 1 add to the end
    , to match the a_flip
#             constraints += [dS[k] == cp.sum(cp.multiply(a2, cp.
    hstack([x2[k: k + m],x[k: k + m],1])))]

        constraints += [cp.abs(x[m-1:n+m])<=1] # dT_setpoint perturb
        constraints += [cp.abs(x2[m-1:n+m])<=1] # dW_Airspeed
    perturb


     prob = cp.Problem(objective, constraints)

#     prob.solve()
     prob.solve(verbose=True) # turn verbose on for sampling method
#     print("status:", prob.status)
#     print("optimal value", prob.value)

     plt.figure(figsize=(11.25, 7.875))
     step = range(n)
     plt.plot(step, Pbase, step, Pbase+dP.value)
     plt.xlabel('Time[Hour]')
     plt.ylabel('[kw]')
     plt.grid(True)
     plt.legend(['Baseline','Optimized'])
     plt.title('Power Consumption_day{}'.format(i/n))
     # adjust the top leaving bottom unchanged
```

```
    plt.yticks(np.arange(0, 4.5, step=0.5))  # Set label locations.
    plt.show()

    plt.figure(figsize=(11.25, 7.875))
    step = range(n)
    plt.plot(step, SETbase, step, SETbase+dS.value)
    plt.xlabel('Time[Hour]')
    plt.ylabel('SET[C]')
    plt.grid(True)
    plt.legend(['Baseline','Optimized'])
    plt.title('SET_day{}'.format(i/n))
    # adjust the top leaving bottom unchanged
    plt.yticks(np.arange(0, 32, step=4))  # Set label locations.
    plt.show()

    # temperature plot (optimized and unoptimized)
    plt.figure(figsize=(11.25, 7.875))
    plt.plot(step, T_range*x.value[m-1:m+n]+T_ref)
    plt.ylabel('C')
    plt.xlabel('Hour')
    plt.title('Setpoint_Perturbation_day{}'.format(i/n))
    plt.yticks(np.arange(18, 30, step=1))
    plt.grid(True)
    plt.show()

#      temperature plot (optimized and unoptimized)
    plt.figure(figsize=(11.25, 7.875))
    plt.plot(step, x2.value[m-1:m+n]*W_range+0.35)
    plt.ylabel('m/s')
    plt.xlabel('Hour')
    plt.title('air velocity_Perturbation_day{}'.format(i/n))
    plt.yticks(np.arange(0, 0.8, step=0.1))  # set the ylim to
   bottom, top
    plt.grid(True)
    plt.show()
```

```
#     return the optimized solution for the designated horizon (24
    hours) take out the memory size value
#     print(len(x.value[m-1:]))
#     print(x.value[m-1:])
#     print(x.value)
#     print(len(x.value))
    return dP.value,dS.value,x.value[m-1:],x2.value[m-1:]
```

Sampling optimization for defined size

```
a1_flip = np.flip(a1)
a2_flip = np.flip(a2)
# flip coefficient a to match the order of x matrix
from smt.sampling_methods import LHS

xlimits = np.array([[0.000, 1.000]])
sampling = LHS(xlimits=xlimits)

num =1000 #!!! define sampling size here
Q = sampling(num)

s_group=Q[:, 0] # radom number from 0-1

P_max=[]
S_max=[]

p_weight=[]
s_weight=[]

optimal_dP = []
optimal_dT = []
optimal_dS = []
optimal_dW = []
n=24
```

```
for k in range (num):
    s=s_group[k] # weight for SET: randomly generated number 0-1
    p=1-s # weight for P: 1-weight_SET
    sS=0.003 # Weight for smoothing the optimized result, adjust the
    value here, try a few, see what is making sense
    sP=0.003

    for i in range(0, sim_period, n):
        Pbase = pbase_all[i+smhr:smhr+i+n] # specifying the
   optimizing day, for here is 8/14, start from hr 312
        SETbase = SETbase_all[i+smhr:smhr+i+n]

        #start calling the optimization:function
   optimization_function_new, dT and dP are returns from the
   optimization function
        dP,dS,dT,dW= optimization_function_new(a1_flip, n, m, Pbase,
   a2_flip,SETbase,p,s,sP,sS,scon,smul,pcon,pmul)

        P_max.append(max(Pbase+dP))
        S_max.append(max(SETbase+dS))


        p_weight.append(p)
        s_weight.append(s)


        # accumulate return results to the list
        optimal_dT = optimal_dT + list(dT)
        optimal_dP = optimal_dP + list(dP)
        optimal_dS = optimal_dS + list(dS)
        optimal_dW = optimal_dW + list(dW)


# round up results
for j in range(len(optimal_dT)):
    if abs(optimal_dT[j]) <= 10**(-3):
```

```
        optimal_dT[j] = 0.0
    else:
        optimal_dT[j] = round(optimal_dT[j], 2)

for j in range(len(optimal_dW)):
    if abs(optimal_dW[j]) <= 10**(-3):
        optimal_dW[j] = 0.0
    else:
        optimal_dW[j] = round(optimal_dW[j], 2)
pd.DataFrame(optimal_dT).to_csv(os.path.join(method_cvx_output_path
    ,'dT_m{}_MOO{}_sample{}.csv'.format(m,num,samplesize)))
pd.DataFrame(optimal_dP).to_csv(os.path.join(method_cvx_output_path
    ,'dP_m{}_MOO{}_sample{}.csv'.format(m,num,samplesize)))
pd.DataFrame(optimal_dS).to_csv(os.path.join(method_cvx_output_path
    ,'dS_m{}_MOO{}_sample{}.csv'.format(m,num,samplesize)))
pd.DataFrame(optimal_dW).to_csv(os.path.join(method_cvx_output_path
    ,'dW_m{}_MOO{}_sample{}.csv'.format(m,num,samplesize)))
pd.DataFrame(P_max).to_csv(os.path.join(method_cvx_output_path,'
    P_max_m{}_MOO{}_sample{}.csv'.format(m,num,samplesize)))
pd.DataFrame(S_max).to_csv(os.path.join(method_cvx_output_path,'
    S_max_m{}_MOO{}_sample{}.csv'.format(m,num,samplesize)))
```

Read optimization results, define weights for the peak power and SET reduction, visualizing the optimized results.

```
P_max= np.genfromtxt(os.path.join(method_cvx_output_path,'P_max_m{}
    _MOO{}_sample{}.csv'.format(m,num,samplesize)),delimiter=",",
    dtype=float,skip_header=1)
P_max=P_max[:,1]
S_max= np.genfromtxt(os.path.join(method_cvx_output_path,'S_max_m{}
    _MOO{}_sample{}.csv'.format(m,num,samplesize)),delimiter=",",
    dtype=float,skip_header=1)
S_max=S_max[:,1]
```

```
# define your weight here for the objective function
s_weight=0.20
p_weight=0.80
# the objective is the weighted sum of the scaled max P and SET
   reduction
objective_score=((P_max-min(P_max))/(max(P_max)-min(P_max)))*
   p_weight+((S_max-min(S_max))/(max(S_max)-min(S_max)))*s_weight
q1=objective_score.tolist().index(min(objective_score))
q1
result_path = os.path.join(result_path,base_fname)
if not os.path.exists(result_path):
    os.mkdir(result_path)
    print('Create new folder: ',result_path)
else:
    print('Folder already existed: ',result_path)

result_output_path = os.path.join(result_path,'s{}p{}index{}'.format
   (s_weight,p_weight,q1))
if not os.path.exists(result_output_path):
    os.mkdir(result_output_path)
    print('Create new folder: ',result_output_path)
else:
    print('Folder already existed: ',result_output_path)
plt.figure(figsize=(11.25, 7.875))
plt.plot(P_max, S_max, "o")
plt.plot(P_max[q1],S_max[q1], "o",color='orange')

plt.xlabel("Peak Power [kw]",fontsize=13)
plt.ylabel("Peak SET [C]",fontsize=13)
plt.legend(['MOO sampling {}'.format(num),'best solution {}_SET {}
   _power, index {}'.format(s_weight,p_weight,q1)])#,'best solution
   about 20%_SET 80%_power, index {}'.format(q2),'best solution
   about 20%_SET 80%_power, index {}'.format(q3)])#,'best solution
   about 20%_SET 80%_power, index {}'.format(q4),'best solution
   about 20%_SET 80%_power, index {}'.format(q5)])
plt.title('MOO sampling and solution',fontsize=15)
```

```
plt.savefig(os.path.join(result_output_path,'MOO single index.png'))
plt.show()
```

Check Optimized Results with EP Simulation, Set data path and import baseline and optimized data

```
import os
import numpy as np
import pandas as pd
from matplotlib import pyplot as plt

index=1
sweight=0.25
pweight=0.75
base_fname='MIAMIPNNL'
current_run_tag = 'Testrun'

samplesize=1# number of ep run in data generation

base_dir='{}_baserun'.format(base_fname)
perturb_dir='{}_perturb'.format(base_fname)
cvx_dir='{}_cvx'.format(base_fname)
TPcvx_dir='{}_cvx_T&P'.format(base_fname)

m=20 # perturbation model training memory size
num=2 # moo sampling size

W_range=0.35
T_range=3

T_ref=23.888888888889
smhr=240 # simulation hour is the 240th hour of the simulation
   period, since 240th hour is the start of the hottest day(7/29),
   we used this day as the optimization day
sim_begin_day=29
```

```
sim_begin_month=7
sim_period = 24 # number of hours
n=24 #optimization period, hr

perturbation_method='scale_shift'

# get current code file path
ipynb_path = os.path.dirname(os.path.realpath("__file__"))

#".." move up one folder
# general_path is the general path where all the file relate to the
   test stored
general_path = os.path.abspath(os.path.join(ipynb_path, ".."))
# data_path where the current run data stores
data_path = os.path.join(general_path, "{}".format(current_run_tag))
# check whether this path exist, if not, build this path
if not os.path.exists(data_path):
    os.mkdir(data_path)
    print('Create new folder: ', data_path)
else:
    print('Folder already existed: ', data_path)

result_path = os.path.join(general_path, 'results',"{}".format(
   current_run_tag),base_fname,'s{}p{}index{}'.format(sweight,
   pweight,index))
if not os.path.exists(result_path):
    os.mkdir(result_path)
    print('Create new folder: ',result_path)
else:
    print('Folder already existed: ',result_path)

base_output_path = os.path.join(data_path,base_dir)
if os.path.exists(base_output_path):
    print('Folder already existed: ',base_output_path)
perturb_output_path = os.path.join(data_path,perturb_dir)
if os.path.exists(perturb_output_path):
```

```
    print('Folder already existed: ',perturb_output_path)

cvx_output_path = os.path.join(data_path,cvx_dir)
if not os.path.exists(cvx_output_path):
    os.mkdir(cvx_output_path)
    print('Create new folder: ',cvx_output_path)
else:
    print('Folder already existed: ',cvx_output_path)

method_cvx_output_path = os.path.join(cvx_output_path,
   perturbation_method)
if not os.path.exists(method_cvx_output_path):
    os.mkdir(method_cvx_output_path)
    print('Create new folder: ',method_cvx_output_path)
else:
    print('Folder already existed: ',method_cvx_output_path)
TPcvx_output_path = os.path.join(data_path,TPcvx_dir)
if not os.path.exists(TPcvx_output_path):
    os.mkdir(TPcvx_output_path)
    print('Create new folder: ',TPcvx_output_path)
else:
    print('Folder already existed: ',TPcvx_output_path)

dT= np.genfromtxt(os.path.join(cvx_output_path ,perturbation_method,
   "dT_m{}_MOO{}_sample{}.csv".format(m,num,samplesize)),delimiter="
   ,", dtype=float, skip_header=1)
setpoint=dT[:,1]*T_range+T_ref # scale back dT
setpoint=setpoint[24*index:24*(index+1)]
setpoint

dW= np.genfromtxt(os.path.join(cvx_output_path ,perturbation_method,
   "dW_m{}_MOO{}_sample{}.csv".format(m,num,samplesize)),delimiter="
   ,", dtype=float, skip_header=1)
airspeed=dW[:,1]*W_range+0.35 # scale back dW
airspeed=airspeed[24*index:24*(index+1)]
airspeed
```

```
fanonoff=airspeed/0.7
fanonoff
```

Listing A.2: Set Data Path and Import Data

Apply optimized cooling system schedules to EP

```
# build IDD file path for windows or mac systems
from sys import platform
if platform == "darwin":
    # Mac (IOS)
    energyplus_path = '/Applications/EnergyPlus-9-5-0'
elif "win" in platform:
    # Windows
    energyplus_path = 'C://EnergyPlusV9-5-0'
else:
    raise ValueError()
print(energyplus_path)

# weather file path
epw_name = 'USA_FL_Miami.Intl.AP.722020_TMY3.epw'
weather_filepath = os.path.join(general_path, 'weather', '
   USA_FL_Miami.Intl.AP.722020_TMY3', epw_name)
assert os.path.exists(weather_filepath)

# set energyplus path, needs python reboot if changed
from eppy.modeleditor import IDF
IDF.setiddname(os.path.join(energyplus_path, 'Energy+.idd'))

# establish idf file
fname= os.path.join(general_path, 'PNNLexamplefile','{}.idf'.format(
   base_fname))
assert os.path.exists(fname)
idf = IDF(fname, weather_filepath)

allschedule=idf.idfobjects['Schedule:Compact']
```

```
ClgSetPSch=allschedule[-5]
VairSch=allschedule[-2]
fanSch=allschedule[0]

run_period=idf.idfobjects['RunPeriod'][0]
run_period

# the perturbationtraining data start from 7/7 end in 8/4
# the cvx optimization day starts on 7/7 end in sim_period/n
# begin day
run_period.Begin_Month=sim_begin_month
run_period.Begin_Day_of_Month=sim_begin_day
# end day
run_period.End_Month=sim_begin_month
run_period.End_Day_of_Month=sim_begin_day

run_period # hottest day as optimization day

# apply setpoint from cvx to energyplus cooling schedule
#if only analyze one day, set schedule through 12/31
#if have more than one days' schedule for input, input day by day,
   end in 12/31
# energyplus need schedule to end in 12/31 to work properly
for i in range(int(sim_period/24)):
    if i+1==int(sim_period/24):
        ClgSetPSch['Field_{}'.format(1+26*i)]='Through:12/31'
        ClgSetPSch['Field_{}'.format(1+1+26*i)]='For: AllDays'
        VairSch['Field_{}'.format(1+26*i)]='Through:12/31'
        VairSch['Field_{}'.format(1+1+26*i)]='For: AllDays'
        fanSch['Field_{}'.format(1+26*i)]='Through:12/31'
        fanSch['Field_{}'.format(1+1+26*i)]='For: AllDays'
    else:
        ClgSetPSch['Field_{}'.format(1+26*i)]='Through:7/{}'.format(
   i+sim_begin_day) # starting from 7/7
        ClgSetPSch['Field_{}'.format(1+1+26*i)]='For: AllDays'
        VairSch['Field_{}'.format(1+26*i)]='Through:7/{}'.format(i+
```

```
    sim_begin_day)
        VairSch['Field_{}'.format(1+1+26*i)]='For: AllDays'
        fanSch['Field_{}'.format(1+26*i)]='Through:7/{}'.format(i+
    sim_begin_day)
        fanSch['Field_{}'.format(1+1+26*i)]='For: AllDays'
     for h in range(24):
        ClgSetPSch['Field_{}'.format(1+1+26*i+h+1)]='Until: {}:00,{}
    '.format(h+1,setpoint[0+i*24:24+i*24][h])
        VairSch['Field_{}'.format(1+1+26*i+h+1)]='Until: {}:00,{}'.
    format(h+1,airspeed[0+i*24:24+i*24][h])
        fanSch['Field_{}'.format(1+1+26*i+h+1)]='Until: {}:00,{}'.
    format(h+1,fanonoff[0+i*24:24+i*24][h])

# build baseline output data folder first
method_TPcvx_output_path= os.path.join(TPcvx_output_path,
    perturbation_method)
if not os.path.exists(method_TPcvx_output_path):
     os.mkdir(method_TPcvx_output_path)
else:
     print('Folder already existed: ',method_TPcvx_output_path)

idf.run(readvars=True, expandobjects=True, output_directory=
    method_TPcvx_output_path)
```

Visualize and save results

```
Data = np.genfromtxt(os.path.join(method_TPcvx_output_path, "
    eplusout.csv"), delimiter=",", dtype=float, skip_header=49)
_,c=Data.shape
Tout=Data[:,1:2] # Tout at collumn 1
MRT=Data[:,2:3]
Tair=Data[:,4:5]
RH=Data[:,5:6]
Setpt=Data[:,6:7]

SET=Data[:,c-1:c]
```

```
P_kw=Data[:,c-2:c-1]/1000
P_kw_cool=Data[:,c-3:c-2]/1000

# import baseline data from data generation folder
pbase = pd.read_csv(os.path.join(base_output_path,'p_base.csv'),
    header=0)
pbase = np.asarray(pbase).squeeze()
pbase=pbase[:,1] # get rid of first collumn of index
# get the baseline P data for the last day
pbase=pbase[smhr:smhr+n]
pbase

SETbase = pd.read_csv(os.path.join(base_output_path,'SET_base.csv'),
    header=0)
SETbase = np.asarray(SETbase).squeeze()
SETbase=SETbase[:,1]
SETbase=SETbase[smhr:smhr+n]
SETbase

dP= np.genfromtxt(os.path.join(method_cvx_output_path,"dP_m{}_MOO{}
    _sample{}.csv".format(m,num,samplesize)), delimiter=",", dtype=
    float, skip_header=1)
p_cvx=dP[:,1][24*index:24*(index+1)]+pbase # get rid of first
    collumn
p_cvx

dS= np.genfromtxt(os.path.join(method_cvx_output_path,"dS_m{}_MOO{}
    _sample{}.csv".format(m,num,samplesize)), delimiter=",", dtype=
    float, skip_header=1)
SET_cvx=dS[:,1][24*index:24*(index+1)]+SETbase # get rid of first
    collumn
SET_cvx

SET_flatten=np.reshape(SET,24)
SET_flatten
```

```
err=SET_cvx.tolist()-SET_flatten
err

rel_errs = abs(err)/SET_flatten
rel_errs

UL=30*np.ones(24)
LL=17*np.ones(24)
nL=22.2*np.ones(24)
nU=25.6*np.ones(24)

plt.figure(figsize=(11.25, 7.875))
step = range(n)
plt.errorbar(step,SET_cvx[0:n], yerr=err, capsize=2,uplims=True,
    color='lightsteelblue',linewidth=2.5) #, uplims=True, lolims=True
    , label='uplims=True, lolims=True')
for r_err, x,y in zip(rel_errs, step,SET_cvx[0:n]):
    plt.annotate('{:.2f}'.format(r_err), (x-0.05, y+0.05))
# other lines
plt.xlabel('Time[Hour]',fontsize=13)
plt.ylabel('C',fontsize=13)
shadingx = np.linspace(0, 24)
plt.gca().fill_between(shadingx, 22.2,25.6, facecolor = 'grey',
    edgecolors = 'grey', alpha = 0.2)
shadingx2 = np.linspace(0, 24)
plt.gca().fill_between(shadingx, 17,30, facecolor = 'lightgrey',
    edgecolors = 'lightgrey', alpha = 0.3)
# plt.plot(step,UL[0:n],color='salmon',linewidth=0.5)
# plt.plot(step,LL[0:n],color='tomato',linewidth=0.5)
# plt.plot(step,nL[0:n],color='gold',linewidth=0.5)
# plt.plot(step,nU[0:n],color='goldenrod',linewidth=0.5)
plt.plot(step,SETbase[0:n],color='palevioletred',linewidth=2.5)
plt.plot(step,SET[0:n],color='royalblue',linewidth=3)
plt.legend(['baseline SET','SET_EnergyPlus','Thermal neutrality zone
    ','Thermal comfort zone','SET_CVX',])
plt.title('SET',fontsize=15)
```

```
plt.yticks(np.arange(0, 32, step=2))
plt.grid(True,linewidth=0.2)
plt.savefig(os.path.join(result_path,'SET_withRE_p{}s{}_index{}.png'
    .format(pweight,sweight,index)))

P_kw_total_flatten=np.reshape(P_kw,24)
P_kw_total_flatten

p_err=p_cvx.tolist()-P_kw_total_flatten
p_err

#RELATIVE ERROR
p_rel_errs=abs(p_err)/P_kw_total_flatten
p_rel_errs

# power with error
plt.figure(figsize=(11.25, 7.875))
step = range(n)

plt.errorbar(step,p_cvx[0:n], yerr=p_err, capsize=2,uplims=True,
    color='lightsteelblue',linewidth=2.5) #, uplims=True, lolims=True
    , label='uplims=True, lolims=True')
for r_err, x,y in zip(p_rel_errs, step,p_cvx[0:n]):
    plt.annotate('{:.2f}'.format(r_err), (x-0.05, y+0.05))

plt.plot(step,pbase[0:24],color='palevioletred',linewidth=2.5)
plt.plot(step,P_kw[0:24],color='royalblue',linewidth=3)
plt.xlabel('Time[Hour]',fontsize=13)
plt.ylabel('P[kw]',fontsize=13)
plt.legend(['baseline','Power_EnergyPlus','Power_CVX',])
plt.title('Power',fontsize=15)
plt.grid(True,linewidth=0.2)
plt.yticks(np.arange(0, 6, step=0.5))  # Set label locations.
plt.savefig(os.path.join(result_path,'power_withRE_p{}s{}_index{}.
    png'.format(pweight,sweight,index)))
```

```
plt.figure(figsize=(10, 7))
step = range(n)
plt.plot(step, airspeed[0:24],linewidth=2.5,color='teal')
plt.plot(step, baselineairspeed[0:24],linewidth=1.5,color='
    palevioletred')
plt.xlabel('Time[Hour]',fontsize=13)
plt.ylabel('m/s',fontsize=13)
plt.grid(True)
plt.title('Airspeed',fontsize=15)
plt.ylim(-0.1, 0.8)   # set the ylim to bottom, top
plt.xlim(0, 24)   # set the ylim to bottom, top
plt.grid(True,linewidth=0.2)
plt.savefig(os.path.join(result_path,'airspeed_p{}s{}_index{}.png'.
    format(pweight,sweight,index)))

plt.figure(figsize=(10, 7))
step = range(n)
plt.plot(step, setpoint[0:24],linewidth=2.5,color='teal')
plt.plot(step, baselinesetpoint[0:24],linewidth=1.5,color='
    palevioletred')
plt.xlabel('Time[Hour]', fontsize=15)
plt.ylabel('C', fontsize=15)
plt.grid(True)
plt.title('Setpoint', fontsize=15)
plt.ylim(17, 30)   # set the ylim to bottom, top
plt.xlim(0, 24)   # set the ylim to bottom, top
plt.grid(True,linewidth=0.2)
plt.savefig(os.path.join(result_path,'setpoint_p{}s{}_index{}.png'.
    format(pweight,sweight,index)))

pd.DataFrame(P_kw_cool).to_csv(os.path.join(result_path,'Pcool_EP_p
    {}s{}_index{}.csv'.format(pweight,sweight,index)))
pd.DataFrame(P_kw-P_kw_cool).to_csv(os.path.join(result_path,'
    Pother_EP_p{}s{}_index{}.csv'.format(pweight,sweight,index)))
pd.DataFrame(P_kw).to_csv(os.path.join(result_path,'p_EP_p{}s{}
    _index{}.csv'.format(pweight,sweight,index)))
```

```
pd.DataFrame(SET).to_csv(os.path.join(result_path,'SET_EP_p{}s{}
    _index{}.csv'.format(pweight,sweight,index)))
pd.DataFrame(p_cvx).to_csv(os.path.join(result_path,'p_cvx_p{}s{}
    _index{}.csv'.format(pweight,sweight,index)))
pd.DataFrame(SET_cvx).to_csv(os.path.join(result_path,'SET_cvx_p{}s
    {}_index{}.csv'.format(pweight,sweight,index)))
pd.DataFrame(pbase).to_csv(os.path.join(result_path,'pbase_p{}s{}
    _index{}.csv'.format(pweight,sweight,index)))
pd.DataFrame(SETbase).to_csv(os.path.join(result_path,'SETbase_p{}s
    {}_index{}.csv'.format(pweight,sweight,index)))
pd.DataFrame(setpoint).to_csv(os.path.join(result_path,'setpoint_p{}
    s{}_index{}.csv'.format(pweight,sweight,index)))
pd.DataFrame(airspeed).to_csv(os.path.join(result_path,'airspeed_p{}
    s{}_index{}.csv'.format(pweight,sweight,index)))
```

Appendix B

Energy Storage System Scheduling

This section demonstrate python based workflow works based in google Colab. The setup of EnergyPlus in Colab is different from how it was done in Jupyter Notebook.

B.1 Data Generation

Mount Colab path in Google Drive

```
import pandas as pd
import os
import numpy as np
from matplotlib import pyplot as plt
from google.colab import drive
drive.mount('/content/drive', force_remount=False)
```

Setup EnergyPlus and Eppy in Colab environment

```
# https://github.com/woo-seung/energyplus_colab/blob/master/
    energyplus_colab.ipynb
# install EP to "/usr/local/EnergyPlus-9-5-0"
!chmod +x /content/drive/My\ Drive/EnergyPlus-9.5.0-de239b2e5f-Linux
    -Ubuntu18.04-x86_64.sh
!sudo /content/drive/My\ Drive/EnergyPlus-9.5.0-de239b2e5f-Linux-
    Ubuntu18.04-x86_64.sh
# to capture C-level stdout/stderr pipes in Python
# !pip install wurlitzer
# check EP
print('\n- Check EnergyPlus Version')
!energyplus -version

# setting
# %load_ext wurlitzer
# %unload_ext wurlitzer
import sys
import shutil
energyplus_path = '/usr/local/EnergyPlus-9-5-0'
sys.path.insert(0, energyplus_path)
# from pyenergyplus.api import EnergyPlusAPI
!pip install eppy
# set energyplus path, needs python reboot if changed
from eppy.modeleditor import IDF
IDF.setiddname(os.path.join(energyplus_path, 'Energy+.idd'))
```

Set data paths

```
# for file naming in various battery and pv capacity settings
B_string=5 # number of battery parallel string in battery in the idf
    file
PV_percent=90 # PV surface coverage % in idf file

dic_path= '/content/drive/My Drive/PVbattery/'
run_path=os.path.join(dic_path, "B{}PV{}".format(B_string,PV_percent
    ))
if not os.path.exists(run_path):
```

```
  os.mkdir(run_path)
  print('Create new folder: ', run_path)
else:
  print('Folder already existed: ', run_path)

 # build model specific baseline output path
BASE_OUTPUT_PATH= os.path.join(run_path, "B{}PV{}baserun".format(
    B_string,PV_percent))
if not os.path.exists(BASE_OUTPUT_PATH):
  os.mkdir(BASE_OUTPUT_PATH)
  print('Create new folder: ', BASE_OUTPUT_PATH)
else:
  print('Folder already existed: ', BASE_OUTPUT_PATH)

  # initial base run
sub1_BASE_OUTPUT_PATH= os.path.join(BASE_OUTPUT_PATH, 'B{}PV{}
    baserun1'.format(B_string,PV_percent))
if not os.path.exists(sub1_BASE_OUTPUT_PATH):
  os.mkdir(sub1_BASE_OUTPUT_PATH)
  print('Create new folder: ', sub1_BASE_OUTPUT_PATH)
else:
  print('Folder already existed: ', sub1_BASE_OUTPUT_PATH)

# base run after editing charging schedule
sub2_BASE_OUTPUT_PATH= os.path.join(BASE_OUTPUT_PATH, 'B{}PV{}
    baserun2'.format(B_string,PV_percent))
if not os.path.exists(sub2_BASE_OUTPUT_PATH):
    os.mkdir(sub2_BASE_OUTPUT_PATH)
    print('Create new folder: ', sub2_BASE_OUTPUT_PATH)
else:
    print('Folder already existed: ', sub2_BASE_OUTPUT_PATH)


# build model specific perturb output path
PERTURB_OUTPUT_PATH= os.path.join(run_path, 'B{}PV{}perturb'.format(
    B_string,PV_percent))
```

```
if not os.path.exists(PERTURB_OUTPUT_PATH):
    os.mkdir(PERTURB_OUTPUT_PATH)
    print('Create new folder: ', PERTURB_OUTPUT_PATH)
else:
    print('Folder already existed: ', PERTURB_OUTPUT_PATH)

# path for saving perturbation data
DATA_PERTURB_OUTPUT_PATH= os.path.join(PERTURB_OUTPUT_PATH,"B{}PV{}
   perturbdata".format(B_string,PV_percent))
if not os.path.exists(DATA_PERTURB_OUTPUT_PATH):
    os.mkdir(DATA_PERTURB_OUTPUT_PATH)
    print('Create new folder: ', DATA_PERTURB_OUTPUT_PATH)
else:
    print('Folder already existed: ', DATA_PERTURB_OUTPUT_PATH)

perturb_output_path2= os.path.join(PERTURB_OUTPUT_PATH, 'dTdWdD')
if not os.path.exists(perturb_output_path2):
    os.mkdir(perturb_output_path2)
else:
    print(perturb_output_path2,"exist")

# path for saving ML training data
ML_PATH = os.path.join(PERTURB_OUTPUT_PATH, 'B{}PV{}ML_model'.format
   (B_string,PV_percent))
if not os.path.exists(ML_PATH):
    os.mkdir(ML_PATH)
    print('Create new folder: ', ML_PATH)
else:
    print('Folder already existed: ', ML_PATH)

# path for saving optimization results
OPT_PATH = os.path.join(run_path, 'B{}PV{}opt'.format(B_string,
   PV_percent))
if not os.path.exists(OPT_PATH):
    os.mkdir(OPT_PATH)
    print('Create new folder: ', OPT_PATH)
```

```
else:
    print('Folder already existed: ', OPT_PATH)

# path for saving optimized EP checking results
EP_OPT_PATH = os.path.join(OPT_PATH, 'EP_RUN')
if not os.path.exists(EP_OPT_PATH):
    os.mkdir(EP_OPT_PATH)
    print('Create new folder: ', EP_OPT_PATH)
else:
    print('Folder already existed: ', EP_OPT_PATH)

# path for importing IDF files
IDF_FOLDER = os.path.join(run_path, 'B{}PV{}idf'.format(B_string,
   PV_percent))
if not os.path.exists(IDF_FOLDER):
    os.mkdir(IDF_FOLDER)
    print('Create new folder: ', IDF_FOLDER)
else:
    print('Folder already existed: ', IDF_FOLDER)

MANUAL_PATH = os.path.join(run_path, 'B{}PV{}manual'.format(B_string
   ,PV_percent))
if not os.path.exists(MANUAL_PATH):
    os.mkdir(MANUAL_PATH)
    print('Create new folder: ', MANUAL_PATH)
else:
    print('Folder already existed: ', MANUAL_PATH)

# path for saving plots
PLOT_PATH = os.path.join(run_path, 'B{}PV{}plots'.format(B_string,
   PV_percent))
if not os.path.exists(PLOT_PATH):
    os.mkdir(PLOT_PATH)
    print('Create new folder: ', PLOT_PATH)
else:
    print('Folder already existed: ', PLOT_PATH)
```

Run baseline EP file

```
EPW_PATH = r'/content/drive/My Drive/PVbattery/idf/USA_FL_Miami.Intl
    .AP.722020_TMY3.epw'
IDF_PATH = r'{}/{}.idf'.format(IDF_FOLDER,base_fname)
idf = IDF(IDF_PATH, EPW_PATH)
base_fname='MIAMIPNNL_B{}PV{}opt'.format(B_string,PV_percent)
idf = IDF(IDF_PATH, EPW_PATH)
idf.run(readvars=True, expandobjects=True, output_directory=
    sub1_BASE_OUTPUT_PATH)

df_base = pd.read_csv (os.path.join(sub1_BASE_OUTPUT_PATH,'eplusout.
    csv'))
# df_base[216:]
# after getting rid of 217, starting from 7/19 1:00
# DATE: hottest 7/29 4pm [240:240+24]

L=len(np.array(df_base[216:]['Environment:Site Outdoor Air Drybulb
    Temperature [C](Hourly)']))
Tout=np.reshape(np.array(df_base[216:]['Environment:Site Outdoor Air
     Drybulb Temperature [C](Hourly)']),(L,1))
PV=np.reshape(np.array(df_base[216:]['PV ARRAY LOAD CENTER:Electric
    Load Center Produced Electricity Rate [W](Hourly)'])/1000,(L,1))
BD=np.reshape(np.array(df_base[216:]['LIIONBATTERY:Electric Storage
    Discharge Power [W](Hourly)'])/1000,(L,1))
BC=np.reshape(np.array(df_base[216:]['LIIONBATTERY:Electric Storage
    Charge Power [W](Hourly)'])/1000,(L,1))
P_buy=np.reshape(np.array(df_base[216:]["Whole Building:Facility Net
     Purchased Electricity Rate [W](Hourly)"])/1000,(L,1))
P_demand=np.reshape(np.array(df_base[216:]["Whole Building:Facility
    Total Electricity Demand Rate [W](Hourly)"])/1000,(L,1))
```

B.2 Energy Storage System Scheduling

Extract baseline battery charging and discharging schedules

```
i_num=4
# discharge_baseline_sch
# charge_baseline_sch
allschedule=idf.idfobjects['Schedule:Compact']
dischargeSch=allschedule[-6]
chargeSch=allschedule[-7]

discharge_baseline_sch=[]
charge_baseline_sch=[]
for time_ct in range(24):
    discharge_baseline_sch.append(float(dischargeSch['Field_{}'.
   format(i_num)]))
    charge_baseline_sch.append(float(chargeSch['Field_{}'.format(
   i_num)]))
    i_num=i_num+2
    time_ct=time_ct+1

discharge_capacity_limit=sum(discharge_baseline_sch)
# discharge_capacity_limit=round(discharge_capacity_limit, 1)
discharge_capacity_limit=discharge_capacity_limit*0.978
discharge_capacity_limit

# hrs that PV could supply all demand
x1=[]
for i in range(24):
  if PV[240:240+24][i]>P_demand[240:240+24][i]+BC[240:240+24][i]:
    x1.append(i)
print(x1)
plt.figure(figsize=(6, 3))
plt.xlabel('Time (hour)',fontsize=15)
plt.ylabel('Power (kW)',fontsize=15)
plt.rcParams['font.family'] = 'serif'
```

```
plt.rcParams['font.serif'] = ['Times New Roman']
plt.plot(P_buy[240:240+24],color='palevioletred',linewidth=2.5,label
    ='Baseline Purchased Power ')
plt.plot(PV[240:240+24],color='orange',linewidth=1,label='PV' )
plt.plot(BD[240:240+24],color='teal',linewidth=1,label='Discharge
    Power')
plt.plot(BC[240:240+24],color='yellowgreen',linewidth=1,label='
    Charge Power' )
plt.plot(P_demand[240:240+24],color='grey',linewidth=1,label='Demand
     Power')
# plt.plot(BC[240:240+24]+P_demand[240:240+24],color='green',
    linewidth=1,label='Charge+Demand Power' )
# plt.axhline(y=ave_integrated_value, color='dimgray', linestyle
    =':',label='P buy positive average' )
plt.axvline(x=x1[0], color='dimgray', linestyle=':',label='PV self
    supply start' )
plt.axvline(x=x1[-1], color='dimgray', linestyle=':',label='PV self
    supply end' )

# plt.legend(bbox_to_anchor=(1,0), loc="lower left")
plt.xticks(np.arange(0, 24, step=5))
plt.yticks(np.arange(-14, 18, step=3))

plt.grid(True,linewidth=0.1)

plt.tight_layout()
plt.savefig(os.path.join(PLOT_PATH,"NNP&shcedule_analysis_baseline1.
    PDF"),dpi=1500)
```

Generate New Discharging Schedule

```
P_buy_pos=[]
active_num = 0
for i in range(24):
  if P_buy[240:240+24][i]>0.1:
    P_buy_pos.append(float(list(P_buy[240:240+24])[i]))
    active_num += 1
```

```
  else:
    P_buy_pos.append(0)
print(sum(P_buy_pos))
print(active_num)

ave_integrated_value=np.array(sum(P_buy_pos))/(24-len(x1))
ave_integrated_value

discharge_cap_EP=2780/1000 #this value takes from the the idf file,
   object: ElectricLoadCenter:Distribution, value: Design Storage
   Control Discharge Power. This value represent the discharge power
    with the schedule maximum fraction of value 1.

new_discharge_sch=[]
for j in range(24):
  if x1[0]<=j<=x1[-1]:
    new_discharge_sch.append(0)
  elif j < 24:
      new_discharge_sch.append(discharge_baseline_sch[j]+(P_buy_pos[
   j]-ave_integrated_value)/discharge_cap_EP)
new_discharge_sch


for i in range (24):
  if new_discharge_sch[i]<0:
    new_discharge_sch[i]=0
new_discharge_sch

# if sum(new_discharge_sch)>discharge_capacity_limit:
for i in range(24):
  new_discharge_sch[i]=(new_discharge_sch[i]/sum(new_discharge_sch))
   *discharge_capacity_limit
new_discharge_sch

plt.figure(figsize=(6, 3))
plt.xlabel('Time (hour)',fontsize=15)
```

```
plt.ylabel('Discharge Fraction',fontsize=15)
plt.rcParams['font.family'] = 'serif'
plt.rcParams['font.serif'] = ['Times New Roman']
plt.plot(discharge_baseline_sch,color='palevioletred',linewidth=2.5)
plt.plot(new_discharge_sch,color='royalblue',linewidth=2.5)
# plt.legend(['baseline discharge schedule','optmized discharge
    schedule'])#,loc='lower center')
plt.axvline(x=x1[0], color='dimgray', linestyle=':',label='PV self
    supply start' )
plt.axvline(x=x1[-1], color='dimgray', linestyle=':',label='PV self
    supply end' )
plt.xticks(np.arange(0, 24, step=5))
plt.yticks(np.arange(0, 1.2, step=0.2))
plt.grid(True,linewidth=0.1)
# plt.legend(bbox_to_anchor=(1,0), loc="lower left")

plt.tight_layout()
plt.savefig(os.path.join(PLOT_PATH,"NN_manual_dischargesch{}.PDF".
    format(discharge_capacity_limit)),dpi=1500)
```

Apply new discharge schedule to Idf file

```
# idf_updated = IDF(IDF_PATH_updated, EPW_PATH)
allschedule=idf.idfobjects['Schedule:Compact']
dischargeSch=allschedule[-6]
i_str=3  # string field
i_num=4 # setpoint number field
i_hr=0 # field time start
time_ct=0 # count number of setpoint for a day
for time_ct in range(24):
  i_hr=i_hr+1
  dischargeSch['Field_{}'.format(i_str)] = 'Until: {}:00'.format(
    i_hr)
  i_str=i_str+2
  dischargeSch['Field_{}'.format(i_num)]=list(new_discharge_sch)[
    time_ct]
  i_num=i_num+2
```

```
idf.run(readvars=True, expandobjects=True, output_directory=
    MANUAL_PATH)

df_manual = pd.read_csv (os.path.join(MANUAL_PATH,'eplusout.csv'))

Tout3=list(df_manual[216:]['Environment:Site Outdoor Air Drybulb
    Temperature [C](Hourly)'])
PV3=list(df_manual[216:]['PV ARRAY LOAD CENTER:Electric Load Center
    Produced Electricity Rate [W](Hourly)']/1000)
BD3=list(df_manual[216:]['LIIONBATTERY:Electric Storage Discharge
    Power [W](Hourly)']/1000)
P_buy3=list(df_manual[216:]["Whole Building:Facility Net Purchased
    Electricity Rate [W](Hourly)"]/1000)
P_demand3=list(df_manual[216:]["Whole Building:Facility Total
    Electricity Demand Rate [W](Hourly)"]/1000)
BC3=list(df_manual[216:]['LIIONBATTERY:Electric Storage Charge Power
     [W](Hourly)']/1000)

max(P_buy3[240:240+24])

# baseline peak without PV and battery
baseline_peak=3.446326647640300

a=int((max(P_buy[240:240+24])-max(P_buy3[240:240+24]))/max(P_buy
    [240:240+24])*100)
print("Reduced Power compare to PVB default without new scheduling",
    a,"%")

b=int((baseline_peak-max(P_buy3[240:240+24]))/baseline_peak*100)
print("Reduced Power compare to baseline",b,"%")

plt.figure(figsize=(6, 3))
plt.xlabel('Time (hour)',fontsize=15)
plt.ylabel('Power (kW)',fontsize=15)
plt.rcParams['font.family'] = 'serif'
```

```
plt.rcParams['font.serif'] = ['Times New Roman']
plt.plot(P_buy[240:240+24],color='palevioletred',linewidth=2.5)
# plt.plot(list(predicted_opt_pbuy[minindex*24:minindex*24+24]),
    color='royalblue',linewidth=2.5, linestyle='dotted')
plt.plot(P_buy3[240:240+24],color='royalblue',linewidth=2.5)
# plt.legend(['Purchased Power_baseline ','Purchased Power manual
    reshedule'])#,loc='lower center')
# plt.title("Reduced Power{}%".format(a))
plt.yticks(np.arange(-14, 7, step=3))
plt.axhline(y=ave_integrated_value, color='dimgray', linestyle=':',
    label='P buy positive average' )
plt.axvline(x=x1[0], color='dimgray', linestyle=':',label='PV self
    supply start' )
plt.axvline(x=x1[-1], color='dimgray', linestyle=':',label='PV self
    supply end' )
plt.grid(True,linewidth=0.1)
# plt.legend(bbox_to_anchor=(1,0), loc="lower left")

plt.tight_layout()
plt.savefig(os.path.join(PLOT_PATH,"NN_EP_manual{}.PDF".format(
    discharge_capacity_limit)),dpi=1500)

P_buy_pos3=[]
for i in range(24):
  if P_buy3[240:240+24][i]>0.1:
    P_buy_pos3.append(list(P_buy3[240:240+24])[i])
  else:
    P_buy_pos3.append(0)
plt.figure(figsize=(6, 3))
plt.xlabel('Time (hour)',fontsize=15)
plt.ylabel('Power (kW)',fontsize=15)
plt.rcParams['font.family'] = 'serif'
plt.rcParams['font.serif'] = ['Times New Roman']
plt.plot(P_buy_pos,color='palevioletred',linewidth=2.5,label='
    Purchased power baseline')
plt.plot(P_buy_pos3,color='royalblue',linewidth=2.5,label='Purchased
```

```
    power manual reschedule')

plt.axhline(y=ave_integrated_value, color='dimgray', linestyle=':',
    label='P buy positive average' )
# plt.axhline(y=ave_integrated_value2, color='dimgray', linestyle
    =':',label='P buy positive average' )

plt.axvline(x=x1[0], color='dimgray', linestyle=':',label='PV self
    supply start' )
plt.axvline(x=x1[-1], color='dimgray', linestyle=':',label='PV self
    supply end' )
plt.xticks(np.arange(0, 24, step=5))


# plt.title("Reduced Power{}%".format(a))
# plt.legend(bbox_to_anchor=(1,0), loc="lower left")
plt.yticks(np.arange(0,4, step=0.6))
plt.grid(True,linewidth=0.1)

plt.tight_layout()
plt.savefig(os.path.join(PLOT_PATH,"NN_EP_manual_posP{}.PDF".format(
    discharge_capacity_limit)),dpi=1500)

idf_updated.saveas('/content/drive/My Drive/PVbattery/B{}PV{}/B{}PV
    {}idf/MIAMIPNNL_B{}PV{}opt_BDreschedule.idf'.format(B_string,
PV_percent,B_string,PV_percent,B_string,PV_percent))
```

Appendix C

Cooling and Energy Storage Systems Scheduling

This section demonstrate python based workflow works based in google Colab. The setup of EnergyPlus in Colab is different from how it was done in Jupyter Notebook.

C.1 Training Data Generation

Mount Colab path in Google Drive

```
import pandas as pd
import os
import numpy as np
from matplotlib import pyplot as plt
from google.colab import drive
drive.mount('/content/drive', force_remount=False)
```

Setup EnergyPlus and Eppy in Colab environment

```
# https://github.com/woo-seung/energyplus_colab/blob/master/
   energyplus_colab.ipynb
```

```
# install EP to "/usr/local/EnergyPlus-9-5-0"
!chmod +x /content/drive/My\ Drive/EnergyPlus-9.5.0-de239b2e5f-Linux
   -Ubuntu18.04-x86_64.sh
!sudo /content/drive/My\ Drive/EnergyPlus-9.5.0-de239b2e5f-Linux-
   Ubuntu18.04-x86_64.sh
# to capture C-level stdout/stderr pipes in Python
# !pip install wurlitzer
# check EP
print('\n- Check EnergyPlus Version')
!energyplus -version

# setting
# %load_ext wurlitzer
# %unload_ext wurlitzer
import sys
import shutil
energyplus_path = '/usr/local/EnergyPlus-9-5-0'
sys.path.insert(0, energyplus_path)
# from pyenergyplus.api import EnergyPlusAPI
!pip install eppy
# set energyplus path, needs python reboot if changed
from eppy.modeleditor import IDF
IDF.setiddname(os.path.join(energyplus_path, 'Energy+.idd'))
```

Set Data paths

```
B_string= 15 # number of battery parallel string in battery in the
   idf file
 PV_percent=50 # PV surface coverage % in idf file

dic_path= '/content/drive/My Drive/PVbattery/'
run_path=os.path.join(dic_path, "B{}PV{}".format(B_string,PV_percent
   ))
if not os.path.exists(run_path):
  os.mkdir(run_path)
  print('Create new folder: ', run_path)
else:
```

```
  print('Folder already existed: ', run_path)

# build model specific baseline output path
BASE_OUTPUT_PATH= os.path.join(run_path, "B{}PV{}baserun".format(
    B_string,PV_percent))
if not os.path.exists(BASE_OUTPUT_PATH):
  os.mkdir(BASE_OUTPUT_PATH)
  print('Create new folder: ', BASE_OUTPUT_PATH)
else:
  print('Folder already existed: ', BASE_OUTPUT_PATH)

# initial base run
sub1_BASE_OUTPUT_PATH= os.path.join(BASE_OUTPUT_PATH, 'B{}PV{}
    baserun1'.format(B_string,PV_percent))
if not os.path.exists(sub1_BASE_OUTPUT_PATH):
  os.mkdir(sub1_BASE_OUTPUT_PATH)
  print('Create new folder: ', sub1_BASE_OUTPUT_PATH)
else:
  print('Folder already existed: ', sub1_BASE_OUTPUT_PATH)
# base run after editing charging sche
sub2_BASE_OUTPUT_PATH= os.path.join(BASE_OUTPUT_PATH, 'B{}PV{}
    baserun2'.format(B_string,PV_percent))
if not os.path.exists(sub2_BASE_OUTPUT_PATH):
    os.mkdir(sub2_BASE_OUTPUT_PATH)
    print('Create new folder: ', sub2_BASE_OUTPUT_PATH)
else:
    print('Folder already existed: ', sub2_BASE_OUTPUT_PATH)
# build model specific perturb output path
PERTURB_OUTPUT_PATH= os.path.join(run_path, 'B{}PV{}perturb'.format(
    B_string,PV_percent))
if not os.path.exists(PERTURB_OUTPUT_PATH):
    os.mkdir(PERTURB_OUTPUT_PATH)
    print('Create new folder: ', PERTURB_OUTPUT_PATH)
else:
    print('Folder already existed: ', PERTURB_OUTPUT_PATH)
# path for saving perturbation data
```

```
DATA_PERTURB_OUTPUT_PATH= os.path.join(PERTURB_OUTPUT_PATH,"B{}PV{}
    perturbdata".format(B_string,PV_percent))
if not os.path.exists(DATA_PERTURB_OUTPUT_PATH):
    os.mkdir(DATA_PERTURB_OUTPUT_PATH)
    print('Create new folder: ', DATA_PERTURB_OUTPUT_PATH)
else:
    print('Folder already existed: ', DATA_PERTURB_OUTPUT_PATH)
# path for saving ML training data
ML_PATH = os.path.join(PERTURB_OUTPUT_PATH, 'B{}PV{}ML_model'.format
    (B_string,PV_percent))
if not os.path.exists(ML_PATH):
    os.mkdir(ML_PATH)
    print('Create new folder: ', ML_PATH)
else:
    print('Folder already existed: ', ML_PATH)

# path for saving
perturb_output_path2= os.path.join(PERTURB_OUTPUT_PATH, 'dTdWdD')
if not os.path.exists(perturb_output_path2):
    os.mkdir(perturb_output_path2)
else:
    print(perturb_output_path2,"exist")
# path for saving optimization results
OPT_PATH = os.path.join(run_path, 'B{}PV{}opt'.format(B_string,
    PV_percent))
if not os.path.exists(OPT_PATH):
    os.mkdir(OPT_PATH)
    print('Create new folder: ', OPT_PATH)
else:
    print('Folder already existed: ', OPT_PATH)

# path for saving optimized EP checking results
EP_OPT_PATH = os.path.join(OPT_PATH, 'EP_RUN')
if not os.path.exists(EP_OPT_PATH):
    os.mkdir(EP_OPT_PATH)
    print('Create new folder: ', EP_OPT_PATH)
```

```
else:
    print('Folder already existed: ', EP_OPT_PATH)

# path for saving plots
PLOT_PATH = os.path.join(run_path, 'B{}PV{}plots'.format(B_string,
   PV_percent))
if not os.path.exists(PLOT_PATH):
    os.mkdir(PLOT_PATH)
    print('Create new folder: ', PLOT_PATH)
else:
    print('Folder already existed: ', PLOT_PATH)
MANUAL_PATH = os.path.join(run_path, 'B{}PV{}manual'.format(B_string
   ,PV_percent))
if not os.path.exists(MANUAL_PATH):
    os.mkdir(MANUAL_PATH)
    print('Create new folder: ', MANUAL_PATH)
else:
    print('Folder already existed: ', MANUAL_PATH)
# for manual adjust setpoint for test
MANUAL_PATH_precool= os.path.join(MANUAL_PATH, 'manualprecool')
if not os.path.exists(MANUAL_PATH_precool):
    os.mkdir(MANUAL_PATH_precool)
else:
    print(MANUAL_PATH_precool,"exist")
# path for saving plots
IDF_FOLDER = os.path.join(run_path, 'B{}PV{}idf'.format(B_string,
   PV_percent))
if not os.path.exists(IDF_FOLDER):
    os.mkdir(IDF_FOLDER)
    print('Create new folder: ', IDF_FOLDER)
else:
    print('Folder already existed: ', IDF_FOLDER)

base_fname='MIAMIPNNL_B{}PV{}opt'.format(B_string,PV_percent)
```

Run Baseline EP file

```
# path for idf files
IDF_FOLDER = os.path.join(run_path, 'B{}PV{}idf'.format(B_string,
    PV_percent))
if not os.path.exists(IDF_FOLDER):
    os.mkdir(IDF_FOLDER)
    print('Create new folder: ', IDF_FOLDER)
else:
    print('Folder already existed: ', IDF_FOLDER)
base_fname='MIAMIPNNL_B{}PV{}opt'.format(B_string,PV_percent)
# set energyplus path, needs python reboot if changed
from eppy.modeleditor import IDF
IDF.setiddname(os.path.join(energyplus_path, 'Energy+.idd'))
EPW_PATH = r'/content/drive/My Drive/PVbattery/idf/USA_FL_Miami.Intl
    .AP.722020_TMY3.epw'
IDF_PATH_BD='/content/drive/My Drive/PVbattery/B{}PV{}/B{}PV{}idf/
    MIAMIPNNL_B{}PV{}opt_BDreschedule.idf'.format(B_string,
PV_percent,B_string,PV_percent,B_string,PV_percent)
idf = IDF(IDF_PATH_BD, EPW_PATH)

idf.run(readvars=True, expandobjects=True, output_directory=
    MANUAL_PATH)

df_manual = pd.read_csv (os.path.join(MANUAL_PATH,'eplusout.csv'))
# after getting rid of 217, starting from 7/19 1:00
# DATE: hottest 7/29 4pm [240:240+24]

l=len(list(df_manual[216:]['Environment:Site Outdoor Air Drybulb
    Temperature [C](Hourly)']))
Tout=np.reshape(list(df_manual[216:]['Environment:Site Outdoor Air
    Drybulb Temperature [C](Hourly)']),(l,1))
PV=np.reshape(list(df_manual[216:]['PV ARRAY LOAD CENTER:Electric
    Load Center Produced Electricity Rate [W](Hourly)']/1000),(l,1))
BD=np.reshape(list(df_manual[216:]['LIIONBATTERY:Electric Storage
    Discharge Power [W](Hourly)']/1000),(l,1))
P_buy=np.reshape(list(df_manual[216:]["Whole Building:Facility Net
    Purchased Electricity Rate [W](Hourly)"]/1000),(l,1))
```

```
P_demand=np.reshape(list(df_manual[216:]["Whole Building:Facility
    Total Electricity Demand Rate [W](Hourly)"]/1000),(1,1))
BC=np.reshape(list(df_manual[216:]['LIIONBATTERY:Electric Storage
    Charge Power [W](Hourly)']/1000),(1,1))
SET=np.reshape(list(df_manual[216:]["PEOPLE_UNIT1:Zone Thermal
    Comfort Pierce Model Standard Effective Temperature [C](Hourly) "
    ]),(1,1))
```

Generate cooling and energy storage system schedules for defined number of times

```
!pip install geomdl
import numpy as np
import random
from geomdl import BSpline
from geomdl import knotvector



num = 100
i = 0
failed_i = 0
saved_discharge_sch = []
saved_setpoint_sch=[]
saved_air_sch=[]
saved_fan_sch=[]
while i < num:
  q_discharge_sch=[]
  q_setpoint_sch=[]
  q_air_sch=[]
  q_fan_sch=[]
  for j in range(24):
    if j in x0:
      q_setpoint_sch.append(23.88-3)
    else:
      q_setpoint_sch.append(23.88+(0 + (3-(0))*np.random.random()))
```

```
  for g in range (24):
    air_v= 0 + (0.7-(0))*np.random.random()
    q_air_sch.append(air_v)
    q_fan_sch.append(air_v/0.7)

  for k in range(24):
    if k in x1:
      q_discharge_sch.append(0)
    else:
      q_discharge_sch.append(discharge_baseline_sch[k]+(-0.4 +
   (0.4-(-0.4))*np.random.random()))

  saved_setpoint_sch.append(q_setpoint_sch)
  saved_air_sch.append(q_air_sch)
  saved_fan_sch.append(q_fan_sch)
  if sum(q_discharge_sch)<discharge_capacity_limit:
    saved_discharge_sch.append(q_discharge_sch)
    i += 1
  else:
    failed_i += 1
    continue
print(f'succeeded attempt {i}, failed attempt {failed_i}')
# saved_discharge_sch
```

Define training data generation function

```
def clg_setpoints(i):
    import random
    idf = IDF(IDF_PATH_BD, EPW_PATH)
    allschedule=idf.idfobjects['Schedule:Compact']
    ClgSetPSch=allschedule[-5]
    VairSch=allschedule[-2]
    fanSch=allschedule[0]
    dischargeSch=allschedule[-6]
    i_str=3  # string field
    i_num=4 # setpoint number field
    i_hr=0 # field time start
```

```
 time_ct=0 # count number of setpoint for a day
 wk=4

 for time_ct in range(24):
     i_hr=i_hr+1
     fanSch['Field_{}'.format(i_str)] = 'Until: {}:00'.format(
i_hr)
     VairSch['Field_{}'.format(i_str)] = 'Until: {}:00'.format(
i_hr)
     ClgSetPSch['Field_{}'.format(i_str)] = 'Until: {}:00'.format
(i_hr)
     dischargeSch['Field_{}'.format(i_str)] = 'Until: {}:00'.
format(i_hr)
     i_str=i_str+2
     fanSch['Field_{}'.format(i_num)] = saved_fan_sch[i][time_ct]
     VairSch['Field_{}'.format(i_num)] = saved_air_sch[i][time_ct
]
     ClgSetPSch['Field_{}'.format(i_num)] = saved_setpoint_sch[i
][time_ct]
     dischargeSch['Field_{}'.format(i_num)]=saved_discharge_sch[i
][time_ct]
     i_num=i_num+2

 idf.run(readvars=True, expandobjects=True, output_directory=
perturb_output_path2)
 df1 = pd.read_csv (os.path.join(perturb_output_path2,'eplusout.
csv'))

 l=len(list(df1[216:]['Environment:Site Outdoor Air Drybulb
Temperature [C](Hourly)']))
 Tout1=np.reshape(list(df1[216:]['Environment:Site Outdoor Air
Drybulb Temperature [C](Hourly)']),(l,1))
 PV1=np.reshape(list(df1[216:]['PV ARRAY LOAD CENTER:Electric
Load Center Produced Electricity Rate [W](Hourly)']/1000),(l,1))
 BD1=np.reshape(list(df1[216:]['LIIONBATTERY:Electric Storage
Discharge Power [W](Hourly)']/1000),(l,1))
```

```
    P_buy1=np.reshape(list(df1[216:]["Whole Building:Facility Net
   Purchased Electricity Rate [W](Hourly)"]/1000),(1,1))
    SET1=np.reshape(list(df1[216:]["PEOPLE_UNIT1:Zone Thermal
   Comfort Pierce Model Standard Effective Temperature [C](Hourly) "
   ]),(1,1))

    Discharge=np.reshape(saved_discharge_sch[i], (len(
   saved_discharge_sch[i]), 1))
    Discharge_nstack=np.vstack([Discharge for c in range(7*wk)])

    Setpoint=np.reshape(saved_setpoint_sch[i], (len(
   saved_setpoint_sch[i]), 1))
    Setpoint_nstack=np.vstack([Setpoint for c in range(7*wk)])

    Air=np.reshape(saved_air_sch[i], (len(saved_air_sch[i]), 1))
    Air_nstack=np.vstack([Air for c in range(7*wk)])

    Fan=np.reshape(saved_fan_sch[i], (len(saved_fan_sch[i]), 1))
    Fan_nstack=np.vstack([Fan for c in range(7*wk)])

    results=np.hstack((P_buy1,SET1,Tout1,PV1,Discharge_nstack,
   Setpoint_nstack,Air_nstack,Fan_nstack))

    return results
```

Generate training data for defined number of times

```
num=100

R=np.hstack((SET,SET,SET,SET,SET,SET,SET,SET)) #dim 7 (P_buy, SET,
   setpoint, discharge sche, outside T,P_pv,solar radiation)
row,_=R.shape
t=R[0:row-7*24,:] # data start from 0_row, t matrix, training data 3
    week
v=R[row-7*24:row,:] # data end in row_row, v matrix, validation data
   : last 1 week
```

```
# empty shape SIZE according to base run
t_row,_=t.shape
v_row,_=v.shape
train=np.zeros(t.shape)
valid=np.zeros(v.shape)

for i in range(num):
    r=clg_setpoints(i) # result of one run of function:
   clg_setpoints
    ## START PARSING THE DATA
    r_t=r[0:t_row,:]
    r_v=r[t_row:row,:]
    train=np.vstack((train,r_t))
    valid=np.vstack((valid,r_v))
    i=i+1

# take out zeros
T_row,_=train.shape
train_data=train[t_row:T_row,:]
V_row,_=valid.shape
valid_data=valid[v_row:V_row,:]

DATA_PERTURB_OUTPUT_PATH= os.path.join(perturb_output_path2,"B{}PV{}
   perturbdata".format(B_string,PV_percent))
if not os.path.exists(DATA_PERTURB_OUTPUT_PATH):
    os.mkdir(DATA_PERTURB_OUTPUT_PATH)
# save data
import pandas as pd
pd.DataFrame(train_data).to_csv(os.path.join(
   DATA_PERTURB_OUTPUT_PATH,'train_data.csv'))
pd.DataFrame(valid_data).to_csv(os.path.join(
   DATA_PERTURB_OUTPUT_PATH,'valid_data.csv'))
```

C.2 Neural Network Model Training

```
import pandas as pd
import numpy as np
from matplotlib import pyplot as plt
import os
import math
import tensorflow as tf
from sklearn.model_selection import train_test_split
from tensorflow.keras import layers, models
from sklearn import preprocessing

X_train_data=train_data[:,2:7]
X_train_data
X_test_data=val_data[:,2:7]
X_test_data
q=np.array(train_data[:,0:2])
Y_train_data=q.reshape(len(q),2)
Y_train_data

qt=np.array(val_data[:,0:2])
Y_test_data=qt.reshape(len(qt),2)
Y_test_data

# Should not have sepratre scalers for train and test data
X_train_scaler = preprocessing.MinMaxScaler()
X_train_scaler.fit(X_train_data)

X_train_data_scaled = X_train_scaler.transform(X_train_data)
X_test_data_scaled = X_train_scaler.transform(X_test_data)



Y_train_scaler = preprocessing.MinMaxScaler()
Y_train_scaler.fit(Y_train_data)

Y_train_data_scaled = Y_train_scaler.transform(Y_train_data)
Y_test_data_scaled = Y_train_scaler.transform(Y_test_data)
```

```
random_state=42
X_training, X_validation, Y_training, Y_validation =
    train_test_split(X_train_data_scaled, Y_train_data_scaled,
    test_size=.2, random_state=random_state)

# TRAINED ML MODEL 2: EPOCH 25
def create_regression_param_model(input_dim, output_dim):
    model=[layers.InputLayer(input_shape=input_dim)]

    model.append(layers.Dense(10, name="e0"))
    model.append(layers.BatchNormalization())
    model.append(layers.ReLU())
    model.append(layers.Dropout(0.05))

    model.append(layers.Dense(20, name="e22"))
    model.append(layers.BatchNormalization())
    model.append(layers.ReLU())
    model.append(layers.Dropout(0.05))

    model.append(layers.Dense(50, name="e23"))
    model.append(layers.BatchNormalization())
    model.append(layers.ReLU())
    model.append(layers.Dropout(0.05))

    model.append(layers.Dense(20, name="e3"))
    model.append(layers.BatchNormalization())
    model.append(layers.ReLU())
    model.append(layers.Dropout(0.05))

    model.append(layers.Dense(10, name="e4")) # activation='sigmoid
    '))
    model.append(layers.BatchNormalization())
    model.append(layers.Softmax()) # try last layer with soft max,
    sigmoid
    model.append(layers.Dense(output_dim))
```

```
    return tf.keras.Sequential(model, name='
   regression_prediction_model')

# compile NN regression model
input_dim = 5
output_dim = 2

learning_rate = 0.1
# normalizer = tf.keras.layers.Normalization()
# normalizer.adapt(np.array(param_train))

NNmodel = create_regression_param_model(input_dim, output_dim)
# tf.keras.losses.MeanSquaredError()
NNmodel.compile(loss='mean_squared_error',
              optimizer=tf.keras.optimizers.Adam(learning_rate))

early_stopping=tf.keras.callbacks.EarlyStopping(
    monitor='val_loss',
    # min_delta=0.01,
    patience=100,
    # # verbose=0,
    # # mode='min',
    # # baseline=None,
    restore_best_weights=True)

epoch_num =200

# callback = tf.keras.callbacks.EarlyStopping(monitor='val_loss',
   patience=200)
history = NNmodel.fit(x=X_training, y=Y_training, epochs=epoch_num,
   batch_size=128,
                  validation_data=(X_validation,Y_validation),
   callbacks=[early_stopping])
from matplotlib.pyplot import figure
font = {'weight' : 'normal','size': 14}
plt.rc('font', **font)
```

```
plt.rc('axes', labelsize=22)     # fontsize of the axes title
plt.rc('axes', titlesize=22)
figure(figsize=(6, 3))
plt.plot(history.history['loss'], color='#173000')
plt.plot(history.history['val_loss'], color='#b73000')
plt.ylabel('loss_MSE')
plt.xlabel('epoch')
plt.legend(['Train', 'Validation'], loc='upper right')
plt.tight_layout()
plt.savefig(os.path.join(ML_PATH,"MSE_dTdWdD{}_scaledxy.PDF".format(
    epoch_num)),dpi=1500)

NNmodel.save_weights( os.path.join(ML_PATH,'dTdWdD{}_scaledxy.pt'.
    format(epoch_num)))
```

C.3 Optimization

```
!pip install geneticalgorithm
from geneticalgorithm import geneticalgorithm as ga

def obj_fn_y(X):
  fixed_P_pv=PV[240:240+24]
  fixede_Tout=Tout[240:240+24]
  # nn_input_batch = []
  nn_input_batch=np.zeros((0,5))
  for i in range(24):
    hourly_vars_BD = X[i]
    hourly_vars_T = X[24+i]
    hourly_vars_Air = X[48+i]
    nn_input = np.hstack([fixede_Tout[i],fixed_P_pv[i],
   hourly_vars_BD,hourly_vars_T,hourly_vars_Air]) # [
   Discharge_nstack,PV_1,Tout_1]
    nn_input_scaled = X_train_scaler.transform([nn_input])
    nn_input_batch=np.vstack((nn_input_batch,nn_input_scaled))
    # nn_input_batch.append(nn_input) ## for list
```

```
  model_pred = NNmodel.predict(nn_input_batch)

  return model_pred
def obj_fn_maxy(X):
  fixed_P_pv=PV[240:240+24]
  fixede_Tout=Tout[240:240+24]
  # nn_input_batch = []
  nn_input_batch=np.zeros((0,5))
  for i in range(24):
    # hourly_vars = X[i]
    hourly_vars_BD = X[i]
    hourly_vars_T = X[24+i]
    hourly_vars_Air = X[48+i]
    nn_input = np.hstack([fixede_Tout[i],fixed_P_pv[i],
   hourly_vars_BD,hourly_vars_T,hourly_vars_Air])#, shared_vars])
    nn_input_scaled = X_train_scaler.transform([nn_input])
    nn_input_batch=np.vstack((nn_input_batch,nn_input_scaled))
    # nn_input_batch.append(nn_input) ## for list
  # model_pred = NNmodel.predict(np.array(nn_input_batch))
  model_pred = NNmodel.predict(nn_input_batch)

  return sum(model_pred[:,0]*0.9)/20+np.max(model_pred[:,1]*0.1) #
   assign weight to the objective, since here the two objective
   values are not scaled, some scaling factor would need to be
   applied

h_BD=np.array([[0,1]]*24)
h_T=np.array([[20.89,26.89]]*24)
h_Air=np.array([[0,0.7]]*24)
varbound=np.vstack((h_BD,h_T,h_Air))
# varbound

def constraint_fn(x):
  x_BD=[]
  for i in range (24):
    x_BD.append(x[i])
```

```
  return discharge_capacity_limit - np.sum(x_BD)
  # constrain function need to write in a form result >=0
# equivalent to lambda x: np.sum(x) - discharge_capacity_limit

cons = ({'type': 'ineq','fun' : constraint_fn}) #,'jac' : lambda x:
    np.array([0.0, 1.0])})

def nurb(p1,p2,p3,p4):
  import random
  from geomdl import BSpline
  from geomdl import knotvector

  # Create the curve instance
  crv = BSpline.Curve()

  # Set degree
  crv.degree = 2

  crv.ctrlpts = [[0, p1], [1/4, p2], [2/4, p3], [3/4, p4],[1, p1]]
  crv.knotvector = knotvector.generate(crv.degree, crv.ctrlpts_size)

  # Update delta
  num_pts = 24
  crv.delta = 1.0/num_pts
  points_b = np.array(crv.evalpts)
  # points_b[:,1]
  return points_b[:,1]
#function
def optimization_with_constraint(new_sch):
  import scipy.optimize
  x_initial=new_sch
  res = scipy.optimize.minimize(obj_fn_maxy, x_initial, bounds=
    varbound, constraints=cons, method='SLSQP', options={'disp': True
    , 'maxiter': 1000, 'ftol': 1e-06})

  if res.success:
```

```
    opt_schedule=res.x
    opt_BD=np.reshape(opt_schedule[0:24],(24,1))
    opt_T=np.reshape(opt_schedule[24:48],(24,1))
    opt_Air=np.reshape(opt_schedule[48:72],(24,1))
    opt_schedule_forEP=np.hstack((opt_BD,opt_T,opt_Air))
    predicted_opt_y=obj_fn_y(res.x)
    results=np.hstack((predicted_opt_y,opt_schedule_forEP))
    return results
    # return opt_schedule_forEP,predicted_opt_y
  else:
    return None
#func
# random sampling number
num=50
testname='noBD_newNNlayer_p0.9s0.1_newNN_initial_dTdWdD{}'.format(
   num)
import numpy as np
saving_results = np.zeros((0,5))
for i in range(num):
    import random
    new_discharge_sch=[]
    new_setpoint_sch=[]
    new_air_sch=[]
    p1= 0 + (4-(0)) * np.random.random() # lower + (upp - lower) *
   random(0~1)
    p2= 0 + (4-(0)) * np.random.random()
    p3= 0 + (3-(0)) * np.random.random()
    p4= 0 + (4-(0)) * np.random.random()
    a1= 0 + (0.35-(0)) * np.random.random() # lower + (upp - lower)
   * random(0~1)
    a2= 0 + (0.35-(0)) * np.random.random()
    a3= -0.35 + (0-(-0.35)) * np.random.random()
    a4= 0 + (0.35-(0)) * np.random.random()
    dTs = nurb(p1,p2,p3,p4)
    dWs=  nurb(a1,a2,a3,a4)
    for j in range(24):
```

```
      if j in x0:
        new_setpoint_sch.append(23.88-3)
      else:
        new_setpoint_sch.append(23.88+dTs[j])

    for g in range (24):
      new_air_sch.append(0.35+dWs[g])

    for k in range(24):
      new_discharge_sch.append(0)

    # for k in range(24):
    #   if k in x1:
    #     new_discharge_sch.append(0)
    #   else:
    #     if k < x1[0]:
    #       new_discharge_sch.append(discharge_baseline_sch[k]+(0 +
   (0.2-(0))*np.random.random()))
    #     else:
    #       new_discharge_sch.append(discharge_baseline_sch[k]+(-0.2
    + (0-(-0.2))*np.random.random()))

    new_sch=new_discharge_sch+new_setpoint_sch+new_air_sch ##??
    result_opt=optimization_with_constraint(new_sch)

    if result_opt is not None:
      saving_results = np.vstack([saving_results, result_opt])
      pd.DataFrame(np.array(saving_results)).to_csv(os.path.join(
   OPT_PATH,'{}.csv'.format(testname)))

df = pd.read_csv (os.path.join(OPT_PATH,'{}.csv'.format(testname)))
print (df)
df.rename(columns = {'0':"predicted_opt_pbuy","1":"predicted_opt_SET
   ",'2':'opt_discharge_schedule_forEP','3':'
   opt_setpoint_schedule_forEP','4':'opt_airspeed_schedule_forEP'},
   inplace = True)
```

```
predicted_opt_pbuy=df["predicted_opt_pbuy"]
predicted_opt_SET=df["predicted_opt_SET"]

# devide every 24
predicted_opt_y_max=[]
for i in range (num):
  predicted_opt_y_max.append(predicted_opt_pbuy[i*24:i*24+24].max()
   *0.8+predicted_opt_SET[i*24:i*24+24].max()*0.2)
predicted_opt_y_max

minindex=predicted_opt_y_max.index(min(predicted_opt_y_max))
minindex

i=minindex
max(predicted_opt_pbuy[i*24:i*24+24])
max(predicted_opt_SET[i*24:i*24+24])
Y_opt_scaled=np.hstack((np.reshape(np.array(predicted_opt_pbuy[i*24:
   i*24+24]),(24,1)),np.reshape(np.array(predicted_opt_SET[i*24:i
   *24+24]),(24,1))))
# Y_opt_scaled
Y_opt_pred=Y_train_scaler.inverse_transform(Y_opt_scaled)
Y_opt_pred
opt_discharge_schedule_forEP=list(df["opt_discharge_schedule_forEP"
   ][minindex*24:minindex*24+24])
opt_setpoint_schedule_forEP=list(df["opt_setpoint_schedule_forEP"][
   minindex*24:minindex*24+24])
opt_air_schedule_forEP=list(df["opt_airspeed_schedule_forEP"][
   minindex*24:minindex*24+24])
opt_fan_schedule_forEP=list(np.array(opt_air_schedule_forEP)/0.7)

plt.figure(figsize=(6, 3))
plt.xlabel('Time (hour)',fontsize=15)
plt.ylabel('Discharge Fraction',fontsize=15)
plt.rcParams['font.family'] = 'serif'
plt.rcParams['font.serif'] = ['Times New Roman']
plt.plot(discharge_baseline_sch,color='palevioletred',linewidth=2.5)
```

```
plt.plot(list(opt_discharge_schedule_forEP),color='royalblue',
    linewidth=2.5)
plt.legend(['baseline discharge schedule','optmized discharge
    schedule'])#,loc='lower center')
# plt.axhline(y=ave_integrated_value, color='dimgray', linestyle
    =':',label='P buy positive average' )
plt.axvline(x=x1[0], color='dimgray', linestyle=':',label='PV self
    supply start' )
plt.axvline(x=x1[-1], color='dimgray', linestyle=':',label='PV self
    supply end' )
plt.xticks(np.arange(0, 24, step=5))
# plt.yticks(np.arange(0, 1.6, step=0.5))
plt.grid(True,linewidth=0.1)

# plt.legend(bbox_to_anchor=(1,0), loc="lower left")

plt.tight_layout()
plt.savefig(os.path.join(PLOT_PATH,"dTdWdD_dischargesch{}_index{}.
    PDF".format(testname,minindex)),dpi=1500)



plt.figure(figsize=(6, 3))
plt.xlabel('Time (hour)',fontsize=15)
plt.ylabel('Setpoint (C)',fontsize=15)
plt.rcParams['font.family'] = 'serif'
plt.rcParams['font.serif'] = ['Times New Roman']
plt.plot(np.ones(24)*23.99,color='palevioletred',linewidth=2.5)
plt.plot(list(opt_setpoint_schedule_forEP),color='royalblue',
    linewidth=2.5)
plt.legend(['baseline discharge schedule','optmized discharge
    schedule'])#,loc='lower center')
# plt.axhline(y=ave_integrated_value, color='dimgray', linestyle
    =':',label='P buy positive average' )
plt.axvline(x=x1[0], color='dimgray', linestyle=':',label='PV self
    supply start' )
plt.axvline(x=x1[-1], color='dimgray', linestyle=':',label='PV self
```

```
    supply end' )
plt.xticks(np.arange(0, 24, step=5))
# plt.yticks(np.arange(0, 1.6, step=0.5))
plt.grid(True,linewidth=0.1)
# plt.legend(bbox_to_anchor=(1,0), loc="lower left")

plt.tight_layout()
plt.savefig(os.path.join(PLOT_PATH,"dTdWdD_setpoint{}_index{}.PDF".
    format(testname,minindex)),dpi=1500)
plt.figure(figsize=(6, 3))
plt.xlabel('Time (hour)',fontsize=15)
plt.ylabel('Fan Airspeed (m/s) ',fontsize=15)
plt.rcParams['font.family'] = 'serif'
plt.rcParams['font.serif'] = ['Times New Roman']
plt.plot(np.ones(24)*0.35,color='palevioletred',linewidth=2.5)
plt.plot(list(opt_air_schedule_forEP),color='royalblue',linewidth
    =2.5)
plt.legend(['baseline discharge schedule','optmized discharge
    schedule'])#,loc='lower center')
# plt.axhline(y=ave_integrated_value, color='dimgray', linestyle
    =':',label='P buy positive average' )
plt.axvline(x=x1[0], color='dimgray', linestyle=':',label='PV self
    supply start' )
plt.axvline(x=x1[-1], color='dimgray', linestyle=':',label='PV self
    supply end' )
plt.xticks(np.arange(0, 24, step=5))
# plt.yticks(np.arange(0, 1.6, step=0.5))
plt.grid(True,linewidth=0.1)
# plt.legend(bbox_to_anchor=(1,0), loc="lower left")

plt.tight_layout()
plt.savefig(os.path.join(PLOT_PATH,"dTdWdD_air{}_index{}.PDF".format
    (testname,minindex)),dpi=1500)
```

Check Optimized Solutions with EP

```
idf = IDF(IDF_PATH_BD, EPW_PATH)
```

```
allschedule=idf.idfobjects['Schedule:Compact']
ClgSetPSch=allschedule[-5]
VairSch=allschedule[-2]
fanSch=allschedule[0]
dischargeSch=allschedule[-6]
i_str=3  # string field
i_num=4 # setpoint number field
i_hr=0 # field time start
time_ct=0 # count number of setpoint for a day

for time_ct in range(24):
    i_hr=i_hr+1
    fanSch['Field_{}'.format(i_str)] = 'Until: {}:00'.format(i_hr)
    VairSch['Field_{}'.format(i_str)] = 'Until: {}:00'.format(i_hr)
    ClgSetPSch['Field_{}'.format(i_str)] = 'Until: {}:00'.format(
   i_hr)
    # dischargeSch['Field_{}'.format(i_str)] = 'Until: {}:00'.format
   (i_hr)
    i_str=i_str+2
    fanSch['Field_{}'.format(i_num)] = opt_fan_schedule_forEP[
   time_ct]
    VairSch['Field_{}'.format(i_num)] = opt_air_schedule_forEP[
   time_ct]
    ClgSetPSch['Field_{}'.format(i_num)] =
   opt_setpoint_schedule_forEP[time_ct]
    # dischargeSch['Field_{}'.format(i_num)]=
   opt_discharge_schedule_forEP[time_ct]
    i_num=i_num+2
idf.run(readvars=True, expandobjects=True, output_directory=
   EP_OPT_PATH)

df_opt = pd.read_csv (os.path.join(EP_OPT_PATH,'eplusout.csv'))
Tout_opt=list(df_opt[216:]['Environment:Site Outdoor Air Drybulb
   Temperature [C](Hourly)'])
PV_opt=list(df_opt[216:]['PV ARRAY LOAD CENTER:Electric Load Center
   Produced Electricity Rate [W](Hourly)']/1000)
```

```
BD_opt=list(df_opt[216:]['LIIONBATTERY:Electric Storage Discharge
    Power [W](Hourly)']/1000)
P_buy_opt=list(df_opt[216:]["Whole Building:Facility Net Purchased
    Electricity Rate [W](Hourly)"]/1000)
SET_opt=list(df_opt[216:]["PEOPLE_UNIT1:Zone Thermal Comfort Pierce
    Model Standard Effective Temperature [C](Hourly) "])

a=int((max(P_buy[240:240+24])-max(P_buy_opt[240:240+24]))/max(P_buy
    [240:240+24])*100)
print("Reduced Power",a,"%")
b=int((max(SET[240:240+24])-max(SET_opt[240:240+24]))/max(SET
    [240:240+24])*100)
print("Reduced SET",b,"%")

plt.figure(figsize=(6, 3))
plt.xlabel('Time (hour)',fontsize=15)
plt.ylabel('Power (kW)',fontsize=15)
plt.rcParams['font.family'] = 'serif'
plt.rcParams['font.serif'] = ['Times New Roman']
plt.plot(P_buy[240:240+24],color='palevioletred',linewidth=2.5)
plt.plot(Y_opt_pred[:,0],color='royalblue',linewidth=2.5, linestyle=
    'dotted')
plt.plot(P_buy_opt[240:240+24],color='royalblue',linewidth=2.5)
# plt.legend(['Purchased Power_baseline ','Purchased Power_NN
    prediction','Purchased Power_EP simulation'])#,loc='lower center
    ')
plt.title("Reduced Power{}%".format(a))
# plt.yticks(np.arange(-14, 8, step=3))
plt.grid(True,linewidth=0.1)

plt.tight_layout()
plt.savefig(os.path.join(PLOT_PATH,"dTdWdD_EP_Popt{}_index{}_reduce
    {}%.PDF".format(testname,minindex,a)),dpi=1500)

P_buy_pos_opt=[]
for i in range(24):
```

```
  if P_buy_opt[240:240+24][i]>0.1:
    P_buy_pos_opt.append(list(P_buy_opt[240:240+24])[i])
  else:
    P_buy_pos_opt.append(0)
P_buy_pos_NN=[]
for i in range(24):
  if Y_opt_pred[:,0][i]>0.1:
    P_buy_pos_NN.append(Y_opt_pred[:,0][i])
  else:
    P_buy_pos_NN.append(0)

plt.figure(figsize=(6, 3))
plt.xlabel('Time (hour)',fontsize=15)
plt.ylabel('Power (kW)',fontsize=15)
plt.rcParams['font.family'] = 'serif'
plt.rcParams['font.serif'] = ['Times New Roman']
plt.plot(P_buy_pos,color='palevioletred',linewidth=2.5,label='
    Purchased Power_baseline ')
plt.plot(P_buy_pos_opt,color='royalblue',linewidth=2.5,label='
    Purchased Power_EP simulation')
plt.plot(P_buy_pos_NN,color='royalblue',linewidth=2.5,label='
    Purchased Power_NN prediction',linestyle="dotted")
plt.axvline(x=x1[0], color='dimgray', linestyle=':',label='PV self
    supply start' )
plt.axvline(x=x1[-1], color='dimgray', linestyle=':',label='PV self
    supply end' )
plt.title("Reduced Power{}%".format(a))
# plt.legend(bbox_to_anchor=(1,0), loc="lower left")
# plt.yticks(np.arange(-14, 8, step=3))
plt.grid(True,linewidth=0.1)

plt.tight_layout()
plt.savefig(os.path.join(PLOT_PATH,"dTdWdD_EP_pos_Popt{}_index{}
    _reduce{}%.PDF".format(testname,minindex,a)),dpi=1500)

plt.figure(figsize=(6, 3))
```

```
plt.xlabel('Time (hour)',fontsize=15)
plt.ylabel('SET (C)',fontsize=15)
plt.rcParams['font.family'] = 'serif'
plt.rcParams['font.serif'] = ['Times New Roman']
plt.plot(SET[240:240+24],color='palevioletred',linewidth=2.5)
plt.plot(SET_opt[240:240+24],color='royalblue',linewidth=2.5)
plt.plot(Y_opt_pred[:,1],color='royalblue',linewidth=2.5, linestyle=
    'dotted')
# plt.legend(['Purchased Power_baseline ','Purchased Power_NN
    prediction','Purchased Power_EP simulation'])#,loc='lower center
    ')
plt.axvline(x=x1[0], color='dimgray', linestyle=':',label='PV self
    supply start' )
plt.axvline(x=x1[-1], color='dimgray', linestyle=':',label='PV self
    supply end' )

plt.grid(True,linewidth=0.1)

plt.tight_layout()
plt.savefig(os.path.join(PLOT_PATH,"dTdWdD_EP_SET_opt{}_index{}
    _reduce{}%.PDF".format(testname,minindex,b)),dpi=1500)
```

Appendix D

Example IDF Files

cooling system optimization idf

D.1 MIAMIPNNL idf

This file is modified based on the Building energy codes program published prototype residential energy model for 1A climate. The original model could be found here: https://www.energycodes.go
building-models.

```
!-Generator IDFEditor 1.51
!-Option SortedOrder

!-NOTE: All comments with '!-' are ignored by the IDFEditor and are
   generated automatically.
!-      Use '!' comments if they need to be retained when using the
   IDFEditor.


!-   ===========  ALL OBJECTS IN CLASS: VERSION ===========
```

```
! GPARM parameters as run:
!    ID = US+SF+CZ1AWH+hp+slab+IECC_2021
!    weatherfile = USA_FL_Miami.Intl.AP.722020_TMY3.epw
!    climate_zone = Climate Zone 1
!    moisture_regime = Moist
!    humidity_designation = Warm-Humid
!    tropical_designation = Not Tropical
!    bldg_type = Single-Family
!    fndn_type = Slab
!    system_tag = Heat Pump
!    code = IECC_2021
!    permits = 21846.545507574
!    vent_fan_efficacy = 1.4
!    cfm25 = 4
!    afn_control = MultizoneWithDistribution
!    is_duct_base = no
!    leakage_ratio = 0.0792
!    dhw_type =
!    TEMPLATE_PATH = template/v9.5
Version,
    9.5;                     !- Version Identifier


!-   ===========  ALL OBJECTS IN CLASS: SIMULATIONCONTROL
   ===========

SimulationControl,
    Yes,                     !- Do Zone Sizing Calculation
    Yes,                     !- Do System Sizing Calculation
    No,                      !- Do Plant Sizing Calculation
    Yes,                     !- Run Simulation for Sizing Periods
    Yes,                     !- Run Simulation for Weather File Run
   Periods
    ,                        !- Do HVAC Sizing Simulation for Sizing
    Periods
```

```
    ;                         !- Maximum Number of HVAC Sizing
   Simulation Passes


!-   ===========  ALL OBJECTS IN CLASS: BUILDING ===========

Building,
    US+SF+CZ1AWH+hp+slab+IECC_2021,  !- Name
    0,                        !- North Axis {deg}
    Suburbs,                  !- Terrain
    0.04,                     !- Loads Convergence Tolerance Value {W
   }
    0.4,                      !- Temperature Convergence Tolerance
   Value {deltaC}
    FullExterior,             !- Solar Distribution
    25,                       !- Maximum Number of Warmup Days
    6;                        !- Minimum Number of Warmup Days


!-   ===========  ALL OBJECTS IN CLASS: SURFACECONVECTIONALGORITHM:
   INSIDE ===========

SurfaceConvectionAlgorithm:Inside,
    TARP;                     !- Algorithm


!-   ===========  ALL OBJECTS IN CLASS: TIMESTEP ===========

Timestep,
    6;                        !- Number of Timesteps per Hour


!-   ===========  ALL OBJECTS IN CLASS: SITE:LOCATION ===========

! Location and design-day objects created by:
! Site:Location and design-day objects created by:
```

```
! ./tools/bin/ddy2idf ./tools/epw//USA_FL_Miami.Intl.AP.722020_TMY3.
   ddy
!
Site:Location,
    Miami Intl Ap_FL_USA Design_Conditions,  !- Name
    25.82,                   !- Latitude {deg}
    -80.30,                  !- Longitude {deg}
    -5.00,                   !- Time Zone {hr}
    11.00;                   !- Elevation {m}


!-   ===========  ALL OBJECTS IN CLASS: SIZINGPERIOD:DESIGNDAY
   ===========

SizingPeriod:DesignDay,
    Miami Intl Ap Ann Htg 99.6% Condns DB,  !- Name
    1,                       !- Month
    21,                      !- Day of Month
    WinterDesignDay,         !- Day Type
    8.7,                     !- Maximum Dry-Bulb Temperature {C}
    0.0,                     !- Daily Dry-Bulb Temperature Range {
   deltaC}
    DefaultMultipliers,      !- Dry-Bulb Temperature Range Modifier
   Type
    ,                        !- Dry-Bulb Temperature Range Modifier
   Day Schedule Name
    Wetbulb,                 !- Humidity Condition Type
    8.7,                     !- Wetbulb or DewPoint at Maximum Dry-
   Bulb {C}
    ,                        !- Humidity Condition Day Schedule Name
    ,                        !- Humidity Ratio at Maximum Dry-Bulb {
   kgWater/kgDryAir}
    ,                        !- Enthalpy at Maximum Dry-Bulb {J/kg}
    ,                        !- Daily Wet-Bulb Temperature Range {
   deltaC}
    101193.,                 !- Barometric Pressure {Pa}
```

```
    3.8,                    !- Wind Speed {m/s}
    340,                    !- Wind Direction {deg}
    No,                     !- Rain Indicator
    No,                     !- Snow Indicator
    No,                     !- Daylight Saving Time Indicator
    ASHRAEClearSky,         !- Solar Model Indicator
    ,                       !- Beam Solar Day Schedule Name
    ,                       !- Diffuse Solar Day Schedule Name
    ,                       !- ASHRAE Clear Sky Optical Depth for
   Beam Irradiance (taub) {dimensionless}
    ,                       !- ASHRAE Clear Sky Optical Depth for
   Diffuse Irradiance (taud) {dimensionless}
    0.00;                   !- Sky Clearness

SizingPeriod:DesignDay,
    Miami Intl Ap Ann Clg .4% Condns DB=>MWB,  !- Name
    7,                      !- Month
    21,                     !- Day of Month
    SummerDesignDay,        !- Day Type
    33.2,                   !- Maximum Dry-Bulb Temperature {C}
    6.7,                    !- Daily Dry-Bulb Temperature Range {
   deltaC}
    DefaultMultipliers,     !- Dry-Bulb Temperature Range Modifier
   Type
    ,                       !- Dry-Bulb Temperature Range Modifier
   Day Schedule Name
    Wetbulb,                !- Humidity Condition Type
    25.3,                   !- Wetbulb or DewPoint at Maximum Dry-
   Bulb {C}
    ,                       !- Humidity Condition Day Schedule Name
    ,                       !- Humidity Ratio at Maximum Dry-Bulb {
   kgWater/kgDryAir}
    ,                       !- Enthalpy at Maximum Dry-Bulb {J/kg}
    ,                       !- Daily Wet-Bulb Temperature Range {
   deltaC}
    101193.,                !- Barometric Pressure {Pa}
```

```
    4.5,                     !- Wind Speed {m/s}
    140,                     !- Wind Direction {deg}
    No,                      !- Rain Indicator
    No,                      !- Snow Indicator
    No,                      !- Daylight Saving Time Indicator
    ASHRAETau,               !- Solar Model Indicator
    ,                        !- Beam Solar Day Schedule Name
    ,                        !- Diffuse Solar Day Schedule Name
    0.528,                   !- ASHRAE Clear Sky Optical Depth for
   Beam Irradiance (taub) {dimensionless}
    1.905;                   !- ASHRAE Clear Sky Optical Depth for
   Diffuse Irradiance (taud) {dimensionless}


!-   ===========  ALL OBJECTS IN CLASS: RUNPERIOD ===========

RunPeriod,
    annual,                  !- Name
    7,                       !- Begin Month
    12,                       !- Begin Day of Month
    ,                        !- Begin Year
    8,                      !- End Month
    15,                      !- End Day of Month
    ,                        !- End Year
    Sunday,                  !- Day of Week for Start Day
    Yes,                     !- Use Weather File Holidays and
   Special Days
    Yes,                     !- Use Weather File Daylight Saving
   Period
    No,                      !- Apply Weekend Holiday Rule
    Yes,                     !- Use Weather File Rain Indicators
    Yes;                     !- Use Weather File Snow Indicators


!-   ===========  ALL OBJECTS IN CLASS: SITE:WATERMAINSTEMPERATURE
   ===========
```

```
! Weather_file = USA_FL_Miami.Intl.AP.722020_TMY3.epw;
! Using the stat2idf and the ddy2idf script...
! Water mains temperature correlation object created by:
! Water mains temperature object created by:
! ./tools/bin/stat2idf ./tools/epw//USA_FL_Miami.Intl.AP.722020_TMY3
   .stat
!
Site:WaterMainsTemperature,
    Correlation,             !- Calculation Method
    ,                        !- Temperature Schedule Name
    24.4916666666667,        !- Annual Average Outdoor Air
   Temperature {C}
    8.7;                     !- Maximum Difference In Monthly
   Average Outdoor Air Temperatures {deltaC}


!-   ===========  ALL OBJECTS IN CLASS: SCHEDULETYPELIMITS
   ===========

ScheduleTypeLimits,
    any number;              !- Name

ScheduleTypeLimits,
    On/Off,                  !- Name
    0,                       !- Lower Limit Value
    1,                       !- Upper Limit Value
    Discrete;                !- Numeric Type

ScheduleTypeLimits,
    control_type,            !- Name
    0,                       !- Lower Limit Value
    4,                       !- Upper Limit Value
    Discrete;                !- Numeric Type

ScheduleTypeLimits,
```

```
    fraction,                !- Name
    0,                       !- Lower Limit Value
    1,                       !- Upper Limit Value
    Continuous;              !- Numeric Type

ScheduleTypeLimits,
    Temperature,             !- Name
    -60,                     !- Lower Limit Value
    200,                     !- Upper Limit Value
    Continuous;              !- Numeric Type

ScheduleTypeLimits,
    Fractional,              !- Name
    0,                       !- Lower Limit Value
    1,                       !- Upper Limit Value
    Continuous,              !- Numeric Type
    dimensionless;           !- Unit Type


!-   ===========  ALL OBJECTS IN CLASS: SCHEDULE:DAY:HOURLY
   ===========

!
!
Schedule:Day:Hourly,
    OccupancyDay,            !- Name
    Fraction,                !- Schedule Type Limits Name
    1.00000,                 !- Hour 1
    1.00000,                 !- Hour 2
    1.00000,                 !- Hour 3
    1.00000,                 !- Hour 4
    1.00000,                 !- Hour 5
    1.00000,                 !- Hour 6
    1.00000,                 !- Hour 7
    0.88310,                 !- Hour 8
    0.40861,                 !- Hour 9
```

```
    0.24189,                !- Hour 10
    0.24189,                !- Hour 11
    0.24189,                !- Hour 12
    0.24189,                !- Hour 13
    0.24189,                !- Hour 14
    0.24189,                !- Hour 15
    0.24189,                !- Hour 16
    0.29498,                !- Hour 17
    0.55310,                !- Hour 18
    0.89693,                !- Hour 19
    0.89693,                !- Hour 20
    0.89693,                !- Hour 21
    1.00000,                !- Hour 22
    1.00000,                !- Hour 23
    1.00000;                !- Hour 24

Schedule:Day:Hourly,
    LightingDay,            !- Name
    Fraction,               !- Schedule Type Limits Name
    0.0625,                 !- Hour 1
    0.0625,                 !- Hour 2
    0.0625,                 !- Hour 3
    0.0625,                 !- Hour 4
    0.1875,                 !- Hour 5
    0.390625,               !- Hour 6
    0.4375,                 !- Hour 7
    0.390625,               !- Hour 8
    0.171875,               !- Hour 9
    0.1171875,              !- Hour 10
    0.1171875,              !- Hour 11
    0.1171875,              !- Hour 12
    0.1171875,              !- Hour 13
    0.1171875,              !- Hour 14
    0.1171875,              !- Hour 15
    0.203125,               !- Hour 16
    0.4375,                 !- Hour 17
```

```
    0.609375,                !- Hour 18
    0.8203125,               !- Hour 19
    0.984375,                !- Hour 20
    1,                       !- Hour 21
    0.6875,                  !- Hour 22
    0.3828125,               !- Hour 23
    0.15625;                 !- Hour 24

Schedule:Day:Hourly,
    LightingDay_EELighting_OccSensors,  !- Name
    Fraction,                !- Schedule Type Limits Name
    0.065170403,             !- Hour 1
    0.065170403,             !- Hour 2
    0.065170403,             !- Hour 3
    0.065170403,             !- Hour 4
    0.195511208,             !- Hour 5
    0.407315016,             !- Hour 6
    0.456192818,             !- Hour 7
    0.407315016,             !- Hour 8
    0.179218607,             !- Hour 9
    0.122194505,             !- Hour 10
    0.122194505,             !- Hour 11
    0.122194505,             !- Hour 12
    0.122194505,             !- Hour 13
    0.122194505,             !- Hour 14
    0.122194505,             !- Hour 15
    0.211803808,             !- Hour 16
    0.456192818,             !- Hour 17
    0.635411425,             !- Hour 18
    0.855361533,             !- Hour 19
    0.947933128,             !- Hour 20
    0.947933128,             !- Hour 21
    0.716874428,             !- Hour 22
    0.399168715,             !- Hour 23
    0.162926006;             !- Hour 24
```

```
Schedule:Day:Hourly,
    LightingDay_EELighting_Garage_OccSensors,  !- Name
    Fraction,                 !- Schedule Type Limits Name
    0.048125,                 !- Hour 1
    0.048125,                 !- Hour 2
    0.048125,                 !- Hour 3
    0.048125,                 !- Hour 4
    0.144375,                 !- Hour 5
    0.30078125,               !- Hour 6
    0.336875,                 !- Hour 7
    0.30078125,               !- Hour 8
    0.13234375,               !- Hour 9
    0.090234375,              !- Hour 10
    0.090234375,              !- Hour 11
    0.090234375,              !- Hour 12
    0.090234375,              !- Hour 13
    0.090234375,              !- Hour 14
    0.090234375,              !- Hour 15
    0.15640625,               !- Hour 16
    0.336875,                 !- Hour 17
    0.46921875,               !- Hour 18
    0.631640625,              !- Hour 19
    0.7,                      !- Hour 20
    0.7,                      !- Hour 21
    0.529375,                 !- Hour 22
    0.294765625,              !- Hour 23
    0.1203125;                !- Hour 24

Schedule:Day:Hourly,
    ExteriorLightingDay,      !- Name
    Fraction,                 !- Schedule Type Limits Name
    1,                        !- Hour 1
    1,                        !- Hour 2
    1,                        !- Hour 3
    1,                        !- Hour 4
    1,                        !- Hour 5
```

```
    1,                          !- Hour 6
    0,                          !- Hour 7
    0,                          !- Hour 8
    0,                          !- Hour 9
    0,                          !- Hour 10
    0,                          !- Hour 11
    0,                          !- Hour 12
    0,                          !- Hour 13
    0,                          !- Hour 14
    0,                          !- Hour 15
    0,                          !- Hour 16
    0,                          !- Hour 17
    0,                          !- Hour 18
    1,                          !- Hour 19
    1,                          !- Hour 20
    1,                          !- Hour 21
    1,                          !- Hour 22
    1,                          !- Hour 23
    1;                          !- Hour 24

Schedule:Day:Hourly,
    LightingDay_EELighting,  !- Name
    Fraction,                !- Schedule Type Limits Name
    0.06875,                 !- Hour 1
    0.06875,                 !- Hour 2
    0.06875,                 !- Hour 3
    0.06875,                 !- Hour 4
    0.20625,                 !- Hour 5
    0.4296875,               !- Hour 6
    0.48125,                 !- Hour 7
    0.4296875,               !- Hour 8
    0.1890625,               !- Hour 9
    0.12890625,              !- Hour 10
    0.12890625,              !- Hour 11
    0.12890625,              !- Hour 12
    0.12890625,              !- Hour 13
```

```
    0.12890625,             !- Hour 14
    0.12890625,             !- Hour 15
    0.2234375,              !- Hour 16
    0.48125,                !- Hour 17
    0.6703125,              !- Hour 18
    0.90234375,             !- Hour 19
    1,                      !- Hour 20
    1,                      !- Hour 21
    0.75625,                !- Hour 22
    0.42109375,             !- Hour 23
    0.171875;               !- Hour 24

Schedule:Day:Hourly,
    RefrigeratorDay,        !- Name
    Fraction,               !- Schedule Type Limits Name
    0.8,                    !- Hour 1
    0.782696177062374,      !- Hour 2
    0.765593561368209,      !- Hour 3
    0.742857142857143,      !- Hour 4
    0.731388329979879,      !- Hour 5
    0.731388329979879,      !- Hour 6
    0.759959758551308,      !- Hour 7
    0.8,                    !- Hour 8
    0.817102615694165,      !- Hour 9
    0.828571428571429,      !- Hour 10
    0.8,                    !- Hour 11
    0.8,                    !- Hour 12
    0.839839034205231,      !- Hour 13
    0.839839034205231,      !- Hour 14
    0.828571428571429,      !- Hour 15
    0.839839034205231,      !- Hour 16
    0.885714285714286,      !- Hour 17
    0.971428571428572,      !- Hour 18
    1,                      !- Hour 19
    0.971428571428572,      !- Hour 20
    0.942857142857143,      !- Hour 21
```

```
    0.925553319919517,       !- Hour 22
    0.885714285714286,       !- Hour 23
    0.828571428571429;       !- Hour 24

Schedule:Day:Hourly,
    MiscPlugLoadDay,         !- Name
    Fraction,                !- Schedule Type Limits Name
    0.607490272373541,       !- Hour 1
    0.559338521400778,       !- Hour 2
    0.552853437094682,       !- Hour 3
    0.545071335927367,       !- Hour 4
    0.524481193255512,       !- Hour 5
    0.585278858625162,       !- Hour 6
    0.676232166018158,       !- Hour 7
    0.718547341115435,       !- Hour 8
    0.607490272373541,       !- Hour 9
    0.517023346303502,       !- Hour 10
    0.529182879377432,       !- Hour 11
    0.529345006485084,       !- Hour 12
    0.520428015564202,       !- Hour 13
    0.538424124513619,       !- Hour 14
    0.568741893644617,       !- Hour 15
    0.600356679636835,       !- Hour 16
    0.71011673151751,        !- Hour 17
    0.862678339818418,       !- Hour 18
    0.936608300907912,       !- Hour 19
    0.966763942931258,       !- Hour 20
    1,                       !- Hour 21
    0.976653696498055,       !- Hour 22
    0.845168612191959,       !- Hour 23
    0.73443579766537;        !- Hour 24

Schedule:Day:Hourly,
    CookingRangeDay,         !- Name
    Fraction,                !- Schedule Type Limits Name
    0.04715848452508,        !- Hour 1
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    0.04715848452508,        !- Hour 2
    0.0235458911419424,      !- Hour 3
    0.0235458911419424,      !- Hour 4
    0.04715848452508,        !- Hour 5
    0.0707043756670224,      !- Hour 6
    0.165088046958378,       !- Hour 7
    0.283017609391676,       !- Hour 8
    0.306563500533618,       !- Hour 9
    0.320771077908218,       !- Hour 10
    0.283017609391676,       !- Hour 11
    0.330176093916756,       !- Hour 12
    0.377334578441836,       !- Hour 13
    0.306563500533618,       !- Hour 14
    0.292422625400213,       !- Hour 15
    0.377334578441836,       !- Hour 16
    0.613193703308431,       !- Hour 17
    1,                       !- Hour 18
    0.778348452508004,       !- Hour 19
    0.400947171824973,       !- Hour 20
    0.235859124866596,       !- Hour 21
    0.165088046958378,       !- Hour 22
    0.103721985058698,       !- Hour 23
    0.0707043756670224;      !- Hour 24

Schedule:Day:Hourly,
    DishwasherWeekday,       !- Name
    Fraction,                !- Schedule Type Limits Name
    0.115858456545258,       !- Hour 1
    0.0514758745041469,      !- Hour 2
    0.0385691669671833,      !- Hour 3
    0.0257379372520738,      !- Hour 4
    0.0257379372520738,      !- Hour 5
    0.0772138117562207,      !- Hour 6
    0.154503101334295,       !- Hour 7
    0.23179239091237,        !- Hour 8
    0.437922322394519,       !- Hour 9
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    0.489398196898665,       !- Hour 10
    0.425015614857555,       !- Hour 11
    0.360633032816445,       !- Hour 12
    0.309081680490443,       !- Hour 13
    0.347726325279481,       !- Hour 14
    0.28334374323837,        !- Hour 15
    0.270437035701407,       !- Hour 16
    0.28334374323837,        !- Hour 17
    0.373464262531554,       !- Hour 18
    0.656883483591778,       !- Hour 19
    0.837199999999997,       !- Hour 20
    0.682621420843852,       !- Hour 21
    0.502304904435629,       !- Hour 22
    0.334819617742518,       !- Hour 23
    0.23179239091237;        !- Hour 24

Schedule:Day:Hourly,
    DishwasherWeekend,       !- Name
    Fraction,                !- Schedule Type Limits Name
    0.124134060584205,       !- Hour 1
    0.0551527226830148,      !- Hour 2
    0.0413241074648395,      !- Hour 3
    0.0275763613415074,      !- Hour 4
    0.0275763613415074,      !- Hour 5
    0.0827290840245222,      !- Hour 6
    0.165539037143888,       !- Hour 7
    0.248348990263252,       !- Hour 8
    0.469202488279841,       !- Hour 9
    0.524355210962856,       !- Hour 10
    0.455373873061666,       !- Hour 11
    0.386392535160476,       !- Hour 12
    0.331158943382618,       !- Hour 13
    0.3725639199423,         !- Hour 14
    0.303582582041111,       !- Hour 15
    0.289753966822935,       !- Hour 16
    0.303582582041111,       !- Hour 17
```

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    0.400140281283808,       !- Hour 18
    0.703803732419762,       !- Hour 19
    0.897,                   !- Hour 20
    0.731380093761269,       !- Hour 21
    0.538183826181031,       !- Hour 22
    0.358735304724125,       !- Hour 23
    0.248348990263252;       !- Hour 24

Schedule:Day:Hourly,
    DishwasherVacation,      !- Name
    Fraction,                !- Schedule Type Limits Name
    0,                       !- Hour 1
    0,                       !- Hour 2
    0,                       !- Hour 3
    0,                       !- Hour 4
    0,                       !- Hour 5
    0,                       !- Hour 6
    0,                       !- Hour 7
    0,                       !- Hour 8
    0,                       !- Hour 9
    0,                       !- Hour 10
    0,                       !- Hour 11
    0,                       !- Hour 12
    0,                       !- Hour 13
    0,                       !- Hour 14
    0,                       !- Hour 15
    0,                       !- Hour 16
    0,                       !- Hour 17
    0,                       !- Hour 18
    0,                       !- Hour 19
    0,                       !- Hour 20
    0,                       !- Hour 21
    0,                       !- Hour 22
    0,                       !- Hour 23
    0;                       !- Hour 24
```

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Schedule:Day:Hourly,
    ClothesWasherWeekday,    !- Name
    Fraction,                !- Schedule Type Limits Name
    0.0796474528960224,      !- Hour 1
    0.0637009071877185,      !- Hour 2
    0.0318078157711097,      !- Hour 3
    0.0318078157711097,      !- Hour 4
    0.0637009071877185,      !- Hour 5
    0.0955939986043261,      !- Hour 6
    0.191187997208654,       !- Hour 7
    0.414354361479414,       !- Hour 8
    0.62157418004187,        !- Hour 9
    0.7332,                  !- Hour 10
    0.717253454291697,       !- Hour 11
    0.637520725750175,       !- Hour 12
    0.573734542916957,       !- Hour 13
    0.510033635729239,       !- Hour 14
    0.446247452896022,       !- Hour 15
    0.414354361479414,       !- Hour 16
    0.430300907187718,       !- Hour 17
    0.414354361479414,       !- Hour 18
    0.414354361479414,       !- Hour 19
    0.414354361479414,       !- Hour 20
    0.414354361479414,       !- Hour 21
    0.398407815771109,       !- Hour 22
    0.270920725750174,       !- Hour 23
    0.143433635729239;       !- Hour 24

Schedule:Day:Hourly,
    ClothesWasherWeekend,    !- Name
    Fraction,                !- Schedule Type Limits Name
    0.0974410327983253,      !- Hour 1
    0.0779319609211445,      !- Hour 2
    0.038913817166783,       !- Hour 3
    0.038913817166783,       !- Hour 4
    0.0779319609211445,      !- Hour 5
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    0.116950104675506,       !- Hour 6
    0.233900209351012,       !- Hour 7
    0.506922889043964,       !- Hour 8
    0.760436496859734,       !- Hour 9
    0.897,                   !- Hour 10
    0.877490928122819,       !- Hour 11
    0.779945568736915,       !- Hour 12
    0.701909281228193,       !- Hour 13
    0.623977320307048,       !- Hour 14
    0.545941032798325,       !- Hour 15
    0.506922889043964,       !- Hour 16
    0.526431960921144,       !- Hour 17
    0.506922889043964,       !- Hour 18
    0.506922889043964,       !- Hour 19
    0.506922889043964,       !- Hour 20
    0.506922889043964,       !- Hour 21
    0.487413817166783,       !- Hour 22
    0.331445568736915,       !- Hour 23
    0.175477320307048;       !- Hour 24

Schedule:Day:Hourly,
    ClothesWasherVacation,   !- Name
    Fraction,                !- Schedule Type Limits Name
    0,                       !- Hour 1
    0,                       !- Hour 2
    0,                       !- Hour 3
    0,                       !- Hour 4
    0,                       !- Hour 5
    0,                       !- Hour 6
    0,                       !- Hour 7
    0,                       !- Hour 8
    0,                       !- Hour 9
    0,                       !- Hour 10
    0,                       !- Hour 11
    0,                       !- Hour 12
    0,                       !- Hour 13
```

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    0,                          !- Hour 14
    0,                          !- Hour 15
    0,                          !- Hour 16
    0,                          !- Hour 17
    0,                          !- Hour 18
    0,                          !- Hour 19
    0,                          !- Hour 20
    0,                          !- Hour 21
    0,                          !- Hour 22
    0,                          !- Hour 23
    0;                          !- Hour 24

Schedule:Day:Hourly,
    dhw_profile_day,            !- Name
    fraction,                   !- Schedule Type Limits Name
    0.006,                      !- Hour 1
    0.003,                      !- Hour 2
    0.001,                      !- Hour 3
    0.001,                      !- Hour 4
    0.003,                      !- Hour 5
    0.021,                      !- Hour 6
    0.075,                      !- Hour 7
    0.079,                      !- Hour 8
    0.076,                      !- Hour 9
    0.067,                      !- Hour 10
    0.061,                      !- Hour 11
    0.05,                       !- Hour 12
    0.042,                      !- Hour 13
    0.038,                      !- Hour 14
    0.033,                      !- Hour 15
    0.038,                      !- Hour 16
    0.043,                      !- Hour 17
    0.058,                      !- Hour 18
    0.068,                      !- Hour 19
    0.065,                      !- Hour 20
    0.06,                       !- Hour 21
```

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    0.047,                  !- Hour 22
    0.041,                  !- Hour 23
    0.024;                  !- Hour 24

Schedule:Day:Hourly,
    ClothesDryerWeekday,    !- Name
    Fraction,               !- Schedule Type Limits Name
    0.0996818663838815,     !- Hour 1
    0.0598091198303289,     !- Hour 2
    0.0398727465535526,     !- Hour 3
    0.0199363732767763,     !- Hour 4
    0.0398727465535526,     !- Hour 5
    0.0598091198303289,     !- Hour 6
    0.15949098621421,       !- Hour 7
    0.31898197242842,       !- Hour 8
    0.486427370202556,      !- Hour 9
    0.685791102970318,      !- Hour 10
    0.785472969354199,      !- Hour 11
    0.817391304347826,      !- Hour 12
    0.745600222800647,      !- Hour 13
    0.677836691410393,      !- Hour 14
    0.610073160020138,      !- Hour 15
    0.578154825026511,      !- Hour 16
    0.558218451749735,      !- Hour 17
    0.546236490032885,      !- Hour 18
    0.518345705196183,      !- Hour 19
    0.510391293636256,      !- Hour 20
    0.526300116756109,      !- Hour 21
    0.546236490032885,      !- Hour 22
    0.438600212089077,      !- Hour 23
    0.239236479321316;      !- Hour 24

Schedule:Day:Hourly,
    ClothesDryerWeekend,    !- Name
    Fraction,               !- Schedule Type Limits Name
    0.121951219512195,      !- Hour 1
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    0.0731707317073171,       !- Hour 2
    0.0487804878048781,       !- Hour 3
    0.024390243902439,        !- Hour 4
    0.0487804878048781,       !- Hour 5
    0.0731707317073171,       !- Hour 6
    0.195121951219512,        !- Hour 7
    0.390243902439024,        !- Hour 8
    0.59509731460951,         !- Hour 9
    0.8389997536339,          !- Hour 10
    0.960950973146095,        !- Hour 11
    1,                        !- Hour 12
    0.912170485341217,        !- Hour 13
    0.829268292682927,        !- Hour 14
    0.746366100024637,        !- Hour 15
    0.707317073170732,        !- Hour 16
    0.682926829268293,        !- Hour 17
    0.668268046316827,        !- Hour 18
    0.634146341463415,        !- Hour 19
    0.624414880512441,        !- Hour 20
    0.643877802414388,        !- Hour 21
    0.668268046316827,        !- Hour 22
    0.536585365853659,        !- Hour 23
    0.292682926829268;        !- Hour 24

Schedule:Day:Hourly,
    ClothesDryerVacation,     !- Name
    Fraction,                 !- Schedule Type Limits Name
    0,                        !- Hour 1
    0,                        !- Hour 2
    0,                        !- Hour 3
    0,                        !- Hour 4
    0,                        !- Hour 5
    0,                        !- Hour 6
    0,                        !- Hour 7
    0,                        !- Hour 8
    0,                        !- Hour 9
```

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    0,                      !- Hour 10
    0,                      !- Hour 11
    0,                      !- Hour 12
    0,                      !- Hour 13
    0,                      !- Hour 14
    0,                      !- Hour 15
    0,                      !- Hour 16
    0,                      !- Hour 17
    0,                      !- Hour 18
    0,                      !- Hour 19
    0,                      !- Hour 20
    0,                      !- Hour 21
    0,                      !- Hour 22
    0,                      !- Hour 23
    0;                      !- Hour 24

Schedule:Day:Hourly,
    SinksWeekday,           !- Name
    Fraction,               !- Schedule Type Limits Name
    0.160052687884461,      !- Hour 1
    0.0767484287242575,     !- Hour 2
    0.0575330636533838,     !- Hour 3
    0.0575330636533838,     !- Hour 4
    0.0767484287242575,     !- Hour 5
    0.204926216902916,      !- Hour 6
    0.480271095212623,      !- Hour 7
    0.704412677186414,      !- Hour 8
    0.742843407328163,      !- Hour 9
    0.697969878309708,      !- Hour 10
    0.614778650708746,      !- Hour 11
    0.563462322813587,      !- Hour 12
    0.550689756619418,      !- Hour 13
    0.512259026477668,      !- Hour 14
    0.467385497459214,      !- Hour 15
    0.486600862530089,      !- Hour 16
    0.544246957742712,      !- Hour 17
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    0.736400608451458,       !- Hour 18
    0.84525,                 !- Hour 19
    0.781274137469912,       !- Hour 20
    0.640323783097085,       !- Hour 21
    0.544246957742712,       !- Hour 22
    0.44828316394758,        !- Hour 23
    0.307332809574753;       !- Hour 24

Schedule:Day:Hourly,
    SinksWeekend,            !- Name
    Fraction,                !- Schedule Type Limits Name
    0.169851832040653,       !- Hour 1
    0.0814473121155389,      !- Hour 2
    0.0610554961219577,      !- Hour 3
    0.0610554961219577,      !- Hour 4
    0.0814473121155389,      !- Hour 5
    0.217472719978604,       !- Hour 6
    0.509675447980744,       !- Hour 7
    0.747539983952929,       !- Hour 8
    0.788323615940091,       !- Hour 9
    0.74070272800214,        !- Hour 10
    0.652418159935812,       !- Hour 11
    0.597960016047071,       !- Hour 12
    0.58440545600428,        !- Hour 13
    0.543621824017117,       !- Hour 14
    0.496000936079166,       !- Hour 15
    0.516392752072746,       !- Hour 16
    0.57756820005349,        !- Hour 17
    0.781486359989302,       !- Hour 18
    0.897,                   !- Hour 19
    0.829107247927254,       !- Hour 20
    0.679527280021396,       !- Hour 21
    0.57756820005349,        !- Hour 22
    0.47572907194437,        !- Hour 23
    0.326149104038513;       !- Hour 24
```

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Schedule:Day:Hourly,
    SinksVacation,           !- Name
    Fraction,                !- Schedule Type Limits Name
    0,                       !- Hour 1
    0,                       !- Hour 2
    0,                       !- Hour 3
    0,                       !- Hour 4
    0,                       !- Hour 5
    0,                       !- Hour 6
    0,                       !- Hour 7
    0,                       !- Hour 8
    0,                       !- Hour 9
    0,                       !- Hour 10
    0,                       !- Hour 11
    0,                       !- Hour 12
    0,                       !- Hour 13
    0,                       !- Hour 14
    0,                       !- Hour 15
    0,                       !- Hour 16
    0,                       !- Hour 17
    0,                       !- Hour 18
    0,                       !- Hour 19
    0,                       !- Hour 20
    0,                       !- Hour 21
    0,                       !- Hour 22
    0,                       !- Hour 23
    0;                       !- Hour 24

Schedule:Day:Hourly,
    ShowersWeekday,          !- Name
    Fraction,                !- Schedule Type Limits Name
    0.076044361285933,       !- Hour 1
    0.0345332539547544,      !- Hour 2
    0.0242088790610646,      !- Hour 3
    0.0345332539547544,      !- Hour 4
    0.0968355162442594,      !- Hour 5
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    0.366693315189659,       !- Hour 6
    0.837199999999997,       !- Hour 7
    0.830293349209049,       !- Hour 8
    0.674644497363497,       !- Hour 9
    0.529320020411635,       !- Hour 10
    0.425506650790951,       !- Hour 11
    0.335577785337642,       !- Hour 12
    0.242159993196122,       !- Hour 13
    0.207555536655894,       !- Hour 14
    0.179857730906617,       !- Hour 15
    0.186764381697567,       !- Hour 16
    0.214462187446844,       !- Hour 17
    0.27676444973635,        !- Hour 18
    0.300973328797414,       !- Hour 19
    0.300973328797414,       !- Hour 20
    0.297484402109202,       !- Hour 21
    0.290577751318252,       !- Hour 22
    0.207555536655894,       !- Hour 23
    0.148742201054601;       !- Hour 24

Schedule:Day:Hourly,
    ShowersWeekend,          !- Name
    Fraction,                !- Schedule Type Limits Name
    0.0814761013777853,      !- Hour 1
    0.0369999149515223,      !- Hour 2
    0.0259380847082837,      !- Hour 3
    0.0369999149515223,      !- Hour 4
    0.103752338833135,       !- Hour 5
    0.392885694846062,       !- Hour 6
    0.897,                   !- Hour 7
    0.889600017009696,       !- Hour 8
    0.722833390032318,       !- Hour 9
    0.56712859329818,        !- Hour 10
    0.455899982990304,       !- Hour 11
    0.359547627147474,       !- Hour 12
    0.259457135567274,       !- Hour 13
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    0.222380932131315,       !- Hour 14
    0.19270471168566,        !- Hour 15
    0.200104694675966,       !- Hour 16
    0.229780915121619,       !- Hour 17
    0.296533339003232,       !- Hour 18
    0.322471423711515,       !- Hour 19
    0.322471423711515,       !- Hour 20
    0.318733287974145,       !- Hour 21
    0.311333304983841,       !- Hour 22
    0.222380932131315,       !- Hour 23
    0.159366643987073;       !- Hour 24

Schedule:Day:Hourly,
    ShowersVacation,         !- Name
    Fraction,                !- Schedule Type Limits Name
    0,                       !- Hour 1
    0,                       !- Hour 2
    0,                       !- Hour 3
    0,                       !- Hour 4
    0,                       !- Hour 5
    0,                       !- Hour 6
    0,                       !- Hour 7
    0,                       !- Hour 8
    0,                       !- Hour 9
    0,                       !- Hour 10
    0,                       !- Hour 11
    0,                       !- Hour 12
    0,                       !- Hour 13
    0,                       !- Hour 14
    0,                       !- Hour 15
    0,                       !- Hour 16
    0,                       !- Hour 17
    0,                       !- Hour 18
    0,                       !- Hour 19
    0,                       !- Hour 20
    0,                       !- Hour 21
```

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    0,                      !- Hour 22
    0,                      !- Hour 23
    0;                      !- Hour 24

Schedule:Day:Hourly,
    BathsWeekday,           !- Name
    Fraction,               !- Schedule Type Limits Name
    0.0492758944582015,     !- Hour 1
    0.0246379472291013,     !- Hour 2
    0.0246379472291013,     !- Hour 3
    0.0246379472291013,     !- Hour 4
    0.0492758944582015,     !- Hour 5
    0.123189736145504,      !- Hour 6
    0.295719195628041,      !- Hour 7
    0.369633037315344,      !- Hour 8
    0.418908931773546,      !- Hour 9
    0.369633037315344,      !- Hour 10
    0.295719195628041,      !- Hour 11
    0.221741525061908,      !- Hour 12
    0.197103577832807,      !- Hour 13
    0.147827683374605,      !- Hour 14
    0.147827683374605,      !- Hour 15
    0.147827683374605,      !- Hour 16
    0.24644330116984,       !- Hour 17
    0.295719195628041,      !- Hour 18
    0.492886602339681,      !- Hour 19
    0.640714285714285,      !- Hour 20
    0.640714285714285,      !- Hour 21
    0.492886602339681,      !- Hour 22
    0.418908931773546,      !- Hour 23
    0.24644330116984;       !- Hour 24

Schedule:Day:Hourly,
    BathsWeekend,           !- Name
    Fraction,               !- Schedule Type Limits Name
    0.0689862522414824,     !- Hour 1
```

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    0.0344931261207412,      !- Hour 2
    0.0344931261207412,      !- Hour 3
    0.0344931261207412,      !- Hour 4
    0.0689862522414824,      !- Hour 5
    0.172465630603706,       !- Hour 6
    0.414006873879259,       !- Hour 7
    0.517486252241482,       !- Hour 8
    0.586472504482965,       !- Hour 9
    0.517486252241482,       !- Hour 10
    0.414006873879259,       !- Hour 11
    0.310438135086671,       !- Hour 12
    0.27594500896593,        !- Hour 13
    0.206958756724447,       !- Hour 14
    0.206958756724447,       !- Hour 15
    0.206958756724447,       !- Hour 16
    0.345020621637776,       !- Hour 17
    0.414006873879259,       !- Hour 18
    0.690041243275553,       !- Hour 19
    0.897,                   !- Hour 20
    0.897,                   !- Hour 21
    0.690041243275553,       !- Hour 22
    0.586472504482965,       !- Hour 23
    0.345020621637776;       !- Hour 24

Schedule:Day:Hourly,
    BathsVacation,           !- Name
    Fraction,                !- Schedule Type Limits Name
    0,                       !- Hour 1
    0,                       !- Hour 2
    0,                       !- Hour 3
    0,                       !- Hour 4
    0,                       !- Hour 5
    0,                       !- Hour 6
    0,                       !- Hour 7
    0,                       !- Hour 8
    0,                       !- Hour 9
```

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    0,                          !- Hour 10
    0,                          !- Hour 11
    0,                          !- Hour 12
    0,                          !- Hour 13
    0,                          !- Hour 14
    0,                          !- Hour 15
    0,                          !- Hour 16
    0,                          !- Hour 17
    0,                          !- Hour 18
    0,                          !- Hour 19
    0,                          !- Hour 20
    0,                          !- Hour 21
    0,                          !- Hour 22
    0,                          !- Hour 23
    0;                          !- Hour 24

Schedule:Day:Hourly,
    DHWDistDay,                 !- Name
    Fraction,                   !- Schedule Type Limits Name
    0.142553149370226,          !- Hour 1
    0.0764866759550322,         !- Hour 2
    0.0516611840277747,         !- Hour 3
    0.0584039294664903,         !- Hour 4
    0.121469841058603,          !- Hour 5
    0.366180268451559,          !- Hour 6
    0.833258955739606,          !- Hour 7
    0.999999987228391,          !- Hour 8
    0.995483090581232,          !- Hour 9
    0.916474762598139,          !- Hour 10
    0.800898393293271,          !- Hour 11
    0.682564390940485,          !- Hour 12
    0.590066600109555,          !- Hour 13
    0.522371887032053,          !- Hour 14
    0.466005974303267,          !- Hour 15
    0.46573704253214,           !- Hour 16
    0.527514234916123,          !- Hour 17
```

```
    0.637905701335668,       !- Hour 18
    0.727588642310272,       !- Hour 19
    0.732551127624518,       !- Hour 20
    0.681468471942116,       !- Hour 21
    0.610804704600985,       !- Hour 22
    0.464292318119835,       !- Hour 23
    0.299867724445383;       !- Hour 24

Schedule:Day:Hourly,
    WinterLoadDay,           !- Name
    Fraction,                !- Schedule Type Limits Name
    0,                       !- Hour 1
    0,                       !- Hour 2
    0,                       !- Hour 3
    0,                       !- Hour 4
    0,                       !- Hour 5
    0,                       !- Hour 6
    0,                       !- Hour 7
    0,                       !- Hour 8
    0,                       !- Hour 9
    0,                       !- Hour 10
    0,                       !- Hour 11
    0,                       !- Hour 12
    0,                       !- Hour 13
    0,                       !- Hour 14
    0,                       !- Hour 15
    0,                       !- Hour 16
    0,                       !- Hour 17
    0,                       !- Hour 18
    0,                       !- Hour 19
    0,                       !- Hour 20
    0,                       !- Hour 21
    0,                       !- Hour 22
    0,                       !- Hour 23
    0;                       !- Hour 24
```

```
Schedule:Day:Hourly,
    SummerLoadDay,           !- Name
    Fraction,                !- Schedule Type Limits Name
    1,                       !- Hour 1
    1,                       !- Hour 2
    1,                       !- Hour 3
    1,                       !- Hour 4
    1,                       !- Hour 5
    1,                       !- Hour 6
    1,                       !- Hour 7
    1,                       !- Hour 8
    1,                       !- Hour 9
    1,                       !- Hour 10
    1,                       !- Hour 11
    1,                       !- Hour 12
    1,                       !- Hour 13
    1,                       !- Hour 14
    1,                       !- Hour 15
    1,                       !- Hour 16
    1,                       !- Hour 17
    1,                       !- Hour 18
    1,                       !- Hour 19
    1,                       !- Hour 20
    1,                       !- Hour 21
    1,                       !- Hour 22
    1,                       !- Hour 23
    1;                       !- Hour 24


!-   ===========  ALL OBJECTS IN CLASS: SCHEDULE:WEEK:COMPACT
   ===========

Schedule:Week:Compact,
    RefrigeratorWeek,        !- Name
    For: AllDays,            !- DayType List 1
    RefrigeratorDay;         !- Schedule:Day Name 1
```

```
Schedule:Week:Compact,
    MiscPlugLoadWeek,         !- Name
    For: AllDays,             !- DayType List 1
    MiscPlugLoadDay;          !- Schedule:Day Name 1

Schedule:Week:Compact,
    CookingRangeWeek,         !- Name
    For: AllDays,             !- DayType List 1
    CookingRangeDay;          !- Schedule:Day Name 1

Schedule:Week:Compact,
    DishwasherWeek,           !- Name
    For: Weekdays,            !- DayType List 1
    DishwasherWeekday,        !- Schedule:Day Name 1
    For: CustomDay1,          !- DayType List 2
    DishwasherVacation,       !- Schedule:Day Name 2
    For: AllOtherDays,        !- DayType List 3
    DishwasherWeekend;        !- Schedule:Day Name 3

Schedule:Week:Compact,
    ClothesWasherWeek,        !- Name
    For: Weekdays,            !- DayType List 1
    ClothesWasherWeekday,     !- Schedule:Day Name 1
    For: CustomDay1,          !- DayType List 2
    ClothesWasherVacation,    !- Schedule:Day Name 2
    For: AllOtherDays,        !- DayType List 3
    ClothesWasherWeekend;     !- Schedule:Day Name 3

Schedule:Week:Compact,
    dhw_profile_week,         !- Name
    AllDays,                  !- DayType List 1
    dhw_profile_day;          !- Schedule:Day Name 1

Schedule:Week:Compact,
    ClothesDryerWeek,         !- Name
```

```
    For: Weekdays,           !- DayType List 1
    ClothesDryerWeekday,     !- Schedule:Day Name 1
    For: CustomDay1,         !- DayType List 2
    ClothesDryerVacation,    !- Schedule:Day Name 2
    For: AllOtherDays,       !- DayType List 3
    ClothesDryerWeekend;     !- Schedule:Day Name 3

Schedule:Week:Compact,
    SinksWeek,               !- Name
    For: Weekdays,           !- DayType List 1
    SinksWeekday,            !- Schedule:Day Name 1
    For: CustomDay1,         !- DayType List 2
    SinksVacation,           !- Schedule:Day Name 2
    For: AllOtherDays,       !- DayType List 3
    SinksWeekend;            !- Schedule:Day Name 3

Schedule:Week:Compact,
    ShowersWeek,             !- Name
    For: Weekdays,           !- DayType List 1
    ShowersWeekday,          !- Schedule:Day Name 1
    For: CustomDay1,         !- DayType List 2
    ShowersVacation,         !- Schedule:Day Name 2
    For: AllOtherDays,       !- DayType List 3
    ShowersWeekend;          !- Schedule:Day Name 3

Schedule:Week:Compact,
    BathsWeek,               !- Name
    For: Weekdays,           !- DayType List 1
    BathsWeekday,            !- Schedule:Day Name 1
    For: CustomDay1,         !- DayType List 2
    BathsVacation,           !- Schedule:Day Name 2
    For: AllOtherDays,       !- DayType List 3
    BathsWeekend;            !- Schedule:Day Name 3

Schedule:Week:Compact,
    DHWDistWeek,             !- Name
```

```
    For: AllDays,            !- DayType List 1
    DHWDistDay;              !- Schedule:Day Name 1

Schedule:Week:Compact,
    OccupancyWeek,           !- Name
    AllDays,                 !- DayType List 1
    OccupancyDay;            !- Schedule:Day Name 1

Schedule:Week:Compact,
    LightingProfileWeek,     !- Name
    For: AllDays,            !- DayType List 1
    LightingDay;             !- Schedule:Day Name 1

Schedule:Week:Compact,
    LightingProfileWeek_EELighting,  !- Name
    For: AllDays,            !- DayType List 1
    LightingDay_EELighting;  !- Schedule:Day Name 1

Schedule:Week:Compact,
    LightingProfileWeek_EELighting_interior_controls,  !- Name
    For: AllDays,            !- DayType List 1
    LightingDay_EELighting_OccSensors;  !- Schedule:Day Name 1

Schedule:Week:Compact,
    LightingProfileWeek_EELighting_garage_controls,  !- Name
    For: AllDays,            !- DayType List 1
    LightingDay_EELighting_Garage_OccSensors;  !- Schedule:Day Name
   1

Schedule:Week:Compact,
    ExteriorLightingProfileWeek,  !- Name
    For: AllDays,            !- DayType List 1
    ExteriorLightingDay;     !- Schedule:Day Name 1


!-   ===========  ALL OBJECTS IN CLASS: SCHEDULE:YEAR ===========
```

```
Schedule:Year,
    Occupancy,               !- Name
    Fraction,                !- Schedule Type Limits Name
    OccupancyWeek,           !- Schedule:Week Name 1
    1,                       !- Start Month 1
    1,                       !- Start Day 1
    12,                      !- End Month 1
    31;                      !- End Day 1

Schedule:Year,
    InteriorLighting,        !- Name
    Fraction,                !- Schedule Type Limits Name
    LightingProfileWeek,     !- Schedule:Week Name 1
    1,                       !- Start Month 1
    1,                       !- Start Day 1
    12,                      !- End Month 1
    31;                      !- End Day 1

Schedule:Year,
    InteriorLightingHE,      !- Name
    Fraction,                !- Schedule Type Limits Name
    LightingProfileWeek_EELighting,  !- Schedule:Week Name 1
    1,                       !- Start Month 1
    1,                       !- Start Day 1
    12,                      !- End Month 1
    31;                      !- End Day 1

Schedule:Year,
    InteriorLightingHE_OS,   !- Name
    Fraction,                !- Schedule Type Limits Name
    LightingProfileWeek_EELighting_interior_controls,  !- Schedule:
   Week Name 1
    1,                       !- Start Month 1
    1,                       !- Start Day 1
    12,                      !- End Month 1
```

```
    31;                       !- End Day 1

Schedule:Year,
    InteriorLightingHE_VS,    !- Name
    Fraction,                 !- Schedule Type Limits Name
    LightingProfileWeek_EELighting_garage_controls,  !- Schedule:
   Week Name 1
    1,                        !- Start Month 1
    1,                        !- Start Day 1
    12,                       !- End Month 1
    31;                       !- End Day 1

Schedule:Year,
    ExteriorLighting,         !- Name
    Fraction,                 !- Schedule Type Limits Name
    ExteriorLightingProfileWeek,  !- Schedule:Week Name 1
    1,                        !- Start Month 1
    1,                        !- Start Day 1
    12,                       !- End Month 1
    31;                       !- End Day 1

Schedule:Year,
    Refrigerator,             !- Name
    Fraction,                 !- Schedule Type Limits Name
    RefrigeratorWeek,         !- Schedule:Week Name 1
    1,                        !- Start Month 1
    1,                        !- Start Day 1
    12,                       !- End Month 1
    31;                       !- End Day 1

Schedule:Year,
    MiscPlugLoad,             !- Name
    Fraction,                 !- Schedule Type Limits Name
    MiscPlugLoadWeek,         !- Schedule:Week Name 1
    1,                        !- Start Month 1
    1,                        !- Start Day 1
```

```
    12,                       !- End Month 1
    31;                       !- End Day 1

Schedule:Year,
    CookingRange,             !- Name
    Fraction,                 !- Schedule Type Limits Name
    CookingRangeWeek,         !- Schedule:Week Name 1
    1,                        !- Start Month 1
    1,                        !- Start Day 1
    12,                       !- End Month 1
    31;                       !- End Day 1

Schedule:Year,
    dhw_sch,                  !- Name
    fraction,                 !- Schedule Type Limits Name
    dhw_profile_week,         !- Schedule:Week Name 1
    1,                        !- Start Month 1
    1,                        !- Start Day 1
    12,                       !- End Month 1
    31;                       !- End Day 1

Schedule:Year,
    Dishwasher,               !- Name
    Fraction,                 !- Schedule Type Limits Name
    DishwasherWeek,           !- Schedule:Week Name 1
    1,                        !- Start Month 1
    1,                        !- Start Day 1
    12,                       !- End Month 1
    31;                       !- End Day 1

Schedule:Year,
    ClothesWasher,            !- Name
    Fraction,                 !- Schedule Type Limits Name
    ClothesWasherWeek,        !- Schedule:Week Name 1
    1,                        !- Start Month 1
    1,                        !- Start Day 1
```

```
    12,                       !- End Month 1
    31;                       !- End Day 1

Schedule:Year,
    ClothesDryer,             !- Name
    Fraction,                 !- Schedule Type Limits Name
    ClothesDryerWeek,         !- Schedule:Week Name 1
    1,                        !- Start Month 1
    1,                        !- Start Day 1
    12,                       !- End Month 1
    31;                       !- End Day 1

Schedule:Year,
    Sinks,                    !- Name
    Fraction,                 !- Schedule Type Limits Name
    SinksWeek,                !- Schedule:Week Name 1
    1,                        !- Start Month 1
    1,                        !- Start Day 1
    12,                       !- End Month 1
    31;                       !- End Day 1

Schedule:Year,
    Showers,                  !- Name
    Fraction,                 !- Schedule Type Limits Name
    ShowersWeek,              !- Schedule:Week Name 1
    1,                        !- Start Month 1
    1,                        !- Start Day 1
    12,                       !- End Month 1
    31;                       !- End Day 1

Schedule:Year,
    Baths,                    !- Name
    Fraction,                 !- Schedule Type Limits Name
    BathsWeek,                !- Schedule:Week Name 1
    1,                        !- Start Month 1
    1,                        !- Start Day 1
```

```
    12,                       !- End Month 1
    31;                       !- End Day 1

Schedule:Year,
    DHWDist,                  !- Name
    Fraction,                 !- Schedule Type Limits Name
    DHWDistWeek,              !- Schedule:Week Name 1
    1,                        !- Start Month 1
    1,                        !- Start Day 1
    12,                       !- End Month 1
    31;                       !- End Day 1



!-   ===========  ALL OBJECTS IN CLASS: SCHEDULE:COMPACT ===========
Schedule:Compact,
    fan_sch,                   !- Name
    Fractional,                !- Schedule Type Limits Name
    Through: 12/31,            !- Field 1
    For: AllDays,              !- Field 2
    Until: 24:00,              !- Field 3
    0.5;                       !- Field 4

Schedule:Compact,
    BA_shower_sch,            !- Name
    any number,               !- Schedule Type Limits Name
    Through: 12/31,           !- Field 1
    For: AllDays,             !- Field 2
    Until: 1:00,              !- Field 3
    0.00174682444444444,      !- Field 4
    Until: 2:00,              !- Field 5
    0.000794011111111111,     !- Field 6
    Until: 3:00,              !- Field 7
    0.000476406666666667,     !- Field 8
    Until: 4:00,              !- Field 9
    0.000794011111111111,     !- Field 10
    Until: 5:00,              !- Field 11
```

```
    0.00222323111111111,     !- Field 12
    Until: 6:00,             !- Field 13
    0.00825771555555556,     !- Field 14
    Until: 7:00,             !- Field 15
    0.0187386622222222,      !- Field 16
    Until: 8:00,             !- Field 17
    0.01857986,              !- Field 18
    Until: 9:00,             !- Field 19
    0.0150862111111111,      !- Field 20
    Until: 10:00,            !- Field 21
    0.0117513644444444,      !- Field 22
    Until: 11:00,            !- Field 23
    0.00952813333333333,     !- Field 24
    Until: 12:00,            !- Field 25
    0.00746370444444444,     !- Field 26
    Until: 13:00,            !- Field 27
    0.00539927555555556,     !- Field 28
    Until: 14:00,            !- Field 29
    0.00460526444444444,     !- Field 30
    Until: 15:00,            !- Field 31
    0.00412885777777778,     !- Field 32
    Until: 16:00,            !- Field 33
    0.00397005555555556,     !- Field 34
    Until: 17:00,            !- Field 35
    0.00476406666666667,     !- Field 36
    Until: 18:00,            !- Field 37
    0.00619328666666667,     !- Field 38
    Until: 19:00,            !- Field 39
    0.00666969333333333,     !- Field 40
    Until: 20:00,            !- Field 41
    0.00666969333333333,     !- Field 42
    Until: 21:00,            !- Field 43
    0.00666969333333333,     !- Field 44
    Until: 22:00,            !- Field 45
    0.00651089111111111,     !- Field 46
    Until: 23:00,            !- Field 47
```

```
    0.00460526444444444,     !- Field 48
    Until: 24:00,            !- Field 49
    0.00333484666666667;     !- Field 50

Schedule:Compact,
    BA_bath_sch,             !- Name
    any number,              !- Schedule Type Limits Name
    Through: 12/31,          !- Field 1
    For: AllDays,            !- Field 2
    Until: 1:00,             !- Field 3
    0.000163090909090909,    !- Field 4
    Until: 2:00,             !- Field 5
    8.15454545454545e-05,    !- Field 6
    Until: 3:00,             !- Field 7
    8.15454545454545e-05,    !- Field 8
    Until: 4:00,             !- Field 9
    8.15454545454545e-05,    !- Field 10
    Until: 5:00,             !- Field 11
    0.000163090909090909,    !- Field 12
    Until: 6:00,             !- Field 13
    0.000387340909090909,    !- Field 14
    Until: 7:00,             !- Field 15
    0.000937772727272727,    !- Field 16
    Until: 8:00,             !- Field 17
    0.00118240909090909,     !- Field 18
    Until: 9:00,             !- Field 19
    0.0013455,               !- Field 20
    Until: 10:00,            !- Field 21
    0.00118240909090909,     !- Field 22
    Until: 11:00,            !- Field 23
    0.000937772727272727,    !- Field 24
    Until: 12:00,            !- Field 25
    0.000713522727272727,    !- Field 26
    Until: 13:00,            !- Field 27
    0.000631977272727273,    !- Field 28
    Until: 14:00,            !- Field 29
```

```
    0.000468886363636364,    !- Field 30
    Until: 15:00,            !- Field 31
    0.000468886363636364,    !- Field 32
    Until: 16:00,            !- Field 33
    0.000468886363636364,    !- Field 34
    Until: 17:00,            !- Field 35
    0.000795068181818182,    !- Field 36
    Until: 18:00,            !- Field 37
    0.000937772727272727,    !- Field 38
    Until: 19:00,            !- Field 39
    0.00156975,              !- Field 40
    Until: 20:00,            !- Field 41
    0.00203863636363636,     !- Field 42
    Until: 21:00,            !- Field 43
    0.00203863636363636,     !- Field 44
    Until: 22:00,            !- Field 45
    0.00156975,              !- Field 46
    Until: 23:00,            !- Field 47
    0.0013455,               !- Field 48
    Until: 24:00,            !- Field 49
    0.000795068181818182;    !- Field 50

Schedule:Compact,
    BA_sink_sch,             !- Name
    any number,              !- Schedule Type Limits Name
    Through: 12/31,          !- Field 1
    For: AllDays,            !- Field 2
    Until: 1:00,             !- Field 3
    0.00387388596491228,     !- Field 4
    Until: 2:00,             !- Field 5
    0.00193694298245614,     !- Field 6
    Until: 3:00,             !- Field 7
    0.00138353070175439,     !- Field 8
    Until: 4:00,             !- Field 9
    0.00138353070175439,     !- Field 10
    Until: 5:00,             !- Field 11
```

```
    0.00193694298245614,     !- Field 12
    Until: 6:00,             !- Field 13
    0.00498071052631579,     !- Field 14
    Until: 7:00,             !- Field 15
    0.0116216578947368,      !- Field 16
    Until: 8:00,             !- Field 17
    0.0171557807017544,      !- Field 18
    Until: 9:00,             !- Field 19
    0.0182626052631579,      !- Field 20
    Until: 10:00,            !- Field 21
    0.0171557807017544,      !- Field 22
    Until: 11:00,            !- Field 23
    0.0149421315789474,      !- Field 24
    Until: 12:00,            !- Field 25
    0.0138353070175439,      !- Field 26
    Until: 13:00,            !- Field 27
    0.013558600877193,       !- Field 28
    Until: 14:00,            !- Field 29
    0.0124517763157895,      !- Field 30
    Until: 15:00,            !- Field 31
    0.0118983640350877,      !- Field 32
    Until: 16:00,            !- Field 33
    0.011344951754386,       !- Field 34
    Until: 17:00,            !- Field 35
    0.0132818947368421,      !- Field 36
    Until: 18:00,            !- Field 37
    0.017985899122807,       !- Field 38
    Until: 19:00,            !- Field 39
    0.0207529605263158,      !- Field 40
    Until: 20:00,            !- Field 41
    0.0190927236842105,      !- Field 42
    Until: 21:00,            !- Field 43
    0.01577225,              !- Field 44
    Until: 22:00,            !- Field 45
    0.0132818947368421,      !- Field 46
    Until: 23:00,            !- Field 47
```

```
    0.0110682456140351,      !- Field 48
    Until: 24:00,            !- Field 49
    0.00747106578947368;     !- Field 50

Schedule:Compact,
    activity_sch,            !- Name
    any number,              !- Schedule Type Limits Name
    Through: 12/31,          !- Field 1
    For: AllDays,            !- Field 2
    Until: 24:00,            !- Field 3
    117.28;                  !- Field 4

Schedule:Compact,
    inf_sch,                 !- Name
    any number,              !- Schedule Type Limits Name
    Through: 12/31,          !- Field 1
    For: AllDays,            !- Field 2
    Until: 24:00,            !- Field 3
    1;                       !- Field 4

Schedule:Compact,
    zone_control_type,       !- Name
    control_type,            !- Schedule Type Limits Name
    Through: 12/31,          !- Field 1
    For: AllDays,            !- Field 2
    Until 24:00,             !- Field 3
    4;                       !- Field 4

Schedule:Compact,
    shading_2012iecc,        !- Name
    fraction,                !- Schedule Type Limits Name
    Through: 12/31,          !- Field 1
    For: AllDays,            !- Field 2
    Until 24:00,             !- Field 3
    0;                       !- Field 4
```

```
Schedule:Compact,
    shading_2009iecc,        !- Name
    any number,              !- Schedule Type Limits Name
    Through: 5/30,           !- Field 1
    For: AllDays,            !- Field 2
    Until 24:00,             !- Field 3
    0.85,                    !- Field 4
    Through: 8/31,           !- Field 5
    For: AllDays,            !- Field 6
    Until 24:00,             !- Field 7
    0.7,                     !- Field 8
    Through: 12/31,          !- Field 9
    For: AllDays,            !- Field 10
    Until: 24:00,            !- Field 11
    0.85;                    !- Field 12

Schedule:Compact,
    dhw_setpt,               !- Name
    Temperature,             !- Schedule Type Limits Name
    Through: 12/31,          !- Field 1
    For: AllDays,            !- Field 2
    Until 24:00,             !- Field 3
    48;                      !- Field 4

Schedule:Compact,
    dhw_setpt_hpwh,          !- Name
    Temperature,             !- Schedule Type Limits Name
    Through: 12/31,          !- Field 1
    For: AllDays,            !- Field 2
    Until 24:00,             !- Field 3
    44;                      !- Field 4

Schedule:Compact,
    Supply-Air-Temp-Sch,     !- Name
    Temperature,             !- Schedule Type Limits Name
    Through: 12/31,          !- Field 1
```

```
    For: AllDays,            !- Field 2
    Until: 24:00,            !- Field 3
    12;                      !- Field 4

Schedule:Compact,
    always_avail,            !- Name
    On/Off,                  !- Schedule Type Limits Name
    Through: 12/31,          !- Field 1
    For: AllDays,            !- Field 2
    Until: 24:00,            !- Field 3
    1;                       !- Field 4

Schedule:Compact,
    always_off,              !- Name
    On/Off,                  !- Schedule Type Limits Name
    Through: 12/31,          !- Field 1
    For: AllDays,            !- Field 2
    Until: 24:00,            !- Field 3
    0;                       !- Field 4

Schedule:Compact,
    heating_sch_HRef,        !- Name
    Temperature,             !- Schedule Type Limits Name
    Through: 12/31,          !- Field 1
    For: AllDays,            !- Field 2
    Until: 24:00,            !- Field 3
    17;                      !- Field 4

Schedule:Compact,
    cooling_sch_HRef,        !- Name
    Temperature,             !- Schedule Type Limits Name
    Through: 12/31,          !- Field 1
    For: AllDays,            !- Field 2
    Until: 24:00,            !- Field 3
    25.55;                   !- Field 4
```

```
Schedule:Compact,
    heating_sch,              !- Name
    Temperature,              !- Schedule Type Limits Name
    Through: 12/31,           !- Field 1
    For: AllDays,             !- Field 2
    Until: 24:00,             !- Field 3
    17;         !- Field 4

Schedule:Compact,
    cooling_sch,              !- Name
    Temperature,              !- Schedule Type Limits Name
    Through: 12/31,           !- Field 1
    For: AllDays,             !- Field 2
    Until: 24:00,             !- Field 3
    23.888888888889;          !- Field 4

Schedule:Compact,
    fan_cycle,                !- Name
    any number,               !- Schedule Type Limits Name
    Through: 12/31,           !- Field 1
    For: AllDays,             !- Field 2
    Until: 24:00,             !- Field 3
    0;                        !- Field 4

Schedule:Compact,
    Clothing Sch,             !- Name
    Fractional,               !- Schedule Type Limits Name
    Through: 12/31,           !- Field 1
    For: AllDays,             !- Field 2
    Until: 24:00,             !- Field 3
    0.45;                      !- Field 4

Schedule:Compact,
    Air Velo Sch,             !- Name
    Fractional,               !- Schedule Type Limits Name
    Through: 12/31,           !- Field 1
```

```
    For: AllDays,            !- Field 2
    Until: 24:00,            !- Field 3
    0.35;                    !- Field 4


Schedule:Compact,
    Work Eff Sch,            !- Name
    Fractional,              !- Schedule Type Limits Name
    Through: 12/31,          !- Field 1
    For: AllDays,            !- Field 2
    Until: 24:00,            !- Field 3
    0;                       !- Field 4


!-   ===========  ALL OBJECTS IN CLASS: SCHEDULE:CONSTANT
   ===========

Schedule:Constant,
    DWWaterTempSchedule,     !- Name
    Temperature,             !- Schedule Type Limits Name
    48.8888888888889;        !- Hourly Value

Schedule:Constant,
    CWWaterTempSchedule,     !- Name
    Temperature,             !- Schedule Type Limits Name
    48.8888888888889;        !- Hourly Value

Schedule:Constant,
    SinkSensSchedule,        !- Name
    Fraction,                !- Schedule Type Limits Name
    0.687777777777778;       !- Hourly Value

Schedule:Constant,
    SinkLatSchedule,         !- Name
    Fraction,                !- Schedule Type Limits Name
    0.312222222222222;       !- Hourly Value
```

```
Schedule:Constant,
    ShowerSensSchedule,      !- Name
    Fraction,                !- Schedule Type Limits Name
    0.51280276816609;        !- Hourly Value

Schedule:Constant,
    ShowerLatSchedule,       !- Name
    Fraction,                !- Schedule Type Limits Name
    0.48719723183391;        !- Hourly Value

Schedule:Constant,
    BathSensSchedule,        !- Name
    Fraction,                !- Schedule Type Limits Name
    1;                       !- Hourly Value

Schedule:Constant,
    BathLatSchedule,         !- Name
    Fraction,                !- Schedule Type Limits Name
    0;                       !- Hourly Value

Schedule:Constant,
    SSBWaterTempSchedule,    !- Name
    Temperature,             !- Schedule Type Limits Name
    40.5555555555556;        !- Hourly Value

Schedule:Constant,
    WaterHeaterSP1Schedule,  !- Name
    Temperature,             !- Schedule Type Limits Name
    48.8888888888889;        !- Hourly Value

Schedule:Constant,
    WaterHeaterSP2Schedule,  !- Name
    Temperature,             !- Schedule Type Limits Name
    40.5555555555556;        !- Hourly Value
```

```
Schedule:Constant,
    DHWSupplySetpoint,       !- Name
    Temperature,             !- Schedule Type Limits Name
    48.8888888888889;        !- Hourly Value

Schedule:Constant,
    boiler_setpt,            !- Name
    Temperature,             !- Schedule Type Limits Name
    80;                      !- Hourly Value

Schedule:Constant,
    Compressor Setpoint,     !- Name
    Temperature,             !- Schedule Type Limits Name
    50;                      !- Hourly Value

Schedule:Constant,
    DOAShightemp,            !- Name
    Temperature,             !- Schedule Type Limits Name
    200;                     !- Hourly Value

Schedule:Constant,
    DOASlowtemp,             !- Name
    Temperature,             !- Schedule Type Limits Name
    -60;                     !- Hourly Value


!-   ===========  ALL OBJECTS IN CLASS: MATERIAL ===========

!Name
Material,
    sheathing_consol_layer,  !- Name
    Rough,                   !- Roughness
    0.0127,                  !- Thickness {m}
    0.0940184,               !- Conductivity {W/m-K}
    685.008,                 !- Density {kg/m3}
    1172.332;                !- Specific Heat {J/kg-K}
```

```
!Name
Material,
    ceil_consol_layer,       !- Name
    Rough,                   !- Roughness
    0.284817435151397,       !- Thickness {m}
    0.0617176,               !- Conductivity {W/m-K}
    41.9286,                 !- Density {kg/m3}
    776.25126;               !- Specific Heat {J/kg-K}

!Name
Material,
    floor_consol_layer,      !- Name
    Rough,                   !- Roughness
    0.000254,                !- Thickness {m}
    12.989536,               !- Conductivity {W/m-K}
    55.074,                  !- Density {kg/m3}
    916.9311;                !- Specific Heat {J/kg-K}

!Name
Material,
    bsmtwall_consol_layer,   !- Name
    Rough,                   !- Roughness
    0.000254,                !- Thickness {m}
    10.84384,                !- Conductivity {W/m-K}
    120.801,                 !- Density {kg/m3}
    1036.25775;              !- Specific Heat {J/kg-K}

!Name
Material,
    crawlwall_consol_layer,  !- Name
    Rough,                   !- Roughness
    0.000254,                !- Thickness {m}
    10.84384,                !- Conductivity {W/m-K}
    120.801,                 !- Density {kg/m3}
    1036.25775;              !- Specific Heat {J/kg-K}
```

```
!Name
Material,
    wall_consol_layer,       !- Name
    Rough,                   !- Roughness
    0.0889,                  !- Thickness {m}
    0.0579573076923077,      !- Conductivity {W/m-K}
    120.801,                 !- Density {kg/m3}
    1036.25775;              !- Specific Heat {J/kg-K}

Material,
    Very High Reflectivity Surface,  !- Name
    Smooth,                  !- Roughness
    0.0005,                  !- Thickness {m}
    237,                     !- Conductivity {W/m-K}
    2702,                    !- Density {kg/m3}
    903,                     !- Specific Heat {J/kg-K}
    0.90,                    !- Thermal Absorptance
    0.05,                    !- Solar Absorptance
    0.05;                    !- Visible Absorptance

Material,
    GypsumBoard-5/16in,      !- Name
    Rough,                   !- Roughness
    7.93953E-03,             !- Thickness {m}
    0.1586200,               !- Conductivity {W/m-K}
    640,                     !- Density {kg/m3}
    1129.6,                  !- Specific Heat {J/kg-K}
    0.9,                     !- Thermal Absorptance
    0.4,                     !- Solar Absorptance
    0.1;                     !- Visible Absorptance

Material,
    CopperPipe,              !- Name
    MediumRough,             !- Roughness
    1.90500386169072E-02,    !- Thickness {m}
```

```
    401,                     !- Conductivity {W/m-K}
    2243.000,                !- Density {kg/m3}
    837.0000,                !- Specific Heat {J/kg-K}
    0.9000000,               !- Thermal Absorptance
    0.6500000,               !- Solar Absorptance
    0.6500000;               !- Visible Absorptance

Material,
    F08 Metal surface,       !- Name
    Smooth,                  !- Roughness
    0.0008,                  !- Thickness {m}
    45.28,                   !- Conductivity {W/m-K}
    7824,                    !- Density {kg/m3}
    500;                     !- Specific Heat {J/kg-K}

Material,
    Concrete_4in,            !- Name
    Rough,                   !- Roughness
    0.1014984,               !- Thickness {m}
    1.312098,                !- Conductivity {W/m-K}
    2242.8,                  !- Density {kg/m3}
    465.2;                   !- Specific Heat {J/kg-K}

Material,
    Asphalt_shingle,         !- Name
    MediumRough,             !- Roughness
    6.33985285170672E-03,    !- Thickness {m}
    0.08186,                 !- Conductivity {W/m-K}
    1121.2917044623,         !- Density {kg/m3}
    1255.20000949809,        !- Specific Heat {J/kg-K}
    ,                        !- Thermal Absorptance
    0.75;                    !- Solar Absorptance

Material,
    Wood_shingle,            !- Name
    MediumSmooth,            !- Roughness
```

```
    1.27000257446048E-02,    !- Thickness {m}
    0.11388,                 !- Conductivity {W/m-K}
    426.090847695673,        !- Density {kg/m3}
    1631.76001234752;        !- Specific Heat {J/kg-K}

Material,
    Slate_shingle,           !- Name
    MediumSmooth,            !- Roughness
    1.27000257446048E-02,    !- Thickness {m}
    1.44219,                 !- Conductivity {W/m-K}
    1601.845292089,          !- Density {kg/m3}
    1255.20000949809;        !- Specific Heat {J/kg-K}

Material,
    cement_stucco,           !- Name
    MediumSmooth,            !- Roughness
    1.905E-02,               !- Thickness {m}
    0.721,                   !- Conductivity {W/m-K}
    1865.58,                 !- Density {kg/m3}
    878.640006648665;        !- Specific Heat {J/kg-K}

Material,
    syn_stucco,              !- Name
    MediumSmooth,            !- Roughness
    0.3048E-02,              !- Thickness {m}
    8.65E-02,                !- Conductivity {W/m-K}
    400,                     !- Density {kg/m3}
    878.640006648665;        !- Specific Heat {J/kg-K}

Material,
    Drywall_1/2in,           !- Name
    MediumSmooth,            !- Roughness
    1.27000257446048E-02,    !- Thickness {m}
    0.16009,                 !- Conductivity {W/m-K}
    800.922646044499,        !- Density {kg/m3}
    1087.84000823168;        !- Specific Heat {J/kg-K}
```

```
Material,
    OSB_5/8in,               !- Name
    MediumSmooth,            !- Roughness
    0.015875032180756,       !- Thickness {m}
    0.1163,                  !- Conductivity {W/m-K}
    544.627399310259,        !- Density {kg/m3}
    1213.36000918149;        !- Specific Heat {J/kg-K}

Material,
    OSB_7/16in,              !- Name
    MediumSmooth,            !- Roughness
    0.0111125,               !- Thickness {m}
    0.1163,                  !- Conductivity {W/m-K}
    544.627399310259,        !- Density {kg/m3}
    1213.36000918149;        !- Specific Heat {J/kg-K}

Material,
    Blown_R30,               !- Name
    MediumRough,             !- Roughness
    0.212598430964684,       !- Thickness {m}
    0.04119,                 !- Conductivity {W/m-K}
    9.61107175253399,        !- Density {kg/m3}
    836.800006332062;        !- Specific Heat {J/kg-K}

Material,
    Blown_R30_top,           !- Name
    MediumRough,             !- Roughness
    0.117348237880148,       !- Thickness {m}
    0.04119,                 !- Conductivity {W/m-K}
    9.61107175253399,        !- Density {kg/m3}
    836.800006332062,        !- Specific Heat {J/kg-K}
    0.9,                     !- Thermal Absorptance
    0.7,                     !- Solar Absorptance
    0.7;                     !- Visible Absorptance
```

```
Material,
    Plywood_3/4in,           !- Name
    Rough,                   !- Roughness
    0.01905,                 !- Thickness {m}
    0.1154577,               !- Conductivity {W/m-K}
    544.68,                  !- Density {kg/m3}
    674.54,                  !- Specific Heat {J/kg-K}
    0.9,                     !- Thermal Absorptance
    0.7,                     !- Solar Absorptance
    0.7;                     !- Visible Absorptance

Material,
    Batt_R19,                !- Name
    MediumRough,             !- Roughness
    2.54000514892096E-02,    !- Thickness {m}
    3.47522010738099E-03,    !- Conductivity {W/m-K}
    9.61107175253399,        !- Density {kg/m3}
    836.800006332062,        !- Specific Heat {J/kg-K}
    0.9,                     !- Thermal Absorptance
    0.7,                     !- Solar Absorptance
    0.7;                     !- Visible Absorptance

Material,
    Lumber_2x4,              !- Name
    Rough ,                  !- Roughness
    0.0890016,               !- Thickness {m}
    0.1154577,               !- Conductivity {W/m-K}
    512.64,                  !- Density {kg/m3}
    767.58,                  !- Specific Heat {J/kg-K}
    0.9,                     !- Thermal Absorptance
    0.7,                     !- Solar Absorptance
    0.7;                     !- Visible Absorptance

Material,
    Carpet_n_pad,            !- Name
    MediumSmooth,            !- Roughness
```

```
    2.54000514892096E-02,    !- Thickness {m}
    6.01314018580031E-02,    !- Conductivity {W/m-K}
    32.03690584178,          !- Density {kg/m3}
    836.800006332062,        !- Specific Heat {J/kg-K}
    0.9,                     !- Thermal Absorptance
    0.7,                     !- Solar Absorptance
    0.7;                     !- Visible Absorptance

Material,
    Batt_R13,                !- Name
    MediumRough,             !- Roughness
    0.0889,                  !- Thickness {m}
    0.03876,                 !- Conductivity {W/m-K}
    9.61107175253399,        !- Density {kg/m3}
    836.800006332062,        !- Specific Heat {J/kg-K}
    0.9,                     !- Thermal Absorptance
    0.7,                     !- Solar Absorptance
    0.7;                     !- Visible Absorptance

Material,
    OSB_1/2in,               !- Name
    MediumSmooth,            !- Roughness
    1.27000257446048E-02,    !- Thickness {m}
    0.1163,                  !- Conductivity {W/m-K}
    544.627399310259,        !- Density {kg/m3}
    1213.36000918149,        !- Specific Heat {J/kg-K}
    0.9,                     !- Thermal Absorptance
    0.7,                     !- Solar Absorptance
    0.7;                     !- Visible Absorptance

Material,
    soil_12in,               !- Name
    Rough,                   !- Roughness
    0.3048,                  !- Thickness {m}
    1.731,                   !- Conductivity {W/m-K}
    1842.3,                  !- Density {kg/m3}
```

```
    232.6,                  !- Specific Heat {J/kg-K}
    0.9,                    !- Thermal Absorptance
    0.7,                    !- Solar Absorptance
    0.7;                    !- Visible Absorptance

Material,
    door_const,             !- Name
    Smooth,                 !- Roughness
    0.0253617440918536,     !- Thickness {m}
    0.0720096,              !- Conductivity {W/m-K}
    512.64,                 !- Density {kg/m3}
    767.58;                 !- Specific Heat {J/kg-K}

Material,
    Gyp_board_1/2in,        !- Name
    Rough,                  !- Roughness
    0.01271016,             !- Thickness {m}
    0.1586200,              !- Conductivity {W/m-K}
    640,                    !- Density {kg/m3}
    1129.6,                 !- Specific Heat {J/kg-K}
    0.9,                    !- Thermal Absorptance
    0.4,                    !- Solar Absorptance
    0.1;                    !- Visible Absorptance

Material,
    Std Wood 6inch,         !- Name
    MediumSmooth,           !- Roughness
    0.15,                   !- Thickness {m}
    0.12,                   !- Conductivity {W/m-K}
    540.0000,               !- Density {kg/m3}
    1210,                   !- Specific Heat {J/kg-K}
    0.9000000,              !- Thermal Absorptance
    0.7000000,              !- Solar Absorptance
    0.7000000;              !- Visible Absorptance

Material,
```

```
    Pipe Insulation,          !- Name
    VeryRough,                !- Roughness
    0.0127032520325203,       !- Thickness {m}
    0.03317175,               !- Conductivity {W/m-K}
    91.0,                     !- Density {kg/m3}
    836.0,                    !- Specific Heat {J/kg-K}
    0.9,                      !- Thermal Absorptance
    0.5,                      !- Solar Absorptance
    0.5;                      !- Visible Absorptance


!-   ===========  ALL OBJECTS IN CLASS: MATERIAL:NOMASS ===========

Material:NoMass,
    Manf_wall_airgap,         !- Name
    Smooth,                   !- Roughness
    0.12;                     !- Thermal Resistance {m2-K/W}

Material:NoMass,
    Bldg_paper_felt,          !- Name
    Smooth,                   !- Roughness
    1.05666113069662E-02;     !- Thermal Resistance {m2-K/W}

Material:NoMass,
    R_high,                   !- Name
    MediumRough,              !- Roughness
    177;                      !- Thermal Resistance {m2-K/W}


!-   ===========  ALL OBJECTS IN CLASS: MATERIAL:AIRGAP ===========

Material:AirGap,
    Air_4_in_vert,            !- Name
    0.158499169604493;        !- Thermal Resistance {m2-K/W}

Material:AirGap,
```

```
    3/4in_air_space,          !- Name
    0.08513;                  !- Thermal Resistance {m2-K/W}

Material:AirGap,
    3/4in_Reflective_air_space,  !- Name
    0.246554;                 !- Thermal Resistance {m2-K/W}


!-   ===========  ALL OBJECTS IN CLASS: WINDOWMATERIAL:GLAZING
   ===========

WindowMaterial:Glazing,
    Clear Acrylic Plastic,    !- Name
    SpectralAverage,          !- Optical Data Type
    ,                         !- Window Glass Spectral Data Set Name
    0.003,                    !- Thickness {m}
    0.92,                     !- Solar Transmittance at Normal
   Incidence
    0.05,                     !- Front Side Solar Reflectance at
   Normal Incidence
    0.05,                     !- Back Side Solar Reflectance at
   Normal Incidence
    0.92,                     !- Visible Transmittance at Normal
   Incidence
    0.05,                     !- Front Side Visible Reflectance at
   Normal Incidence
    0.05,                     !- Back Side Visible Reflectance at
   Normal Incidence
    0.00,                     !- Infrared Transmittance at Normal
   Incidence
    0.90,                     !- Front Side Infrared Hemispherical
   Emissivity
    0.90,                     !- Back Side Infrared Hemispherical
   Emissivity
    0.90;                     !- Conductivity {W/m-K}
```

```
WindowMaterial:Glazing,
    Diffusing Acrylic Plastic,  !- Name
    SpectralAverage,            !- Optical Data Type
    ,                           !- Window Glass Spectral Data Set Name
    0.0022,                     !- Thickness {m}
    0.90,                       !- Solar Transmittance at Normal
   Incidence
    0.08,                       !- Front Side Solar Reflectance at
   Normal Incidence
    0.08,                       !- Back Side Solar Reflectance at
   Normal Incidence
    0.90,                       !- Visible Transmittance at Normal
   Incidence
    0.08,                       !- Front Side Visible Reflectance at
   Normal Incidence
    0.08,                       !- Back Side Visible Reflectance at
   Normal Incidence
    0.00,                       !- Infrared Transmittance at Normal
   Incidence
    0.90,                       !- Front Side Infrared Hemispherical
   Emissivity
    0.90,                       !- Back Side Infrared Hemispherical
   Emissivity
    0.90;                       !- Conductivity {W/m-K}


!-   ===========  ALL OBJECTS IN CLASS: WINDOWMATERIAL:BLIND
   ===========

!*** Properties for blinds taken from E+ dataset for 'Blinds with
   Medium Reflectivity Slats'***
!
WindowMaterial:Blind,
    int_blind,                  !- Name
    Horizontal,                 !- Slat Orientation
    0.025,                      !- Slat Width {m}
```

```
 0.01875,                  !- Slat Separation {m}
 0.001,                    !- Slat Thickness {m}
 45.0,                     !- Slat Angle {deg}
 221,                      !- Slat Conductivity {W/m-K}
 0.0,                      !- Slat Beam Solar Transmittance
 0.5,                      !- Front Side Slat Beam Solar
Reflectance
 0.5,                      !- Back Side Slat Beam Solar
Reflectance
 0.0,                      !- Slat Diffuse Solar Transmittance
 0.5,                      !- Front Side Slat Diffuse Solar
Reflectance
 0.5,                      !- Back Side Slat Diffuse Solar
Reflectance
 0.0,                      !- Slat Beam Visible Transmittance
 0.5,                      !- Front Side Slat Beam Visible
Reflectance
 0.5,                      !- Back Side Slat Beam Visible
Reflectance
 0.0,                      !- Slat Diffuse Visible Transmittance
 0.5,                      !- Front Side Slat Diffuse Visible
Reflectance
 0.5,                      !- Back Side Slat Diffuse Visible
Reflectance
 0.0,                      !- Slat Infrared Hemispherical
Transmittance
 0.9,                      !- Front Side Slat Infrared
Hemispherical Emissivity
 0.9,                      !- Back Side Slat Infrared
Hemispherical Emissivity
 0.050,                    !- Blind to Glass Distance {m}
 0.5,                      !- Blind Top Opening Multiplier
 0.5,                      !- Blind Bottom Opening Multiplier
 0.5,                      !- Blind Left Side Opening Multiplier
 0.5,                      !- Blind Right Side Opening Multiplier
 ,                         !- Minimum Slat Angle {deg}
```

```
    ;                         !- Maximum Slat Angle {deg}


!-   ===========  ALL OBJECTS IN CLASS: CONSTRUCTION ===========

Construction,
    Exterior Wall,            !- Name
    syn_stucco,               !- Outside Layer
    sheathing_consol_layer,   !- Layer 2
    OSB_7/16in,               !- Layer 3
    wall_consol_layer,        !- Layer 4
    Drywall_1/2in;            !- Layer 5

Construction,
    InteriorFurnishings,      !- Name
    Std Wood 6inch;           !- Outside Layer

Construction,
    ceiling-floor-layer,      !- Name
    Lumber_2x4;               !- Outside Layer

Construction,
    Exterior Floor,           !- Name
    floor_consol_layer,       !- Outside Layer
    Plywood_3/4in,            !- Layer 2
    Carpet_n_pad;             !- Layer 3

Construction,
    Interior Floor,           !- Name
    Plywood_3/4in,            !- Outside Layer
    Carpet_n_pad;             !- Layer 2

Construction,
    Interior Ceiling,         !- Name
    ceil_consol_layer,        !- Outside Layer
    Drywall_1/2in;            !- Layer 2
```

```
Construction,
    attic floor,             !- Name
    Drywall_1/2in,           !- Outside Layer
    ceil_consol_layer;       !- Layer 2

Construction,
    fndn_roof,               !- Name
    Carpet_n_pad,            !- Outside Layer
    Plywood_3/4in,           !- Layer 2
    ceil_consol_layer;       !- Layer 3

Construction,
    interiorwall,            !- Name
    Drywall_1/2in,           !- Outside Layer
    OSB_5/8in,               !- Layer 2
    Drywall_1/2in;           !- Layer 3

Construction,
    Interior Wall,           !- Name
    Drywall_1/2in,           !- Outside Layer
    Air_4_in_vert,           !- Layer 2
    Drywall_1/2in;           !- Layer 3

Construction,
    Exterior Roof,           !- Name
    Asphalt_shingle,         !- Outside Layer
    OSB_1/2in;               !- Layer 2

Construction,
    Exterior Window,         !- Name
    Glass;                   !- Outside Layer

Construction,
    Interior Window,         !- Name
    Glass;                   !- Outside Layer
```

```
Construction,
    Exterior Door,           !- Name
    door_const;              !- Outside Layer

Construction,
    Interior Door,           !- Name
    door_const;              !- Outside Layer

Construction,
    Gable_end,               !- Name
    cement_stucco,           !- Outside Layer
    Bldg_paper_felt,         !- Layer 2
    OSB_5/8in,               !- Layer 3
    Air_4_in_vert,           !- Layer 4
    Drywall_1/2in;           !- Layer 5

Construction,
    crawl_floor,             !- Name
    R_high,                  !- Outside Layer
    soil_12in;               !- Layer 2

Construction,
    window_w_blinds,         !- Name
    Glass,                   !- Outside Layer
    int_blind;               !- Layer 2

Construction,
    Insulated Pipe,          !- Name
    Pipe Insulation,         !- Outside Layer
    CopperPipe;              !- Layer 2

Construction,
    Plain Pipe,              !- Name
    CopperPipe;              !- Outside Layer
```

```
Construction,
    TDD Pipe,                !- Name
    Very High Reflectivity Surface;  !- Outside Layer

Construction,
    TDD Dome,                !- Name
    Clear Acrylic Plastic;   !- Outside Layer

Construction,
    TDD Diffuser,            !- Name
    Diffusing Acrylic Plastic;  !- Outside Layer



!-   ===========  ALL OBJECTS IN CLASS: WINDOWMATERIAL:
   SIMPLEGLAZINGSYSTEM ===========

!Name
!U-Factor {W/m2-K}
!Solar Heat Gain Coefficient
!Visible Transmittance
WindowMaterial:SimpleGlazingSystem,
    Glass,                   !- Name
    2.8393,                  !- U-Factor {W/m2-K}
    0.216875,                !- Solar Heat Gain Coefficient
    0.88;                    !- Visible Transmittance


!-   ===========  ALL OBJECTS IN CLASS: GLOBALGEOMETRYRULES
   ===========

GlobalGeometryRules,
    LowerLeftCorner,         !- Starting Vertex Position
    Counterclockwise,        !- Vertex Entry Direction
    World;                !- Coordinate System
```

```
!-   ===========  ALL OBJECTS IN CLASS: ZONE ===========

Zone,
    living_unit1,           !- Name
    0.0,                    !- Direction of Relative North {deg}
    0.0,                    !- X Origin {m}
    0.0,                    !- Y Origin {m}
    0.0,                    !- Z Origin {m}
    ,                       !- Type
    1;                      !- Multiplier

Zone,
    attic_unit1,            !- Name
    0.0,                    !- Direction of Relative North {deg}
    0.0,                    !- X Origin {m}
    0.0,                    !- Y Origin {m}
    0.0,                    !- Z Origin {m}
    ,                       !- Type
    1;                      !- Multiplier


!-   ===========  ALL OBJECTS IN CLASS: BUILDINGSURFACE:DETAILED
   ===========

BuildingSurface:Detailed,
    Inter zone floor 1,     !- Name
    Floor,                  !- Surface Type
    Interior Floor,         !- Construction Name
    living_unit1,           !- Zone Name
    Adiabatic,              !- Outside Boundary Condition
    ,                       !- Outside Boundary Condition Object
    NoSun,                  !- Sun Exposure
    NoWind,                 !- Wind Exposure
    0.0,                    !- View Factor to Ground
    4,                      !- Number of Vertices
```

```
    0,                      !- Vertex 1 X-coordinate {m}
    0,                      !- Vertex 1 Y-coordinate {m}
    2.60156341463415,       !- Vertex 1 Z-coordinate {m}
    0,                      !- Vertex 2 X-coordinate {m}
    9.09981820971244,       !- Vertex 2 Y-coordinate {m}
    2.60156341463415,       !- Vertex 2 Z-coordinate {m}
    12.1330909462833,       !- Vertex 3 X-coordinate {m}
    9.09981820971244,       !- Vertex 3 Y-coordinate {m}
    2.60156341463415,       !- Vertex 3 Z-coordinate {m}
    12.1330909462833,       !- Vertex 4 X-coordinate {m}
    0,                      !- Vertex 4 Y-coordinate {m}
    2.60156341463415;       !- Vertex 4 Z-coordinate {m}

BuildingSurface:Detailed,
    ceiling_unit1,          !- Name
    Ceiling,                !- Surface Type
    Interior Ceiling,       !- Construction Name
    living_unit1,           !- Zone Name
    Zone,                   !- Outside Boundary Condition
    attic_unit1,            !- Outside Boundary Condition Object
    NoSun,                  !- Sun Exposure
    NoWind,                 !- Wind Exposure
    0.0,                    !- View Factor to Ground
    4,                      !- Number of Vertices
    0,                      !- Vertex 1 X-coordinate {m}
    0,                      !- Vertex 1 Y-coordinate {m}
    5.19302682926829,       !- Vertex 1 Z-coordinate {m}
    12.1330909462833,       !- Vertex 2 X-coordinate {m}
    0,                      !- Vertex 2 Y-coordinate {m}
    5.19302682926829,       !- Vertex 2 Z-coordinate {m}
    12.1330909462833,       !- Vertex 3 X-coordinate {m}
    9.09981820971244,       !- Vertex 3 Y-coordinate {m}
    5.19302682926829,       !- Vertex 3 Z-coordinate {m}
    0,                      !- Vertex 4 X-coordinate {m}
    9.09981820971244,       !- Vertex 4 Y-coordinate {m}
    5.19302682926829;       !- Vertex 4 Z-coordinate {m}
```

```
BuildingSurface:Detailed,
    Roof_front_unit1,        !- Name
    Roof,                    !- Surface Type
    Exterior Roof,           !- Construction Name
    attic_unit1,             !- Zone Name
    Outdoors,                !- Outside Boundary Condition
    ,                        !- Outside Boundary Condition Object
    SunExposed,              !- Sun Exposure
    WindExposed,             !- Wind Exposure
    0.0,                     !- View Factor to Ground
    4,                       !- Number of Vertices
    0,                       !- Vertex 1 X-coordinate {m}
    0,                       !- Vertex 1 Y-coordinate {m}
    5.19302682926829,        !- Vertex 1 Z-coordinate {m}
    12.1330909462833,        !- Vertex 2 X-coordinate {m}
    0,                       !- Vertex 2 Y-coordinate {m}
    5.19302682926829,        !- Vertex 2 Z-coordinate {m}
    12.1330909462833,        !- Vertex 3 X-coordinate {m}
    4.54990910485622,        !- Vertex 3 Y-coordinate {m}
    6.6995631975537,         !- Vertex 3 Z-coordinate {m}
    0,                       !- Vertex 4 X-coordinate {m}
    4.54990910485622,        !- Vertex 4 Y-coordinate {m}
    6.6995631975537;         !- Vertex 4 Z-coordinate {m}

BuildingSurface:Detailed,
    Roof_back_unit1,         !- Name
    Roof,                    !- Surface Type
    Exterior Roof,           !- Construction Name
    attic_unit1,             !- Zone Name
    Outdoors,                !- Outside Boundary Condition
    ,                        !- Outside Boundary Condition Object
    SunExposed,              !- Sun Exposure
    WindExposed,             !- Wind Exposure
    0.0,                     !- View Factor to Ground
    4,                       !- Number of Vertices
```

```
    12.1330909462833,        !- Vertex 1 X-coordinate {m}
    9.09981820971244,        !- Vertex 1 Y-coordinate {m}
    5.19302682926829,        !- Vertex 1 Z-coordinate {m}
    0,                       !- Vertex 2 X-coordinate {m}
    9.09981820971244,        !- Vertex 2 Y-coordinate {m}
    5.19302682926829,        !- Vertex 2 Z-coordinate {m}
    0,                       !- Vertex 3 X-coordinate {m}
    4.54990910485622,        !- Vertex 3 Z-coordinate {m}
    6.6995631975537,         !- Vertex 3 Z-coordinate {m}
    12.1330909462833,        !- Vertex 4 X-coordinate {m}
    4.54990910485622,        !- Vertex 4 Y-coordinate {m}
    6.6995631975537;         !- Vertex 4 Z-coordinate {m}

BuildingSurface:Detailed,
    Roof_right_unit1,        !- Name
    Wall,                    !- Surface Type
    Gable_end,               !- Construction Name
    attic_unit1,             !- Zone Name
    Outdoors,                !- Outside Boundary Condition
    ,                        !- Outside Boundary Condition Object
    SunExposed,              !- Sun Exposure
    WindExposed,             !- Wind Exposure
    ,                        !- View Factor to Ground
    3,                       !- Number of Vertices
    12.1330909462833,        !- Vertex 1 X-coordinate {m}
    0,                       !- Vertex 1 Y-coordinate {m}
    5.19302682926829,        !- Vertex 1 Z-coordinate {m}
    12.1330909462833,        !- Vertex 2 X-coordinate {m}
    9.09981820971244,        !- Vertex 2 Y-coordinate {m}
    5.19302682926829,        !- Vertex 2 Z-coordinate {m}
    12.1330909462833,        !- Vertex 3 X-coordinate {m}
    4.54990910485622,        !- Vertex 3 Y-coordinate {m}
    6.6995631975537;         !- Vertex 3 Z-coordinate {m}

BuildingSurface:Detailed,
    Roof_left_unit1,         !- Name
```

```
    Wall,                    !- Surface Type
    Gable_end,               !- Construction Name
    attic_unit1,             !- Zone Name
    Outdoors,                !- Outside Boundary Condition
    ,                        !- Outside Boundary Condition Object
    SunExposed,              !- Sun Exposure
    WindExposed,             !- Wind Exposure
    ,                        !- View Factor to Ground
    3,                       !- Number of Vertices
    0,                       !- Vertex 1 X-coordinate {m}
    9.09981820971244,        !- Vertex 1 Y-coordinate {m}
    5.19302682926829,        !- Vertex 1 Z-coordinate {m}
    0,                       !- Vertex 2 X-coordinate {m}
    0,                       !- Vertex 2 Y-coordinate {m}
    5.19302682926829,        !- Vertex 2 Z-coordinate {m}
    0,                       !- Vertex 3 X-coordinate {m}
    4.54990910485622,        !- Vertex 3 Y-coordinate {m}
    6.6995631975537;         !- Vertex 3 Z-coordinate {m}

BuildingSurface:Detailed,
    Wall_ldf_1.unit1,        !- Name
    Wall,                    !- Surface Type
    Exterior Wall,           !- Construction Name
    living_unit1,            !- Zone Name
    Outdoors,                !- Outside Boundary Condition
    ,                        !- Outside Boundary Condition Object
    SunExposed,              !- Sun Exposure
    WindExposed,             !- Wind Exposure
    ,                        !- View Factor to Ground
    4,                       !- Number of Vertices
    0,                       !- Vertex 1 X-coordinate {m}
    0,                       !- Vertex 1 Y-coordinate {m}
    0.0101,                  !- Vertex 1 Z-coordinate {m}
    12.1330909462833,        !- Vertex 2 X-coordinate {m}
    0,                       !- Vertex 2 Y-coordinate {m}
    0.0101,                  !- Vertex 2 Z-coordinate {m}
```

```
    12.1330909462833,        !- Vertex 3 X-coordinate {m}
    0,                       !- Vertex 3 Y-coordinate {m}
    2.60156341463415,        !- Vertex 3 Z-coordinate {m}
    0,                       !- Vertex 4 X-coordinate {m}
    0,                       !- Vertex 4 Y-coordinate {m}
    2.60156341463415;        !- Vertex 4 Z-coordinate {m}

BuildingSurface:Detailed,
    Wall_sdr_1.unit1,        !- Name
    Wall,                    !- Surface Type
    Exterior Wall,           !- Construction Name
    living_unit1,            !- Zone Name
    Outdoors,                !- Outside Boundary Condition
    ,                        !- Outside Boundary Condition Object
    SunExposed,              !- Sun Exposure
    WindExposed,             !- Wind Exposure
    ,                        !- View Factor to Ground
    4,                       !- Number of Vertices
    12.1330909462833,        !- Vertex 1 X-coordinate {m}
    0,                       !- Vertex 1 Y-coordinate {m}
    0.0101,                  !- Vertex 1 Z-coordinate {m}
    12.1330909462833,        !- Vertex 2 X-coordinate {m}
    9.09981820971244,        !- Vertex 2 Y-coordinate {m}
    0.0101,                  !- Vertex 2 Z-coordinate {m}
    12.1330909462833,        !- Vertex 3 X-coordinate {m}
    9.09981820971244,        !- Vertex 3 Y-coordinate {m}
    2.60156341463415,        !- Vertex 3 Z-coordinate {m}
    12.1330909462833,        !- Vertex 4 X-coordinate {m}
    0,                       !- Vertex 4 Y-coordinate {m}
    2.60156341463415;        !- Vertex 4 Z-coordinate {m}

BuildingSurface:Detailed,
    Wall_ldb_1.unit1,        !- Name
    Wall,                    !- Surface Type
    Exterior Wall,           !- Construction Name
    living_unit1,            !- Zone Name
```

```
    Outdoors,                !- Outside Boundary Condition
    ,                        !- Outside Boundary Condition Object
    SunExposed,              !- Sun Exposure
    WindExposed,             !- Wind Exposure
    ,                        !- View Factor to Ground
    4,                       !- Number of Vertices
    12.1330909462833,        !- Vertex 1 X-coordinate {m}
    9.09981820971244,        !- Vertex 1 Y-coordinate {m}
    0.0101,                  !- Vertex 1 Z-coordinate {m}
    0,                       !- Vertex 2 X-coordinate {m}
    9.09981820971244,        !- Vertex 2 Y-coordinate {m}
    0.0101,                  !- Vertex 2 Z-coordinate {m}
    0,                       !- Vertex 3 X-coordinate {m}
    9.09981820971244,        !- Vertex 3 Y-coordinate {m}
    2.60156341463415,        !- Vertex 3 Z-coordinate {m}
    12.1330909462833,        !- Vertex 4 X-coordinate {m}
    9.09981820971244,        !- Vertex 4 Y-coordinate {m}
    2.60156341463415;        !- Vertex 4 Z-coordinate {m}

BuildingSurface:Detailed,
    Wall_sdl_1.unit1,        !- Name
    Wall,                    !- Surface Type
    Exterior Wall,           !- Construction Name
    living_unit1,            !- Zone Name
    Outdoors,                !- Outside Boundary Condition
    ,                        !- Outside Boundary Condition Object
    SunExposed,              !- Sun Exposure
    WindExposed,             !- Wind Exposure
    ,                        !- View Factor to Ground
    4,                       !- Number of Vertices
    0,                       !- Vertex 1 X-coordinate {m}
    9.09981820971244,        !- Vertex 1 Y-coordinate {m}
    0.0101,                  !- Vertex 1 Z-coordinate {m}
    0,                       !- Vertex 2 X-coordinate {m}
    0,                       !- Vertex 2 Y-coordinate {m}
    0.0101,                  !- Vertex 2 Z-coordinate {m}
```

```
    0,                      !- Vertex 3 X-coordinate {m}
    0,                      !- Vertex 3 Y-coordinate {m}
    2.60156341463415,       !- Vertex 3 Z-coordinate {m}
    0,                      !- Vertex 4 X-coordinate {m}
    9.09981820971244,       !- Vertex 4 Y-coordinate {m}
    2.60156341463415;       !- Vertex 4 Z-coordinate {m}

BuildingSurface:Detailed,
    Wall_ldf_2.unit1,       !- Name
    Wall,                   !- Surface Type
    Exterior Wall,          !- Construction Name
    living_unit1,           !- Zone Name
    Outdoors,               !- Outside Boundary Condition
    ,                       !- Outside Boundary Condition Object
    SunExposed,             !- Sun Exposure
    WindExposed,            !- Wind Exposure
    ,                       !- View Factor to Ground
    4,                      !- Number of Vertices
    0,                      !- Vertex 1 X-coordinate {m}
    0,                      !- Vertex 1 Y-coordinate {m}
    2.60156341463415,       !- Vertex 1 Z-coordinate {m}
    12.1330909462833,       !- Vertex 2 X-coordinate {m}
    0,                      !- Vertex 2 Y-coordinate {m}
    2.60156341463415,       !- Vertex 2 Z-coordinate {m}
    12.1330909462833,       !- Vertex 3 X-coordinate {m}
    0,                      !- Vertex 3 Y-coordinate {m}
    5.19302682926829,       !- Vertex 3 Z-coordinate {m}
    0,                      !- Vertex 4 X-coordinate {m}
    0,                      !- Vertex 4 Y-coordinate {m}
    5.19302682926829;       !- Vertex 4 Z-coordinate {m}

BuildingSurface:Detailed,
    Wall_sdr_2.unit1,       !- Name
    Wall,                   !- Surface Type
    Exterior Wall,          !- Construction Name
    living_unit1,           !- Zone Name
```

```
    Outdoors,                !- Outside Boundary Condition
    ,                        !- Outside Boundary Condition Object
    SunExposed,              !- Sun Exposure
    WindExposed,             !- Wind Exposure
    ,                        !- View Factor to Ground
    4,                       !- Number of Vertices
    12.1330909462833,        !- Vertex 1 X-coordinate {m}
    0,                       !- Vertex 1 Y-coordinate {m}
    2.60156341463415,        !- Vertex 1 Z-coordinate {m}
    12.1330909462833,        !- Vertex 2 X-coordinate {m}
    9.09981820971244,        !- Vertex 2 Y-coordinate {m}
    2.60156341463415,        !- Vertex 2 Z-coordinate {m}
    12.1330909462833,        !- Vertex 3 X-coordinate {m}
    9.09981820971244,        !- Vertex 3 Y-coordinate {m}
    5.19302682926829,        !- Vertex 3 Z-coordinate {m}
    12.1330909462833,        !- Vertex 4 X-coordinate {m}
    0,                       !- Vertex 4 Y-coordinate {m}
    5.19302682926829;        !- Vertex 4 Z-coordinate {m}

BuildingSurface:Detailed,
    Wall_ldb_2.unit1,        !- Name
    Wall,                    !- Surface Type
    Exterior Wall,           !- Construction Name
    living_unit1,            !- Zone Name
    Outdoors,                !- Outside Boundary Condition
    ,                        !- Outside Boundary Condition Object
    SunExposed,              !- Sun Exposure
    WindExposed,             !- Wind Exposure
    ,                        !- View Factor to Ground
    4,                       !- Number of Vertices
    12.1330909462833,        !- Vertex 1 X-coordinate {m}
    9.09981820971244,        !- Vertex 1 Y-coordinate {m}
    2.60156341463415,        !- Vertex 1 Z-coordinate {m}
    0,                       !- Vertex 2 X-coordinate {m}
    9.09981820971244,        !- Vertex 2 Y-coordinate {m}
    2.60156341463415,        !- Vertex 2 Z-coordinate {m}
```

```
    0,                      !- Vertex 3 X-coordinate {m}
    9.09981820971244,       !- Vertex 3 Y-coordinate {m}
    5.19302682926829,       !- Vertex 3 Z-coordinate {m}
    12.1330909462833,       !- Vertex 4 X-coordinate {m}
    9.09981820971244,       !- Vertex 4 Y-coordinate {m}
    5.19302682926829;       !- Vertex 4 Z-coordinate {m}

BuildingSurface:Detailed,
    Wall_sdl_2.unit1,       !- Name
    Wall,                   !- Surface Type
    Exterior Wall,          !- Construction Name
    living_unit1,           !- Zone Name
    Outdoors,               !- Outside Boundary Condition
    ,                       !- Outside Boundary Condition Object
    SunExposed,             !- Sun Exposure
    WindExposed,            !- Wind Exposure
    ,                       !- View Factor to Ground
    4,                      !- Number of Vertices
    0,                      !- Vertex 1 X-coordinate {m}
    9.09981820971244,       !- Vertex 1 Y-coordinate {m}
    2.60156341463415,       !- Vertex 1 Z-coordinate {m}
    0,                      !- Vertex 2 X-coordinate {m}
    0,                      !- Vertex 2 Y-coordinate {m}
    2.60156341463415,       !- Vertex 2 Z-coordinate {m}
    0,                      !- Vertex 3 X-coordinate {m}
    0,                      !- Vertex 3 Y-coordinate {m}
    5.19302682926829,       !- Vertex 3 Z-coordinate {m}
    0,                      !- Vertex 4 X-coordinate {m}
    9.09981820971244,       !- Vertex 4 Y-coordinate {m}
    5.19302682926829;       !- Vertex 4 Z-coordinate {m}

BuildingSurface:Detailed,
    Floor_unit1,            !- Name
    Floor,                  !- Surface Type
    Interior Floor,         !- Construction Name
    living_unit1,           !- Zone Name
```

```
    Ground,                  !- Outside Boundary Condition
    ,                        !- Outside Boundary Condition Object
    NoSun,                   !- Sun Exposure
    NoWind,                  !- Wind Exposure
    0.0,                     !- View Factor to Ground
    4,                       !- Number of Vertices
    0,                       !- Vertex 1 X-coordinate {m}
    0,                       !- Vertex 1 Y-coordinate {m}
    0.0101,                  !- Vertex 1 Z-coordinate {m}
    0,                       !- Vertex 2 X-coordinate {m}
    9.09981820971244,        !- Vertex 2 Y-coordinate {m}
    0.0101,                  !- Vertex 2 Z-coordinate {m}
    12.1330909462833,        !- Vertex 3 X-coordinate {m}
    9.09981820971244,        !- Vertex 3 Y-coordinate {m}
    0.0101,                  !- Vertex 3 Z-coordinate {m}
    12.1330909462833,        !- Vertex 4 X-coordinate {m}
    0,                       !- Vertex 4 Y-coordinate {m}
    0.0101;                  !- Vertex 4 Z-coordinate {m}


!-   ===========  ALL OBJECTS IN CLASS: WINDOW ===========

Window,
    Window_ldf_1.unit1,      !- Name
    Exterior Window,         !- Construction Name
    Wall_ldf_1.unit1,        !- Building Surface Name
    ,                        !- Frame and Divider Name
    1,                       !- Multiplier
    1,                       !- Starting X Coordinate {m}
    0.914634146341463,       !- Starting Z Coordinate {m}
    2.70719591738945,        !- Length {m}
    1.52439024390244;        !- Height {m}

Window,
    Window_ldb_1.unit1,      !- Name
    Exterior Window,         !- Construction Name
```

```
    Wall_ldb_1.unit1,        !- Building Surface Name
    ,                        !- Frame and Divider Name
    1,                       !- Multiplier
    2.74190122145512,        !- Starting X Coordinate {m}
    0.914634146341463,       !- Starting Z Coordinate {m}
    2.70719591738945,        !- Length {m}
    1.52439024390244;        !- Height {m}

Window,
    Window_sdr_1.unit1,      !- Name
    Exterior Window,         !- Construction Name
    Wall_sdr_1.unit1,        !- Building Surface Name
    ,                        !- Frame and Divider Name
    1,                       !- Multiplier
    1,                       !- Starting X Coordinate {m}
    0.914634146341463,       !- Starting Z Coordinate {m}
    2.70719591738945,        !- Length {m}
    1.52439024390244;        !- Height {m}

Window,
    Window_sdl_1.unit1,      !- Name
    Exterior Window,         !- Construction Name
    Wall_sdl_1.unit1,        !- Building Surface Name
    ,                        !- Frame and Divider Name
    1,                       !- Multiplier
    1,                       !- Starting X Coordinate {m}
    0.914634146341463,       !- Starting Z Coordinate {m}
    2.70719591738945,        !- Length {m}
    1.52439024390244;        !- Height {m}

Window,
    Window_ldf_2.unit1,      !- Name
    Exterior Window,         !- Construction Name
    Wall_ldf_2.unit1,        !- Building Surface Name
    ,                        !- Frame and Divider Name
    1,                       !- Multiplier
```

```
    1,                      !- Starting X Coordinate {m}
    0.914634146341463,      !- Starting Z Coordinate {m}
    2.70719591738945,       !- Length {m}
    1.52439024390244;       !- Height {m}

Window,
    Window_ldb_2.unit1,     !- Name
    Exterior Window,        !- Construction Name
    Wall_ldb_2.unit1,       !- Building Surface Name
    ,                       !- Frame and Divider Name
    1,                      !- Multiplier
    2.74190122145512,       !- Starting X Coordinate {m}
    0.914634146341463,      !- Starting Z Coordinate {m}
    2.70719591738945,       !- Length {m}
    1.52439024390244;       !- Height {m}

Window,
    Window_sdr_2.unit1,     !- Name
    Exterior Window,        !- Construction Name
    Wall_sdr_2.unit1,       !- Building Surface Name
    ,                       !- Frame and Divider Name
    1,                      !- Multiplier
    1,                      !- Starting X Coordinate {m}
    0.914634146341463,      !- Starting Z Coordinate {m}
    2.70719591738945,       !- Length {m}
    1.52439024390244;       !- Height {m}

Window,
    Window_sdl_2.unit1,     !- Name
    Exterior Window,        !- Construction Name
    Wall_sdl_2.unit1,       !- Building Surface Name
    ,                       !- Frame and Divider Name
    1,                      !- Multiplier
    1,                      !- Starting X Coordinate {m}
    0.914634146341463,      !- Starting Z Coordinate {m}
    2.70719591738945,       !- Length {m}
```

```
    1.52439024390244;        !- Height {m}


!-   ===========  ALL OBJECTS IN CLASS: DOOR ===========

Door,
    Door_ldb_unit1,          !- Name
    Exterior Door,           !- Construction Name
    Wall_ldb_1.unit1,        !- Building Surface Name
    1,                       !- Multiplier
    0.5,                     !- Starting X Coordinate {m}
    0,                       !- Starting Z Coordinate {m}
    1.74190122145513,        !- Length {m}
    2.13414634146341;        !- Height {m}


!-   ===========  ALL OBJECTS IN CLASS: WINDOWSHADINGCONTROL
   ===========

WindowShadingControl,
    Shades-living_unit1,     !- Name
    living_unit1,            !- Zone Name
    1,                       !- Shading Control Sequence Number
    InteriorBlind,           !- Shading Type
    window_w_blinds,         !- Construction with Shading Name
    OnIfScheduleAllows,      !- Shading Control Type
    shading_2012iecc,        !- Schedule Name
    ,                        !- Setpoint {W/m2, W or deg C}
    Yes,                     !- Shading Control Is Scheduled
    No,                      !- Glare Control Is Active
    ,                        !- Shading Device Material Name
    ,                        !- Type of Slat Angle Control for
   Blinds
    ,                        !- Slat Angle Schedule Name
    ,                        !- Setpoint 2 {W/m2 or deg C}
    ,                        !- Daylighting Control Object Name
```

```
    Sequential,               !- Multiple Surface Control Type
    Window_ldf_1.unit1,       !- Fenestration Surface 1 Name
    Window_ldb_1.unit1,       !- Fenestration Surface 2 Name
    Window_sdr_1.unit1,       !- Fenestration Surface 3 Name
    Window_sdl_1.unit1,       !- Fenestration Surface 4 Name
    Window_ldf_2.unit1,       !- Fenestration Surface 5 Name
    Window_ldb_2.unit1,       !- Fenestration Surface 6 Name
    Window_sdr_2.unit1,       !- Fenestration Surface 7 Name
    Window_sdl_2.unit1;       !- Fenestration Surface 8 Name


!-   ===========  ALL OBJECTS IN CLASS: INTERNALMASS ===========

InternalMass,
    Internalmass_unit1,       !- Name
    InteriorFurnishings,      !- Construction Name
    living_unit1,             !- Zone or ZoneList Name
    9.89591078066915;         !- Surface Area {m2}


!-   ===========  ALL OBJECTS IN CLASS: SHADING:OVERHANG ===========

Shading:Overhang,
    Overhang_sdr_1.unit1,     !- Name
    Window_sdr_1.unit1,       !- Window or Door Name
    0,                        !- Height above Window or Door {m}
    90,                       !- Tilt Angle from Window/Door {deg}
    0,                        !- Left extension from Window/Door
   Width {m}
    0,                        !- Right extension from Window/Door
   Width {m}
    0.0152439024390244;       !- Depth {m}

Shading:Overhang,
    Overhang_sdr_2.unit1,     !- Name
    Window_sdr_2.unit1,       !- Window or Door Name
```

```
    0,                        !- Height above Window or Door {m}
    90,                       !- Tilt Angle from Window/Door {deg}
    0,                        !- Left extension from Window/Door
   Width {m}
    0,                        !- Right extension from Window/Door
   Width {m}
    0.0152439024390244;       !- Depth {m}


!-   ===========  ALL OBJECTS IN CLASS: GROUNDHEATTRANSFER:CONTROL
   ===========

GroundHeatTransfer:Control,
    gtp_control,              !- Name
    no,                       !- Run Basement Preprocessor
    yes;                      !- Run Slab Preprocessor


!-   ===========  ALL OBJECTS IN CLASS: GROUNDHEATTRANSFER:SLAB:
   MATERIALS ===========

GroundHeatTransfer:Slab:Materials,
    2,                        !- NMAT: Number of materials
    0.16,                     !- ALBEDO: Surface Albedo: No Snow
    0.4,                      !- ALBEDO: Surface Albedo: Snow
    0.9,                      !- EPSLW: Surface Emissivity: No Snow
    0.9,                      !- EPSLW: Surface Emissivity: Snow
    0.75,                     !- Z0: Surface Roughness: No Snow {cm}
    0.05,                     !- Z0: Surface Roughness: Snow {cm}
    6,                        !- HIN: Indoor HConv: Downward Flow {W/
   m2-K}
    9;                        !- HIN: Indoor HConv: Upward {W/m2-K}


!-   ===========  ALL OBJECTS IN CLASS: GROUNDHEATTRANSFER:SLAB:
   MATLPROPS ===========
```

```
GroundHeatTransfer:Slab:MatlProps,
    2300,                    !- RHO: Slab Material density {kg/m3}
    1200,                    !- RHO: Soil Density {kg/m3}
    650,                     !- CP: Slab CP {J/kg-K}
    1200,                    !- CP: Soil CP {J/kg-K}
    0.9,                     !- TCON: Slab k {W/m-K}
    1;                       !- TCON: Soil k {W/m-K}


!-   ===========  ALL OBJECTS IN CLASS: GROUNDHEATTRANSFER:SLAB:
   BOUNDCONDS ===========

GroundHeatTransfer:Slab:BoundConds,
    FALSE,                   !- EVTR: Is surface evapotranspiration
   modeled
    TRUE,                    !- FIXBC: is the lower boundary at a
   fixed temperature
    10,                      !- TDEEPin {C}
    FALSE;                   !- USRHflag: Is the ground surface h
   specified by the user?


!-   ===========  ALL OBJECTS IN CLASS: GROUNDHEATTRANSFER:SLAB:
   BLDGPROPS ===========

GroundHeatTransfer:Slab:BldgProps,
    10,                      !- IYRS: Number of years to iterate
    0,                       !- Shape: Slab shape
    4,                       !- HBLDG: Building height {m}
    22.22,                   !- TIN1: January Indoor Average
   Temperature Setpoint {C}
    22.22,                   !- TIN2: February Indoor Average
   Temperature Setpoint {C}
    22.22,                   !- TIN3: March Indoor Average
   Temperature Setpoint {C}
```

```
    22.22,                  !- TIN4: April Indoor Average
   Temperature Setpoint {C}
    22.22,                  !- TIN5: May Indoor Average Temperature
    Setpoint {C}
    23.88,                  !- TIN6: June Indoor Average
   Temperature Setpoint {C}
    23.88,                  !- TIN7: July Indoor Average
   Temperature Setpoint {C}
    23.88,                  !- TIN8: August Indoor Average
   Temperature Setpoint {C}
    23.88,                  !- TIN9: September Indoor Average
   Temperature Setpoint {C}
    22.22,                  !- TIN10: October Indoor Average
   Temperature Setpoint {C}
    22.22,                  !- TIN11: November Indoor Average
   Temperature Setpoint {C}
    22.22,                  !- TIN12: December Indoor Average
   Temperature Setpoint {C}
    0,                      !- TINAmp: Daily Indoor sine wave
   variation amplitude {deltaC}
    0.1;                    !- ConvTol: Convergence Tolerance


!-   ===========  ALL OBJECTS IN CLASS: GROUNDHEATTRANSFER:SLAB:
   INSULATION ===========

GroundHeatTransfer:Slab:Insulation,
    0,                      !- RINS: R value of under slab
   insulation {m2-K/W}
    0,                      !- DINS: Width of strip of under slab
   insulation {m}
    0,                      !- RVINS: R value of vertical
   insulation {m2-K/W}
    0.6,                    !- ZVINS: Depth of vertical insulation
   {m}
```

```
    0;                      !- IVINS: Flag: Is there vertical
   insulation


!-   ===========  ALL OBJECTS IN CLASS: GROUNDHEATTRANSFER:SLAB:
   EQUIVALENTSLAB ===========

GroundHeatTransfer:Slab:EquivalentSlab,
    2.59994805991784,       !- APRatio: The area to perimeter ratio
    for this slab {m}
    0.1,                    !- SLABDEPTH: Thickness of slab on
   grade {m}
    15,                     !- CLEARANCE: Distance from edge of
   slab to domain edge {m}
    15;                     !- ZCLEARANCE: Distance from bottom of
   slab to domain bottom {m}


!-   ===========  ALL OBJECTS IN CLASS: GROUNDHEATTRANSFER:BASEMENT:
   SIMPARAMETERS ===========

GroundHeatTransfer:Basement:SimParameters,
    0.1,                    !- F: Multiplier for the ADI solution
    15;                     !- IYRS: Maximum number of yearly
   iterations:


!-   ===========  ALL OBJECTS IN CLASS: GROUNDHEATTRANSFER:BASEMENT:
   MATLPROPS ===========

GroundHeatTransfer:Basement:MatlProps,
    6,                      !- NMAT: Number of materials in this
   domain
    2243,                   !- Density for Foundation Wall {kg/m3}
    2243,                   !- density for Floor Slab {kg/m3}
    311,                    !- density for Ceiling {kg/m3}
```

```
    1500,                    !- density for Soil {kg/m3}
    2000,                    !- density for Gravel {kg/m3}
    449,                     !- density for Wood {kg/m3}
    880,                     !- Specific heat for foundation wall {J
   /kg-K}
    880,                     !- Specific heat for floor slab {J/kg-K
   }
    1530,                    !- Specific heat for ceiling {J/kg-K}
    840,                     !- Specific heat for soil {J/kg-K}
    720,                     !- Specific heat for gravel {J/kg-K}
    1530,                    !- Specific heat for wood {J/kg-K}
    1.4,                     !- Thermal conductivity for foundation
   wall {W/m-K}
    1.4,                     !- Thermal conductivity for floor slab
   {W/m-K}
    0.09,                    !- Thermal conductivity for ceiling {W/
   m-K}
    1.1,                     !- thermal conductivity for soil {W/m-K
   }
    1.9,                     !- thermal conductivity for gravel {W/m
   -K}
    0.12;                    !- thermal conductivity for wood {W/m-K
   }


!-   ===========  ALL OBJECTS IN CLASS: GROUNDHEATTRANSFER:BASEMENT:
   INSULATION ===========

GroundHeatTransfer:Basement:Insulation,
    1.76099742894375e-05,    !- REXT: R Value of any exterior
   insulation {m2-K/W}
    True;                    !- INSFULL: Flag: Is the wall fully
   insulated?
```

```
!-   ===========  ALL OBJECTS IN CLASS: GROUNDHEATTRANSFER:BASEMENT:
   SURFACEPROPS ===========

GroundHeatTransfer:Basement:SurfaceProps,
    0.16,                    !- ALBEDO: Surface albedo for No snow
   conditions
    0.4,                     !- ALBEDO: Surface albedo for snow
   conditions
    0.94,                    !- EPSLN: Surface emissivity No Snow
    0.86,                    !- EPSLN: Surface emissivity with Snow
    6,                       !- VEGHT: Surface roughness No snow
   conditions {cm}
    0.25,                    !- VEGHT: Surface roughness Snow
   conditions {cm}
    False;                   !- PET: Flag, Potential
   evapotranspiration on?


!-   ===========  ALL OBJECTS IN CLASS: GROUNDHEATTRANSFER:BASEMENT:
   BLDGDATA ===========

GroundHeatTransfer:Basement:BldgData,
    0.200000006162114,       !- DWALL: Wall thickness {m}
    0.243828108701145,       !- DSLAB: Floor slab thickness {m}
    0.3,                     !- DGRAVXY: Width of gravel pit beside
   basement wall {m}
    0.2,                     !- DGRAVZN: Gravel depth extending
   above the floor slab {m}
    0.1;                     !- DGRAVZP: Gravel depth below the
   floor slab {m}


!-   ===========  ALL OBJECTS IN CLASS: GROUNDHEATTRANSFER:BASEMENT:
   INTERIOR ===========

GroundHeatTransfer:Basement:Interior,
```

```
    True,                    !- COND: Flag: Is the basement
   conditioned?
    0.92,                    !- HIN: Downward convection only heat
   transfer coefficient {W/m2-K}
    4.04,                    !- HIN: Upward convection only heat
   transfer coefficient {W/m2-K}
    3.08,                    !- HIN: Horizontal convection only heat
    transfer coefficient {W/m2-K}
    6.13,                    !- HIN: Downward combined (convection
   and radiation) heat transfer coefficient {W/m2-K}
    9.26,                    !- HIN: Upward combined (convection and
    radiation) heat transfer coefficient {W/m2-K}
    8.29;                    !- HIN: Horizontal combined (convection
    and radiation) heat transfer coefficient {W/m2-K}


!-   ===========  ALL OBJECTS IN CLASS: GROUNDHEATTRANSFER:BASEMENT:
   COMBLDG ===========

GroundHeatTransfer:Basement:ComBldg,
    21,                      !- January average temperature {C}
    21,                      !- February average temperature {C}
    21,                      !- March average temperature {C}
    21,                      !- April average temperature {C}
    24,                      !- May average temperature {C}
    24,                      !- June average temperature {C}
    24,                      !- July average temperature {C}
    24,                      !- August average temperature {C}
    24,                      !- September average temperature {C}
    24,                      !- October average temperature {C}
    21,                      !- November average temperature {C}
    21,                      !- December average temperature {C}
    21;                      !- Daily variation sine wave amplitude
   {deltaC}
```

```
!-   ===========  ALL OBJECTS IN CLASS: GROUNDHEATTRANSFER:BASEMENT:
   EQUIVSLAB ===========

GroundHeatTransfer:Basement:EquivSlab,
    2.59994805991784,        !- APRatio: The area to perimeter ratio
    for this slab {m}
    True;                    !- EquivSizing: Flag


!-   ===========  ALL OBJECTS IN CLASS: GROUNDHEATTRANSFER:BASEMENT:
   EQUIVAUTOGRID ===========

GroundHeatTransfer:Basement:EquivAutoGrid,
    15,                      !- CLEARANCE: Distance from outside of
   wall to edge of 3-D ground domain {m}
    0.1,                     !- SlabDepth: Thickness of the floor
   slab {m}
    1.21914054350572;        !- BaseDepth: Depth of the basement
   wall below grade {m}


!-   ===========  ALL OBJECTS IN CLASS: PEOPLE ===========

People,
    people_unit1,            !- Name
    living_unit1,            !- Zone or ZoneList Name
    Occupancy,               !- Number of People Schedule Name
    People,                  !- Number of People Calculation Method
    3,                       !- Number of People
    ,                        !- People per Zone Floor Area {person/
   m2}
    ,                        !- Zone Floor Area per Person {m2/
   person}
    0,                       !- Fraction Radiant
    autocalculate,           !- Sensible Heat Fraction
    activity_sch,            !- Activity Level Schedule Name
```

```
    ,                         !- Carbon Dioxide Generation Rate {m3/s
   -W}
    No,                       !- Enable ASHRAE 55 Comfort Warnings
    ZoneAveraged,             !- Mean Radiant Temperature Calculation
    Type
    ,                         !- Surface Name/Angle Factor List Name
    Work Eff Sch,             !- Work Efficiency Schedule Name
    ClothingInsulationSchedule,  !- Clothing Insulation Calculation
   Method
    ,                         !- Clothing Insulation Calculation
   Method Schedule Name
    Clothing Sch,             !- Clothing Insulation Schedule Name
    Air Velo Sch,             !- Air Velocity Schedule Name
    Fanger,                   !- Thermal Comfort Model 1 Type
    Pierce,                   !- Thermal Comfort Model 2 Type
    AdaptiveASH55,            !- Thermal Comfort Model 3 Type
    KSU;                      !- Thermal Comfort Model 4 Type


!-   ===========  ALL OBJECTS IN CLASS: LIGHTS ===========

Lights,
    Living Hardwired Lighting1,  !- Name
    living_unit1,             !- Zone or ZoneList Name
    InteriorLightingHE,       !- Schedule Name
    Watts/Area,               !- Design Level Calculation Method
    ,                         !- Lighting Level {W}
    1.05216214401829,         !- Watts per Zone Floor Area {W/m2}
    ,                         !- Watts per Person {W/person}
    0,                        !- Return Air Fraction
    0.6,                      !- Fraction Radiant
    0.2,                      !- Fraction Visible
    0;                        !- Fraction Replaceable

Lights,
    Living Plug-in Lighting1,!- Name
```

```
    living_unit1,             !- Zone or ZoneList Name
    InteriorLightingHE,       !- Schedule Name
    Watts/Area,               !- Design Level Calculation Method
    ,                         !- Lighting Level {W}
    0.478467682251396,        !- Watts per Zone Floor Area {W/m2}
    ,                         !- Watts per Person {W/person}
    0,                        !- Return Air Fraction
    0.6,                      !- Fraction Radiant
    0.2,                      !- Fraction Visible
    0;                        !- Fraction Replaceable


!-   ===========  ALL OBJECTS IN CLASS: ELECTRICEQUIPMENT
   ===========
ElectricEquipment,
    ceiling_fan,              !- Name
    living_unit1,                    !- Zone or ZoneList Name
    fan_sch,                  !- Schedule Name
    EquipmentLevel,           !- Design Level Calculation Method
    230,                      !- Design Level
    ,                         !- Watts per Zone Floor Area
    ,                         !- Watts per Person
    0,                        !- Fraction Latent
    0.4,                      !- Fraction Radiant
    0,                        !- Fraction Lost
    General;                  !- EndUse Subcategory

ElectricEquipment,
    dishwasher1,              !- Name
    living_unit1,             !- Zone or ZoneList Name
    DishWasher,               !- Schedule Name
    EquipmentLevel,           !- Design Level Calculation Method
    65.698787492023,          !- Design Level {W}
    ,                         !- Watts per Zone Floor Area {W/m2}
    ,                         !- Watts per Person {W/person}
    0.15,                     !- Fraction Latent
```

```
    0.6,                    !- Fraction Radiant
    0.25,                   !- Fraction Lost
    dishwasher;             !- End-Use Subcategory

ElectricEquipment,
    refrigerator1,          !- Name
    living_unit1,           !- Zone or ZoneList Name
    Refrigerator,           !- Schedule Name
    EquipmentLevel,         !- Design Level Calculation Method
    91.0575745202123,       !- Design Level {W}
    ,                       !- Watts per Zone Floor Area {W/m2}
    ,                       !- Watts per Person {W/person}
    0,                      !- Fraction Latent
    1,                      !- Fraction Radiant
    0,                      !- Fraction Lost
    refrigerator;           !- End-Use Subcategory

ElectricEquipment,
    clotheswasher1,         !- Name
    living_unit1,           !- Zone or ZoneList Name
    ClothesWasher,          !- Schedule Name
    EquipmentLevel,         !- Design Level Calculation Method
    28.4784377542718,       !- Design Level {W}
    ,                       !- Watts per Zone Floor Area {W/m2}
    ,                       !- Watts per Person {W/person}
    0,                      !- Fraction Latent
    0.8,                    !- Fraction Radiant
    0.2,                    !- Fraction Lost
    clotheswasher;          !- End-Use Subcategory

ElectricEquipment,
    electric_dryer1,        !- Name
    living_unit1,           !- Zone or ZoneList Name
    ClothesDryer,           !- Schedule Name
    EquipmentLevel,         !- Design Level Calculation Method
    213.064557285022,       !- Design Level {W}
```

```
    ,                       !- Watts per Zone Floor Area {W/m2}
    ,                       !- Watts per Person {W/person}
    0.05,                   !- Fraction Latent
    0.15,                   !- Fraction Radiant
    0.8,                    !- Fraction Lost
    electric_dryer;         !- End-Use Subcategory

ElectricEquipment,
    electric_range1,        !- Name
    living_unit1,           !- Zone or ZoneList Name
    CookingRange,           !- Schedule Name
    EquipmentLevel,         !- Design Level Calculation Method
    248.154224774405,       !- Design Level {W}
    ,                       !- Watts per Zone Floor Area {W/m2}
    ,                       !- Watts per Person {W/person}
    0.3,                    !- Fraction Latent
    0.4,                    !- Fraction Radiant
    0.3,                    !- Fraction Lost
    electric_range;         !- End-Use Subcategory

ElectricEquipment,
    television1,            !- Name
    living_unit1,           !- Zone or ZoneList Name
    InteriorLighting,       !- Schedule Name
    EquipmentLevel,         !- Design Level Calculation Method
    0,                      !- Design Level {W}
    ,                       !- Watts per Zone Floor Area {W/m2}
    ,                       !- Watts per Person {W/person}
    0,                      !- Fraction Latent
    1,                      !- Fraction Radiant
    0,                      !- Fraction Lost
    television;             !- End-Use Subcategory

ElectricEquipment,
    electric_mels1,         !- Name
    living_unit1,           !- Zone or ZoneList Name
```

```
    MiscPlugLoad,            !- Schedule Name
    EquipmentLevel,          !- Design Level Calculation Method
    567.464237516869,        !- Design Level {W}
    ,                        !- Watts per Zone Floor Area {W/m2}
    ,                        !- Watts per Person {W/person}
    0.06,                    !- Fraction Latent
    0.69,                    !- Fraction Radiant
    0.25,                    !- Fraction Lost
    electric_mels;           !- End-Use Subcategory

ElectricEquipment,
    IECC_Adj1,               !- Name
    living_unit1,            !- Zone or ZoneList Name
    MiscPlugLoad,            !- Schedule Name
    Watts/Area,              !- Design Level Calculation Method
    ,                        !- Design Level {W}
    1.54356736989469,        !- Watts per Zone Floor Area {W/m2}
    ,                        !- Watts per Person {W/person}
    0.0624390461422629,      !- Fraction Latent
    0.41190936353998,        !- Fraction Radiant
    0.251045347957769,       !- Fraction Lost
    IECC_adj;                !- End-Use Subcategory


!-   ===========  ALL OBJECTS IN CLASS: ZONEVENTILATION:
   DESIGNFLOWRATE ===========

ZoneVentilation:DesignFlowRate,
    Ventilation_unit1,       !- Name
    living_unit1,            !- Zone or ZoneList Name
    always_avail,            !- Schedule Name
    Flow/Zone,               !- Design Flow Rate Calculation Method
    0,                       !- Design Flow Rate {m3/s}
    ,                        !- Flow Rate per Zone Floor Area {m3/s-
   m2}
    ,                        !- Flow Rate per Person {m3/s-person}
```

```
    ,                         !- Air Changes per Hour {1/hr}
    Exhaust,                  !- Ventilation Type
    0,                        !- Fan Pressure Rise {Pa}
    0.6,                      !- Fan Total Efficiency
    1,                        !- Constant Term Coefficient
    0,                        !- Temperature Term Coefficient
    0,                        !- Velocity Term Coefficient
    0,                        !- Velocity Squared Term Coefficient
    -100,                     !- Minimum Indoor Temperature {C}
    ,                         !- Minimum Indoor Temperature Schedule
   Name
    100,                      !- Maximum Indoor Temperature {C}
    ,                         !- Maximum Indoor Temperature Schedule
   Name
    -100,                     !- Delta Temperature {deltaC}
    ,                         !- Delta Temperature Schedule Name
    -100,                     !- Minimum Outdoor Temperature {C}
    ,                         !- Minimum Outdoor Temperature Schedule
    Name
    100,                      !- Maximum Outdoor Temperature {C}
    ,                         !- Maximum Outdoor Temperature Schedule
    Name
    40;                       !- Maximum Wind Speed {m/s}


!-   ==========  ALL OBJECTS IN CLASS: AIRFLOWNETWORK:
   SIMULATIONCONTROL ==========

AirflowNetwork:SimulationControl,
    House AirflowNetwork,     !- Name
    MultizoneWithDistribution,  !- AirflowNetwork Control
    SurfaceAverageCalculation,  !- Wind Pressure Coefficient Type
    ,                         !- Height Selection for Local Wind
   Pressure Calculation
    LOWRISE,                  !- Building Type
```

```
    500,                      !- Maximum Number of Iterations {
   dimensionless}
    ,                         !- Initialization Type
    0.001,                    !- Relative Airflow Convergence
   Tolerance {dimensionless}
    0.00001,                  !- Absolute Airflow Convergence
   Tolerance {kg/s}
    0,                        !- Convergence Acceleration Limit {
   dimensionless}
    0,                        !- Azimuth Angle of Long Axis of
   Building {deg}
    0.75,                     !- Ratio of Building Width Along Short
   Axis to Width Along Long Axis
    ,                         !- Height Dependence of External Node
   Temperature
    ,                         !- Solver
    Yes;                      !- Allow Unsupported Zone Equipment


!-   ===========  ALL OBJECTS IN CLASS: AIRFLOWNETWORK:MULTIZONE:
   ZONE ===========

AirflowNetwork:MultiZone:Zone,
    living_unit1,             !- Zone Name
    NoVent,                   !- Ventilation Control Mode
    ,                         !- Ventilation Control Zone Temperature
    Setpoint Schedule Name
    0,                        !- Minimum Venting Open Factor {
   dimensionless}
    0.0,                      !- Indoor and Outdoor Temperature
   Difference Lower Limit For Maximum Venting Open Factor {deltaC}
    100.0,                    !- Indoor and Outdoor Temperature
   Difference Upper Limit for Minimum Venting Open Factor {deltaC}
    0.0,                      !- Indoor and Outdoor Enthalpy
   Difference Lower Limit For Maximum Venting Open Factor {deltaJ/kg
   }
```

```
    300000.0;                !- Indoor and Outdoor Enthalpy
   Difference Upper Limit for Minimum Venting Open Factor {deltaJ/kg
   }

AirflowNetwork:MultiZone:Zone,
    attic_unit1,             !- Zone Name
    Constant,                !- Ventilation Control Mode
    ,                        !- Ventilation Control Zone Temperature
    Setpoint Schedule Name
    ,                        !- Minimum Venting Open Factor {
   dimensionless}
    ,                        !- Indoor and Outdoor Temperature
   Difference Lower Limit For Maximum Venting Open Factor {deltaC}
    100,                     !- Indoor and Outdoor Temperature
   Difference Upper Limit for Minimum Venting Open Factor {deltaC}
    ,                        !- Indoor and Outdoor Enthalpy
   Difference Lower Limit For Maximum Venting Open Factor {deltaJ/kg
   }
    300000,                  !- Indoor and Outdoor Enthalpy
   Difference Upper Limit for Minimum Venting Open Factor {deltaJ/kg
   }
    inf_sch;                 !- Venting Availability Schedule Name


!-   ===========  ALL OBJECTS IN CLASS: AIRFLOWNETWORK:MULTIZONE:
   SURFACE ===========

AirflowNetwork:MultiZone:Surface,
    Roof_front_unit1,        !- Surface Name
    AtticVent,               !- Leakage Component Name
    ,                        !- External Node Name
    1,                       !- Window/Door Opening Factor, or Crack
    Factor {dimensionless}
    Constant,                !- Ventilation Control Mode
    ,                        !- Ventilation Control Zone Temperature
    Setpoint Schedule Name
```

```
    0,                       !- Minimum Venting Open Factor {
   dimensionless}
    ,                        !- Indoor and Outdoor Temperature
   Difference Lower Limit For Maximum Venting Open Factor {deltaC}
    100,                     !- Indoor and Outdoor Temperature
   Difference Upper Limit for Minimum Venting Open Factor {deltaC}
    ,                        !- Indoor and Outdoor Enthalpy
   Difference Lower Limit For Maximum Venting Open Factor {deltaJ/kg
   }
    300000,                  !- Indoor and Outdoor Enthalpy
   Difference Upper Limit for Minimum Venting Open Factor {deltaJ/kg
   }
    inf_sch;                 !- Venting Availability Schedule Name

AirflowNetwork:MultiZone:Surface,
    Roof_back_unit1,         !- Surface Name
    AtticVent,               !- Leakage Component Name
    ,                        !- External Node Name
    1,                       !- Window/Door Opening Factor, or Crack
    Factor {dimensionless}
    Constant,                !- Ventilation Control Mode
    ,                        !- Ventilation Control Zone Temperature
    Setpoint Schedule Name
    ,                        !- Minimum Venting Open Factor {
   dimensionless}
    ,                        !- Indoor and Outdoor Temperature
   Difference Lower Limit For Maximum Venting Open Factor {deltaC}
    100,                     !- Indoor and Outdoor Temperature
   Difference Upper Limit for Minimum Venting Open Factor {deltaC}
    ,                        !- Indoor and Outdoor Enthalpy
   Difference Lower Limit For Maximum Venting Open Factor {deltaJ/kg
   }
    300000,                  !- Indoor and Outdoor Enthalpy
   Difference Upper Limit for Minimum Venting Open Factor {deltaJ/kg
   }
    inf_sch;                 !- Venting Availability Schedule Name
```

```
AirflowNetwork:MultiZone:Surface,
    Roof_right_unit1,        !- Surface Name
    AtticVent,               !- Leakage Component Name
    ,                        !- External Node Name
    1,                       !- Window/Door Opening Factor, or Crack
    Factor {dimensionless}
    Constant,                !- Ventilation Control Mode
    ,                        !- Ventilation Control Zone Temperature
    Setpoint Schedule Name
    ,                        !- Minimum Venting Open Factor {
   dimensionless}
    ,                        !- Indoor and Outdoor Temperature
   Difference Lower Limit For Maximum Venting Open Factor {deltaC}
    100,                     !- Indoor and Outdoor Temperature
   Difference Upper Limit for Minimum Venting Open Factor {deltaC}
    ,                        !- Indoor and Outdoor Enthalpy
   Difference Lower Limit For Maximum Venting Open Factor {deltaJ/kg
   }
    300000,                  !- Indoor and Outdoor Enthalpy
   Difference Upper Limit for Minimum Venting Open Factor {deltaJ/kg
   }
    inf_sch;                 !- Venting Availability Schedule Name

AirflowNetwork:MultiZone:Surface,
    Roof_left_unit1,         !- Surface Name
    AtticVent,               !- Leakage Component Name
    ,                        !- External Node Name
    1,                       !- Window/Door Opening Factor, or Crack
    Factor {dimensionless}
    Constant,                !- Ventilation Control Mode
    ,                        !- Ventilation Control Zone Temperature
    Setpoint Schedule Name
    ,                        !- Minimum Venting Open Factor {
   dimensionless}
```

```
    ,                       !- Indoor and Outdoor Temperature
   Difference Lower Limit For Maximum Venting Open Factor {deltaC}
    100,                    !- Indoor and Outdoor Temperature
   Difference Upper Limit for Minimum Venting Open Factor {deltaC}
    ,                       !- Indoor and Outdoor Enthalpy
   Difference Lower Limit For Maximum Venting Open Factor {deltaJ/kg
   }
    300000,                 !- Indoor and Outdoor Enthalpy
   Difference Upper Limit for Minimum Venting Open Factor {deltaJ/kg
   }
    inf_sch;                !- Venting Availability Schedule Name

AirflowNetwork:MultiZone:Surface,
    ceiling_unit1,          !- Surface Name
    ZoneLeak_Ceiling,       !- Leakage Component Name
    ,                       !- External Node Name
    1.0,                    !- Window/Door Opening Factor, or Crack
    Factor {dimensionless}
    NoVent;                 !- Ventilation Control Mode

AirflowNetwork:MultiZone:Surface,
    Wall_ldf_1.unit1,       !- Surface Name
    ZoneLeak_LongWall,      !- Leakage Component Name
    ,                       !- External Node Name
    1.0,                    !- Window/Door Opening Factor, or Crack
    Factor {dimensionless}
    NoVent;                 !- Ventilation Control Mode

AirflowNetwork:MultiZone:Surface,
    Wall_ldb_1.unit1,       !- Surface Name
    ZoneLeak_LongWall,      !- Leakage Component Name
    ,                       !- External Node Name
    1.0,                    !- Window/Door Opening Factor, or Crack
    Factor {dimensionless}
    NoVent;                 !- Ventilation Control Mode
```

```
AirflowNetwork:MultiZone:Surface,
    Wall_sdl_1.unit1,         !- Surface Name
    ZoneLeak_ShortWall,       !- Leakage Component Name
    ,                         !- External Node Name
    1,                        !- Window/Door Opening Factor, or Crack
    Factor {dimensionless}
    NoVent;                   !- Ventilation Control Mode

AirflowNetwork:MultiZone:Surface,
    Wall_sdr_1.unit1,         !- Surface Name
    ZoneLeak_ShortWall,       !- Leakage Component Name
    ,                         !- External Node Name
    1,                        !- Window/Door Opening Factor, or Crack
    Factor {dimensionless}
    NoVent;                   !- Ventilation Control Mode

AirflowNetwork:MultiZone:Surface,
    Wall_ldf_2.unit1,         !- Surface Name
    ZoneLeak_LongWall,        !- Leakage Component Name
    ,                         !- External Node Name
    1.0,                      !- Window/Door Opening Factor, or Crack
    Factor {dimensionless}
    NoVent;                   !- Ventilation Control Mode

AirflowNetwork:MultiZone:Surface,
    Wall_ldb_2.unit1,         !- Surface Name
    ZoneLeak_LongWall,        !- Leakage Component Name
    ,                         !- External Node Name
    1,                        !- Window/Door Opening Factor, or Crack
    Factor {dimensionless}
    NoVent;                   !- Ventilation Control Mode

AirflowNetwork:MultiZone:Surface,
    Wall_sdr_2.unit1,         !- Surface Name
    ZoneLeak_ShortWall,       !- Leakage Component Name
    ,                         !- External Node Name
```

```
    1,                        !- Window/Door Opening Factor, or Crack
    Factor {dimensionless}
    NoVent;                   !- Ventilation Control Mode

AirflowNetwork:MultiZone:Surface,
    Wall_sdl_2.unit1,         !- Surface Name
    ZoneLeak_ShortWall,       !- Leakage Component Name
    ,                         !- External Node Name
    1,                        !- Window/Door Opening Factor, or Crack
    Factor {dimensionless}
    NoVent;                   !- Ventilation Control Mode


!-   ===========  ALL OBJECTS IN CLASS: AIRFLOWNETWORK:MULTIZONE:
   SURFACE:EFFECTIVELEAKAGEAREA ===========

AirflowNetwork:MultiZone:Surface:EffectiveLeakageArea,
    ZoneLeak_LongWall,        !- Name
    0.00566687461767392,      !- Effective Leakage Area {m2}
    1.15,                     !- Discharge Coefficient {dimensionless
   }
    4,                        !- Reference Pressure Difference {Pa}
    0.65;                     !- Air Mass Flow Exponent {
   dimensionless}

AirflowNetwork:MultiZone:Surface:EffectiveLeakageArea,
    ZoneLeak_ShortWall,       !- Name
    0.00425015596325544,      !- Effective Leakage Area {m2}
    1.15,                     !- Discharge Coefficient {dimensionless
   }
    4,                        !- Reference Pressure Difference {Pa}
    0.65;                     !- Air Mass Flow Exponent {
   dimensionless}

AirflowNetwork:MultiZone:Surface:EffectiveLeakageArea,
    ZoneLeak_Ceiling,         !- Name
```

```
    0.019898999363395,       !- Effective Leakage Area {m2}
    1.15,                    !- Discharge Coefficient {dimensionless
   }
    4,                       !- Reference Pressure Difference {Pa}
    0.65;                    !- Air Mass Flow Exponent {
   dimensionless}

AirflowNetwork:MultiZone:Surface:EffectiveLeakageArea,
    ZoneLeak_Floor,          !- Name
    0.00001,                 !- Effective Leakage Area {m2}
    1.15,                    !- Discharge Coefficient {dimensionless
   }
    4,                       !- Reference Pressure Difference {Pa}
    0.65;                    !- Air Mass Flow Exponent {
   dimensionless}

AirflowNetwork:MultiZone:Surface:EffectiveLeakageArea,
    AtticVent,               !- Name
    0.37,                    !- Effective Leakage Area {m2}
    1.15,                    !- Discharge Coefficient {dimensionless
   }
    4,                       !- Reference Pressure Difference {Pa}
    0.65;                    !- Air Mass Flow Exponent {
   dimensionless}

AirflowNetwork:MultiZone:Surface:EffectiveLeakageArea,
    CrawlVent,               !- Name
    0.37,                    !- Effective Leakage Area {m2}
    1.15,                    !- Discharge Coefficient {dimensionless
   }
    4,                       !- Reference Pressure Difference {Pa}
    0.65;                    !- Air Mass Flow Exponent {
   dimensionless}
```

```
!-   ===========  ALL OBJECTS IN CLASS: AIRFLOWNETWORK:DISTRIBUTION:
   NODE ===========

! AirflowNetwork:MultiZone:Surface,
!    Wall_sdr_2.unit1,       !- Surface Name
!    Zone Exhaust Fan_unit1,                !- Leakage Component
   Name
!    ,                       !- External Node Name
!    1,                      !- Window/Door Opening Factor, or
   Crack Factor {dimensionless}
!    Constant;               !- Ventilation Control Mode
!
! AirflowNetwork:MultiZone:Component:ZoneExhaustFan,
!    Zone Exhaust Fan_unit1,        !- Name
!    0.01,                   !- Air Mass Flow Coefficient When the
   Zone Exhaust Fan is Off at Reference Conditions {kg/s}
!    0.667;                  !- Air Mass Flow Exponent When the
   Zone Exhaust Fan is Off {dimensionless}
AirflowNetwork:Distribution:Node,
    EquipmentInletNode_unit1,!- Name
    Zone Equipment Inlet Node_unit1,  !- Component Name or Node Name
    Other,                  !- Component Object Type or Node Type
    3.0;                    !- Node Height {m}

AirflowNetwork:Distribution:Node,
    SplitterNode_unit1,     !- Name
    ,                       !- Component Name or Node Name
    AirLoopHVAC:ZoneSplitter,!- Component Object Type or Node Type
    3.0;                    !- Node Height {m}

AirflowNetwork:Distribution:Node,
    ZoneSupplyNode_unit1,   !- Name
    ,                       !- Component Name or Node Name
    Other,                  !- Component Object Type or Node Type
    3.0;                    !- Node Height {m}
```

```
AirflowNetwork:Distribution:Node,
    ZoneSupplyRegisterNode_unit1 ATInlet,  !- Name
    Zone Inlet Node_unit1 ATInlet,  !- Component Name or Node Name
    Other,                  !- Component Object Type or Node Type
    3.0;                    !- Node Height {m}

AirflowNetwork:Distribution:Node,
    ZoneSupplyRegisterNode_unit1,  !- Name
    Zone Inlet Node_unit1,  !- Component Name or Node Name
    Other,                  !- Component Object Type or Node Type
    3.0;                    !- Node Height {m}

AirflowNetwork:Distribution:Node,
    ZoneOutletNode_unit1,   !- Name
    Zone Outlet node_unit1,  !- Component Name or Node Name
    Other,                  !- Component Object Type or Node Type
    3.0;                    !- Node Height {m}

AirflowNetwork:Distribution:Node,
    ZoneReturnNode_unit1,   !- Name
    ,                       !- Component Name or Node Name
    Other,                  !- Component Object Type or Node Type
    3.0;                    !- Node Height {m}

AirflowNetwork:Distribution:Node,
    MixerNode_unit1,        !- Name
    ,                       !- Component Name or Node Name
    AirLoopHVAC:ZoneMixer,  !- Component Object Type or Node Type
    3.0;                    !- Node Height {m}

AirflowNetwork:Distribution:Node,
    MainReturnNode_unit1,   !- Name
    Return Air Mixer Outlet_unit1,  !- Component Name or Node Name
    Other,                  !- Component Object Type or Node Type
    3.0;                    !- Node Height {m}
```

```
AirflowNetwork:Distribution:Node,
    MainInletNode_unit1,     !- Name
    Air Loop Inlet Node_unit1,  !- Component Name or Node Name
    Other,                   !- Component Object Type or Node Type
    3.0;                     !- Node Height {m}

AirflowNetwork:Distribution:Node,
    FanOutletNode_unit1,     !- Name
    Cooling Coil Air Inlet Node_unit1,  !- Component Name or Node
   Name
    Other,                   !- Component Object Type or Node Type
    3.0;                     !- Node Height {m}

AirflowNetwork:Distribution:Node,
    HeatingInletNode_unit1,  !- Name
    Heating Coil Air Inlet Node_unit1,  !- Component Name or Node
   Name
    Other,                   !- Component Object Type or Node Type
    3.0;                     !- Node Height {m}

AirflowNetwork:Distribution:Node,
    HeatingOutletNode_unit1, !- Name
    Air Loop Outlet Node_unit1,  !- Component Name or Node Name
    Other,                   !- Component Object Type or Node Type
    3.0;                     !- Node Height {m}

AirflowNetwork:Distribution:Node,
    SuppHeatingInletNode_unit1,  !- Name
    Supp Heating coil air inlet Node_unit1,  !- Component Name or
   Node Name
    Other,                   !- Component Object Type or Node Type
    3.0;                     !- Node Height {m}


!-   ===========  ALL OBJECTS IN CLASS: AIRFLOWNETWORK:DISTRIBUTION:
   COMPONENT:LEAKAGERATIO ===========
```

```
AirflowNetwork:Distribution:Component:LeakageRatio,
    SupplyLeak,               !- Name
    0.0396,                   !- Effective Leakage Ratio {
   dimensionless}
    0.56034,                  !- Maximum Flow Rate {m3/s}
    25,                       !- Reference Pressure Difference {Pa}
    0.65;                     !- Air Mass Flow Exponent {
   dimensionless}

AirflowNetwork:Distribution:Component:LeakageRatio,
    ReturnLeak,               !- Name
    0.0396,                   !- Effective Leakage Ratio {
   dimensionless}
    0.56034,                  !- Maximum Flow Rate {m3/s}
    25,                       !- Reference Pressure Difference {Pa}
    0.65;                     !- Air Mass Flow Exponent {
   dimensionless}


!-   ===========  ALL OBJECTS IN CLASS: AIRFLOWNETWORK:DISTRIBUTION:
   COMPONENT:DUCT ===========

AirflowNetwork:Distribution:Component:Duct,
    MainTrunk_unit1,          !- Name
    2.0,                      !- Duct Length {m}
    0.591921113608382,        !- Hydraulic Diameter {m}
    0.275216110019646,        !- Cross Section Area {m2}
    0.0009,                   !- Surface Roughness {m}
    0.01,                     !- Coefficient for Local Dynamic Loss
   Due to Fitting {dimensionless}
    0.709825,                 !- Heat Transmittance Coefficient (U-
   Factor) for Duct Wall Construction {W/m2-K}
    0.0000001;                !- Overall Moisture Transmittance
   Coefficient from Air to Air {kg/m2}
```

```
AirflowNetwork:Distribution:Component:Duct,
    ZoneSupply_unit1,        !- Name
    15,                      !- Duct Length {m}
    0.591921113608382,       !- Hydraulic Diameter {m}
    0.275216110019646,       !- Cross Section Area {m2}
    0.0009,                  !- Surface Roughness {m}
    10,                      !- Coefficient for Local Dynamic Loss
   Due to Fitting {dimensionless}
    0.709825,                !- Heat Transmittance Coefficient (U-
   Factor) for Duct Wall Construction {W/m2-K}
    0.0000001;               !- Overall Moisture Transmittance
   Coefficient from Air to Air {kg/m2}

AirflowNetwork:Distribution:Component:Duct,
    ZoneSupplyLink2_unit1 ATInlet Duct,  !- Name
    0.0001,                  !- Duct Length {m}
    0.591921113608382,       !- Hydraulic Diameter {m}
    0.275216110019646,       !- Cross Section Area {m2}
    0.0009,                  !- Surface Roughness {m}
    0,                       !- Coefficient for Local Dynamic Loss
   Due to Fitting {dimensionless}
    0.709825,                !- Heat Transmittance Coefficient (U-
   Factor) for Duct Wall Construction {W/m2-K}
    0.0000001;               !- Overall Moisture Transmittance
   Coefficient from Air to Air {kg/m2}

AirflowNetwork:Distribution:Component:Duct,
    ZoneReturn_unit1,        !- Name
    8.0,                     !- Duct Length {m}
    0.529430338938287,       !- Hydraulic Diameter {m}
    0.220172888015717,       !- Cross Section Area {m2}
    0.0009,                  !- Surface Roughness {m}
    9,                       !- Coefficient for Local Dynamic Loss
   Due to Fitting {dimensionless}
    0.709825,                !- Heat Transmittance Coefficient (U-
   Factor) for Duct Wall Construction {W/m2-K}
```

```
    0.0000001;               !- Overall Moisture Transmittance
   Coefficient from Air to Air {kg/m2}

AirflowNetwork:Distribution:Component:Duct,
    ZoneConnectionDuct_unit1,!- Name
    0.1,                     !- Duct Length {m}
    0.591921113608382,       !- Hydraulic Diameter {m}
    0.275216110019646,       !- Cross Section Area {m2}
    0.0001,                  !- Surface Roughness {m}
    0.00,                    !- Coefficient for Local Dynamic Loss
   Due to Fitting {dimensionless}
    0.709825,                !- Heat Transmittance Coefficient (U-
   Factor) for Duct Wall Construction {W/m2-K}
    0.0000001;               !- Overall Moisture Transmittance
   Coefficient from Air to Air {kg/m2}

AirflowNetwork:Distribution:Component:Duct,
    MainReturn_unit1,        !- Name
    1.0,                     !- Duct Length {m}
    0.529430338938287,       !- Hydraulic Diameter {m}
    0.220172888015717,       !- Cross Section Area {m2}
    0.0009,                  !- Surface Roughness {m}
    0.01,                    !- Coefficient for Local Dynamic Loss
   Due to Fitting {dimensionless}
    0.709825,                !- Heat Transmittance Coefficient (U-
   Factor) for Duct Wall Construction {W/m2-K}
    0.0000001;               !- Overall Moisture Transmittance
   Coefficient from Air to Air {kg/m2}

AirflowNetwork:Distribution:Component:Duct,
    AirLoopReturn_unit1,     !- Name
    0.1,                     !- Duct Length {m}
    0.529430338938287,       !- Hydraulic Diameter {m}
    0.220172888015717,       !- Cross Section Area {m2}
    0.0001,                  !- Surface Roughness {m}
```

```
    0.00,                    !- Coefficient for Local Dynamic Loss
   Due to Fitting {dimensionless}
    0.709825,                !- Heat Transmittance Coefficient (U-
   Factor) for Duct Wall Construction {W/m2-K}
    0.0000001;               !- Overall Moisture Transmittance
   Coefficient from Air to Air {kg/m2}

AirflowNetwork:Distribution:Component:Duct,
    AirLoopSupply_unit1,     !- Name
    0.1,                     !- Duct Length {m}
    0.591921113608382,       !- Hydraulic Diameter {m}
    0.275216110019646,       !- Cross Section Area {m2}
    0.0001,                  !- Surface Roughness {m}
    0.00,                    !- Coefficient for Local Dynamic Loss
   Due to Fitting {dimensionless}
    0.709825,                !- Heat Transmittance Coefficient (U-
   Factor) for Duct Wall Construction {W/m2-K}
    0.0000001;               !- Overall Moisture Transmittance
   Coefficient from Air to Air {kg/m2}


!-   ===========  ALL OBJECTS IN CLASS: AIRFLOWNETWORK:DISTRIBUTION:
   COMPONENT:FAN ===========

AirflowNetwork:Distribution:Component:Fan,
    Supply Fan_unit1,        !- Fan Name
    Fan:OnOff;               !- Supply Fan Object Type


!-   ===========  ALL OBJECTS IN CLASS: AIRFLOWNETWORK:DISTRIBUTION:
   COMPONENT:COIL ===========

AirflowNetwork:Distribution:Component:Coil,
    DX Cooling Coil_unit1,   !- Coil Name
    Coil:Cooling:DX:SingleSpeed,  !- Coil Object Type
    0.1,                     !- Air Path Length {m}
```

```
    1.000;                   !- Air Path Hydraulic Diameter {m}

AirflowNetwork:Distribution:Component:Coil,
    Main DX Heating Coil_unit1,  !- Coil Name
    Coil:Heating:DX:Singlespeed,  !- Coil Object Type
    0.1,                     !- Air Path Length {m}
    1.000;                   !- Air Path Hydraulic Diameter {m}

AirflowNetwork:Distribution:Component:Coil,
    Supp Heating Coil_unit1, !- Coil Name
    Coil:Heating:Electric,   !- Coil Object Type
    0.1,                     !- Air Path Length {m}
    1.000;                   !- Air Path Hydraulic Diameter {m}


!-   ===========  ALL OBJECTS IN CLASS: AIRFLOWNETWORK:DISTRIBUTION:
   LINKAGE ===========

AirflowNetwork:Distribution:Linkage,
    MainSupplyLink_unit1,    !- Name
    EquipmentInletNode_unit1,!- Node 1 Name
    SplitterNode_unit1,      !- Node 2 Name
    MainTrunk_unit1,         !- Component Name
    attic_unit1;             !- Thermal Zone Name

AirflowNetwork:Distribution:Linkage,
    ZoneSupplyLink_unit1,    !- Name
    SplitterNode_unit1,      !- Node 1 Name
    ZoneSupplyNode_unit1,    !- Node 2 Name
    ZoneSupply_unit1,        !- Component Name
    attic_unit1;             !- Thermal Zone Name

AirflowNetwork:Distribution:Linkage,
    ZoneSupplyLink2_unit1 ATInlet,  !- Name
    ZoneSupplyRegisterNode_unit1 ATInlet,  !- Node 1 Name
    ZoneSupplyRegisterNode_unit1,  !- Node 2 Name
```

```
    ZoneSupplyLink2_unit1 ATInlet Duct,  !- Component Name
    attic_unit1;             !- Thermal Zone Name

AirflowNetwork:Distribution:Linkage,
    ZoneSupplyLink2_unit1,   !- Name
    ZoneSupplyNode_unit1,    !- Node 1 Name
    ZoneSupplyRegisterNode_unit1 ATInlet,  !- Node 2 Name
    ZoneSupply_unit1,        !- Component Name
    attic_unit1;             !- Thermal Zone Name

AirflowNetwork:Distribution:Linkage,
    ZoneSupplyConnectionLink_unit1,  !- Name
    ZoneSupplyRegisterNode_unit1,  !- Node 1 Name
    living_unit1,            !- Node 2 Name
    ZoneConnectionDuct_unit1;!- Component Name

AirflowNetwork:Distribution:Linkage,
    ZoneReturnConnectionLink_unit1,  !- Name
    living_unit1,            !- Node 1 Name
    ZoneOutletNode_unit1,    !- Node 2 Name
    ZoneConnectionDuct_unit1;!- Component Name

AirflowNetwork:Distribution:Linkage,
    ZoneReturnLink1_unit1,   !- Name
    Zoneoutletnode_unit1,    !- Node 1 Name
    ZoneReturnNode_unit1,    !- Node 2 Name
    ZoneReturn_unit1,        !- Component Name
    attic_unit1;             !- Thermal Zone Name

AirflowNetwork:Distribution:Linkage,
    ZoneReturnLink2_unit1,   !- Name
    ZoneReturnNode_unit1,    !- Node 1 Name
    MixerNode_unit1,         !- Node 2 Name
    ZoneReturn_unit1,        !- Component Name
    attic_unit1;             !- Thermal Zone Name
```

```
AirflowNetwork:Distribution:Linkage,
    MainReturnLink_unit1,    !- Name
    MixerNode_unit1,         !- Node 1 Name
    MainReturnNode_unit1,    !- Node 2 Name
    MainReturn_unit1,        !- Component Name
    attic_unit1;             !- Thermal Zone Name

AirflowNetwork:Distribution:Linkage,
    SystemReturnLink_unit1,  !- Name
    MainReturnNode_unit1,    !- Node 1 Name
    MainInletNode_unit1,     !- Node 2 Name
    AirLoopReturn_unit1;     !- Component Name

AirflowNetwork:Distribution:Linkage,
    SupplyFanLink_unit1,     !- Name
    MainInletNode_unit1,     !- Node 1 Name
    FanOutletNode_unit1,     !- Node 2 Name
    Supply Fan_unit1;        !- Component Name

AirflowNetwork:Distribution:Linkage,
    CoolingCoilLink_unit1,   !- Name
    FanOutletNode_unit1,     !- Node 1 Name
    HeatingInletNode_unit1,  !- Node 2 Name
    DX Cooling Coil_unit1;   !- Component Name

AirflowNetwork:Distribution:Linkage,
    EquipmentAirLoopLink_unit1,  !- Name
    HeatingOutletNode_unit1, !- Node 1 Name
    EquipmentInletNode_unit1,!- Node 2 Name
    AirLoopSupply_unit1;     !- Component Name

AirflowNetwork:Distribution:Linkage,
    HeatingCoilLink_unit1,   !- Name
    HeatingInletNode_unit1,  !- Node 1 Name
    SuppHeatingInletNode_unit1,  !- Node 2 Name
    Main DX Heating Coil_unit1;  !- Component Name
```

```
AirflowNetwork:Distribution:Linkage,
    SuppHeatingCoilLink_unit1,  !- Name
    SuppHeatingInletNode_unit1,  !- Node 1 Name
    HeatingOutletNode_unit1, !- Node 2 Name
    Supp Heating Coil_unit1; !- Component Name

AirflowNetwork:Distribution:Linkage,
    ZoneSupplyLeakLink_unit1,!- Name
    ZoneSupplyNode_unit1,    !- Node 1 Name
    attic_unit1,             !- Node 2 Name
    SupplyLeak;              !- Component Name

AirflowNetwork:Distribution:Linkage,
    ZoneReturnLeakLink_unit1,!- Name
    attic_unit1,             !- Node 1 Name
    ZoneReturnNode_unit1,    !- Node 2 Name
    ReturnLeak;              !- Component Name


!-   ===========  ALL OBJECTS IN CLASS: EXTERIOR:LIGHTS ===========

Exterior:Lights,
    Exterior-Lights_unit1,   !- Name
    ExteriorLighting,        !- Schedule Name
    43.2424607481559,        !- Design Level {W}
    ,                        !- Control Option
    Exterior-Lights;         !- End-Use Subcategory

Exterior:Lights,
    Garage-Lights_unit1,     !- Name
    InteriorLightingHE,      !- Schedule Name
    7.16294617434682,        !- Design Level {W}
    ,                        !- Control Option
    Garage-Lights;           !- End-Use Subcategory
```

```
!-   ===========  ALL OBJECTS IN CLASS: DESIGNSPECIFICATION:
   OUTDOORAIR ===========

DesignSpecification:OutdoorAir,
    SZ_DSOA_living_unit1,    !- Name
    Flow/Zone,               !- Outdoor Air Method
    0,                       !- Outdoor Air Flow per Person {m3/s-
   person}
    ,                        !- Outdoor Air Flow per Zone Floor Area
    {m3/s-m2}
    0.0283168464628752;      !- Outdoor Air Flow per Zone {m3/s}


!-   ===========  ALL OBJECTS IN CLASS: SIZING:ZONE ===========

Sizing:Zone,
    living_unit1,            !- Zone or ZoneList Name
    SupplyAirTemperature,    !- Zone Cooling Design Supply Air
   Temperature Input Method
    12,                      !- Zone Cooling Design Supply Air
   Temperature {C}
    ,                        !- Zone Cooling Design Supply Air
   Temperature Difference {deltaC}
    SupplyAirTemperature,    !- Zone Heating Design Supply Air
   Temperature Input Method
    50,                      !- Zone Heating Design Supply Air
   Temperature {C}
    ,                        !- Zone Heating Design Supply Air
   Temperature Difference {deltaC}
    0.008,                   !- Zone Cooling Design Supply Air
   Humidity Ratio {kgWater/kgDryAir}
    0.008,                   !- Zone Heating Design Supply Air
   Humidity Ratio {kgWater/kgDryAir}
    SZ_DSOA_living_unit1,    !- Design Specification Outdoor Air
   Object Name
```

```
    ,                         !- Zone Heating Sizing Factor
    ,                         !- Zone Cooling Sizing Factor
    DesignDay,                !- Cooling Design Air Flow Method
    ,                         !- Cooling Design Air Flow Rate {m3/s}
    0.000762,                 !- Cooling Minimum Air Flow per Zone
   Floor Area {m3/s-m2}
    ,                         !- Cooling Minimum Air Flow {m3/s}
    ,                         !- Cooling Minimum Air Flow Fraction
    DesignDay,                !- Heating Design Air Flow Method
    ,                         !- Heating Design Air Flow Rate {m3/s}
    0.002032,                 !- Heating Maximum Air Flow per Zone
   Floor Area {m3/s-m2}
    0.1415762,                !- Heating Maximum Air Flow {m3/s}
    0.3,                      !- Heating Maximum Air Flow Fraction
    ,                         !- Design Specification Zone Air
   Distribution Object Name
    ,                         !- Account for Dedicated Outdoor Air
   System
    ,                         !- Dedicated Outdoor Air System Control
    Strategy
    ,                         !- Dedicated Outdoor Air Low Setpoint
   Temperature for Design {C}
    ;                         !- Dedicated Outdoor Air High Setpoint
   Temperature for Design {C}


!-   ===========  ALL OBJECTS IN CLASS: SIZING:SYSTEM ===========

Sizing:System,
    Central System_unit1,     !- AirLoop Name
    Sensible,                 !- Type of Load to Size On
    autosize,                 !- Design Outdoor Air Flow Rate {m3/s}
    1,                        !- Central Heating Maximum System Air
   Flow Ratio
    7,                        !- Preheat Design Temperature {C}
```

```
 0.008,                   !- Preheat Design Humidity Ratio {
kgWater/kgDryAir}
 11,                      !- Precool Design Temperature {C}
 0.008,                   !- Precool Design Humidity Ratio {
kgWater/kgDryAir}
 12,                      !- Central Cooling Design Supply Air
Temperature {C}
 50,                      !- Central Heating Design Supply Air
Temperature {C}
 NonCoincident,           !- Type of Zone Sum to Use
 No,                      !- 100% Outdoor Air in Cooling
 No,                      !- 100% Outdoor Air in Heating
 0.008,                   !- Central Cooling Design Supply Air
Humidity Ratio {kgWater/kgDryAir}
 0.008,                   !- Central Heating Design Supply Air
Humidity Ratio {kgWater/kgDryAir}
 DesignDay,               !- Cooling Supply Air Flow Rate Method
 ,                        !- Cooling Supply Air Flow Rate {m3/s}
 ,                        !- Cooling Supply Air Flow Rate Per
Floor Area {m3/s-m2}
 ,                        !- Cooling Fraction of Autosized
Cooling Supply Air Flow Rate
 ,                        !- Cooling Supply Air Flow Rate Per
Unit Cooling Capacity {m3/s-W}
 DesignDay,               !- Heating Supply Air Flow Rate Method
 ,                        !- Heating Supply Air Flow Rate {m3/s}
 ,                        !- Heating Supply Air Flow Rate Per
Floor Area {m3/s-m2}
 ,                        !- Heating Fraction of Autosized
Heating Supply Air Flow Rate
 ,                        !- Heating Fraction of Autosized
Cooling Supply Air Flow Rate
 ,                        !- Heating Supply Air Flow Rate Per
Unit Heating Capacity {m3/s-W}
 ,                        !- System Outdoor Air Method
```

```
    1.0,                      !- Zone Maximum Outdoor Air Fraction {
   dimensionless}
    CoolingDesignCapacity,    !- Cooling Design Capacity Method
    autosize,                 !- Cooling Design Capacity {W}
    ,                         !- Cooling Design Capacity Per Floor
   Area {W/m2}
    ,                         !- Fraction of Autosized Cooling Design
    Capacity
    HeatingDesignCapacity,    !- Heating Design Capacity Method
    autosize,                 !- Heating Design Capacity {W}
    ,                         !- Heating Design Capacity Per Floor
   Area {W/m2}
    ,                         !- Fraction of Autosized Heating Design
    Capacity
    OnOff;                    !- Central Cooling Capacity Control
   Method


!-   ===========  ALL OBJECTS IN CLASS: SIZING:PLANT ===========

Sizing:Plant,
    DHW Loop_unit1,           !- Plant or Condenser Loop Name
    Heating,                  !- Loop Type
    48.8888888888889,         !- Design Loop Exit Temperature {C}
    5.55555555555556;         !- Loop Design Temperature Difference {
   deltaC}


!-   ===========  ALL OBJECTS IN CLASS: ZONECONTROL:THERMOSTAT
   ===========

ZoneControl:Thermostat,
    Zone Thermostat_unit1,    !- Name
    living_unit1,             !- Zone or ZoneList Name
    zone_control_type,        !- Control Type Schedule Name
    ThermostatSetpoint:DualSetpoint,  !- Control 1 Object Type
```

```
    thermostat_living Dual SP Control;  !- Control 1 Name


!-   ===========  ALL OBJECTS IN CLASS: THERMOSTATSETPOINT:
   DUALSETPOINT ===========

ThermostatSetpoint:DualSetpoint,
    thermostat_living Dual SP Control,  !- Name
    heating_sch,             !- Heating Setpoint Temperature
   Schedule Name
    cooling_sch;             !- Cooling Setpoint Temperature
   Schedule Name


!-   ===========  ALL OBJECTS IN CLASS: ZONEHVAC:
   ENERGYRECOVERYVENTILATOR ===========

ZoneHVAC:EnergyRecoveryVentilator,
    ERV_unit1,               !- Name
    always_avail,            !- Availability Schedule Name
    OA_Heat_Recovery_Unit1,  !- Heat Exchanger Name
    0.0283168464628752,      !- Supply Air Flow Rate {m3/s}
    0.0283168464628752,      !- Exhaust Air Flow Rate {m3/s}
    OASupplyFan_unit1,       !- Supply Air Fan Name
    OAExhaustFan_unit1;      !- Exhaust Air Fan Name


!-   ===========  ALL OBJECTS IN CLASS: AIRTERMINAL:SINGLEDUCT:
   CONSTANTVOLUME:NOREHEAT ===========

AirTerminal:SingleDuct:ConstantVolume:NoReheat,
    ZoneDirectAir_unit1,     !- Name
    always_avail,            !- Availability Schedule Name
    Zone Inlet Node_unit1 ATInlet,  !- Air Inlet Node Name
    Zone Inlet Node_unit1,   !- Air Outlet Node Name
    autosize;                !- Maximum Air Flow Rate {m3/s}
```

```
!-   ===========  ALL OBJECTS IN CLASS: ZONEHVAC:AIRDISTRIBUTIONUNIT
    ===========

ZoneHVAC:AirDistributionUnit,
    ZoneDirectAir_unit1 ADU, !- Name
    Zone Inlet Node_unit1,   !- Air Distribution Unit Outlet Node
   Name
    AirTerminal:SingleDuct:ConstantVolume:NoReheat,  !- Air Terminal
    Object Type
    ZoneDirectAir_unit1;     !- Air Terminal Name


!-   ===========  ALL OBJECTS IN CLASS: ZONEHVAC:EQUIPMENTLIST
   ===========

!     Fan:ZoneExhaust,         !- Zone Equipment 2 Object Type
!     Zone Exhaust Fan_unit1,        !- Zone Equipment 2 Name
!     4,                       !- Zone Equipment 2 Cooling Sequence
!     4,                       !- Zone Equipment 2 Heating or No-
   Load Sequence
!     ,                        !- Zone Equipment 1 Sequential
   Cooling Fraction Schedule Name
!     ,                        !- Zone Equipment 1 Sequential
   Heating Fraction Schedule Name
ZoneHVAC:EquipmentList,
    ZoneEquipment_unit1,     !- Name
    SequentialLoad,          !- Load Distribution Scheme
    ZoneHVAC:AirDistributionUnit,  !- Zone Equipment 1 Object Type
    ZoneDirectAir_unit1 ADU, !- Zone Equipment 1 Name
    3,                       !- Zone Equipment 1 Cooling Sequence
    3,                       !- Zone Equipment 1 Heating or No-Load
   Sequence
    ,                        !- Zone Equipment 1 Sequential Cooling
   Fraction Schedule Name
```

```
    ,                         !- Zone Equipment 1 Sequential Heating
   Fraction Schedule Name
    WaterHeater:HeatPump:WrappedCondenser,  !- Zone Equipment 2
   Object Type
    Water Heater_unit1,       !- Zone Equipment 2 Name
    1,                        !- Zone Equipment 2 Cooling Sequence
    1,                        !- Zone Equipment 2 Heating or No-Load
   Sequence
    ,                         !- Zone Equipment 2 Sequential Cooling
   Fraction Schedule Name
    ,                         !- Zone Equipment 2 Sequential Heating
   Fraction Schedule Name
    ZoneHVAC:EnergyRecoveryVentilator,  !- Zone Equipment 3 Object
   Type
    ERV_unit1,                !- Zone Equipment 3 Name
    2,                        !- Zone Equipment 3 Cooling Sequence
    2;                        !- Zone Equipment 3 Heating or No-Load
   Sequence


!-   ===========  ALL OBJECTS IN CLASS: ZONEHVAC:
   EQUIPMENTCONNECTIONS ===========

ZoneHVAC:EquipmentConnections,
    living_unit1,             !- Zone Name
    ZoneEquipment_unit1,      !- Zone Conditioning Equipment List
   Name
    zone inlet nodes_unit1,   !- Zone Air Inlet Node or NodeList Name
    Zone Exhaust Node_list_unit1,  !- Zone Air Exhaust Node or
   NodeList Name
    Zone Node_unit1,          !- Zone Air Node Name
    Zone Outlet Node_unit1;   !- Zone Return Air Node or NodeList
   Name


!-   ===========  ALL OBJECTS IN CLASS: FAN:ONOFF ===========
```

```
Fan:OnOff,
    Supply Fan_unit1,        !- Name
    always_avail,            !- Availability Schedule Name
    0.50054,                 !- Fan Total Efficiency
    400,                     !- Pressure Rise {Pa}
    autosize,                !- Maximum Flow Rate {m3/s}
    0.863,                   !- Motor Efficiency
    1,                       !- Motor In Airstream Fraction
    air loop inlet node_unit1,  !- Air Inlet Node Name
    cooling coil air inlet node_unit1,  !- Air Outlet Node Name
    ,                        !- Fan Power Ratio Function of Speed
   Ratio Curve Name
    ,                        !- Fan Efficiency Ratio Function of
   Speed Ratio Curve Name
    General;                 !- End-Use Subcategory

Fan:OnOff,
    OASupplyFan_unit1,       !- Name
    always_avail,            !- Availability Schedule Name
    0.6,                     !- Fan Total Efficiency
    227.022858530508,        !- Pressure Rise {Pa}
    0.0283168464628752,      !- Maximum Flow Rate {m3/s}
    1,                       !- Motor Efficiency
    0,                       !- Motor In Airstream Fraction
    OA fan inlet node_unit1, !- Air Inlet Node Name
    OA inlet node_unit1,     !- Air Outlet Node Name
    ,                        !- Fan Power Ratio Function of Speed
   Ratio Curve Name
    ,                        !- Fan Efficiency Ratio Function of
   Speed Ratio Curve Name
    Ventilation;             !- End-Use Subcategory

Fan:OnOff,
    OAExhaustFan_unit1,      !- Name
    always_avail,            !- Availability Schedule Name
```

```
    0.6,                      !- Fan Total Efficiency
    227.022858530508,         !- Pressure Rise {Pa}
    0.0283168464628752,       !- Maximum Flow Rate {m3/s}
    1,                        !- Motor Efficiency
    0,                        !- Motor In Airstream Fraction
    ERVexhaustnode_unit1,     !- Air Inlet Node Name
    exhaust outlet node_unit1,  !- Air Outlet Node Name
    ,                         !- Fan Power Ratio Function of Speed
   Ratio Curve Name
    ,                         !- Fan Efficiency Ratio Function of
   Speed Ratio Curve Name
    Ventilation;              !- End-Use Subcategory

Fan:OnOff,
    Heat Pump Water Heater Fan_unit1,  !- Name
    always_avail,             !- Availability Schedule Name
    0.7,                      !- Fan Total Efficiency
    100.0,                    !- Pressure Rise {Pa}
    autosize,                 !- Maximum Flow Rate {m3/s}
    0.9,                      !- Motor Efficiency
    1.0,                      !- Motor In Airstream Fraction
    Heat Pump Water Heater Fan Inlet Node_unit1,  !- Air Inlet Node
   Name
    HPWH zone inlet node_unit1,  !- Air Outlet Node Name
    ,                         !- Fan Power Ratio Function of Speed
   Ratio Curve Name
    ,                         !- Fan Efficiency Ratio Function of
   Speed Ratio Curve Name
    General;                  !- End-Use Subcategory


!-   ===========  ALL OBJECTS IN CLASS: COIL:COOLING:DX:SINGLESPEED
   ===========

Coil:Cooling:DX:SingleSpeed,
    DX Cooling Coil_unit1,    !- Name
```

```
    always_avail,            !- Availability Schedule Name
    autosize,                !- Gross Rated Total Cooling Capacity {
   W}
    autosize,                !- Gross Rated Sensible Heat Ratio
    4.06853019625951,        !- Gross Rated Cooling COP {W/W}
    autosize,                !- Rated Air Flow Rate {m3/s}
    ,                        !- Rated Evaporator Fan Power Per
   Volume Flow Rate {W/(m3/s)}
    Cooling Coil Air Inlet Node_unit1,  !- Air Inlet Node Name
    Heating Coil Air Inlet Node_unit1,  !- Air Outlet Node Name
    HPACCoolCapFT,           !- Total Cooling Capacity Function of
   Temperature Curve Name
    HPACCoolCapFFF,          !- Total Cooling Capacity Function of
   Flow Fraction Curve Name
    HPACCOOLEIRFT,           !- Energy Input Ratio Function of
   Temperature Curve Name
    HPACCOOLEIRFFF,          !- Energy Input Ratio Function of Flow
   Fraction Curve Name
    HPACCOOLPLFFPLR;         !- Part Load Fraction Correlation Curve
    Name


!-   ===========  ALL OBJECTS IN CLASS: COIL:HEATING:ELECTRIC
   ===========

Coil:Heating:Electric,
    Supp Heating Coil_unit1, !- Name
    always_avail,            !- Availability Schedule Name
    1,                       !- Efficiency
    autosize,                !- Nominal Capacity {W}
    Supp Heating Coil Air Inlet Node_unit1,  !- Air Inlet Node Name
    Air Loop Outlet Node_unit1;  !- Air Outlet Node Name


!-   ===========  ALL OBJECTS IN CLASS: COIL:HEATING:DX:SINGLESPEED
   ===========
```

```
Coil:Heating:DX:SingleSpeed,
    Main DX Heating Coil_unit1,  !- Name
    always_avail,            !- Availability Schedule Name
    autosize,                !- Gross Rated Heating Capacity {W}
    3.69308080013886,        !- Gross Rated Heating COP {W/W}
    autosize,                !- Rated Air Flow Rate {m3/s}
    ,                        !- Rated Supply Fan Power Per Volume
   Flow Rate {W/(m3/s)}
    Heating Coil Air Inlet Node_unit1,  !- Air Inlet Node Name
    Supp Heating Coil Air Inlet Node_unit1,  !- Air Outlet Node Name
    HPACHeatCapFT,           !- Heating Capacity Function of
   Temperature Curve Name
    HPACHeatCapFFF,          !- Heating Capacity Function of Flow
   Fraction Curve Name
    HPACHeatEIRFT,           !- Energy Input Ratio Function of
   Temperature Curve Name
    HPACHeatEIRFFF,          !- Energy Input Ratio Function of Flow
   Fraction Curve Name
    HPACCOOLPLFFPLR,         !- Part Load Fraction Correlation Curve
    Name
    Defrost_EIR_FT,          !- Defrost Energy Input Ratio Function
   of Temperature Curve Name
    -17.78,                  !- Minimum Outdoor Dry-Bulb Temperature
    for Compressor Operation {C}
    ,                        !- Outdoor Dry-Bulb Temperature to Turn
    On Compressor {C}
    5.0,                     !- Maximum Outdoor Dry-Bulb Temperature
    for Defrost Operation {C}
    200.0,                   !- Crankcase Heater Capacity {W}
    10.0,                    !- Maximum Outdoor Dry-Bulb Temperature
    for Crankcase Heater Operation {C}
    ReverseCycle,            !- Defrost Strategy
    OnDemand;                !- Defrost Control
```

```
!-   ===========  ALL OBJECTS IN CLASS: COIL:WATERHEATING:
   AIRTOWATERHEATPUMP:WRAPPED ===========

Coil:WaterHeating:AirToWaterHeatPump:Wrapped,
    Heat Pump Water Heater Evaporator_unit1,  !- Name
    1500,                     !- Rated Heating Capacity {W}
    3.0,                      !- Rated COP {W/W}
    0.981,                    !- Rated Sensible Heat Ratio
    19.7,                     !- Rated Evaporator Inlet Air Dry-Bulb
   Temperature {C}
    13.5,                     !- Rated Evaporator Inlet Air Wet-Bulb
   Temperature {C}
    48.89,                    !- Rated Condenser Water Temperature {C
   }
    0.189,                    !- Rated Evaporator Air Flow Rate {m3/s
   }
    yes,                      !- Evaporator Fan Power Included in
   Rated COP
    Zone Exhaust Node1_unit1,!- Evaporator Air Inlet Node Name
    Heat Pump Water Heater Fan Inlet Node_unit1,  !- Evaporator Air
   Outlet Node Name
    ,                         !- Crankcase Heater Capacity {W}
    10,                       !- Maximum Ambient Temperature for
   Crankcase Heater Operation {C}
    WetBulbTemperature,       !- Evaporator Air Temperature Type for
   Curve Objects
    HPWH-Htg-Cap-fT,          !- Heating Capacity Function of
   Temperature Curve Name
    ,                         !- Heating Capacity Function of Air
   Flow Fraction Curve Name
    HPWH-Htg-COP-fT,          !- Heating COP Function of Temperature
   Curve Name
    ,                         !- Heating COP Function of Air Flow
   Fraction Curve Name
    HPWH-COP-fPLR;            !- Part Load Fraction Correlation Curve
    Name
```

```
!-   ===========  ALL OBJECTS IN CLASS: HEATEXCHANGER:AIRTOAIR:
   SENSIBLEANDLATENT ===========

HeatExchanger:AirToAir:SensibleAndLatent,
    OA_Heat_Recovery_Unit1,  !- Name
    always_off,              !- Availability Schedule Name
    0.0283168464628752,      !- Nominal Supply Air Flow Rate {m3/s}
    0.65,                    !- Sensible Effectiveness at 100%
   Heating Air Flow {dimensionless}
    0,                       !- Latent Effectiveness at 100% Heating
    Air Flow {dimensionless}
    0.65,                    !- Sensible Effectiveness at 75%
   Heating Air Flow {dimensionless}
    0,                       !- Latent Effectiveness at 75% Heating
   Air Flow {dimensionless}
    0.65,                    !- Sensible Effectiveness at 100%
   Cooling Air Flow {dimensionless}
    0,                       !- Latent Effectiveness at 100% Cooling
    Air Flow {dimensionless}
    0.65,                    !- Sensible Effectiveness at 75%
   Cooling Air Flow {dimensionless}
    0,                       !- Latent Effectiveness at 75% Cooling
   Air Flow {dimensionless}
    outdoor air node_unit1,  !- Supply Air Inlet Node Name
    OA fan inlet node_unit1, !- Supply Air Outlet Node Name
    Zone Exhaust Node_unit1, !- Exhaust Air Inlet Node Name
    ERVexhaustnode_unit1,    !- Exhaust Air Outlet Node Name
    0,                       !- Nominal Electric Power {W}
    No,                      !- Supply Air Outlet Temperature
   Control
    Plate,                   !- Heat Exchanger Type
    None,                    !- Frost Control Type
    -16.8333337792644,       !- Threshold Temperature {C}
```

```
    0.083,                   !- Initial Defrost Time Fraction {
   dimensionless}
    2.15999989700318E-02,    !- Rate of Defrost Time Fraction
   Increase {1/K}
    No;                      !- Economizer Lockout


!-   ===========  ALL OBJECTS IN CLASS: AIRLOOPHVAC:UNITARYHEATPUMP:
   AIRTOAIR ===========

AirLoopHVAC:UnitaryHeatPump:AirToAir,
    Heat Pump_unit1,         !- Name
    always_avail,            !- Availability Schedule Name
    Air Loop Inlet node_unit1,  !- Air Inlet Node Name
    Air Loop Outlet Node_unit1,  !- Air Outlet Node Name
    autosize,                !- Cooling Supply Air Flow Rate {m3/s}
    autosize,                !- Heating Supply Air Flow Rate {m3/s}
    0.0,                     !- No Load Supply Air Flow Rate {m3/s}
    living_unit1,            !- Controlling Zone or Thermostat
   Location
    Fan:OnOff,               !- Supply Air Fan Object Type
    Supply Fan_unit1,        !- Supply Air Fan Name
    Coil:Heating:DX:SingleSpeed,  !- Heating Coil Object Type
    Main DX Heating Coil_unit1,  !- Heating Coil Name
    Coil:Cooling:DX:SingleSpeed,  !- Cooling Coil Object Type
    DX Cooling Coil_unit1,   !- Cooling Coil Name
    Coil:Heating:Electric,   !- Supplemental Heating Coil Object
   Type
    Supp Heating Coil_unit1, !- Supplemental Heating Coil Name
    50,                      !- Maximum Supply Air Temperature from
   Supplemental Heater {C}
    10,                      !- Maximum Outdoor Dry-Bulb Temperature
    for Supplemental Heater Operation {C}
    BlowThrough,             !- Fan Placement
    fan_cycle;               !- Supply Air Fan Operating Mode
   Schedule Name
```

```
!-   ===========  ALL OBJECTS IN CLASS: AIRLOOPHVAC ===========

! Fan:ZoneExhaust,
!    Zone Exhaust Fan_unit1,        !- Name
!    always_avail,            !- Availability Schedule Name
!    0.6,                       !- Fan Total Efficiency
!    0.00001,                    !- Pressure Rise {Pa}
!    0.000001,    !- Maximum Flow Rate {m3/s}
!    Zone Exhaust Node_unit1,  !- Air Inlet Node Name
!    zone exhaust fan outlet nodes_unit1,  !- Air Outlet Node Name
!    Ventilation,                 !- End-Use Subcategory
!    ,                         !- Flow Fraction Schedule Name
!    Decoupled;                !- System Availability Manager
   Coupling Mode
AirLoopHVAC,
    Central System_unit1,    !- Name
    ,                        !- Controller List Name
    availability list,       !- Availability Manager List Name
    autosize,                !- Design Supply Air Flow Rate {m3/s}
    Air Loop Branches_unit1, !- Branch List Name
    ,                        !- Connector List Name
    Air Loop Inlet Node_unit1,  !- Supply Side Inlet Node Name
    Return Air Mixer Outlet_unit1,  !- Demand Side Outlet Node Name
    Zone Equipment Inlet Node_unit1,  !- Demand Side Inlet Node
   Names
    Air Loop Outlet Node_unit1;  !- Supply Side Outlet Node Names


!-   ===========  ALL OBJECTS IN CLASS: AIRLOOPHVAC:ZONESPLITTER
   ===========

AirLoopHVAC:ZoneSplitter,
    Zone Supply Air Splitter_unit1,  !- Name
    Zone Equipment Inlet Node_unit1,  !- Inlet Node Name
```

```
    Zone Inlet Node_unit1 ATInlet;  !- Outlet 1 Node Name


!-   ===========  ALL OBJECTS IN CLASS: AIRLOOPHVAC:SUPPLYPATH
   ===========

AirLoopHVAC:SupplyPath,
    SupplyPath_unit1,        !- Name
    Zone Equipment Inlet Node_unit1,  !- Supply Air Path Inlet Node
   Name
    AirLoopHVAC:ZoneSplitter,!- Component 1 Object Type
    Zone Supply Air Splitter_unit1;  !- Component 1 Name


!-   ===========  ALL OBJECTS IN CLASS: AIRLOOPHVAC:ZONEMIXER
   ===========

AirLoopHVAC:ZoneMixer,
    Zone Return Air Mixer_unit1,  !- Name
    Return Air Mixer Outlet_unit1,  !- Outlet Node Name
    Zone Outlet Node_unit1;  !- Inlet 1 Node Name


!-   ===========  ALL OBJECTS IN CLASS: AIRLOOPHVAC:RETURNPATH
   ===========

AirLoopHVAC:ReturnPath,
    ReturnPath_unit1,        !- Name
    Return Air Mixer Outlet_unit1,  !- Return Air Path Outlet Node
   Name
    AirLoopHVAC:ZoneMixer,   !- Component 1 Object Type
    Zone Return Air Mixer_unit1;  !- Component 1 Name


!-   ===========  ALL OBJECTS IN CLASS: BRANCH ===========
```

```
Branch,
    Air Loop Main Branch_unit1,  !- Name
    ,                           !- Pressure Drop Curve Name
    AirLoopHVAC:UnitaryHeatPump:AirtoAir,  !- Component 1 Object
   Type
    Heat Pump_unit1,            !- Component 1 Name
    Air Loop Inlet Node_unit1,  !- Component 1 Inlet Node Name
    Air Loop Outlet Node_unit1;  !- Component 1 Outlet Node Name

Branch,
    Mains Inlet Branch_unit1,!- Name
    ,                           !- Pressure Drop Curve Name
    Pump:VariableSpeed,         !- Component 1 Object Type
    Mains Pressure_unit1,       !- Component 1 Name
    Mains Inlet Node_unit1,  !- Component 1 Inlet Node Name
    Mains Pressure Outlet Node_unit1;  !- Component 1 Outlet Node
   Name

Branch,
    DHW Supply Outlet Branch_unit1,  !- Name
    ,                           !- Pressure Drop Curve Name
    Pipe:Adiabatic,             !- Component 1 Object Type
    DHW Supply Outlet Pipe_unit1,  !- Component 1 Name
    DHW Supply Outlet Pipe Inlet Node_unit1,  !- Component 1 Inlet
   Node Name
    DHW Supply Outlet Node_unit1;  !- Component 1 Outlet Node Name

Branch,
    DHW Demand Inlet Branch_unit1,  !- Name
    ,                           !- Pressure Drop Curve Name
    Pipe:Adiabatic,             !- Component 1 Object Type
    DHW Demand Inlet Pipe_unit1,  !- Component 1 Name
    DHW Demand Inlet Node_unit1,  !- Component 1 Inlet Node Name
    DHW Demand Inlet Pipe Outlet Node_unit1;  !- Component 1 Outlet
   Node Name
```

```
Branch,
    Water Sink Branch_unit1, !- Name
    ,                        !- Pressure Drop Curve Name
    WaterUse:Connections,    !- Component 1 Object Type
    DHW Sinks_unit1,         !- Component 1 Name
    Water Sink Inlet Node_unit1,  !- Component 1 Inlet Node Name
    Water Sink outlet Node_unit1;  !- Component 1 Outlet Node Name

Branch,
    Water Shower Branch_unit1,  !- Name
    ,                        !- Pressure Drop Curve Name
    WaterUse:Connections,    !- Component 1 Object Type
    DHW Showers_unit1,       !- Component 1 Name
    Water Shower Inlet Node_unit1,  !- Component 1 Inlet Node Name
    Water Shower Outlet Node_unit1;  !- Component 1 Outlet Node Name

Branch,
    Water ClothesWasher Branch_unit1,  !- Name
    ,                        !- Pressure Drop Curve Name
    WaterUse:Connections,    !- Component 1 Object Type
    DHW ClothesWasher_unit1, !- Component 1 Name
    Water ClothesWasher Inlet Node_unit1,  !- Component 1 Inlet Node
    Name
    Water ClothesWasher Outlet Node_unit1;  !- Component 1 Outlet
   Node Name

Branch,
    Water Dishwasher Branch_unit1,  !- Name
    ,                        !- Pressure Drop Curve Name
    WaterUse:Connections,    !- Component 1 Object Type
    DHW DishWasher_unit1,    !- Component 1 Name
    Water DishWasher Inlet Node_unit1,  !- Component 1 Inlet Node
   Name
    Water DishWasher outlet Node_unit1;  !- Component 1 Outlet Node
   Name
```

```
Branch,
    Water Bath Branch_unit1, !- Name
    ,                        !- Pressure Drop Curve Name
    WaterUse:Connections,    !- Component 1 Object Type
    DHW Baths_unit1,         !- Component 1 Name
    Water Bath Inlet Node_unit1,  !- Component 1 Inlet Node Name
    Water bath Outlet Node_unit1;  !- Component 1 Outlet Node Name

Branch,
    Mains Makeup Branch_unit1,  !- Name
    ,                        !- Pressure Drop Curve Name
    Pipe:Adiabatic,          !- Component 1 Object Type
    Mains Makeup Pipe_unit1, !- Component 1 Name
    Mains Makeup Pipe Inlet Node_unit1,  !- Component 1 Inlet Node
   Name
    Mains Makeup Node_unit1; !- Component 1 Outlet Node Name

Branch,
    Water Heater Branch_unit1,  !- Name
    ,                        !- Pressure Drop Curve Name
    WaterHeater:HeatPump:WrappedCondenser,  !- Component 1 Object
   Type
    Water Heater_unit1,      !- Component 1 Name
    Water Heater Use Inlet Node_unit1,  !- Component 1 Inlet Node
   Name
    Water Heater Use Outlet Node_unit1;  !- Component 1 Outlet Node
   Name


!-   ===========  ALL OBJECTS IN CLASS: BRANCHLIST ===========

BranchList,
    Air Loop Branches_unit1, !- Name
    Air Loop Main Branch_unit1;  !- Branch 1 Name

BranchList,
```

```
    DHW Supply Branches_unit1,  !- Name
    Mains Inlet Branch_unit1,!- Branch 1 Name
    Water Heater Branch_unit1,  !- Branch 2 Name
    DHW Supply Outlet Branch_unit1;  !- Branch 3 Name

BranchList,
    DHW Demand Branches_unit1,  !- Name
    DHW Demand Inlet Branch_unit1,  !- Branch 1 Name
    Water Sink Branch_unit1, !- Branch 2 Name
    Water Shower Branch_unit1,  !- Branch 3 Name
    Water ClothesWasher Branch_unit1,  !- Branch 4 Name
    Water Dishwasher Branch_unit1,  !- Branch 5 Name
    Water Bath Branch_unit1, !- Branch 6 Name
    Mains Makeup Branch_unit1;  !- Branch 7 Name


!-   ===========  ALL OBJECTS IN CLASS: CONNECTOR:SPLITTER
   ===========

Connector:Splitter,
    DHW Demand Splitter_unit1,  !- Name
    DHW Demand Inlet Branch_unit1,  !- Inlet Branch Name
    Water Sink Branch_unit1, !- Outlet Branch 1 Name
    Water Shower Branch_unit1,  !- Outlet Branch 2 Name
    Water ClothesWasher Branch_unit1,  !- Outlet Branch 3 Name
    Water Dishwasher Branch_unit1,  !- Outlet Branch 4 Name
    Water Bath Branch_unit1; !- Outlet Branch 5 Name

Connector:Splitter,
    DHW Supply Splitter_unit1,  !- Name
    Mains Inlet Branch_unit1,!- Inlet Branch Name
    Water Heater Branch_unit1;  !- Outlet Branch 1 Name


!-   ===========  ALL OBJECTS IN CLASS: CONNECTOR:MIXER ===========
```

```
Connector:Mixer,
    DHW Demand Mixer_unit1,  !- Name
    Mains Makeup Branch_unit1,  !- Outlet Branch Name
    Water Sink Branch_unit1, !- Inlet Branch 1 Name
    Water Shower Branch_unit1,  !- Inlet Branch 2 Name
    Water ClothesWasher Branch_unit1,  !- Inlet Branch 3 Name
    Water Dishwasher Branch_unit1,  !- Inlet Branch 4 Name
    Water Bath Branch_unit1; !- Inlet Branch 5 Name

Connector:Mixer,
    DHW Supply Mixer_unit1,  !- Name
    DHW Supply Outlet Branch_unit1,  !- Outlet Branch Name
    Water Heater Branch_unit1;  !- Inlet Branch 1 Name



!-   ===========  ALL OBJECTS IN CLASS: CONNECTORLIST ===========

ConnectorList,
    DHW Demand Connectors_unit1,  !- Name
    Connector:Splitter,      !- Connector 1 Object Type
    DHW Demand Splitter_unit1,  !- Connector 1 Name
    Connector:Mixer,         !- Connector 2 Object Type
    DHW Demand Mixer_unit1;  !- Connector 2 Name

ConnectorList,
    DHW Supply Connectors_unit1,  !- Name
    Connector:Splitter,      !- Connector 1 Object Type
    DHW Supply Splitter_unit1,  !- Connector 1 Name
    Connector:Mixer,         !- Connector 2 Object Type
    DHW Supply Mixer_unit1;  !- Connector 2 Name



!-   ===========  ALL OBJECTS IN CLASS: NODELIST ===========

NodeList,
    Zone Inlet Nodes_unit1,  !- Name
```

```
    Zone Inlet Node_unit1,   !- Node 1 Name
    HPWH Zone Inlet Node_unit1,  !- Node 2 Name
    OA Inlet Node_unit1;     !- Node 3 Name

NodeList,
    Zone Exhaust Node_list_unit1,  !- Name
    Zone Exhaust Node_unit1, !- Node 1 Name
    Zone Exhaust Node1_unit1;!- Node 2 Name


!-   ===========  ALL OBJECTS IN CLASS: OUTDOORAIR:NODE ===========

OutdoorAir:Node,
    outside air inlet node_unit1,  !- Name
    0.914355407629293;       !- Height Above Ground {m}


!-   ===========  ALL OBJECTS IN CLASS: OUTDOORAIR:NODELIST
   ===========

OutdoorAir:NodeList,
    outdoor air node_unit1;  !- Node or NodeList Name 1


!-   ===========  ALL OBJECTS IN CLASS: PIPE:ADIABATIC ===========

Pipe:Adiabatic,
    DHW Supply Outlet Pipe_unit1,  !- Name
    DHW Supply Outlet Pipe Inlet Node_unit1,  !- Inlet Node Name
    DHW Supply Outlet Node_unit1;  !- Outlet Node Name

Pipe:Adiabatic,
    Mains Makeup Pipe_unit1, !- Name
    Mains Makeup Pipe Inlet Node_unit1,  !- Inlet Node Name
    Mains Makeup Node_unit1; !- Outlet Node Name
```

```
Pipe:Adiabatic,
    DHW Demand Inlet Pipe_unit1,  !- Name
    DHW Demand Inlet Node_unit1,  !- Inlet Node Name
    DHW Demand Inlet Pipe Outlet Node_unit1;  !- Outlet Node Name


!-   ===========  ALL OBJECTS IN CLASS: PUMP:VARIABLESPEED
   ===========

Pump:VariableSpeed,
    Mains Pressure_unit1,    !- Name
    Mains Inlet Node_unit1,  !- Inlet Node Name
    Mains Pressure Outlet Node_unit1,  !- Outlet Node Name
    autosize,                !- Design Maximum Flow Rate {m3/s}
    1,                       !- Design Pump Head {Pa}
    0,                       !- Design Power Consumption {W}
    1,                       !- Motor Efficiency
    0,                       !- Fraction of Motor Inefficiencies to
   Fluid Stream
    0,                       !- Coefficient 1 of the Part Load
   Performance Curve
    1,                       !- Coefficient 2 of the Part Load
   Performance Curve
    0,                       !- Coefficient 3 of the Part Load
   Performance Curve
    0,                       !- Coefficient 4 of the Part Load
   Performance Curve
    0,                       !- Design Minimum Flow Rate {m3/s}
    Intermittent;            !- Pump Control Type


!-   ===========  ALL OBJECTS IN CLASS: WATERHEATER:STRATIFIED
   ===========

WaterHeater:Stratified,
    Water Heater_Tank_unit1, !- Name
```

```
 Water Heater,             !- End-Use Subcategory
 0.196841372,              !- Tank Volume {m3}
 1.594,                    !- Tank Height {m}
 VerticalCylinder,         !- Tank Shape
 ,                         !- Tank Perimeter {m}
 51,                       !- Maximum Temperature Limit {C}
 MasterSlave,              !- Heater Priority Control
 dhw_setpt_hpwh,           !- Heater 1 Setpoint Temperature
Schedule Name
 2,                        !- Heater 1 Deadband Temperature
Difference {deltaC}
 autosize,                 !- Heater 1 Capacity {W}
 1.129,                    !- Heater 1 Height {m}
 dhw_setpt_hpwh,           !- Heater 2 Setpoint Temperature
Schedule Name
 2,                        !- Heater 2 Deadband Temperature
Difference {deltaC}
 0,                        !- Heater 2 Capacity {W}
 0.266,                    !- Heater 2 Height {m}
 electricity,              !- Heater Fuel Type
 1,                        !- Heater Thermal Efficiency
 8.3,                      !- Off Cycle Parasitic Fuel Consumption
 Rate {W}
 Electricity,              !- Off Cycle Parasitic Fuel Type
 0,                        !- Off Cycle Parasitic Heat Fraction to
 Tank
 1,                        !- Off Cycle Parasitic Height {m}
 8.3,                      !- On Cycle Parasitic Fuel Consumption
Rate {W}
 Electricity,              !- On Cycle Parasitic Fuel Type
 0,                        !- On Cycle Parasitic Heat Fraction to
Tank
 1,                        !- On Cycle Parasitic Height {m}
 Zone,                     !- Ambient Temperature Indicator
 ,                         !- Ambient Temperature Schedule Name
 living_unit1,             !- Ambient Temperature Zone Name
```

```
    ,                         !- Ambient Temperature Outdoor Air Node
    Name
    0.730336050939686,        !- Uniform Skin Loss Coefficient per
   Unit Area to Ambient Temperature {W/m2-K}
    1,                        !- Skin Loss Fraction to Zone
    ,                         !- Off Cycle Flue Loss Coefficient to
   Ambient Temperature {W/K}
    1,                        !- Off Cycle Flue Loss Fraction to Zone
    ,                         !- Peak Use Flow Rate {m3/s}
    ,                         !- Use Flow Rate Fraction Schedule Name
    ,                         !- Cold Water Supply Temperature
   Schedule Name
    Water Heater use inlet node_unit1,  !- Use Side Inlet Node Name
    Water Heater use outlet node_unit1,  !- Use Side Outlet Node
   Name
    1,                        !- Use Side Effectiveness
    0,                        !- Use Side Inlet Height {m}
    autocalculate,            !- Use Side Outlet Height {m}
    ,                         !- Source Side Inlet Node Name
    ,                         !- Source Side Outlet Node Name
    1,                        !- Source Side Effectiveness
    0.7,                      !- Source Side Inlet Height {m}
    0,                        !- Source Side Outlet Height {m}
    Fixed,                    !- Inlet Mode
    autosize,                 !- Use Side Design Flow Rate {m3/s}
    autosize,                 !- Source Side Design Flow Rate {m3/s}
    1.5,                      !- Indirect Water Heating Recovery Time
    {hr}
    1;                        !- Number of Nodes


!-   ===========  ALL OBJECTS IN CLASS: WATERHEATER:SIZING
   ===========

WaterHeater:Sizing,
    Water Heater_Tank_unit1, !- WaterHeater Name
```

```
    ResidentialHUD-FHAMinimum,  !- Design Mode
    ,                           !- Time Storage Can Meet Peak Draw {hr}
    ,                           !- Time for Tank Recovery {hr}
    ,                           !- Nominal Tank Volume for Autosizing
   Plant Connections {m3}
    3,                          !- Number of Bedrooms
    3;                          !- Number of Bathrooms


!-   ===========  ALL OBJECTS IN CLASS: WATERHEATER:HEATPUMP:
   WRAPPEDCONDENSER ===========

WaterHeater:HeatPump:WrappedCondenser,
    Water Heater_unit1,       !- Name
    always_avail,             !- Availability Schedule Name
    Compressor Setpoint,      !- Compressor Setpoint Temperature
   Schedule Name
    5,                        !- Dead Band Temperature Difference {
   deltaC}
    0.0664166667,             !- Condenser Bottom Location {m}
    0.8634166667,             !- Condenser Top Location {m}
    autocalculate,            !- Evaporator Air Flow Rate {m3/s}
    ZoneAirOnly,              !- Inlet Air Configuration
    Zone Exhaust Node1_unit1,!- Air Inlet Node Name
    HPWH Zone Inlet Node_unit1,  !- Air Outlet Node Name
    ,                         !- Outdoor Air Node Name
    ,                         !- Exhaust Air Node Name
    ,                         !- Inlet Air Temperature Schedule Name
    ,                         !- Inlet Air Humidity Schedule Name
    living_unit1,             !- Inlet Air Zone Name
    WaterHeater:Stratified,   !- Tank Object Type
    Water Heater_Tank_unit1, !- Tank Name
    Water Heater use inlet node_unit1,  !- Tank Use Side Inlet Node
   Name
    Water Heater use outlet node_unit1,  !- Tank Use Side Outlet
   Node Name
```

```
    Coil:WaterHeating:AirToWaterHeatPump:Wrapped,  !- DX Coil Object
    Type
    Heat Pump Water Heater Evaporator_unit1,  !- DX Coil Name
    10.0,                    !- Minimum Inlet Air Temperature for
   Compressor Operation {C}
    48.89,                   !- Maximum Inlet Air Temperature for
   Compressor Operation {C}
    Zone,                    !- Compressor Location
    ,                        !- Compressor Ambient Temperature
   Schedule Name
    Fan:OnOff,               !- Fan Object Type
    Heat Pump Water Heater Fan_unit1,  !- Fan Name
    DrawThrough,             !- Fan Placement
    0,                       !- On Cycle Parasitic Electric Load {W}
    0,                       !- Off Cycle Parasitic Electric Load {W
   }
    ,                        !- Parasitic Heat Rejection Location
    ,                        !- Inlet Air Mixer Node Name
    ,                        !- Outlet Air Splitter Node Name
    ,                        !- Inlet Air Mixer Schedule Name
    MutuallyExclusive,       !- Tank Element Control Logic
    1.262,                   !- Control Sensor 1 Height In
   Stratified Tank {m}
    0.75,                    !- Control Sensor 1 Weight {
   dimensionless}
    0.464;                   !- Control Sensor 2 Height In
   Stratified Tank {m}


!-   ===========  ALL OBJECTS IN CLASS: PLANTLOOP ===========

PlantLoop,
    DHW Loop_unit1,          !- Name
    Water,                   !- Fluid Type
    ,                        !- User Defined Fluid Type
```

```
    DHW Loop Operation_unit1,!- Plant Equipment Operation Scheme
   Name
    DHW Supply Outlet Node_unit1,  !- Loop Temperature Setpoint Node
    Name
    100,                     !- Maximum Loop Temperature {C}
    0,                       !- Minimum Loop Temperature {C}
    autosize,                !- Maximum Loop Flow Rate {m3/s}
    0,                       !- Minimum Loop Flow Rate {m3/s}
    autocalculate,           !- Plant Loop Volume {m3}
    Mains Inlet Node_unit1,  !- Plant Side Inlet Node Name
    DHW Supply Outlet Node_unit1,  !- Plant Side Outlet Node Name
    DHW Supply Branches_unit1,  !- Plant Side Branch List Name
    DHW Supply Connectors_unit1,  !- Plant Side Connector List Name
    DHW Demand Inlet Node_unit1,  !- Demand Side Inlet Node Name
    Mains Makeup Node_unit1, !- Demand Side Outlet Node Name
    DHW Demand Branches_unit1,  !- Demand Side Branch List Name
    DHW Demand Connectors_unit1,  !- Demand Side Connector List Name
    Optimal;                 !- Load Distribution Scheme


!-   ===========  ALL OBJECTS IN CLASS: PLANTEQUIPMENTLIST
   ===========

PlantEquipmentList,
    DHW Plant Equipment_unit1,  !- Name
    WaterHeater:HeatPump:WrappedCondenser,  !- Equipment 1 Object
   Type
    Water Heater_unit1;      !- Equipment 1 Name


!-   ===========  ALL OBJECTS IN CLASS: PLANTEQUIPMENTOPERATION:
   HEATINGLOAD ===========

PlantEquipmentOperation:HeatingLoad,
    DHW Control Scheme_unit1,!- Name
    0.0,                     !- Load Range 1 Lower Limit {W}
```

```
    1000000000000000,        !- Load Range 1 Upper Limit {W}
    DHW Plant Equipment_unit1;  !- Range 1 Equipment List Name


!-   ===========  ALL OBJECTS IN CLASS:
   PLANTEQUIPMENTOPERATIONSCHEMES ===========

PlantEquipmentOperationSchemes,
    DHW Loop Operation_unit1,!- Name
    PlantEquipmentOperation:HeatingLoad,  !- Control Scheme 1 Object
    Type
    DHW Control Scheme_unit1,!- Control Scheme 1 Name
    always_avail;            !- Control Scheme 1 Schedule Name


!-   ===========  ALL OBJECTS IN CLASS: AVAILABILITYMANAGER:
   SCHEDULED ===========

AvailabilityManager:Scheduled,
    System availability,     !- Name
    always_avail;            !- Schedule Name


!-   ===========  ALL OBJECTS IN CLASS:
   AVAILABILITYMANAGERASSIGNMENTLIST ===========

AvailabilityManagerAssignmentList,
    availability list,       !- Name
    AvailabilityManager:Scheduled,  !- Availability Manager 1 Object
    Type
    System availability;     !- Availability Manager 1 Name


!-   ===========  ALL OBJECTS IN CLASS: SETPOINTMANAGER:SCHEDULED
   ===========
```

```
SetpointManager:Scheduled,
    DHW Loop Setpoint Manager_unit1,  !- Name
    Temperature,              !- Control Variable
    DHWSupplySetpoint,        !- Schedule Name
    DHW Supply Outlet Node_unit1;  !- Setpoint Node or NodeList Name


!-   ===========  ALL OBJECTS IN CLASS: WATERUSE:EQUIPMENT
   ===========

WaterUse:Equipment,
    Clothes Washer_unit1,     !- Name
    Domestic Hot Water,       !- End-Use Subcategory
    1.6219189818e-06,         !- Peak Flow Rate {m3/s}
    ClothesWasher,            !- Flow Rate Fraction Schedule Name
    CWWaterTempSchedule;      !- Target Temperature Schedule Name

WaterUse:Equipment,
    Dishwasher_unit1,         !- Name
    Domestic Hot Water,       !- End-Use Subcategory
    6.36685353e-07,           !- Peak Flow Rate {m3/s}
    Dishwasher,               !- Flow Rate Fraction Schedule Name
    DWWaterTempSchedule;      !- Target Temperature Schedule Name

WaterUse:Equipment,
    Sinks_unit1,              !- Name
    Domestic Hot Water,       !- End-Use Subcategory
    7.1934e-05,               !- Peak Flow Rate {m3/s}
    BA_sink_sch,              !- Flow Rate Fraction Schedule Name
    SSBWaterTempSchedule;     !- Target Temperature Schedule Name

WaterUse:Equipment,
    Showers_unit1,            !- Name
    Domestic Hot Water,       !- End-Use Subcategory
    0.000141975,              !- Peak Flow Rate {m3/s}
    BA_shower_sch,            !- Flow Rate Fraction Schedule Name
```

```
    SSBWaterTempSchedule;    !- Target Temperature Schedule Name

WaterUse:Equipment,
    Baths_unit1,             !- Name
    Domestic Hot Water,      !- End-Use Subcategory
    0.00027764,              !- Peak Flow Rate {m3/s}
    BA_bath_sch,             !- Flow Rate Fraction Schedule Name
    SSBWaterTempSchedule;    !- Target Temperature Schedule Name


!-   ===========  ALL OBJECTS IN CLASS: WATERUSE:CONNECTIONS
   ===========

WaterUse:Connections,
    DHW Sinks_unit1,         !- Name
    Water Sink Inlet Node_unit1,  !- Inlet Node Name
    Water Sink Outlet Node_unit1,  !- Outlet Node Name
    ,                        !- Supply Water Storage Tank Name
    ,                        !- Reclamation Water Storage Tank Name
    ,                        !- Hot Water Supply Temperature
   Schedule Name
    ,                        !- Cold Water Supply Temperature
   Schedule Name
    None,                    !- Drain Water Heat Exchanger Type
    ,                        !- Drain Water Heat Exchanger
   Destination
    ,                        !- Drain Water Heat Exchanger U-Factor
   Times Area {W/K}
    Sinks_unit1;             !- Water Use Equipment 1 Name

WaterUse:Connections,
    DHW Showers_unit1,       !- Name
    Water Shower Inlet Node_unit1,  !- Inlet Node Name
    Water Shower Outlet Node_unit1,  !- Outlet Node Name
    ,                        !- Supply Water Storage Tank Name
    ,                        !- Reclamation Water Storage Tank Name
```

```
    ,                         !- Hot Water Supply Temperature
   Schedule Name
    ,                         !- Cold Water Supply Temperature
   Schedule Name
    None,                     !- Drain Water Heat Exchanger Type
    ,                         !- Drain Water Heat Exchanger
   Destination
    ,                         !- Drain Water Heat Exchanger U-Factor
   Times Area {W/K}
    Showers_unit1;            !- Water Use Equipment 1 Name

WaterUse:Connections,
    DHW ClothesWasher_unit1, !- Name
    Water ClothesWasher Inlet Node_unit1,  !- Inlet Node Name
    Water ClothesWasher Outlet Node_unit1,  !- Outlet Node Name
    ,                         !- Supply Water Storage Tank Name
    ,                         !- Reclamation Water Storage Tank Name
    ,                         !- Hot Water Supply Temperature
   Schedule Name
    ,                         !- Cold Water Supply Temperature
   Schedule Name
    None,                     !- Drain Water Heat Exchanger Type
    ,                         !- Drain Water Heat Exchanger
   Destination
    ,                         !- Drain Water Heat Exchanger U-Factor
   Times Area {W/K}
    Clothes Washer_unit1;     !- Water Use Equipment 1 Name

WaterUse:Connections,
    DHW DishWasher_unit1,     !- Name
    Water DishWasher Inlet Node_unit1,  !- Inlet Node Name
    Water DishWasher Outlet Node_unit1,  !- Outlet Node Name
    ,                         !- Supply Water Storage Tank Name
    ,                         !- Reclamation Water Storage Tank Name
    ,                         !- Hot Water Supply Temperature
   Schedule Name
```

```
    ,                         !- Cold Water Supply Temperature
   Schedule Name
    None,                     !- Drain Water Heat Exchanger Type
    ,                         !- Drain Water Heat Exchanger
   Destination
    ,                         !- Drain Water Heat Exchanger U-Factor
   Times Area {W/K}
    Dishwasher_unit1;         !- Water Use Equipment 1 Name

WaterUse:Connections,
    DHW Baths_unit1,          !- Name
    Water Bath Inlet Node_unit1,  !- Inlet Node Name
    Water Bath Outlet Node_unit1,  !- Outlet Node Name
    ,                         !- Supply Water Storage Tank Name
    ,                         !- Reclamation Water Storage Tank Name
    ,                         !- Hot Water Supply Temperature
   Schedule Name
    ,                         !- Cold Water Supply Temperature
   Schedule Name
    None,                     !- Drain Water Heat Exchanger Type
    ,                         !- Drain Water Heat Exchanger
   Destination
    ,                         !- Drain Water Heat Exchanger U-Factor
   Times Area {W/K}
    Baths_unit1;              !- Water Use Equipment 1 Name


!-   ===========  ALL OBJECTS IN CLASS: CURVE:QUADRATIC ===========

Curve:Quadratic,
    HPWH-COP-fPLR,            !- Name
    1,                        !- Coefficient1 Constant
    0,                        !- Coefficient2 x
    0,                        !- Coefficient3 x**2
    0,                        !- Minimum Value of x
    1;                        !- Maximum Value of x
```

```
Curve:Quadratic,
    HPACCoolCapFFF,          !- Name
    0.8,                     !- Coefficient1 Constant
    0.2,                     !- Coefficient2 x
    0.0,                     !- Coefficient3 x**2
    0.5,                     !- Minimum Value of x
    1.5;                     !- Maximum Value of x

Curve:Quadratic,
    HPACCOOLEIRFFF,          !- Name
    1.156,                   !- Coefficient1 Constant
    -0.1816,                 !- Coefficient2 x
    0.0256,                  !- Coefficient3 x**2
    0.5,                     !- Minimum Value of x
    1.5;                     !- Maximum Value of x

Curve:Quadratic,
    HPACCOOLPLFFPLR,         !- Name
    0.85,                    !- Coefficient1 Constant
    0.15,                    !- Coefficient2 x
    0.0,                     !- Coefficient3 x**2
    0.0,                     !- Minimum Value of x
    1.0;                     !- Maximum Value of x

Curve:Quadratic,
    HPACHeatEIRFFF,          !- Name
    1.3824,                  !- Coefficient1 Constant
    -0.4336,                 !- Coefficient2 x
    0.0512,                  !- Coefficient3 x**2
    0.0,                     !- Minimum Value of x
    1.0;                     !- Maximum Value of x

Curve:Quadratic,
    ACCoolingCAPFFF,         !- Name
    0.718605468,             !- Coefficient1 Constant
```

```
    0.410099989,              !- Coefficient2 x
    -0.128705457,             !- Coefficient3 x**2
    0,                        !- Minimum Value of x
    1.5,                      !- Maximum Value of x
    0,                        !- Minimum Curve Output
    2,                        !- Maximum Curve Output
    Dimensionless,            !- Input Unit Type for X
    Dimensionless;            !- Output Unit Type

Curve:Quadratic,
    ACCoolingEIRFFF,          !- Name
    1.32299905,               !- Coefficient1 Constant
    -0.477711207,             !- Coefficient2 x
    0.154712157,              !- Coefficient3 x**2
    0,                        !- Minimum Value of x
    1.5,                      !- Maximum Value of x
    0,                        !- Minimum Curve Output
    2,                        !- Maximum Curve Output
    Dimensionless,            !- Input Unit Type for X
    Dimensionless;            !- Output Unit Type

Curve:Quadratic,
    ACCoolingPLFFPLR,         !- Name
    0.90,                     !- Coefficient1 Constant
    0.10,                     !- Coefficient2 x
    0.0,                      !- Coefficient3 x**2
    0.0,                      !- Minimum Value of x
    1.0;                      !- Maximum Value of x

Curve:Quadratic,
    HPCoolingCAPFFF,          !- Name
    0.718664047,              !- Coefficient1 Constant
    0.41797409,               !- Coefficient2 x
    -0.136638137,             !- Coefficient3 x**2
    0,                        !- Minimum Value of x
    1.5,                      !- Maximum Value of x
```

```
    0,                        !- Minimum Curve Output
    2,                        !- Maximum Curve Output
    Dimensionless,            !- Input Unit Type for X
    Dimensionless;            !- Output Unit Type

Curve:Quadratic,
    HPCoolingEIRFFF,          !- Name
    1.143487507,              !- Coefficient1 Constant
    -0.13943972,              !- Coefficient2 x
    -0.004047787,             !- Coefficient3 x**2
    0,                        !- Minimum Value of x
    1.5,                      !- Maximum Value of x
    0,                        !- Minimum Curve Output
    2,                        !- Maximum Curve Output
    Dimensionless,            !- Input Unit Type for X
    Dimensionless;            !- Output Unit Type

Curve:Quadratic,
    HPCOOLPLFFPLR,            !- Name
    0.90,                     !- Coefficient1 Constant
    0.10,                     !- Coefficient2 x
    0.0,                      !- Coefficient3 x**2
    0.0,                      !- Minimum Value of x
    1.0;                      !- Maximum Value of x

Curve:Quadratic,
    HPHeatingCAPFFF,          !- Name
    0.694045465,              !- Coefficient1 Constant
    0.474207981,              !- Coefficient2 x
    -0.168253446,             !- Coefficient3 x**2
    0,                        !- Minimum Value of x
    1.5,                      !- Maximum Value of x
    0,                        !- Minimum Curve Output
    2,                        !- Maximum Curve Output
    Dimensionless,            !- Input Unit Type for X
    Dimensionless;            !- Output Unit Type
```

```
Curve:Quadratic,
    HPHeatingEIRFFF,         !- Name
    2.185418751,             !- Coefficient1 Constant
    -1.942827919,            !- Coefficient2 x
    0.757409168,             !- Coefficient3 x**2
    0,                       !- Minimum Value of x
    1.5,                     !- Maximum Value of x
    0,                       !- Minimum Curve Output
    2,                       !- Maximum Curve Output
    Dimensionless,           !- Input Unit Type for X
    Dimensionless;           !- Output Unit Type

Curve:Quadratic,
    HPHeatPLFFPLR,           !- Name
    0.90,                    !- Coefficient1 Constant
    0.10,                    !- Coefficient2 x
    0.0,                     !- Coefficient3 x**2
    0.0,                     !- Minimum Value of x
    1.0;                     !- Maximum Value of x

Curve:Quadratic,
    HPLowStageHeatingCAPFFF, !- Name
    0.741466907,             !- Coefficient1 Constant
    0.378645444,             !- Coefficient2 x
    -0.119754733,            !- Coefficient3 x**2
    0,                       !- Minimum Value of x
    1.5,                     !- Maximum Value of x
    0,                       !- Minimum Curve Output
    2,                       !- Maximum Curve Output
    Dimensionless,           !- Input Unit Type for X
    Dimensionless;           !- Output Unit Type

Curve:Quadratic,
    HPLowStageHeatingEIRFFF, !- Name
    2.153618211,             !- Coefficient1 Constant
```

```
    -1.737190609,            !- Coefficient2 x
    0.584269478,             !- Coefficient3 x**2
    0,                       !- Minimum Value of x
    1.5,                     !- Maximum Value of x
    0,                       !- Minimum Curve Output
    2,                       !- Maximum Curve Output
    Dimensionless,           !- Input Unit Type for X
    Dimensionless;           !- Output Unit Type

Curve:Quadratic,
    HPHighStageHeatingCAPFFF,!- Name
    0.76634609,              !- Coefficient1 Constant
    0.32840943,              !- Coefficient2 x
    -0.094701495,            !- Coefficient3 x**2
    0,                       !- Minimum Value of x
    1.5,                     !- Maximum Value of x
    0,                       !- Minimum Curve Output
    2,                       !- Maximum Curve Output
    Dimensionless,           !- Input Unit Type for X
    Dimensionless;           !- Output Unit Type

Curve:Quadratic,
    HPHighStageHeatingEIRFFF,!- Name
    2.001041353,             !- Coefficient1 Constant
    -1.58869128,             !- Coefficient2 x
    0.587593517,             !- Coefficient3 x**2
    0,                       !- Minimum Value of x
    1.5,                     !- Maximum Value of x
    0,                       !- Minimum Curve Output
    2,                       !- Maximum Curve Output
    Dimensionless,           !- Input Unit Type for X
    Dimensionless;           !- Output Unit Type

Curve:Quadratic,
    HP2StageHeatingPLFFPLR,  !- Name
    0.93,                    !- Coefficient1 Constant
```

```
    0.07,                    !- Coefficient2 x
    0.0,                     !- Coefficient3 x**2
    0.0,                     !- Minimum Value of x
    1.0;                     !- Maximum Value of x

Curve:Quadratic,
    HPLowStageCoolingCAPFFF, !- Name
    0.655239515,             !- Coefficient1 Constant
    0.511655216,             !- Coefficient2 x
    -0.166894731,            !- Coefficient3 x**2
    0,                       !- Minimum Value of x
    1.5,                     !- Maximum Value of x
    0,                       !- Minimum Curve Output
    2,                       !- Maximum Curve Output
    Dimensionless,           !- Input Unit Type for X
    Dimensionless;           !- Output Unit Type

Curve:Quadratic,
    HPLowStageCoolingEIRFFF, !- Name
    1.639108268,             !- Coefficient1 Constant
    -0.998953996,            !- Coefficient2 x
    0.359845728,             !- Coefficient3 x**2
    0,                       !- Minimum Value of x
    1.5,                     !- Maximum Value of x
    0,                       !- Minimum Curve Output
    2,                       !- Maximum Curve Output
    Dimensionless,           !- Input Unit Type for X
    Dimensionless;           !- Output Unit Type

Curve:Quadratic,
    HPHighStageCoolingCAPFFF,!- Name
    0.618281092,             !- Coefficient1 Constant
    0.569060264,             !- Coefficient2 x
    -0.187341356,            !- Coefficient3 x**2
    0,                       !- Minimum Value of x
    1.5,                     !- Maximum Value of x
```

```
    0,                        !- Minimum Curve Output
    2,                        !- Maximum Curve Output
    Dimensionless,            !- Input Unit Type for X
    Dimensionless;            !- Output Unit Type

Curve:Quadratic,
    HPHighStageCoolingEIRFFF,!- Name
    1.570774717,              !- Coefficient1 Constant
    -0.914152018,             !- Coefficient2 x
    0.343377302,              !- Coefficient3 x**2
    0,                        !- Minimum Value of x
    1.5,                      !- Maximum Value of x
    0,                        !- Minimum Curve Output
    2,                        !- Maximum Curve Output
    Dimensionless,            !- Input Unit Type for X
    Dimensionless;            !- Output Unit Type

Curve:Quadratic,
    HP2StageCoolingPLFFPLR,   !- Name
    0.93,                     !- Coefficient1 Constant
    0.07,                     !- Coefficient2 x
    0.0,                      !- Coefficient3 x**2
    0.0,                      !- Minimum Value of x
    1.0;                      !- Maximum Value of x

Curve:Quadratic,
    ACLowStageCoolingCAPFFF, !- Name
    0.65673024,               !- Coefficient1 Constant
    0.516470835,              !- Coefficient2 x
    -0.172887149,             !- Coefficient3 x**2
    0,                        !- Minimum Value of x
    1.5,                      !- Maximum Value of x
    0,                        !- Minimum Curve Output
    2,                        !- Maximum Curve Output
    Dimensionless,            !- Input Unit Type for X
    Dimensionless;            !- Output Unit Type
```

```
Curve:Quadratic,
    ACLowStageCoolingEIRFFF, !- Name
    1.562945114,             !- Coefficient1 Constant
    -0.791859997,            !- Coefficient2 x
    0.230030877,             !- Coefficient3 x**2
    0,                       !- Minimum Value of x
    1.5,                     !- Maximum Value of x
    0,                       !- Minimum Curve Output
    2,                       !- Maximum Curve Output
    Dimensionless,           !- Input Unit Type for X
    Dimensionless;           !- Output Unit Type

Curve:Quadratic,
    ACHighStageCoolingCAPFFF,!- Name
    0.690334551,             !- Coefficient1 Constant
    0.464383753,             !- Coefficient2 x
    -0.154507638,            !- Coefficient3 x**2
    0,                       !- Minimum Value of x
    1.5,                     !- Maximum Value of x
    0,                       !- Minimum Curve Output
    2,                       !- Maximum Curve Output
    Dimensionless,           !- Input Unit Type for X
    Dimensionless;           !- Output Unit Type

Curve:Quadratic,
    ACHighStageCoolingEIRFFF,!- Name
    1.31565404,              !- Coefficient1 Constant
    -0.482467162,            !- Coefficient2 x
    0.166239001,             !- Coefficient3 x**2
    0,                       !- Minimum Value of x
    1.5,                     !- Maximum Value of x
    0,                       !- Minimum Curve Output
    2,                       !- Maximum Curve Output
    Dimensionless,           !- Input Unit Type for X
    Dimensionless;           !- Output Unit Type
```

```
Curve:Quadratic,
    AC2StageCoolingPLFFPLR,  !- Name
    0.93,                    !- Coefficient1 Constant
    0.07,                    !- Coefficient2 x
    0.0,                     !- Coefficient3 x**2
    0.0,                     !- Minimum Value of x
    1.0;                     !- Maximum Value of x

Curve:Quadratic,
    Cool-PLF-fPLR,           !- Name
    0.80141423,              !- Coefficient1 Constant
    0.23744685,              !- Coefficient2 x
    -0.0393773,              !- Coefficient3 x**2
    0,                       !- Minimum Value of x
    1,                       !- Maximum Value of x
    0.7,                     !- Minimum Curve Output
    1;                       !- Maximum Curve Output


!-   ===========  ALL OBJECTS IN CLASS: CURVE:CUBIC ===========

Curve:Cubic,
    HPACHeatCapFT,           !- Name
    0.758746,                !- Coefficient1 Constant
    0.027626,                !- Coefficient2 x
    0.000148716,             !- Coefficient3 x**2
    0.0000034992,            !- Coefficient4 x**3
    -20.0,                   !- Minimum Value of x
    20.0;                    !- Maximum Value of x

Curve:Cubic,
    HPACHeatCapFFF,          !- Name
    0.84,                    !- Coefficient1 Constant
    0.16,                    !- Coefficient2 x
    0.0,                     !- Coefficient3 x**2
```

```
    0.0,                     !- Coefficient4 x**3
    0.5,                     !- Minimum Value of x
    1.5;                     !- Maximum Value of x

Curve:Cubic,
    HPACHeatEIRFT,           !- Name
    1.19248,                 !- Coefficient1 Constant
    -0.0300438,              !- Coefficient2 x
    0.00103745,              !- Coefficient3 x**2
    -0.000023328,            !- Coefficient4 x**3
    -20.0,                   !- Minimum Value of x
    20.0;                    !- Maximum Value of x

Curve:Cubic,
    Fan-EIR-fPLR,            !- Name
    0.00000000,              !- Coefficient1 Constant
    1.00000000,              !- Coefficient2 x
    0.00000000,              !- Coefficient3 x**2
    0.00000000,              !- Coefficient4 x**3
    0,                       !- Minimum Value of x
    1,                       !- Maximum Value of x
    0,                       !- Minimum Curve Output
    1;                       !- Maximum Curve Output

Curve:Cubic,
    ConstantCubic,           !- Name
    1,                       !- Coefficient1 Constant
    0,                       !- Coefficient2 x
    0,                       !- Coefficient3 x**2
    0,                       !- Coefficient4 x**3
    -100,                    !- Minimum Value of x
    100;                     !- Maximum Value of x


!-   ===========  ALL OBJECTS IN CLASS: CURVE:BIQUADRATIC
   ===========
```

```
!
Curve:Biquadratic,
    HPWH-Htg-Cap-fT,         !- Name
    0.563,                   !- Coefficient1 Constant
    0.0437,                  !- Coefficient2 x
    0.000039,                !- Coefficient3 x**2
    0.0055,                  !- Coefficient4 y
    -.000148,                !- Coefficient5 y**2
    -.000145,                !- Coefficient6 x*y
    0,                       !- Minimum Value of x
    100,                     !- Maximum Value of x
    0,                       !- Minimum Value of y
    100,                     !- Maximum Value of y
    0;                       !- Minimum Curve Output

Curve:Biquadratic,
    HPWH-Htg-COP-fT,         !- Name
    1.1332,                  !- Coefficient1 Constant
    0.063,                   !- Coefficient2 x
    -.0000979,               !- Coefficient3 x**2
    -.00972,                 !- Coefficient4 y
    -.0000214,               !- Coefficient5 y**2
    -.000686,                !- Coefficient6 x*y
    0,                       !- Minimum Value of x
    100,                     !- Maximum Value of x
    0,                       !- Minimum Value of y
    100;                     !- Maximum Value of y

Curve:Biquadratic,
    HPWHHeatingCapFTemp,     !- Name
    0.369827,                !- Coefficient1 Constant
    0.043341,                !- Coefficient2 x
    -0.00023,                !- Coefficient3 x**2
    0.000466,                !- Coefficient4 y
    0.000026,                !- Coefficient5 y**2
```

```
    -0.00027,                !- Coefficient6 x*y
    0.0,                     !- Minimum Value of x
    40.0,                    !- Maximum Value of x
    20.0,                    !- Minimum Value of y
    90.0,                    !- Maximum Value of y
    ,                        !- Minimum Curve Output
    ,                        !- Maximum Curve Output
    Temperature,             !- Input Unit Type for X
    Temperature,             !- Input Unit Type for Y
    Dimensionless;           !- Output Unit Type

Curve:Biquadratic,
    HPWHHeatingCOPFTemp,     !- Name
    1.19713,                 !- Coefficient1 Constant
    0.077849,                !- Coefficient2 x
    -0.0000016,              !- Coefficient3 x**2
    -0.02675,                !- Coefficient4 y
    0.000296,                !- Coefficient5 y**2
    -0.00112,                !- Coefficient6 x*y
    0.0,                     !- Minimum Value of x
    40.0,                    !- Maximum Value of x
    20.0,                    !- Minimum Value of y
    90.0,                    !- Maximum Value of y
    ,                        !- Minimum Curve Output
    ,                        !- Maximum Curve Output
    Temperature,             !- Input Unit Type for X
    Temperature,             !- Input Unit Type for Y
    Dimensionless;           !- Output Unit Type

Curve:Biquadratic,
    HPACCoolCapFT,           !- Name
    0.766956,                !- Coefficient1 Constant
    0.0107756,               !- Coefficient2 x
    -0.0000414703,           !- Coefficient3 x**2
    0.00134961,              !- Coefficient4 y
    -0.000261144,            !- Coefficient5 y**2
```

```
    0.000457488,              !- Coefficient6 x*y
    12.77778,                 !- Minimum Value of x
    23.88889,                 !- Maximum Value of x
    21.11111,                 !- Minimum Value of y
    46.11111;                 !- Maximum Value of y

Curve:Biquadratic,
    HPACCOOLEIRFT,            !- Name
    0.297145,                 !- Coefficient1 Constant
    0.0430933,                !- Coefficient2 x
    -0.000748766,             !- Coefficient3 x**2
    0.00597727,               !- Coefficient4 y
    0.000482112,              !- Coefficient5 y**2
    -0.000956448,             !- Coefficient6 x*y
    12.77778,                 !- Minimum Value of x
    23.88889,                 !- Maximum Value of x
    21.11111,                 !- Minimum Value of y
    46.11111;                 !- Maximum Value of y

Curve:Biquadratic,
    Defrost_EIR_FT,           !- Name
    1,                        !- Coefficient1 Constant
    0,                        !- Coefficient2 x
    0,                        !- Coefficient3 x**2
    0,                        !- Coefficient4 y
    0,                        !- Coefficient5 y**2
    0,                        !- Coefficient6 x*y
    0,                        !- Minimum Value of x
    100,                      !- Maximum Value of x
    0,                        !- Minimum Value of y
    100;                      !- Maximum Value of y

! This is a dummy waste heat function of temp curve required for the
! multispeed coils. The curve is set as a constant curve that would
   yield
! a factor of 1 at all temperatures for simplicity.
```

```
! However, this curve is not used if the fuel type is electricity (
   which is
! what we limit ourselves to in terms of multispeed DX equipment)
   per
! the E+ version 8.0 I/O reference Page 1301.
Curve:Biquadratic,
    dummy-waste-heat-curve,  !- Name
    1,                       !- Coefficient1 Constant
    0,                       !- Coefficient2 x
    0,                       !- Coefficient3 x**2
    0,                       !- Coefficient4 y
    0,                       !- Coefficient5 y**2
    0,                       !- Coefficient6 x*y
    0,                       !- Minimum Value of x
    50,                      !- Maximum Value of x
    0,                       !- Minimum Value of y
    50,                      !- Maximum Value of y
    1,                       !- Minimum Curve Output
    1,                       !- Maximum Curve Output
    Dimensionless,           !- Input Unit Type for X
    Dimensionless,           !- Input Unit Type for Y
    Dimensionless;           !- Output Unit Type

!
!
!
!
Curve:Biquadratic,
    ACCoolingCAPFTemp,       !- Name
    1.5509,                  !- Coefficient1 Constant
    -0.07505,                !- Coefficient2 x
    0.0031,                  !- Coefficient3 x**2
    0.0024,                  !- Coefficient4 y
    -0.00005,                !- Coefficient5 y**2
    -0.00043,                !- Coefficient6 x*y
    0,                       !- Minimum Value of x
```

```
    50,                       !- Maximum Value of x
    0,                        !- Minimum Value of y
    50,                       !- Maximum Value of y
    0,                        !- Minimum Curve Output
    5,                        !- Maximum Curve Output
    Temperature,              !- Input Unit Type for X
    Temperature,              !- Input Unit Type for Y
    Dimensionless;            !- Output Unit Type

Curve:Biquadratic,
    ACCoolingEIRFTemp,        !- Name
    -0.30428,                 !- Coefficient1 Constant
    0.11805,                  !- Coefficient2 x
    -0.00342,                 !- Coefficient3 x**2
    -0.00626,                 !- Coefficient4 y
    0.0007,                   !- Coefficient5 y**2
    -0.00047,                 !- Coefficient6 x*y
    0,                        !- Minimum Value of x
    50,                       !- Maximum Value of x
    0,                        !- Minimum Value of y
    50,                       !- Maximum Value of y
    0,                        !- Minimum Curve Output
    5,                        !- Maximum Curve Output
    Temperature,              !- Input Unit Type for X
    Temperature,              !- Input Unit Type for Y
    Dimensionless;            !- Output Unit Type

Curve:Biquadratic,
    HPCoolingCAPFTemp,        !- Name
    1.55736,                  !- Coefficient1 Constant
    -0.074448,                !- Coefficient2 x
    0.003099,                 !- Coefficient3 x**2
    0.00146,                  !- Coefficient4 y
    -0.000041,                !- Coefficient5 y**2
    -0.000427,                !- Coefficient6 x*y
    0,                        !- Minimum Value of x
```

```
    50,                       !- Maximum Value of x
    0,                        !- Minimum Value of y
    50,                       !- Maximum Value of y
    0,                        !- Minimum Curve Output
    5,                        !- Maximum Curve Output
    Temperature,              !- Input Unit Type for X
    Temperature,              !- Input Unit Type for Y
    Dimensionless;            !- Output Unit Type

Curve:Biquadratic,
    HPCoolingEIRFTemp,        !- Name
    -0.350448,                !- Coefficient1 Constant
    0.11681,                  !- Coefficient2 x
    -0.0034,                  !- Coefficient3 x**2
    -0.001226,                !- Coefficient4 y
    0.000601,                 !- Coefficient5 y**2
    -0.000467,                !- Coefficient6 x*y
    0,                        !- Minimum Value of x
    50,                       !- Maximum Value of x
    0,                        !- Minimum Value of y
    50,                       !- Maximum Value of y
    0,                        !- Minimum Curve Output
    5,                        !- Maximum Curve Output
    Temperature,              !- Input Unit Type for X
    Temperature,              !- Input Unit Type for Y
    Dimensionless;            !- Output Unit Type

Curve:Biquadratic,
    HPHeatingCAPFTemp,        !- Name
    0.876825,                 !- Coefficient1 Constant
    -0.002955,                !- Coefficient2 x
    -0.000058,                !- Coefficient3 x**2
    0.025335,                 !- Coefficient4 y
    0.000196,                 !- Coefficient5 y**2
    -0.000043,                !- Coefficient6 x*y
    0,                        !- Minimum Value of x
```

```
    50,                       !- Maximum Value of x
    0,                        !- Minimum Value of y
    50,                       !- Maximum Value of y
    0,                        !- Minimum Curve Output
    5,                        !- Maximum Curve Output
    Temperature,              !- Input Unit Type for X
    Temperature,              !- Input Unit Type for Y
    Dimensionless;            !- Output Unit Type

Curve:Biquadratic,
    HPHeatingEIRFTemp,        !- Name
    0.704658,                 !- Coefficient1 Constant
    0.008767,                 !- Coefficient2 x
    0.000625,                 !- Coefficient3 x**2
    -0.009037,                !- Coefficient4 y
    0.000738,                 !- Coefficient5 y**2
    -0.001025,                !- Coefficient6 x*y
    0,                        !- Minimum Value of x
    50,                       !- Maximum Value of x
    0,                        !- Minimum Value of y
    50,                       !- Maximum Value of y
    0,                        !- Minimum Curve Output
    5,                        !- Maximum Curve Output
    Temperature,              !- Input Unit Type for X
    Temperature,              !- Input Unit Type for Y
    Dimensionless;            !- Output Unit Type

Curve:Biquadratic,
    HPLowStageHeatingCAPFTemp,  !- Name
    0.84613,                  !- Coefficient1 Constant
    -0.002279,                !- Coefficient2 x
    -0.000047,                !- Coefficient3 x**2
    0.026703,                 !- Coefficient4 y
    0.000201,                 !- Coefficient5 y**2
    -0.000079,                !- Coefficient6 x*y
    0,                        !- Minimum Value of x
```

```
    50,                       !- Maximum Value of x
    0,                        !- Minimum Value of y
    50,                       !- Maximum Value of y
    0,                        !- Minimum Curve Output
    5,                        !- Maximum Curve Output
    Temperature,              !- Input Unit Type for X
    Temperature,              !- Input Unit Type for Y
    Dimensionless;            !- Output Unit Type

Curve:Biquadratic,
    HPLowStageHeatingEIRFTemp,  !- Name
    0.551837,                 !- Coefficient1 Constant
    0.02038,                  !- Coefficient2 x
    0.000546,                 !- Coefficient3 x**2
    -0.009638,                !- Coefficient4 y
    0.000785,                 !- Coefficient5 y**2
    -0.00125,                 !- Coefficient6 x*y
    0,                        !- Minimum Value of x
    50,                       !- Maximum Value of x
    0,                        !- Minimum Value of y
    50,                       !- Maximum Value of y
    0,                        !- Minimum Curve Output
    5,                        !- Maximum Curve Output
    Temperature,              !- Input Unit Type for X
    Temperature,              !- Input Unit Type for Y
    Dimensionless;            !- Output Unit Type

Curve:Biquadratic,
    HPHighStageHeatingCAPFTemp,  !- Name
    0.818223,                 !- Coefficient1 Constant
    0.001981,                 !- Coefficient2 x
    -0.000203,                !- Coefficient3 x**2
    0.028703,                 !- Coefficient4 y
    0.000207,                 !- Coefficient5 y**2
    -0.000071,                !- Coefficient6 x*y
    0,                        !- Minimum Value of x
```

```
    50,                       !- Maximum Value of x
    0,                        !- Minimum Value of y
    50,                       !- Maximum Value of y
    0,                        !- Minimum Curve Output
    5,                        !- Maximum Curve Output
    Temperature,              !- Input Unit Type for X
    Temperature,              !- Input Unit Type for Y
    Dimensionless;            !- Output Unit Type

Curve:Biquadratic,
    HPHighStageHeatingEIRFTemp,  !- Name
    0.81584,                  !- Coefficient1 Constant
    -0.00615,                 !- Coefficient2 x
    0.001021,                 !- Coefficient3 x**2
    -0.001301,                !- Coefficient4 y
    0.001083,                 !- Coefficient5 y**2
    -0.001487,                !- Coefficient6 x*y
    0,                        !- Minimum Value of x
    50,                       !- Maximum Value of x
    0,                        !- Minimum Value of y
    50,                       !- Maximum Value of y
    0,                        !- Minimum Curve Output
    5,                        !- Maximum Curve Output
    Temperature,              !- Input Unit Type for X
    Temperature,              !- Input Unit Type for Y
    Dimensionless;            !- Output Unit Type

Curve:Biquadratic,
    HPLowStageCoolingCAPFTemp,  !- Name
    1.658788,                 !- Coefficient1 Constant
    -0.083453,                !- Coefficient2 x
    0.003424,                 !- Coefficient3 x**2
    0.002433,                 !- Coefficient4 y
    -0.000045,                !- Coefficient5 y**2
    -0.000534,                !- Coefficient6 x*y
    0,                        !- Minimum Value of x
```

```
    50,                       !- Maximum Value of x
    0,                        !- Minimum Value of y
    50,                       !- Maximum Value of y
    0,                        !- Minimum Curve Output
    5,                        !- Maximum Curve Output
    Temperature,              !- Input Unit Type for X
    Temperature,              !- Input Unit Type for Y
    Dimensionless;            !- Output Unit Type

Curve:Biquadratic,
    HPLowStageCoolingEIRFTemp,  !- Name
    -0.582916,                !- Coefficient1 Constant
    0.158101,                 !- Coefficient2 x
    -0.004398,                !- Coefficient3 x**2
    -0.020335,                !- Coefficient4 y
    0.00108,                  !- Coefficient5 y**2
    -0.00064,                 !- Coefficient6 x*y
    0,                        !- Minimum Value of x
    50,                       !- Maximum Value of x
    0,                        !- Minimum Value of y
    50,                       !- Maximum Value of y
    0,                        !- Minimum Curve Output
    5,                        !- Maximum Curve Output
    Temperature,              !- Input Unit Type for X
    Temperature,              !- Input Unit Type for Y
    Dimensionless;            !- Output Unit Type

Curve:Biquadratic,
    HPHighStageCoolingCAPFTemp,  !- Name
    1.472738,                 !- Coefficient1 Constant
    -0.067222,                !- Coefficient2 x
    0.00292,                  !- Coefficient3 x**2
    0.000052,                 !- Coefficient4 y
    -0.00003,                 !- Coefficient5 y**2
    -0.000359,                !- Coefficient6 x*y
    0,                        !- Minimum Value of x
```

```
    50,                       !- Maximum Value of x
    0,                        !- Minimum Value of y
    50,                       !- Maximum Value of y
    0,                        !- Minimum Curve Output
    5,                        !- Maximum Curve Output
    Temperature,              !- Input Unit Type for X
    Temperature,              !- Input Unit Type for Y
    Dimensionless;            !- Output Unit Type

Curve:Biquadratic,
    HPHighStageCoolingEIRFTemp,  !- Name
    -0.488196,                !- Coefficient1 Constant
    0.099162,                 !- Coefficient2 x
    -0.00237,                 !- Coefficient3 x**2
    0.019503,                 !- Coefficient4 y
    0.00043,                  !- Coefficient5 y**2
    -0.001097,                !- Coefficient6 x*y
    0,                        !- Minimum Value of x
    50,                       !- Maximum Value of x
    0,                        !- Minimum Value of y
    50,                       !- Maximum Value of y
    0,                        !- Minimum Curve Output
    5,                        !- Maximum Curve Output
    Temperature,              !- Input Unit Type for X
    Temperature,              !- Input Unit Type for Y
    Dimensionless;            !- Output Unit Type

Curve:Biquadratic,
    ACLowStageCoolingCAPFTemp,  !- Name
    1.66458,                  !- Coefficient1 Constant
    -0.08039,                 !- Coefficient2 x
    0.0033,                   !- Coefficient3 x**2
    0.00124,                  !- Coefficient4 y
    -0.00003,                 !- Coefficient5 y**2
    -0.00052,                 !- Coefficient6 x*y
    0,                        !- Minimum Value of x
```

```
    50,                       !- Maximum Value of x
    0,                        !- Minimum Value of y
    50,                       !- Maximum Value of y
    0,                        !- Minimum Curve Output
    5,                        !- Maximum Curve Output
    Temperature,              !- Input Unit Type for X
    Temperature,              !- Input Unit Type for Y
    Dimensionless;            !- Output Unit Type

Curve:Biquadratic,
    ACLowStageCoolingEIRFTemp,  !- Name
    -0.42738,                 !- Coefficient1 Constant
    0.14191,                  !- Coefficient2 x
    -0.00412,                 !- Coefficient3 x**2
    -0.01406,                 !- Coefficient4 y
    0.00083,                  !- Coefficient5 y**2
    -0.00043,                 !- Coefficient6 x*y
    0,                        !- Minimum Value of x
    50,                       !- Maximum Value of x
    0,                        !- Minimum Value of y
    50,                       !- Maximum Value of y
    0,                        !- Minimum Curve Output
    5,                        !- Maximum Curve Output
    Temperature,              !- Input Unit Type for X
    Temperature,              !- Input Unit Type for Y
    Dimensionless;            !- Output Unit Type

Curve:Biquadratic,
    ACHighStageCoolingCAPFTemp,  !- Name
    1.36788,                  !- Coefficient1 Constant
    -0.06257,                 !- Coefficient2 x
    0.0028,                   !- Coefficient3 x**2
    0.00504,                  !- Coefficient4 y
    -0.00007,                 !- Coefficient5 y**2
    -0.00045,                 !- Coefficient6 x*y
    0,                        !- Minimum Value of x
```

```
    50,                       !- Maximum Value of x
    0,                        !- Minimum Value of y
    50,                       !- Maximum Value of y
    0,                        !- Minimum Curve Output
    5,                        !- Maximum Curve Output
    Temperature,              !- Input Unit Type for X
    Temperature,              !- Input Unit Type for Y
    Dimensionless;            !- Output Unit Type

Curve:Biquadratic,
    ACHighStageCoolingEIRFTemp,  !- Name
    0.04232,                  !- Coefficient1 Constant
    0.07892,                  !- Coefficient2 x
    -0.00238,                 !- Coefficient3 x**2
    -0.00304,                 !- Coefficient4 y
    0.00053,                  !- Coefficient5 y**2
    -0.00032,                 !- Coefficient6 x*y
    0,                        !- Minimum Value of x
    50,                       !- Maximum Value of x
    0,                        !- Minimum Value of y
    50,                       !- Maximum Value of y
    0,                        !- Minimum Curve Output
    5,                        !- Maximum Curve Output
    Temperature,              !- Input Unit Type for X
    Temperature,              !- Input Unit Type for Y
    Dimensionless;            !- Output Unit Type

Curve:Biquadratic,
    Cool-Cap-fT,              !- Name
    1.26489391,               !- Coefficient1 Constant
    -0.035054982,             !- Coefficient2 x
    0.00211086,               !- Coefficient3 x**2
    -0.001526886,             !- Coefficient4 y
    -0.0000070308,            !- Coefficient5 y**2
    -0.0004691844,            !- Coefficient6 x*y
    -100,                     !- Minimum Value of x
```

```
    100,                     !- Maximum Value of x
    -100,                    !- Minimum Value of y
    100;                     !- Maximum Value of y

Curve:Biquadratic,
    Cool-EIR-fT,             !- Name
    0.38402403,              !- Coefficient1 Constant
    0.029696724,             !- Coefficient2 x
    -0.0011329308,           !- Coefficient3 x**2
    0.006490674,             !- Coefficient4 y
    0.0002626992,            !- Coefficient5 y**2
    -0.0001207224,           !- Coefficient6 x*y
    -100,                    !- Minimum Value of x
    100,                     !- Maximum Value of x
    -100,                    !- Minimum Value of y
    100;                     !- Maximum Value of y


!-   ===========  ALL OBJECTS IN CLASS: OUTPUT:VARIABLEDICTIONARY
   ===========

Output:VariableDictionary,
    IDF;                     !- Key Field
Output:Surfaces:Drawing, DXF;


!-   ===========  ALL OBJECTS IN CLASS: OUTPUT:VARIABLE ===========

Output:Variable,
    *,                       !- Key Value
    Site Outdoor Air Drybulb Temperature,  !- Variable Name
    hourly;                  !- Reporting Frequency

Output:Variable,
    *,                       !- Key Value
    Zone Air Temperature,    !- Variable Name
```

```
    hourly;                   !- Reporting Frequency

Output:Variable,
    *,                        !- Key Value
    Zone Air Relative Humidity,  !- Variable Name
    hourly;                   !- Reporting Frequency

Output:Variable,
    *,                        !- Key Value
    Zone Mean Radiant Temperature,  !- Variable Name
    hourly;                   !- Reporting Frequency

Output:Variable,
    *,                        !- Key Value
    Zone Thermostat Cooling Setpoint Temperature,  !- Variable Name
    hourly;                   !- Reporting Frequency

Output:Variable,
    *,                        !- Key Value
    Zone Thermal Comfort Pierce Model Standard Effective Temperature
   ,  !- Variable Name
    hourly;                   !- Reporting Frequency

Output:Variable,
    *,                        !- Key Value
    Facility Total Building Electricity Demand Rate,  !- Variable
   Name
    hourly;                   !- Reporting Frequency

Output:Variable,
    *,                        !- Key Value
    Facility Total HVAC Electricity Demand Rate,  !- Variable Name
    hourly;                   !- Reporting Frequency

Output:Variable,
    *,                        !- Key Value
```

```
    Facility Total Electricity Demand Rate,  !- Variable Name
    hourly;                  !- Reporting Frequency

! GPARM parameters as run:
!    ID = US+SF+CZ1AWH+hp+slab+IECC_2021
!    weatherfile = USA_FL_Miami.Intl.AP.722020_TMY3.epw
!    climate_zone = 1
!    moisture_regime = A
!    humidity_designation = WH
!    tropical_designation =
!    bldg_type = Single-Family
!    fndn_type = slab
!    system_tag = Heat Pump
!    code = IECC_2021
!    permits = 21846.545507574
!    vent_fan_efficacy = 2.8
!    cfm25 = 4
!    afn_control = MultizoneWithDistribution
!    is_duct_base = no
!    leakage_ratio = 0.0792
!    dhw_type = heatpump
!    TEMPLATE_PATH = template/v9.5

! Default values:
!    ach50 = 5
!    afue = 1
!    heating_coil =
!    heating_fuel = electricity
!    hspf =
!    leakage_ratio = 0.0792
!    seer =
!    system = heatpump
!    ua_si = 2.07415438466871

! GPARM computed values:
!    cfa_per_unit = 2376
```

```
!    efficacy_ratio_cfl = 0.272727272727273
!    efficacy_ratio_inc = 1
!    efficacy_ratio_led = 0.230769230769231
!    efficacy_ratio_lf = 0.170454545454545
!    ela = 92.3292232734708
!    f_cfl_hw = 0.2
!    f_inc_hw = 0
!    f_led_hw = 0.8
!    f_lf_hw = 0
!    gtp_filename =
!    internal_gains = 86760.8
!    internal_gains_W = 1059.19523390956
!    internal_gains_kWhyr = 9278.55024904776
!    long_dim =
!    ltg_exterior = 189.401978076923
!    ltg_exterior_benchmark = 344.52
!    ltg_garage = 21.9902447552448
!    ltg_garage_benchmark = 40
!    ltg_hardwired = 713.272060441958
!    ltg_hw_benchmark = 1297.4336
!    ltg_plugin = 324.3584
!    ltg_plugin_benchmark = 324.3584
!    n_bedrooms = 3
!    n_ppl = 3
!    short_dim =
!    window_area = 355.236927696469

! Code requirements: IECC_2021
!    r_bsmtwall = 0
!    r_ceiling = 30
!    r_crawlwall = 0
!    r_floor = 13
!    r_masswall = 3
!    r_sheathing = 0
!    r_slab = 0
!    r_wall = 13
```

```
!    shgc_skylight = 0.25
!    shgc_window = 0.25
!    u_skylight = 0.75
!    u_window = 0.5
! GPARM parameters as run:
!    ID = US+SF+CZ1AWH+hp+slab+IECC_2021
!    weatherfile = USA_FL_Miami.Intl.AP.722020_TMY3.epw
!    climate_zone = 1
!    moisture_regime = A
!    humidity_designation = WH
!    tropical_designation =
!    bldg_type = Single-Family
!    fndn_type = slab
!    system_tag = Heat Pump
!    code = IECC_2021
!    permits = 21846.545507574
!    vent_fan_efficacy = 2.8
!    cfm25 = 4
!    afn_control = MultizoneWithDistribution
!    is_duct_base = no
!    leakage_ratio = 0.0792
!    dhw_type = heatpump
!    TEMPLATE_PATH = template/v9.5

! ====================================================
!           Report on template variables
!
! ------------------------------
! Variables changed in template:
! ------------------------------
!
! CHILD_ERROR:  '-1' --> '0'
! ERRNO:  'Inappropriate ioctl for device' --> ''
! EXTENDED_OS_ERROR:  'Inappropriate ioctl for device' --> ''
! LIST_SEPARATOR:  ' ' --> ','
! OS_ERROR:  'Inappropriate ioctl for device' --> ''
```

```
! climate_zone:  'Climate Zone 1' --> '1'
! dhw_type:  '' --> 'heatpump'
! fndn_type:  'Slab' --> 'slab'
! humidity_designation:  'Warm-Humid' --> 'WH'
! moisture_regime:  'Moist' --> 'A'
! tropical_designation:  'Not Tropical' --> ''
! vent_fan_efficacy:  '1.4' --> '2.8'
!
! --------------------------------
! New variables created in template:
! --------------------------------
!
! LPD_hardwired:  '1.05216214401829'
! LPD_plugin:  '0.478467682251396'
! SAF:  '1'
! SAF_ext:  '1'
! SAF_gar:  '1'
! S_overhang:  '0.0152439024390244'
! S_overhang_pf:  '0.01'
! ach50:  '5'
! afue:  '1'
! aspect_ratio:  '1.33333333333333'
! atticvent:  '0.37'
! atticvent_cm2:  '3700'
! bare_masonry:  'no'
! base_watts:  '400'
! bath_gpm:  '4.4'
! bath_peak_flow:  '0.00027764'
! bldg_azimuth:  '0'
! branch_tag:  'AirLoopHVAC:UnitaryHeatPump:AirToAir'
! ceil_area:  '110.408921933086'
! ceil_insulation:  'fiberglass_blown'
! ceiling_framing_fraction:  '0.07'
! ceiling_ht:  '2.59146341463415'
! cfa_per_unit:  '2376'
! cfa_per_unit_sqmt:  '220.817843866171'
```

```
! cfa_total:  '2376'
! cfa_total_sqmt:  '220.817843866171'
! clotheswasher_peak_flow:  '1.6219189818e-06'
! concrete_density:  '135'
! cond_crawlspace:  'no'
! conv_accel_limit:  '0'
! cooling_setpt:  '75'
! cop_cooling:  '4.06853019625951'
! cop_heating:  '3.69308080013886'
! crawlvent:  '0.37'
! daily_bath_gal:  '6'
! daily_shower_gal:  '23.9'
! daily_sink_gal:  '21.1'
! dday_sched_type:  'annual'
! dhw_heater_control:  'Cycle'
! dhw_heater_eff:  '1'
! dhw_multiplier:  '0.897'
! dhw_pipe_const:  'Insulated pipe'
! dhw_pipe_loc_unit:  'living_unit1'
! dhw_savings_factor:  '0.103'
! dhw_savings_mult:  '1'
! dhw_setpt_sch:  'dhw_setpt_hpwh'
! dhw_source_fuel:  'electricity'
! dhw_tank_loss_SI:  '0.730336050939686'
! dhw_tank_size:  '52'
! dhw_tank_size_SI:  '0.196841372'
! dishwasher_peak_flow:  '6.36685353e-07'
! door_area:  '3.71747211895911'
! door_ht:  '2.13414634146341'
! door_ldb_l:  '1.74190122145513'
! door_t:  '0.0253617440918536'
! duct_loc:  'attic'
! ef:  '2'
! efficacy_ratio_cfl:  '0.272727272727273'
! efficacy_ratio_inc:  '1'
! efficacy_ratio_led:  '0.230769230769231'
```

```
! efficacy_ratio_lf:  '0.170454545454545'
! ela:  '92.3292232734708'
! ela_ceil:  '0.019898999363395'
! ela_floor:  '0.019898999363395'
! ela_longdim_wall:  '0.00566687461767392'
! ela_shortdim_wall:  '0.00425015596325544'
! ela_sqcm:  '595.671216871124'
! ela_sqm:  '0.0595671216871124'
! erv:  'no'
! estar_appl:  'none'
! ext_ltg_control:  ''
! ext_ltg_sch:  'ExteriorLighting'
! ext_wall_type:  'wood_framed'
! f_cfl_ext:  '0.2'
! f_cfl_gar:  '0.2'
! f_cfl_hw:  '0.2'
! f_inc_ext:  '0'
! f_inc_gar:  '0'
! f_inc_hw:  '0'
! f_led_ext:  '0.8'
! f_led_gar:  '0.8'
! f_led_hw:  '0.8'
! f_lf_ext:  '0'
! f_lf_gar:  '0'
! f_lf_hw:  '0'
! facade_watts:  '63.975'
! fan_eff:  '0.58'
! fan_power_per_ton:  '112'
! fan_total_eff:  '0.50054'
! floor_area:  '110.408921933086'
! fndn_zone:  'living'
! fndn_zone_unit:  'living_unit1'
! force_other_fndn_R0:  'yes'
! foundn_depth:  '0'
! fraction_ceil_under_attic:  '0.7'
! framing:  'hardwood'
```

```
! furred_framing_fraction:  '0.25'
! gain_ppl:  '2120.48051567536'
! gar_ltg_sch:  'InteriorLightingHE'
! garage_area:  '400'
! grout_cell_spacing:  '96'
! gtp_filename:  ''
! gtp_ref_floor:  'GroundSlabPreprocessorAverage'
! gtp_ref_floor_obj:  'surfPropOthSdCoefSlabAverage'
! has_ext_ltg_control:  'no'
! has_occ_sensors:  'no'
! has_ventilation:  'yes'
! heat_avail_sched:  'always_avail'
! heating_coil:  'electric'
! heating_fuel:  'electricity'
! heating_setpt:  '72'
! hers_dhw_gains_W:  '1.04420541093893'
! hourly_output:  'No'
! house:  'sitebuilt'
! hrv:  'no'
! hrv_aval:  'always_off'
! hrv_sensible_eff:  '0.65'
! hspf:  '8.2'
! hvac_type:  'heatpump'
! hw_ltg_sch:  'InteriorLightingHE'
! iecc_mels_adj_W_m2:  '1.54356736989469'
! iecc_mels_adj_kWhyr:  '1515.4067333724'
! ins_sheathing:  'eps'
! insulation_loc:  'exterior'
! is_HRef:  'no'
! is_HRtd:  'no'
! is_ISRD:  'yes'
! long_dim:  '12.1330909462833'
! longdim_wall_area:  '31.4424612937218'
! ltg_exterior:  '189.401978076923'
! ltg_exterior_W:  '43.2424607481559'
! ltg_exterior_benchmark:  '344.52'
```

```
! ltg_garage:  '21.9902447552448'
! ltg_garage_W:  '7.16294617434682'
! ltg_garage_benchmark:  '40'
! ltg_hardwired:  '713.272060441958'
! ltg_hw_benchmark:  '1297.4336'
! ltg_plugin:  '324.3584'
! ltg_plugin_benchmark:  '324.3584'
! max_dhw_temp:  '51'
! max_supply:  '0.56034'
! misc_eqpmt2_type:  'ElectricEquipment'
! motor_eff:  '0.863'
! my_coil_type:  'Coil:Cooling:DX:SingleSpeed'
! my_coil_type_heating:  'Coil:Heating:DX:SingleSpeed'
! n_bedrooms:  '3'
! n_doors:  '1'
! n_ppl:  '3'
! n_stories_per_unit:  '2'
! n_units:  '1'
! n_units_modeled:  '1'
! option:  ''
! p:  '5118'
! parkinglot_watts:  '793.72'
! pipe_ins_R:  '2'
! pipe_ins_k_SI:  '0.03317175'
! pipe_ins_thickness_SI:  '0.0127032520325203'
! plugin_ltg_sch:  'InteriorLightingHE'
! plugload_usage_factor:  '0.67553'
! prototype:  'singlefamily'
! r_bsmtwall:  '0.0001'
! r_ceiling:  '30'
! r_crawlwall:  '0'
! r_duct:  '8'
! r_fiberglass_blown:  '2.5'
! r_floor:  '0'
! r_masswall:  '3'
! r_returnduct:  '8'
```

```
! r_sheathing:  '0'
! r_slab:  '0'
! r_wall:  '13'
! re:  '2.75'
! return_duct_loc:  'attic'
! return_duct_loc_unit:  'attic_unit1'
! roof_const:  'Gable_end'
! roof_pitch:  '0.333333333333333'
! roof_pk_ht:  '1.51663636828541'
! roof_surface:  'Wall'
! runbsmt:  'no'
! runslab:  'yes'
! seer:  '14'
! semi_conditioned:  'no'
! sensitivity_analysis:  'no'
! shading_frac:  '0'
! shgc_skylight:  '0.25'
! shgc_window:  '0.25'
! short_dim:  '9.09981820971244'
! shortdim_wall_area:  '23.5818459702914'
! shower_gpm:  '2.25'
! shower_peak_flow:  '0.000141975'
! sink_gpm:  '1.14'
! sink_peak_flow:  '7.1934e-05'
! source_inlet_node:  'Condenser water outlet node_unit1'
! source_outlet_node:  'Condenser water inlet node_unit1'
! stack_coeff:  '0.00029'
! statfile:  'USA_FL_Miami.Intl.AP.722020_TMY3.stat'
! style_ceiling:  'attic'
! style_roof:  'gable'
! supply_duct_loc:  'attic'
! supply_duct_loc_unit:  'attic_unit1'
! supply_leak_ratio_of_total:  '0.5'
! system:  'heatpump'
! temp_vent_cms:  '0'
! thermostat_setpt:  'iecc'
```

```
! total_area:  '330.506150989138'
! u_door:  '0.5'
! u_duct_SI:  '0.709825'
! u_returnduct_SI:  '0.709825'
! u_skylight:  '0.75'
! u_window:  '0.5'
! ua:  '3.93819693017048'
! ua_si:  '2.07415438466871'
! unit_id:  '1'
! vent_cfm:  '60'
! vent_clearance:  '0.0101'
! vent_cms:  '0.0283168464628752'
! vent_fan_prs:  '227.022858530508'
! vent_fan_total_eff:  '0.6'
! vent_sch:  'always_avail'
! wall_framing_fraction:  '0.25'
! wall_ht:  '8.5'
! waterheater_loc_unit:  'living_unit1'
! weatherdir:  './tools/epw/'
! wind_coeff:  '0.000231'
! window_dist:  'equal'
! window_ht:  '1.52439024390244'
! window_ldb_l:  '2.70719591738945'
! window_ldf_l:  '2.70719591738945'
! window_sdl_l:  '2.70719591738945'
! window_sdr_l:  '2.70719591738945'
! wwr:  '0.15'
!
! ====================================================
```

same idf as the one above with battery and PV system implemented.

D.2 MIAMIPNNLB5PV90opt idf

```
!- Darwin Line endings

Version,
    9.5;                        !- Version Identifier

SimulationControl,
    Yes,                        !- Do Zone Sizing Calculation
    Yes,                        !- Do System Sizing Calculation
    No,                         !- Do Plant Sizing Calculation
    Yes,                        !- Run Simulation for Sizing Periods
    Yes,                        !- Run Simulation for Weather File Run
    Periods
    ,                           !- Do HVAC Sizing Simulation for
   Sizing Periods
    ;                           !- Maximum Number of HVAC Sizing
   Simulation Passes

Building,
    US+SF+CZ1AWH+hp+slab+IECC_2021,    !- Name
    0,                          !- North Axis
    Suburbs,                    !- Terrain
    0.04,                       !- Loads Convergence Tolerance Value
    0.4,                        !- Temperature Convergence Tolerance
   Value
    FullExterior,               !- Solar Distribution
    25,                         !- Maximum Number of Warmup Days
    6;                          !- Minimum Number of Warmup Days

SurfaceConvectionAlgorithm:Inside,
    TARP;                       !- Algorithm

Timestep,
    6;                          !- Number of Timesteps per Hour
```

```
Site:Location,
    Miami Intl Ap_FL_USA Design_Conditions,    !- Name
    25.82,                    !- Latitude
    -80.3,                    !- Longitude
    -5,                       !- Time Zone
    11;                       !- Elevation

SizingPeriod:DesignDay,
    Miami Intl Ap Ann Htg 99.6% Condns DB,    !- Name
    1,                        !- Month
    21,                       !- Day of Month
    WinterDesignDay,          !- Day Type
    8.7,                      !- Maximum DryBulb Temperature
    0,                        !- Daily DryBulb Temperature Range
    DefaultMultipliers,       !- DryBulb Temperature Range Modifier
   Type
    ,                         !- DryBulb Temperature Range Modifier
   Day Schedule Name
    Wetbulb,                  !- Humidity Condition Type
    8.7,                      !- Wetbulb or DewPoint at Maximum
   DryBulb
    ,                         !- Humidity Condition Day Schedule
   Name
    ,                         !- Humidity Ratio at Maximum DryBulb
    ,                         !- Enthalpy at Maximum DryBulb
    ,                         !- Daily WetBulb Temperature Range
    101193,                   !- Barometric Pressure
    3.8,                      !- Wind Speed
    340,                      !- Wind Direction
    No,                       !- Rain Indicator
    No,                       !- Snow Indicator
    No,                       !- Daylight Saving Time Indicator
    ASHRAEClearSky,           !- Solar Model Indicator
    ,                         !- Beam Solar Day Schedule Name
    ,                         !- Diffuse Solar Day Schedule Name
    ,                         !- ASHRAE Clear Sky Optical Depth for
```

```
   Beam Irradiance taub
    ,                        !- ASHRAE Clear Sky Optical Depth for
   Diffuse Irradiance taud
    0;                       !- Sky Clearness

SizingPeriod:DesignDay,
    Miami Intl Ap Ann Clg .4% Condns DB=>MWB,    !- Name
    7,                       !- Month
    21,                      !- Day of Month
    SummerDesignDay,         !- Day Type
    33.2,                    !- Maximum DryBulb Temperature
    6.7,                     !- Daily DryBulb Temperature Range
    DefaultMultipliers,      !- DryBulb Temperature Range Modifier
   Type
    ,                        !- DryBulb Temperature Range Modifier
   Day Schedule Name
    Wetbulb,                 !- Humidity Condition Type
    25.3,                    !- Wetbulb or DewPoint at Maximum
   DryBulb
    ,                        !- Humidity Condition Day Schedule
   Name
    ,                        !- Humidity Ratio at Maximum DryBulb
    ,                        !- Enthalpy at Maximum DryBulb
    ,                        !- Daily WetBulb Temperature Range
    101193,                  !- Barometric Pressure
    4.5,                     !- Wind Speed
    140,                     !- Wind Direction
    No,                      !- Rain Indicator
    No,                      !- Snow Indicator
    No,                      !- Daylight Saving Time Indicator
    ASHRAETau,               !- Solar Model Indicator
    ,                        !- Beam Solar Day Schedule Name
    ,                        !- Diffuse Solar Day Schedule Name
    0.528,                   !- ASHRAE Clear Sky Optical Depth for
   Beam Irradiance taub
    1.905;                   !- ASHRAE Clear Sky Optical Depth for
```

```
   Diffuse Irradiance taud

RunPeriod,
    annual,                  !- Name
    7,                       !- Begin Month
    12,                      !- Begin Day of Month
    ,                        !- Begin Year
    8,                       !- End Month
    15,                      !- End Day of Month
    ,                        !- End Year
    Sunday,                  !- Day of Week for Start Day
    Yes,                     !- Use Weather File Holidays and
   Special Days
    Yes,                     !- Use Weather File Daylight Saving
   Period
    No,                      !- Apply Weekend Holiday Rule
    Yes,                     !- Use Weather File Rain Indicators
    Yes;                     !- Use Weather File Snow Indicators

Site:WaterMainsTemperature,
    Correlation,             !- Calculation Method
    ,                        !- Temperature Schedule Name
    24.4916666666667,        !- Annual Average Outdoor Air
   Temperature
    8.7;                     !- Maximum Difference In Monthly
   Average Outdoor Air Temperatures

ScheduleTypeLimits,
    any number;              !- Name

ScheduleTypeLimits,
    On/Off,                  !- Name
    0,                       !- Lower Limit Value
    1,                       !- Upper Limit Value
    Discrete;                !- Numeric Type
```

```
ScheduleTypeLimits,
    control_type,             !- Name
    0,                        !- Lower Limit Value
    4,                        !- Upper Limit Value
    Discrete;                 !- Numeric Type

ScheduleTypeLimits,
    fraction,                 !- Name
    0,                        !- Lower Limit Value
    1,                        !- Upper Limit Value
    Continuous;               !- Numeric Type

ScheduleTypeLimits,
    Temperature,              !- Name
    -60,                      !- Lower Limit Value
    200,                      !- Upper Limit Value
    Continuous;               !- Numeric Type

ScheduleTypeLimits,
    Fractional,               !- Name
    0,                        !- Lower Limit Value
    1,                        !- Upper Limit Value
    Continuous,               !- Numeric Type
    dimensionless;            !- Unit Type

Schedule:Day:Hourly,
    OccupancyDay,             !- Name
    Fraction,                 !- Schedule Type Limits Name
    1,                        !- Hour 1
    1,                        !- Hour 2
    1,                        !- Hour 3
    1,                        !- Hour 4
    1,                        !- Hour 5
    1,                        !- Hour 6
    1,                        !- Hour 7
    0.8831,                   !- Hour 8
```

```
    0.40861,                  !- Hour 9
    0.24189,                  !- Hour 10
    0.24189,                  !- Hour 11
    0.24189,                  !- Hour 12
    0.24189,                  !- Hour 13
    0.24189,                  !- Hour 14
    0.24189,                  !- Hour 15
    0.24189,                  !- Hour 16
    0.29498,                  !- Hour 17
    0.5531,                   !- Hour 18
    0.89693,                  !- Hour 19
    0.89693,                  !- Hour 20
    0.89693,                  !- Hour 21
    1,                        !- Hour 22
    1,                        !- Hour 23
    1;                        !- Hour 24

Schedule:Day:Hourly,
    LightingDay,              !- Name
    Fraction,                 !- Schedule Type Limits Name
    0.0625,                   !- Hour 1
    0.0625,                   !- Hour 2
    0.0625,                   !- Hour 3
    0.0625,                   !- Hour 4
    0.1875,                   !- Hour 5
    0.390625,                 !- Hour 6
    0.4375,                   !- Hour 7
    0.390625,                 !- Hour 8
    0.171875,                 !- Hour 9
    0.1171875,                !- Hour 10
    0.1171875,                !- Hour 11
    0.1171875,                !- Hour 12
    0.1171875,                !- Hour 13
    0.1171875,                !- Hour 14
    0.1171875,                !- Hour 15
    0.203125,                 !- Hour 16
```

```
    0.4375,                   !- Hour 17
    0.609375,                 !- Hour 18
    0.8203125,                !- Hour 19
    0.984375,                 !- Hour 20
    1,                        !- Hour 21
    0.6875,                   !- Hour 22
    0.3828125,                !- Hour 23
    0.15625;                  !- Hour 24

Schedule:Day:Hourly,
    LightingDay_EELighting_OccSensors,    !- Name
    Fraction,                 !- Schedule Type Limits Name
    0.065170403,              !- Hour 1
    0.065170403,              !- Hour 2
    0.065170403,              !- Hour 3
    0.065170403,              !- Hour 4
    0.195511208,              !- Hour 5
    0.407315016,              !- Hour 6
    0.456192818,              !- Hour 7
    0.407315016,              !- Hour 8
    0.179218607,              !- Hour 9
    0.122194505,              !- Hour 10
    0.122194505,              !- Hour 11
    0.122194505,              !- Hour 12
    0.122194505,              !- Hour 13
    0.122194505,              !- Hour 14
    0.122194505,              !- Hour 15
    0.211803808,              !- Hour 16
    0.456192818,              !- Hour 17
    0.635411425,              !- Hour 18
    0.855361533,              !- Hour 19
    0.947933128,              !- Hour 20
    0.947933128,              !- Hour 21
    0.716874428,              !- Hour 22
    0.399168715,              !- Hour 23
    0.162926006;              !- Hour 24
```

```
Schedule:Day:Hourly,
    LightingDay_EELighting_Garage_OccSensors,    !- Name
    Fraction,                 !- Schedule Type Limits Name
    0.048125,                 !- Hour 1
    0.048125,                 !- Hour 2
    0.048125,                 !- Hour 3
    0.048125,                 !- Hour 4
    0.144375,                 !- Hour 5
    0.30078125,               !- Hour 6
    0.336875,                 !- Hour 7
    0.30078125,               !- Hour 8
    0.13234375,               !- Hour 9
    0.090234375,              !- Hour 10
    0.090234375,              !- Hour 11
    0.090234375,              !- Hour 12
    0.090234375,              !- Hour 13
    0.090234375,              !- Hour 14
    0.090234375,              !- Hour 15
    0.15640625,               !- Hour 16
    0.336875,                 !- Hour 17
    0.46921875,               !- Hour 18
    0.631640625,              !- Hour 19
    0.7,                      !- Hour 20
    0.7,                      !- Hour 21
    0.529375,                 !- Hour 22
    0.294765625,              !- Hour 23
    0.1203125;                !- Hour 24

Schedule:Day:Hourly,
    ExteriorLightingDay,      !- Name
    Fraction,                 !- Schedule Type Limits Name
    1,                        !- Hour 1
    1,                        !- Hour 2
    1,                        !- Hour 3
    1,                        !- Hour 4
```

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    1,                          !- Hour 5
    1,                          !- Hour 6
    0,                          !- Hour 7
    0,                          !- Hour 8
    0,                          !- Hour 9
    0,                          !- Hour 10
    0,                          !- Hour 11
    0,                          !- Hour 12
    0,                          !- Hour 13
    0,                          !- Hour 14
    0,                          !- Hour 15
    0,                          !- Hour 16
    0,                          !- Hour 17
    0,                          !- Hour 18
    1,                          !- Hour 19
    1,                          !- Hour 20
    1,                          !- Hour 21
    1,                          !- Hour 22
    1,                          !- Hour 23
    1;                          !- Hour 24

Schedule:Day:Hourly,
    LightingDay_EELighting,     !- Name
    Fraction,                   !- Schedule Type Limits Name
    0.06875,                    !- Hour 1
    0.06875,                    !- Hour 2
    0.06875,                    !- Hour 3
    0.06875,                    !- Hour 4
    0.20625,                    !- Hour 5
    0.4296875,                  !- Hour 6
    0.48125,                    !- Hour 7
    0.4296875,                  !- Hour 8
    0.1890625,                  !- Hour 9
    0.12890625,                 !- Hour 10
    0.12890625,                 !- Hour 11
    0.12890625,                 !- Hour 12
```

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    0.12890625,               !- Hour 13
    0.12890625,               !- Hour 14
    0.12890625,               !- Hour 15
    0.2234375,                !- Hour 16
    0.48125,                  !- Hour 17
    0.6703125,                !- Hour 18
    0.90234375,               !- Hour 19
    1,                        !- Hour 20
    1,                        !- Hour 21
    0.75625,                  !- Hour 22
    0.42109375,               !- Hour 23
    0.171875;                 !- Hour 24

Schedule:Day:Hourly,
    RefrigeratorDay,          !- Name
    Fraction,                 !- Schedule Type Limits Name
    0.8,                      !- Hour 1
    0.782696177062374,        !- Hour 2
    0.765593561368209,        !- Hour 3
    0.742857142857143,        !- Hour 4
    0.731388329979879,        !- Hour 5
    0.731388329979879,        !- Hour 6
    0.759959758551308,        !- Hour 7
    0.8,                      !- Hour 8
    0.817102615694165,        !- Hour 9
    0.828571428571429,        !- Hour 10
    0.8,                      !- Hour 11
    0.8,                      !- Hour 12
    0.839839034205231,        !- Hour 13
    0.839839034205231,        !- Hour 14
    0.828571428571429,        !- Hour 15
    0.839839034205231,        !- Hour 16
    0.885714285714286,        !- Hour 17
    0.971428571428572,        !- Hour 18
    1,                        !- Hour 19
    0.971428571428572,        !- Hour 20
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    0.942857142857143,        !- Hour 21
    0.925553319919517,        !- Hour 22
    0.885714285714286,        !- Hour 23
    0.828571428571429;        !- Hour 24

Schedule:Day:Hourly,
    MiscPlugLoadDay,          !- Name
    Fraction,                 !- Schedule Type Limits Name
    0.607490272373541,        !- Hour 1
    0.559338521400778,        !- Hour 2
    0.552853437094682,        !- Hour 3
    0.545071335927367,        !- Hour 4
    0.524481193255512,        !- Hour 5
    0.585278858625162,        !- Hour 6
    0.676232166018158,        !- Hour 7
    0.718547341115435,        !- Hour 8
    0.607490272373541,        !- Hour 9
    0.517023346303502,        !- Hour 10
    0.529182879377432,        !- Hour 11
    0.529345006485084,        !- Hour 12
    0.520428015564202,        !- Hour 13
    0.538424124513619,        !- Hour 14
    0.568741893644617,        !- Hour 15
    0.600356679636835,        !- Hour 16
    0.71011673151751,         !- Hour 17
    0.862678339818418,        !- Hour 18
    0.936608300907912,        !- Hour 19
    0.966763942931258,        !- Hour 20
    1,                        !- Hour 21
    0.976653696498055,        !- Hour 22
    0.845168612191959,        !- Hour 23
    0.73443579766537;         !- Hour 24

Schedule:Day:Hourly,
    CookingRangeDay,          !- Name
    Fraction,                 !- Schedule Type Limits Name
```

```
    0.04715848452508,         !- Hour 1
    0.04715848452508,         !- Hour 2
    0.0235458911419424,       !- Hour 3
    0.0235458911419424,       !- Hour 4
    0.04715848452508,         !- Hour 5
    0.0707043756670224,       !- Hour 6
    0.165088046958378,        !- Hour 7
    0.283017609391676,        !- Hour 8
    0.306563500533618,        !- Hour 9
    0.320771077908218,        !- Hour 10
    0.283017609391676,        !- Hour 11
    0.330176093916756,        !- Hour 12
    0.377334578441836,        !- Hour 13
    0.306563500533618,        !- Hour 14
    0.292422625400213,        !- Hour 15
    0.377334578441836,        !- Hour 16
    0.613193703308431,        !- Hour 17
    1,                        !- Hour 18
    0.778348452508004,        !- Hour 19
    0.400947171824973,        !- Hour 20
    0.235859124866596,        !- Hour 21
    0.165088046958378,        !- Hour 22
    0.103721985058698,        !- Hour 23
    0.0707043756670224;       !- Hour 24

Schedule:Day:Hourly,
    DishwasherWeekday,        !- Name
    Fraction,                 !- Schedule Type Limits Name
    0.115858456545258,        !- Hour 1
    0.0514758745041469,       !- Hour 2
    0.0385691669671833,       !- Hour 3
    0.0257379372520738,       !- Hour 4
    0.0257379372520738,       !- Hour 5
    0.0772138117562207,       !- Hour 6
    0.154503101334295,        !- Hour 7
    0.23179239091237,         !- Hour 8
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    0.437922322394519,        !- Hour 9
    0.489398196898665,        !- Hour 10
    0.425015614857555,        !- Hour 11
    0.360633032816445,        !- Hour 12
    0.309081680490443,        !- Hour 13
    0.347726325279481,        !- Hour 14
    0.28334374323837,         !- Hour 15
    0.270437035701407,        !- Hour 16
    0.28334374323837,         !- Hour 17
    0.373464262531554,        !- Hour 18
    0.656883483591778,        !- Hour 19
    0.837199999999997,        !- Hour 20
    0.682621420843852,        !- Hour 21
    0.502304904435629,        !- Hour 22
    0.334819617742518,        !- Hour 23
    0.23179239091237;         !- Hour 24

Schedule:Day:Hourly,
    DishwasherWeekend,        !- Name
    Fraction,                 !- Schedule Type Limits Name
    0.124134060584205,        !- Hour 1
    0.0551527226830148,       !- Hour 2
    0.0413241074648395,       !- Hour 3
    0.0275763613415074,       !- Hour 4
    0.0275763613415074,       !- Hour 5
    0.0827290840245222,       !- Hour 6
    0.165539037143888,        !- Hour 7
    0.248348990263252,        !- Hour 8
    0.469202488279841,        !- Hour 9
    0.524355210962856,        !- Hour 10
    0.455373873061666,        !- Hour 11
    0.386392535160476,        !- Hour 12
    0.331158943382618,        !- Hour 13
    0.3725639199423,          !- Hour 14
    0.303582582041111,        !- Hour 15
    0.289753966822935,        !- Hour 16
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    0.303582582041111,        !- Hour 17
    0.400140281283808,        !- Hour 18
    0.703803732419762,        !- Hour 19
    0.897,                    !- Hour 20
    0.731380093761269,        !- Hour 21
    0.538183826181031,        !- Hour 22
    0.358735304724125,        !- Hour 23
    0.248348990263252;        !- Hour 24

Schedule:Day:Hourly,
    DishwasherVacation,       !- Name
    Fraction,                 !- Schedule Type Limits Name
    0,                        !- Hour 1
    0,                        !- Hour 2
    0,                        !- Hour 3
    0,                        !- Hour 4
    0,                        !- Hour 5
    0,                        !- Hour 6
    0,                        !- Hour 7
    0,                        !- Hour 8
    0,                        !- Hour 9
    0,                        !- Hour 10
    0,                        !- Hour 11
    0,                        !- Hour 12
    0,                        !- Hour 13
    0,                        !- Hour 14
    0,                        !- Hour 15
    0,                        !- Hour 16
    0,                        !- Hour 17
    0,                        !- Hour 18
    0,                        !- Hour 19
    0,                        !- Hour 20
    0,                        !- Hour 21
    0,                        !- Hour 22
    0,                        !- Hour 23
    0;                        !- Hour 24
```

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Schedule:Day:Hourly,
    ClothesWasherWeekday,     !- Name
    Fraction,                 !- Schedule Type Limits Name
    0.0796474528960224,       !- Hour 1
    0.0637009071877185,       !- Hour 2
    0.0318078157711097,       !- Hour 3
    0.0318078157711097,       !- Hour 4
    0.0637009071877185,       !- Hour 5
    0.0955939986043261,       !- Hour 6
    0.191187997208654,        !- Hour 7
    0.414354361479414,        !- Hour 8
    0.62157418004187,         !- Hour 9
    0.7332,                   !- Hour 10
    0.717253454291697,        !- Hour 11
    0.637520725750175,        !- Hour 12
    0.573734542916957,        !- Hour 13
    0.510033635729239,        !- Hour 14
    0.446247452896022,        !- Hour 15
    0.414354361479414,        !- Hour 16
    0.430300907187718,        !- Hour 17
    0.414354361479414,        !- Hour 18
    0.414354361479414,        !- Hour 19
    0.414354361479414,        !- Hour 20
    0.414354361479414,        !- Hour 21
    0.398407815771109,        !- Hour 22
    0.270920725750174,        !- Hour 23
    0.143433635729239;        !- Hour 24

Schedule:Day:Hourly,
    ClothesWasherWeekend,     !- Name
    Fraction,                 !- Schedule Type Limits Name
    0.0974410327983253,       !- Hour 1
    0.0779319609211445,       !- Hour 2
    0.038913817166783,        !- Hour 3
    0.038913817166783,        !- Hour 4
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```
    0.0779319609211445,       !- Hour 5
    0.116950104675506,        !- Hour 6
    0.233900209351012,        !- Hour 7
    0.506922889043964,        !- Hour 8
    0.760436496859734,        !- Hour 9
    0.897,                    !- Hour 10
    0.877490928122819,        !- Hour 11
    0.779945568736915,        !- Hour 12
    0.701909281228193,        !- Hour 13
    0.623977320307048,        !- Hour 14
    0.545941032798325,        !- Hour 15
    0.506922889043964,        !- Hour 16
    0.526431960921144,        !- Hour 17
    0.506922889043964,        !- Hour 18
    0.506922889043964,        !- Hour 19
    0.506922889043964,        !- Hour 20
    0.506922889043964,        !- Hour 21
    0.487413817166783,        !- Hour 22
    0.331445568736915,        !- Hour 23
    0.175477320307048;        !- Hour 24

Schedule:Day:Hourly,
    ClothesWasherVacation,    !- Name
    Fraction,                 !- Schedule Type Limits Name
    0,                        !- Hour 1
    0,                        !- Hour 2
    0,                        !- Hour 3
    0,                        !- Hour 4
    0,                        !- Hour 5
    0,                        !- Hour 6
    0,                        !- Hour 7
    0,                        !- Hour 8
    0,                        !- Hour 9
    0,                        !- Hour 10
    0,                        !- Hour 11
    0,                        !- Hour 12
```

```
    0,                          !- Hour 13
    0,                          !- Hour 14
    0,                          !- Hour 15
    0,                          !- Hour 16
    0,                          !- Hour 17
    0,                          !- Hour 18
    0,                          !- Hour 19
    0,                          !- Hour 20
    0,                          !- Hour 21
    0,                          !- Hour 22
    0,                          !- Hour 23
    0;                          !- Hour 24

Schedule:Day:Hourly,
    dhw_profile_day,            !- Name
    fraction,                   !- Schedule Type Limits Name
    0.006,                      !- Hour 1
    0.003,                      !- Hour 2
    0.001,                      !- Hour 3
    0.001,                      !- Hour 4
    0.003,                      !- Hour 5
    0.021,                      !- Hour 6
    0.075,                      !- Hour 7
    0.079,                      !- Hour 8
    0.076,                      !- Hour 9
    0.067,                      !- Hour 10
    0.061,                      !- Hour 11
    0.05,                       !- Hour 12
    0.042,                      !- Hour 13
    0.038,                      !- Hour 14
    0.033,                      !- Hour 15
    0.038,                      !- Hour 16
    0.043,                      !- Hour 17
    0.058,                      !- Hour 18
    0.068,                      !- Hour 19
    0.065,                      !- Hour 20
```

```
    0.06,                    !- Hour 21
    0.047,                   !- Hour 22
    0.041,                   !- Hour 23
    0.024;                   !- Hour 24

Schedule:Day:Hourly,
    ClothesDryerWeekday,     !- Name
    Fraction,                !- Schedule Type Limits Name
    0.0996818663838815,      !- Hour 1
    0.0598091198303289,      !- Hour 2
    0.0398727465535526,      !- Hour 3
    0.0199363732767763,      !- Hour 4
    0.0398727465535526,      !- Hour 5
    0.0598091198303289,      !- Hour 6
    0.15949098621421,        !- Hour 7
    0.31898197242842,        !- Hour 8
    0.486427370202556,       !- Hour 9
    0.685791102970318,       !- Hour 10
    0.785472969354199,       !- Hour 11
    0.817391304347826,       !- Hour 12
    0.745600222800647,       !- Hour 13
    0.677836691410393,       !- Hour 14
    0.610073160020138,       !- Hour 15
    0.578154825026511,       !- Hour 16
    0.558218451749735,       !- Hour 17
    0.546236490032885,       !- Hour 18
    0.518345705196183,       !- Hour 19
    0.510391293636256,       !- Hour 20
    0.526300116756109,       !- Hour 21
    0.546236490032885,       !- Hour 22
    0.438600212089077,       !- Hour 23
    0.239236479321316;       !- Hour 24

Schedule:Day:Hourly,
    ClothesDryerWeekend,     !- Name
    Fraction,                !- Schedule Type Limits Name
```

```
    0.121951219512195,        !- Hour 1
    0.0731707317073171,       !- Hour 2
    0.0487804878048781,       !- Hour 3
    0.024390243902439,        !- Hour 4
    0.0487804878048781,       !- Hour 5
    0.0731707317073171,       !- Hour 6
    0.195121951219512,        !- Hour 7
    0.390243902439024,        !- Hour 8
    0.59509731460951,         !- Hour 9
    0.8389997536339,          !- Hour 10
    0.960950973146095,        !- Hour 11
    1,                        !- Hour 12
    0.912170485341217,        !- Hour 13
    0.829268292682927,        !- Hour 14
    0.746366100024637,        !- Hour 15
    0.707317073170732,        !- Hour 16
    0.682926829268293,        !- Hour 17
    0.668268046316827,        !- Hour 18
    0.634146341463415,        !- Hour 19
    0.624414880512441,        !- Hour 20
    0.643877802414388,        !- Hour 21
    0.668268046316827,        !- Hour 22
    0.536585365853659,        !- Hour 23
    0.292682926829268;        !- Hour 24

Schedule:Day:Hourly,
    ClothesDryerVacation,     !- Name
    Fraction,                 !- Schedule Type Limits Name
    0,                        !- Hour 1
    0,                        !- Hour 2
    0,                        !- Hour 3
    0,                        !- Hour 4
    0,                        !- Hour 5
    0,                        !- Hour 6
    0,                        !- Hour 7
    0,                        !- Hour 8
```

```
    0,                          !- Hour 9
    0,                          !- Hour 10
    0,                          !- Hour 11
    0,                          !- Hour 12
    0,                          !- Hour 13
    0,                          !- Hour 14
    0,                          !- Hour 15
    0,                          !- Hour 16
    0,                          !- Hour 17
    0,                          !- Hour 18
    0,                          !- Hour 19
    0,                          !- Hour 20
    0,                          !- Hour 21
    0,                          !- Hour 22
    0,                          !- Hour 23
    0;                          !- Hour 24

Schedule:Day:Hourly,
    SinksWeekday,               !- Name
    Fraction,                   !- Schedule Type Limits Name
    0.160052687884461,          !- Hour 1
    0.0767484287242575,         !- Hour 2
    0.0575330636533838,         !- Hour 3
    0.0575330636533838,         !- Hour 4
    0.0767484287242575,         !- Hour 5
    0.204926216902916,          !- Hour 6
    0.480271095212623,          !- Hour 7
    0.704412677186414,          !- Hour 8
    0.742843407328163,          !- Hour 9
    0.697969878309708,          !- Hour 10
    0.614778650708746,          !- Hour 11
    0.563462322813587,          !- Hour 12
    0.550689756619418,          !- Hour 13
    0.512259026477668,          !- Hour 14
    0.467385497459214,          !- Hour 15
    0.486600862530089,          !- Hour 16
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    0.544246957742712,        !- Hour 17
    0.736400608451458,        !- Hour 18
    0.84525,                  !- Hour 19
    0.781274137469912,        !- Hour 20
    0.640323783097085,        !- Hour 21
    0.544246957742712,        !- Hour 22
    0.44828316394758,         !- Hour 23
    0.307332809574753;        !- Hour 24

Schedule:Day:Hourly,
    SinksWeekend,             !- Name
    Fraction,                 !- Schedule Type Limits Name
    0.169851832040653,        !- Hour 1
    0.0814473121155389,       !- Hour 2
    0.0610554961219577,       !- Hour 3
    0.0610554961219577,       !- Hour 4
    0.0814473121155389,       !- Hour 5
    0.217472719978604,        !- Hour 6
    0.509675447980744,        !- Hour 7
    0.747539983952929,        !- Hour 8
    0.788323615940091,        !- Hour 9
    0.74070272800214,         !- Hour 10
    0.652418159935812,        !- Hour 11
    0.597960016047071,        !- Hour 12
    0.58440545600428,         !- Hour 13
    0.543621824017117,        !- Hour 14
    0.496000936079166,        !- Hour 15
    0.516392752072746,        !- Hour 16
    0.57756820005349,         !- Hour 17
    0.781486359989302,        !- Hour 18
    0.897,                    !- Hour 19
    0.829107247927254,        !- Hour 20
    0.679527280021396,        !- Hour 21
    0.57756820005349,         !- Hour 22
    0.47572907194437,         !- Hour 23
    0.326149104038513;        !- Hour 24
```

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Schedule:Day:Hourly,
    SinksVacation,            !- Name
    Fraction,                 !- Schedule Type Limits Name
    0,                        !- Hour 1
    0,                        !- Hour 2
    0,                        !- Hour 3
    0,                        !- Hour 4
    0,                        !- Hour 5
    0,                        !- Hour 6
    0,                        !- Hour 7
    0,                        !- Hour 8
    0,                        !- Hour 9
    0,                        !- Hour 10
    0,                        !- Hour 11
    0,                        !- Hour 12
    0,                        !- Hour 13
    0,                        !- Hour 14
    0,                        !- Hour 15
    0,                        !- Hour 16
    0,                        !- Hour 17
    0,                        !- Hour 18
    0,                        !- Hour 19
    0,                        !- Hour 20
    0,                        !- Hour 21
    0,                        !- Hour 22
    0,                        !- Hour 23
    0;                        !- Hour 24

Schedule:Day:Hourly,
    ShowersWeekday,           !- Name
    Fraction,                 !- Schedule Type Limits Name
    0.076044361285933,        !- Hour 1
    0.0345332539547544,       !- Hour 2
    0.0242088790610646,       !- Hour 3
    0.0345332539547544,       !- Hour 4
```

```
    0.0968355162442594,       !- Hour 5
    0.366693315189659,        !- Hour 6
    0.837199999999997,        !- Hour 7
    0.830293349209049,        !- Hour 8
    0.674644497363497,        !- Hour 9
    0.529320020411635,        !- Hour 10
    0.425506650790951,        !- Hour 11
    0.335577785337642,        !- Hour 12
    0.242159993196122,        !- Hour 13
    0.207555536655894,        !- Hour 14
    0.179857730906617,        !- Hour 15
    0.186764381697567,        !- Hour 16
    0.214462187446844,        !- Hour 17
    0.27676444973635,         !- Hour 18
    0.300973328797414,        !- Hour 19
    0.300973328797414,        !- Hour 20
    0.297484402109202,        !- Hour 21
    0.290577751318252,        !- Hour 22
    0.207555536655894,        !- Hour 23
    0.148742201054601;        !- Hour 24

Schedule:Day:Hourly,
    ShowersWeekend,           !- Name
    Fraction,                 !- Schedule Type Limits Name
    0.0814761013777853,       !- Hour 1
    0.0369999149515223,       !- Hour 2
    0.0259380847082837,       !- Hour 3
    0.0369999149515223,       !- Hour 4
    0.103752338833135,        !- Hour 5
    0.392885694846062,        !- Hour 6
    0.897,                    !- Hour 7
    0.889600017009696,        !- Hour 8
    0.722833390032318,        !- Hour 9
    0.56712859329818,         !- Hour 10
    0.455899982990304,        !- Hour 11
    0.359547627147474,        !- Hour 12
```

```
    0.259457135567274,        !- Hour 13
    0.222380932131315,        !- Hour 14
    0.19270471168566,         !- Hour 15
    0.200104694675966,        !- Hour 16
    0.229780915121619,        !- Hour 17
    0.296533339003232,        !- Hour 18
    0.322471423711515,        !- Hour 19
    0.322471423711515,        !- Hour 20
    0.318733287974145,        !- Hour 21
    0.311333304983841,        !- Hour 22
    0.222380932131315,        !- Hour 23
    0.159366643987073;        !- Hour 24

Schedule:Day:Hourly,
    ShowersVacation,          !- Name
    Fraction,                 !- Schedule Type Limits Name
    0,                        !- Hour 1
    0,                        !- Hour 2
    0,                        !- Hour 3
    0,                        !- Hour 4
    0,                        !- Hour 5
    0,                        !- Hour 6
    0,                        !- Hour 7
    0,                        !- Hour 8
    0,                        !- Hour 9
    0,                        !- Hour 10
    0,                        !- Hour 11
    0,                        !- Hour 12
    0,                        !- Hour 13
    0,                        !- Hour 14
    0,                        !- Hour 15
    0,                        !- Hour 16
    0,                        !- Hour 17
    0,                        !- Hour 18
    0,                        !- Hour 19
    0,                        !- Hour 20
```

```
    0,                          !- Hour 21
    0,                          !- Hour 22
    0,                          !- Hour 23
    0;                          !- Hour 24

Schedule:Day:Hourly,
    BathsWeekday,               !- Name
    Fraction,                   !- Schedule Type Limits Name
    0.0492758944582015,         !- Hour 1
    0.0246379472291013,         !- Hour 2
    0.0246379472291013,         !- Hour 3
    0.0246379472291013,         !- Hour 4
    0.0492758944582015,         !- Hour 5
    0.123189736145504,          !- Hour 6
    0.295719195628041,          !- Hour 7
    0.369633037315344,          !- Hour 8
    0.418908931773546,          !- Hour 9
    0.369633037315344,          !- Hour 10
    0.295719195628041,          !- Hour 11
    0.221741525061908,          !- Hour 12
    0.197103577832807,          !- Hour 13
    0.147827683374605,          !- Hour 14
    0.147827683374605,          !- Hour 15
    0.147827683374605,          !- Hour 16
    0.24644330116984,           !- Hour 17
    0.295719195628041,          !- Hour 18
    0.492886602339681,          !- Hour 19
    0.640714285714285,          !- Hour 20
    0.640714285714285,          !- Hour 21
    0.492886602339681,          !- Hour 22
    0.418908931773546,          !- Hour 23
    0.24644330116984;           !- Hour 24

Schedule:Day:Hourly,
    BathsWeekend,               !- Name
    Fraction,                   !- Schedule Type Limits Name
```

```
    0.0689862522414824,       !- Hour 1
    0.0344931261207412,       !- Hour 2
    0.0344931261207412,       !- Hour 3
    0.0344931261207412,       !- Hour 4
    0.0689862522414824,       !- Hour 5
    0.172465630603706,        !- Hour 6
    0.414006873879259,        !- Hour 7
    0.517486252241482,        !- Hour 8
    0.586472504482965,        !- Hour 9
    0.517486252241482,        !- Hour 10
    0.414006873879259,        !- Hour 11
    0.310438135086671,        !- Hour 12
    0.27594500896593,         !- Hour 13
    0.206958756724447,        !- Hour 14
    0.206958756724447,        !- Hour 15
    0.206958756724447,        !- Hour 16
    0.345020621637776,        !- Hour 17
    0.414006873879259,        !- Hour 18
    0.690041243275553,        !- Hour 19
    0.897,                    !- Hour 20
    0.897,                    !- Hour 21
    0.690041243275553,        !- Hour 22
    0.586472504482965,        !- Hour 23
    0.345020621637776;        !- Hour 24

Schedule:Day:Hourly,
    BathsVacation,            !- Name
    Fraction,                 !- Schedule Type Limits Name
    0,                        !- Hour 1
    0,                        !- Hour 2
    0,                        !- Hour 3
    0,                        !- Hour 4
    0,                        !- Hour 5
    0,                        !- Hour 6
    0,                        !- Hour 7
    0,                        !- Hour 8
```

```
    0,                          !- Hour 9
    0,                          !- Hour 10
    0,                          !- Hour 11
    0,                          !- Hour 12
    0,                          !- Hour 13
    0,                          !- Hour 14
    0,                          !- Hour 15
    0,                          !- Hour 16
    0,                          !- Hour 17
    0,                          !- Hour 18
    0,                          !- Hour 19
    0,                          !- Hour 20
    0,                          !- Hour 21
    0,                          !- Hour 22
    0,                          !- Hour 23
    0;                          !- Hour 24

Schedule:Day:Hourly,
    DHWDistDay,                 !- Name
    Fraction,                   !- Schedule Type Limits Name
    0.142553149370226,          !- Hour 1
    0.0764866759550322,         !- Hour 2
    0.0516611840277747,         !- Hour 3
    0.0584039294664903,         !- Hour 4
    0.121469841058603,          !- Hour 5
    0.366180268451559,          !- Hour 6
    0.833258955739606,          !- Hour 7
    0.999999987228391,          !- Hour 8
    0.995483090581232,          !- Hour 9
    0.916474762598139,          !- Hour 10
    0.800898393293271,          !- Hour 11
    0.682564390940485,          !- Hour 12
    0.590066600109555,          !- Hour 13
    0.522371887032053,          !- Hour 14
    0.466005974303267,          !- Hour 15
    0.46573704253214,           !- Hour 16
```

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    0.527514234916123,        !- Hour 17
    0.637905701335668,        !- Hour 18
    0.727588642310272,        !- Hour 19
    0.732551127624518,        !- Hour 20
    0.681468471942116,        !- Hour 21
    0.610804704600985,        !- Hour 22
    0.464292318119835,        !- Hour 23
    0.299867724445383;        !- Hour 24

Schedule:Day:Hourly,
    WinterLoadDay,            !- Name
    Fraction,                 !- Schedule Type Limits Name
    0,                        !- Hour 1
    0,                        !- Hour 2
    0,                        !- Hour 3
    0,                        !- Hour 4
    0,                        !- Hour 5
    0,                        !- Hour 6
    0,                        !- Hour 7
    0,                        !- Hour 8
    0,                        !- Hour 9
    0,                        !- Hour 10
    0,                        !- Hour 11
    0,                        !- Hour 12
    0,                        !- Hour 13
    0,                        !- Hour 14
    0,                        !- Hour 15
    0,                        !- Hour 16
    0,                        !- Hour 17
    0,                        !- Hour 18
    0,                        !- Hour 19
    0,                        !- Hour 20
    0,                        !- Hour 21
    0,                        !- Hour 22
    0,                        !- Hour 23
    0;                        !- Hour 24
```

```
Schedule:Day:Hourly,
    SummerLoadDay,            !- Name
    Fraction,                 !- Schedule Type Limits Name
    1,                        !- Hour 1
    1,                        !- Hour 2
    1,                        !- Hour 3
    1,                        !- Hour 4
    1,                        !- Hour 5
    1,                        !- Hour 6
    1,                        !- Hour 7
    1,                        !- Hour 8
    1,                        !- Hour 9
    1,                        !- Hour 10
    1,                        !- Hour 11
    1,                        !- Hour 12
    1,                        !- Hour 13
    1,                        !- Hour 14
    1,                        !- Hour 15
    1,                        !- Hour 16
    1,                        !- Hour 17
    1,                        !- Hour 18
    1,                        !- Hour 19
    1,                        !- Hour 20
    1,                        !- Hour 21
    1,                        !- Hour 22
    1,                        !- Hour 23
    1;                        !- Hour 24

Schedule:Week:Compact,
    RefrigeratorWeek,         !- Name
    For: AllDays,             !- DayType List 1
    RefrigeratorDay;          !- ScheduleDay Name 1

Schedule:Week:Compact,
    MiscPlugLoadWeek,         !- Name
```

```
    For: AllDays,              !- DayType List 1
    MiscPlugLoadDay;           !- ScheduleDay Name 1

Schedule:Week:Compact,
    CookingRangeWeek,          !- Name
    For: AllDays,              !- DayType List 1
    CookingRangeDay;           !- ScheduleDay Name 1

Schedule:Week:Compact,
    DishwasherWeek,            !- Name
    For: Weekdays,             !- DayType List 1
    DishwasherWeekday,         !- ScheduleDay Name 1
    For: CustomDay1,           !- DayType List 2
    DishwasherVacation,        !- ScheduleDay Name 2
    For: AllOtherDays,         !- DayType List 3
    DishwasherWeekend;         !- ScheduleDay Name 3

Schedule:Week:Compact,
    ClothesWasherWeek,         !- Name
    For: Weekdays,             !- DayType List 1
    ClothesWasherWeekday,      !- ScheduleDay Name 1
    For: CustomDay1,           !- DayType List 2
    ClothesWasherVacation,     !- ScheduleDay Name 2
    For: AllOtherDays,         !- DayType List 3
    ClothesWasherWeekend;      !- ScheduleDay Name 3

Schedule:Week:Compact,
    dhw_profile_week,          !- Name
    AllDays,                   !- DayType List 1
    dhw_profile_day;           !- ScheduleDay Name 1

Schedule:Week:Compact,
    ClothesDryerWeek,          !- Name
    For: Weekdays,             !- DayType List 1
    ClothesDryerWeekday,       !- ScheduleDay Name 1
    For: CustomDay1,           !- DayType List 2
```

```
    ClothesDryerVacation,     !- ScheduleDay Name 2
    For: AllOtherDays,        !- DayType List 3
    ClothesDryerWeekend;      !- ScheduleDay Name 3

Schedule:Week:Compact,
    SinksWeek,                !- Name
    For: Weekdays,            !- DayType List 1
    SinksWeekday,             !- ScheduleDay Name 1
    For: CustomDay1,          !- DayType List 2
    SinksVacation,            !- ScheduleDay Name 2
    For: AllOtherDays,        !- DayType List 3
    SinksWeekend;             !- ScheduleDay Name 3

Schedule:Week:Compact,
    ShowersWeek,              !- Name
    For: Weekdays,            !- DayType List 1
    ShowersWeekday,           !- ScheduleDay Name 1
    For: CustomDay1,          !- DayType List 2
    ShowersVacation,          !- ScheduleDay Name 2
    For: AllOtherDays,        !- DayType List 3
    ShowersWeekend;           !- ScheduleDay Name 3

Schedule:Week:Compact,
    BathsWeek,                !- Name
    For: Weekdays,            !- DayType List 1
    BathsWeekday,             !- ScheduleDay Name 1
    For: CustomDay1,          !- DayType List 2
    BathsVacation,            !- ScheduleDay Name 2
    For: AllOtherDays,        !- DayType List 3
    BathsWeekend;             !- ScheduleDay Name 3

Schedule:Week:Compact,
    DHWDistWeek,              !- Name
    For: AllDays,             !- DayType List 1
    DHWDistDay;               !- ScheduleDay Name 1
```

```
Schedule:Week:Compact,
    OccupancyWeek,            !- Name
    AllDays,                  !- DayType List 1
    OccupancyDay;             !- ScheduleDay Name 1

Schedule:Week:Compact,
    LightingProfileWeek,      !- Name
    For: AllDays,             !- DayType List 1
    LightingDay;              !- ScheduleDay Name 1

Schedule:Week:Compact,
    LightingProfileWeek_EELighting,    !- Name
    For: AllDays,             !- DayType List 1
    LightingDay_EELighting;    !- ScheduleDay Name 1

Schedule:Week:Compact,
    LightingProfileWeek_EELighting_interior_controls,    !- Name
    For: AllDays,             !- DayType List 1
    LightingDay_EELighting_OccSensors;    !- ScheduleDay Name 1

Schedule:Week:Compact,
    LightingProfileWeek_EELighting_garage_controls,    !- Name
    For: AllDays,             !- DayType List 1
    LightingDay_EELighting_Garage_OccSensors;    !- ScheduleDay Name
    1

Schedule:Week:Compact,
    ExteriorLightingProfileWeek,    !- Name
    For: AllDays,             !- DayType List 1
    ExteriorLightingDay;      !- ScheduleDay Name 1

Schedule:Year,
    Occupancy,                !- Name
    Fraction,                 !- Schedule Type Limits Name
    OccupancyWeek,            !- ScheduleWeek Name 1
    1,                        !- Start Month 1
```

```
    1,                          !- Start Day 1
    12,                         !- End Month 1
    31;                         !- End Day 1

Schedule:Year,
    InteriorLighting,           !- Name
    Fraction,                   !- Schedule Type Limits Name
    LightingProfileWeek,        !- ScheduleWeek Name 1
    1,                          !- Start Month 1
    1,                          !- Start Day 1
    12,                         !- End Month 1
    31;                         !- End Day 1

Schedule:Year,
    InteriorLightingHE,         !- Name
    Fraction,                   !- Schedule Type Limits Name
    LightingProfileWeek_EELighting,    !- ScheduleWeek Name 1
    1,                          !- Start Month 1
    1,                          !- Start Day 1
    12,                         !- End Month 1
    31;                         !- End Day 1

Schedule:Year,
    InteriorLightingHE_OS,      !- Name
    Fraction,                   !- Schedule Type Limits Name
    LightingProfileWeek_EELighting_interior_controls,    !-
   ScheduleWeek Name 1
    1,                          !- Start Month 1
    1,                          !- Start Day 1
    12,                         !- End Month 1
    31;                         !- End Day 1

Schedule:Year,
    InteriorLightingHE_VS,      !- Name
    Fraction,                   !- Schedule Type Limits Name
    LightingProfileWeek_EELighting_garage_controls,    !-
```

```
   ScheduleWeek Name 1
    1,                        !- Start Month 1
    1,                        !- Start Day 1
    12,                       !- End Month 1
    31;                       !- End Day 1

Schedule:Year,
    ExteriorLighting,         !- Name
    Fraction,                 !- Schedule Type Limits Name
    ExteriorLightingProfileWeek,    !- ScheduleWeek Name 1
    1,                        !- Start Month 1
    1,                        !- Start Day 1
    12,                       !- End Month 1
    31;                       !- End Day 1

Schedule:Year,
    Refrigerator,             !- Name
    Fraction,                 !- Schedule Type Limits Name
    RefrigeratorWeek,         !- ScheduleWeek Name 1
    1,                        !- Start Month 1
    1,                        !- Start Day 1
    12,                       !- End Month 1
    31;                       !- End Day 1

Schedule:Year,
    MiscPlugLoad,             !- Name
    Fraction,                 !- Schedule Type Limits Name
    MiscPlugLoadWeek,         !- ScheduleWeek Name 1
    1,                        !- Start Month 1
    1,                        !- Start Day 1
    12,                       !- End Month 1
    31;                       !- End Day 1

Schedule:Year,
    CookingRange,             !- Name
    Fraction,                 !- Schedule Type Limits Name
```

```
    CookingRangeWeek,          !- ScheduleWeek Name 1
    1,                         !- Start Month 1
    1,                         !- Start Day 1
    12,                        !- End Month 1
    31;                        !- End Day 1

Schedule:Year,
    dhw_sch,                   !- Name
    fraction,                  !- Schedule Type Limits Name
    dhw_profile_week,          !- ScheduleWeek Name 1
    1,                         !- Start Month 1
    1,                         !- Start Day 1
    12,                        !- End Month 1
    31;                        !- End Day 1

Schedule:Year,
    Dishwasher,                !- Name
    Fraction,                  !- Schedule Type Limits Name
    DishwasherWeek,            !- ScheduleWeek Name 1
    1,                         !- Start Month 1
    1,                         !- Start Day 1
    12,                        !- End Month 1
    31;                        !- End Day 1

Schedule:Year,
    ClothesWasher,             !- Name
    Fraction,                  !- Schedule Type Limits Name
    ClothesWasherWeek,         !- ScheduleWeek Name 1
    1,                         !- Start Month 1
    1,                         !- Start Day 1
    12,                        !- End Month 1
    31;                        !- End Day 1

Schedule:Year,
    ClothesDryer,              !- Name
    Fraction,                  !- Schedule Type Limits Name
```

```
    ClothesDryerWeek,         !- ScheduleWeek Name 1
    1,                        !- Start Month 1
    1,                        !- Start Day 1
    12,                       !- End Month 1
    31;                       !- End Day 1

Schedule:Year,
    Sinks,                    !- Name
    Fraction,                 !- Schedule Type Limits Name
    SinksWeek,                !- ScheduleWeek Name 1
    1,                        !- Start Month 1
    1,                        !- Start Day 1
    12,                       !- End Month 1
    31;                       !- End Day 1

Schedule:Year,
    Showers,                  !- Name
    Fraction,                 !- Schedule Type Limits Name
    ShowersWeek,              !- ScheduleWeek Name 1
    1,                        !- Start Month 1
    1,                        !- Start Day 1
    12,                       !- End Month 1
    31;                       !- End Day 1

Schedule:Year,
    Baths,                    !- Name
    Fraction,                 !- Schedule Type Limits Name
    BathsWeek,                !- ScheduleWeek Name 1
    1,                        !- Start Month 1
    1,                        !- Start Day 1
    12,                       !- End Month 1
    31;                       !- End Day 1

Schedule:Year,
    DHWDist,                  !- Name
    Fraction,                 !- Schedule Type Limits Name
```

```
    DHWDistWeek,              !- ScheduleWeek Name 1
    1,                        !- Start Month 1
    1,                        !- Start Day 1
    12,                       !- End Month 1
    31;                       !- End Day 1

Schedule:Compact,
    fan_sch,                  !- Name
    Fractional,               !- Schedule Type Limits Name
    Through: 12/31,           !- Field 1
    For: AllDays,             !- Field 2
    Until: 24:00,             !- Field 3
    0.5;                      !- Field 4

Schedule:Compact,
    BA_shower_sch,            !- Name
    any number,               !- Schedule Type Limits Name
    Through: 12/31,           !- Field 1
    For: AllDays,             !- Field 2
    Until: 1:00,              !- Field 3
    0.00174682444444444,      !- Field 4
    Until: 2:00,              !- Field 5
    0.000794011111111111,     !- Field 6
    Until: 3:00,              !- Field 7
    0.000476406666666667,     !- Field 8
    Until: 4:00,              !- Field 9
    0.000794011111111111,     !- Field 10
    Until: 5:00,              !- Field 11
    0.00222323111111111,      !- Field 12
    Until: 6:00,              !- Field 13
    0.00825771555555556,      !- Field 14
    Until: 7:00,              !- Field 15
    0.0187386622222222,       !- Field 16
    Until: 8:00,              !- Field 17
    0.01857986,               !- Field 18
    Until: 9:00,              !- Field 19
```

```
    0.0150862111111111,       !- Field 20
    Until: 10:00,             !- Field 21
    0.0117513644444444,       !- Field 22
    Until: 11:00,             !- Field 23
    0.00952813333333333,      !- Field 24
    Until: 12:00,             !- Field 25
    0.00746370444444444,      !- Field 26
    Until: 13:00,             !- Field 27
    0.00539927555555556,      !- Field 28
    Until: 14:00,             !- Field 29
    0.00460526444444444,      !- Field 30
    Until: 15:00,             !- Field 31
    0.00412885777777778,      !- Field 32
    Until: 16:00,             !- Field 33
    0.00397005555555556,      !- Field 34
    Until: 17:00,             !- Field 35
    0.00476406666666667,      !- Field 36
    Until: 18:00,             !- Field 37
    0.00619328666666667,      !- Field 38
    Until: 19:00,             !- Field 39
    0.00666969333333333,      !- Field 40
    Until: 20:00,             !- Field 41
    0.00666969333333333,      !- Field 42
    Until: 21:00,             !- Field 43
    0.00666969333333333,      !- Field 44
    Until: 22:00,             !- Field 45
    0.00651089111111111,      !- Field 46
    Until: 23:00,             !- Field 47
    0.00460526444444444,      !- Field 48
    Until: 24:00,             !- Field 49
    0.00333484666666667;      !- Field 50

Schedule:Compact,
    BA_bath_sch,              !- Name
    any number,               !- Schedule Type Limits Name
    Through: 12/31,           !- Field 1
```

```
  For: AllDays,             !- Field 2
  Until: 1:00,              !- Field 3
  0.000163090909090909,     !- Field 4
  Until: 2:00,              !- Field 5
  8.15454545454545e-05,     !- Field 6
  Until: 3:00,              !- Field 7
  8.15454545454545e-05,     !- Field 8
  Until: 4:00,              !- Field 9
  8.15454545454545e-05,     !- Field 10
  Until: 5:00,              !- Field 11
  0.000163090909090909,     !- Field 12
  Until: 6:00,              !- Field 13
  0.000387340909090909,     !- Field 14
  Until: 7:00,              !- Field 15
  0.000937772727272727,     !- Field 16
  Until: 8:00,              !- Field 17
  0.00118240909090909,      !- Field 18
  Until: 9:00,              !- Field 19
  0.0013455,                !- Field 20
  Until: 10:00,             !- Field 21
  0.00118240909090909,      !- Field 22
  Until: 11:00,             !- Field 23
  0.000937772727272727,     !- Field 24
  Until: 12:00,             !- Field 25
  0.000713522727272727,     !- Field 26
  Until: 13:00,             !- Field 27
  0.000631977272727273,     !- Field 28
  Until: 14:00,             !- Field 29
  0.000468886363636364,     !- Field 30
  Until: 15:00,             !- Field 31
  0.000468886363636364,     !- Field 32
  Until: 16:00,             !- Field 33
  0.000468886363636364,     !- Field 34
  Until: 17:00,             !- Field 35
  0.000795068181818182,     !- Field 36
  Until: 18:00,             !- Field 37
```

```
    0.000937772727272727,     !- Field 38
    Until: 19:00,             !- Field 39
    0.00156975,               !- Field 40
    Until: 20:00,             !- Field 41
    0.00203863636363636,      !- Field 42
    Until: 21:00,             !- Field 43
    0.00203863636363636,      !- Field 44
    Until: 22:00,             !- Field 45
    0.00156975,               !- Field 46
    Until: 23:00,             !- Field 47
    0.0013455,                !- Field 48
    Until: 24:00,             !- Field 49
    0.000795068181818182;     !- Field 50

Schedule:Compact,
    BA_sink_sch,              !- Name
    any number,               !- Schedule Type Limits Name
    Through: 12/31,           !- Field 1
    For: AllDays,             !- Field 2
    Until: 1:00,              !- Field 3
    0.00387388596491228,      !- Field 4
    Until: 2:00,              !- Field 5
    0.00193694298245614,      !- Field 6
    Until: 3:00,              !- Field 7
    0.00138353070175439,      !- Field 8
    Until: 4:00,              !- Field 9
    0.00138353070175439,      !- Field 10
    Until: 5:00,              !- Field 11
    0.00193694298245614,      !- Field 12
    Until: 6:00,              !- Field 13
    0.00498071052631579,      !- Field 14
    Until: 7:00,              !- Field 15
    0.0116216578947368,       !- Field 16
    Until: 8:00,              !- Field 17
    0.0171557807017544,       !- Field 18
    Until: 9:00,              !- Field 19
```

```
    0.0182626052631579,       !- Field 20
    Until: 10:00,             !- Field 21
    0.0171557807017544,       !- Field 22
    Until: 11:00,             !- Field 23
    0.0149421315789474,       !- Field 24
    Until: 12:00,             !- Field 25
    0.0138353070175439,       !- Field 26
    Until: 13:00,             !- Field 27
    0.013558600877193,        !- Field 28
    Until: 14:00,             !- Field 29
    0.0124517763157895,       !- Field 30
    Until: 15:00,             !- Field 31
    0.0118983640350877,       !- Field 32
    Until: 16:00,             !- Field 33
    0.011344951754386,        !- Field 34
    Until: 17:00,             !- Field 35
    0.0132818947368421,       !- Field 36
    Until: 18:00,             !- Field 37
    0.017985899122807,        !- Field 38
    Until: 19:00,             !- Field 39
    0.0207529605263158,       !- Field 40
    Until: 20:00,             !- Field 41
    0.0190927236842105,       !- Field 42
    Until: 21:00,             !- Field 43
    0.01577225,               !- Field 44
    Until: 22:00,             !- Field 45
    0.0132818947368421,       !- Field 46
    Until: 23:00,             !- Field 47
    0.0110682456140351,       !- Field 48
    Until: 24:00,             !- Field 49
    0.00747106578947368;      !- Field 50

Schedule:Compact,
    activity_sch,             !- Name
    any number,               !- Schedule Type Limits Name
    Through: 12/31,           !- Field 1
```

```
    For: AllDays,             !- Field 2
    Until: 24:00,             !- Field 3
    117.28;                   !- Field 4

Schedule:Compact,
    inf_sch,                  !- Name
    any number,               !- Schedule Type Limits Name
    Through: 12/31,           !- Field 1
    For: AllDays,             !- Field 2
    Until: 24:00,             !- Field 3
    1;                        !- Field 4

Schedule:Compact,
    zone_control_type,        !- Name
    control_type,             !- Schedule Type Limits Name
    Through: 12/31,           !- Field 1
    For: AllDays,             !- Field 2
    Until 24:00,              !- Field 3
    4;                        !- Field 4

Schedule:Compact,
    shading_2012iecc,         !- Name
    fraction,                 !- Schedule Type Limits Name
    Through: 12/31,           !- Field 1
    For: AllDays,             !- Field 2
    Until 24:00,              !- Field 3
    0;                        !- Field 4

Schedule:Compact,
    shading_2009iecc,         !- Name
    any number,               !- Schedule Type Limits Name
    Through: 5/30,            !- Field 1
    For: AllDays,             !- Field 2
    Until 24:00,              !- Field 3
    0.85,                     !- Field 4
    Through: 8/31,            !- Field 5
```

```
    For: AllDays,             !- Field 6
    Until 24:00,              !- Field 7
    0.7,                      !- Field 8
    Through: 12/31,           !- Field 9
    For: AllDays,             !- Field 10
    Until: 24:00,             !- Field 11
    0.85;                     !- Field 12

Schedule:Compact,
    dhw_setpt,                !- Name
    Temperature,              !- Schedule Type Limits Name
    Through: 12/31,           !- Field 1
    For: AllDays,             !- Field 2
    Until 24:00,              !- Field 3
    48;                       !- Field 4

Schedule:Compact,
    dhw_setpt_hpwh,           !- Name
    Temperature,              !- Schedule Type Limits Name
    Through: 12/31,           !- Field 1
    For: AllDays,             !- Field 2
    Until 24:00,              !- Field 3
    44;                       !- Field 4

Schedule:Compact,
    Supply-Air-Temp-Sch,      !- Name
    Temperature,              !- Schedule Type Limits Name
    Through: 12/31,           !- Field 1
    For: AllDays,             !- Field 2
    Until: 24:00,             !- Field 3
    12;                       !- Field 4

Schedule:Compact,
    always_avail,             !- Name
    On/Off,                   !- Schedule Type Limits Name
    Through: 12/31,           !- Field 1
```

```
    For: AllDays,               !- Field 2
    Until: 24:00,               !- Field 3
    1;                          !- Field 4

Schedule:Compact,
    ALWAYS_ON,                  !- Name
    On/Off,                     !- Schedule Type Limits Name
    Through: 12/31,             !- Field 1
    For: AllDays,               !- Field 2
    Until: 24:00,               !- Field 3
    1;                          !- Field 4

Schedule:Compact,
    always_off,                 !- Name
    On/Off,                     !- Schedule Type Limits Name
    Through: 12/31,             !- Field 1
    For: AllDays,               !- Field 2
    Until: 24:00,               !- Field 3
    0;                          !- Field 4

Schedule:Compact,
    heating_sch_HRef,           !- Name
    Temperature,                !- Schedule Type Limits Name
    Through: 12/31,             !- Field 1
    For: AllDays,               !- Field 2
    Until: 24:00,               !- Field 3
    17;                         !- Field 4

Schedule:Compact,
    cooling_sch_HRef,           !- Name
    Temperature,                !- Schedule Type Limits Name
    Through: 12/31,             !- Field 1
    For: AllDays,               !- Field 2
    Until: 24:00,               !- Field 3
    25.55;                      !- Field 4
```

```
Schedule:Compact,
    heating_sch,              !- Name
    Temperature,              !- Schedule Type Limits Name
    Through: 12/31,           !- Field 1
    For: AllDays,             !- Field 2
    Until: 24:00,             !- Field 3
    17;                       !- Field 4

Schedule:Compact,
    charge_sch,               !- Name
    Any Number,               !- Schedule Type Limits Name
    Through: 12/31,           !- Field 1
    For: AllDays,             !- Field 2
    Until: 1:00,              !- Field 3
    0,                        !- Field 4
    Until: 2:00,              !- Field 5
    0,                        !- Field 6
    Until: 3:00,              !- Field 7
    0,                        !- Field 8
    Until: 4:00,              !- Field 9
    0,                        !- Field 10
    Until: 5:00,              !- Field 11
    0,                        !- Field 12
    Until: 6:00,              !- Field 13
    0,                        !- Field 14
    Until: 7:00,              !- Field 15
    0.07338484488253715,      !- Field 16
    Until: 8:00,              !- Field 17
    0.7962221805360203,       !- Field 18
    Until: 9:00,              !- Field 19
    1,                        !- Field 20
    Until: 10:00,             !- Field 21
    0,                        !- Field 22
    Until: 11:00,             !- Field 23
    0,                        !- Field 24
    Until: 12:00,             !- Field 25
```

```
    0,                          !- Field 26
    Until: 13:00,               !- Field 27
    0,                          !- Field 28
    Until: 14:00,               !- Field 29
    0,                          !- Field 30
    Until: 15:00,               !- Field 31
    0,                          !- Field 32
    Until: 16:00,               !- Field 33
    0,                          !- Field 34
    Until: 17:00,               !- Field 35
    0,                          !- Field 36
    Until: 18:00,               !- Field 37
    0,                          !- Field 38
    Until: 19:00,               !- Field 39
    0,                          !- Field 40
    Until: 20:00,               !- Field 41
    0,                          !- Field 42
    Until: 21:00,               !- Field 43
    0,                          !- Field 44
    Until: 22:00,               !- Field 45
    0,                          !- Field 46
    Until: 23:00,               !- Field 47
    0,                          !- Field 48
    Until: 24:00,               !- Field 49
    0;                          !- Field 50

Schedule:Compact,
    discharge_sch,              !- Name
    Any Number,                 !- Schedule Type Limits Name
    Through: 12/31,             !- Field 1
    For: AllDays,               !- Field 2
    Until: 1:00,                !- Field 3
    0,                          !- Field 4
    Until: 2:00,                !- Field 5
    0,                          !- Field 6
    Until: 3:00,                !- Field 7
```

```
0,                          !- Field 8
Until: 4:00,                !- Field 9
0,                          !- Field 10
Until: 5:00,                !- Field 11
0,                          !- Field 12
Until: 6:00,                !- Field 13
0,                          !- Field 14
Until: 7:00,                !- Field 15
0,                          !- Field 16
Until: 8:00,                !- Field 17
0,                          !- Field 18
Until: 9:00,                !- Field 19
0,                          !- Field 20
Until: 10:00,               !- Field 21
0,                          !- Field 22
Until: 11:00,               !- Field 23
0,                          !- Field 24
Until: 12:00,               !- Field 25
0,                          !- Field 26
Until: 13:00,               !- Field 27
0,                          !- Field 28
Until: 14:00,               !- Field 29
0,                          !- Field 30
Until: 15:00,               !- Field 31
0,                          !- Field 32
Until: 16:00,               !- Field 33
0,                          !- Field 34
Until: 17:00,               !- Field 35
0,                          !- Field 36
Until: 18:00,               !- Field 37
0.2728391119512886,         !- Field 38
Until: 19:00,               !- Field 39
0.7846101510027408,         !- Field 40
Until: 20:00,               !- Field 41
0.7720685536374493,         !- Field 42
Until: 21:00,               !- Field 43
```

```
    0,                          !- Field 44
    Until: 22:00,               !- Field 45
    0,                          !- Field 46
    Until: 23:00,               !- Field 47
    0,                          !- Field 48
    Until: 24:00,               !- Field 49
    0;                          !- Field 50

Schedule:Compact,
    cooling_sch,                !- Name
    Temperature,                !- Schedule Type Limits Name
    Through: 12/31,             !- Field 1
    For: AllDays,               !- Field 2
    Until: 24:00,               !- Field 3
    23.888888888889;            !- Field 4

Schedule:Compact,
    fan_cycle,                  !- Name
    any number,                 !- Schedule Type Limits Name
    Through: 12/31,             !- Field 1
    For: AllDays,               !- Field 2
    Until: 24:00,               !- Field 3
    0;                          !- Field 4

Schedule:Compact,
    Clothing Sch,               !- Name
    Fractional,                 !- Schedule Type Limits Name
    Through: 12/31,             !- Field 1
    For: AllDays,               !- Field 2
    Until: 24:00,               !- Field 3
    0.45;                       !- Field 4

Schedule:Compact,
    Air Velo Sch,               !- Name
    Fractional,                 !- Schedule Type Limits Name
    Through: 12/31,             !- Field 1
```

```
    For: AllDays,             !- Field 2
    Until: 24:00,             !- Field 3
    0.35;                     !- Field 4

Schedule:Compact,
    Work Eff Sch,             !- Name
    Fractional,               !- Schedule Type Limits Name
    Through: 12/31,           !- Field 1
    For: AllDays,             !- Field 2
    Until: 24:00,             !- Field 3
    0;                        !- Field 4

Schedule:Constant,
    DWWaterTempSchedule,      !- Name
    Temperature,              !- Schedule Type Limits Name
    48.8888888888889;         !- Hourly Value

Schedule:Constant,
    CWWaterTempSchedule,      !- Name
    Temperature,              !- Schedule Type Limits Name
    48.8888888888889;         !- Hourly Value

Schedule:Constant,
    SinkSensSchedule,         !- Name
    Fraction,                 !- Schedule Type Limits Name
    0.687777777777778;        !- Hourly Value

Schedule:Constant,
    SinkLatSchedule,          !- Name
    Fraction,                 !- Schedule Type Limits Name
    0.312222222222222;        !- Hourly Value

Schedule:Constant,
    ShowerSensSchedule,       !- Name
    Fraction,                 !- Schedule Type Limits Name
    0.51280276816609;         !- Hourly Value
```

```
Schedule:Constant,
    ShowerLatSchedule,        !- Name
    Fraction,                 !- Schedule Type Limits Name
    0.48719723183391;         !- Hourly Value

Schedule:Constant,
    BathSensSchedule,         !- Name
    Fraction,                 !- Schedule Type Limits Name
    1;                        !- Hourly Value

Schedule:Constant,
    BathLatSchedule,          !- Name
    Fraction,                 !- Schedule Type Limits Name
    0;                        !- Hourly Value

Schedule:Constant,
    SSBWaterTempSchedule,     !- Name
    Temperature,              !- Schedule Type Limits Name
    40.5555555555556;         !- Hourly Value

Schedule:Constant,
    WaterHeaterSP1Schedule,    !- Name
    Temperature,              !- Schedule Type Limits Name
    48.8888888888889;         !- Hourly Value

Schedule:Constant,
    WaterHeaterSP2Schedule,    !- Name
    Temperature,              !- Schedule Type Limits Name
    40.5555555555556;         !- Hourly Value

Schedule:Constant,
    DHWSupplySetpoint,        !- Name
    Temperature,              !- Schedule Type Limits Name
    48.8888888888889;         !- Hourly Value
```

```
Schedule:Constant,
    boiler_setpt,             !- Name
    Temperature,              !- Schedule Type Limits Name
    80;                       !- Hourly Value

Schedule:Constant,
    Compressor Setpoint,      !- Name
    Temperature,              !- Schedule Type Limits Name
    50;                       !- Hourly Value

Schedule:Constant,
    DOAShightemp,             !- Name
    Temperature,              !- Schedule Type Limits Name
    200;                      !- Hourly Value

Schedule:Constant,
    DOASlowtemp,              !- Name
    Temperature,              !- Schedule Type Limits Name
    -60;                      !- Hourly Value

Material,
    sheathing_consol_layer,    !- Name
    Rough,                    !- Roughness
    0.0127,                   !- Thickness
    0.0940184,                !- Conductivity
    685.008,                  !- Density
    1172.332;                 !- Specific Heat

Material,
    ceil_consol_layer,        !- Name
    Rough,                    !- Roughness
    0.284817435151397,        !- Thickness
    0.0617176,                !- Conductivity
    41.9286,                  !- Density
    776.25126;                !- Specific Heat
```

```
Material,
    floor_consol_layer,       !- Name
    Rough,                    !- Roughness
    0.000254,                 !- Thickness
    12.989536,                !- Conductivity
    55.074,                   !- Density
    916.9311;                 !- Specific Heat

Material,
    bsmtwall_consol_layer,    !- Name
    Rough,                    !- Roughness
    0.000254,                 !- Thickness
    10.84384,                 !- Conductivity
    120.801,                  !- Density
    1036.25775;               !- Specific Heat

Material,
    crawlwall_consol_layer,    !- Name
    Rough,                    !- Roughness
    0.000254,                 !- Thickness
    10.84384,                 !- Conductivity
    120.801,                  !- Density
    1036.25775;               !- Specific Heat

Material,
    wall_consol_layer,        !- Name
    Rough,                    !- Roughness
    0.0889,                   !- Thickness
    0.0579573076923077,       !- Conductivity
    120.801,                  !- Density
    1036.25775;               !- Specific Heat

Material,
    Very High Reflectivity Surface,    !- Name
    Smooth,                   !- Roughness
    0.0005,                   !- Thickness
```

```
    237,                      !- Conductivity
    2702,                     !- Density
    903,                      !- Specific Heat
    0.9,                      !- Thermal Absorptance
    0.05,                     !- Solar Absorptance
    0.05;                     !- Visible Absorptance

Material,
    GypsumBoard-5/16in,       !- Name
    Rough,                    !- Roughness
    0.00793953,               !- Thickness
    0.15862,                  !- Conductivity
    640,                      !- Density
    1129.6,                   !- Specific Heat
    0.9,                      !- Thermal Absorptance
    0.4,                      !- Solar Absorptance
    0.1;                      !- Visible Absorptance

Material,
    CopperPipe,               !- Name
    MediumRough,              !- Roughness
    0.0190500386169072,       !- Thickness
    401,                      !- Conductivity
    2243,                     !- Density
    837,                      !- Specific Heat
    0.9,                      !- Thermal Absorptance
    0.65,                     !- Solar Absorptance
    0.65;                     !- Visible Absorptance

Material,
    F08 Metal surface,        !- Name
    Smooth,                   !- Roughness
    0.0008,                   !- Thickness
    45.28,                    !- Conductivity
    7824,                     !- Density
    500;                      !- Specific Heat
```

```
Material,
    Concrete_4in,             !- Name
    Rough,                    !- Roughness
    0.1014984,                !- Thickness
    1.312098,                 !- Conductivity
    2242.8,                   !- Density
    465.2;                    !- Specific Heat

Material,
    Asphalt_shingle,          !- Name
    MediumRough,              !- Roughness
    0.00633985285170672,      !- Thickness
    0.08186,                  !- Conductivity
    1121.2917044623,          !- Density
    1255.20000949809,         !- Specific Heat
    ,                         !- Thermal Absorptance
    0.75;                     !- Solar Absorptance

Material,
    Wood_shingle,             !- Name
    MediumSmooth,             !- Roughness
    0.0127000257446048,       !- Thickness
    0.11388,                  !- Conductivity
    426.090847695673,         !- Density
    1631.76001234752;         !- Specific Heat

Material,
    Slate_shingle,            !- Name
    MediumSmooth,             !- Roughness
    0.0127000257446048,       !- Thickness
    1.44219,                  !- Conductivity
    1601.845292089,           !- Density
    1255.20000949809;         !- Specific Heat

Material,
```

```
    cement_stucco,            !- Name
    MediumSmooth,             !- Roughness
    0.01905,                  !- Thickness
    0.721,                    !- Conductivity
    1865.58,                  !- Density
    878.640006648665;         !- Specific Heat

Material,
    syn_stucco,               !- Name
    MediumSmooth,             !- Roughness
    0.003048,                 !- Thickness
    0.0865,                   !- Conductivity
    400,                      !- Density
    878.640006648665;         !- Specific Heat

Material,
    Drywall_1/2in,            !- Name
    MediumSmooth,             !- Roughness
    0.0127000257446048,       !- Thickness
    0.16009,                  !- Conductivity
    800.922646044499,         !- Density
    1087.84000823168;         !- Specific Heat

Material,
    OSB_5/8in,                !- Name
    MediumSmooth,             !- Roughness
    0.015875032180756,        !- Thickness
    0.1163,                   !- Conductivity
    544.627399310259,         !- Density
    1213.36000918149;         !- Specific Heat

Material,
    OSB_7/16in,               !- Name
    MediumSmooth,             !- Roughness
    0.0111125,                !- Thickness
    0.1163,                   !- Conductivity
```

```
    544.627399310259,         !- Density
    1213.36000918149;         !- Specific Heat

Material,
    Blown_R30,                !- Name
    MediumRough,              !- Roughness
    0.212598430964684,        !- Thickness
    0.04119,                  !- Conductivity
    9.61107175253399,         !- Density
    836.800006332062;         !- Specific Heat

Material,
    Blown_R30_top,            !- Name
    MediumRough,              !- Roughness
    0.117348237880148,        !- Thickness
    0.04119,                  !- Conductivity
    9.61107175253399,         !- Density
    836.800006332062,         !- Specific Heat
    0.9,                      !- Thermal Absorptance
    0.7,                      !- Solar Absorptance
    0.7;                      !- Visible Absorptance

Material,
    Plywood_3/4in,            !- Name
    Rough,                    !- Roughness
    0.01905,                  !- Thickness
    0.1154577,                !- Conductivity
    544.68,                   !- Density
    674.54,                   !- Specific Heat
    0.9,                      !- Thermal Absorptance
    0.7,                      !- Solar Absorptance
    0.7;                      !- Visible Absorptance

Material,
    Batt_R19,                 !- Name
    MediumRough,              !- Roughness
```

```
    0.0254000514892096,       !- Thickness
    0.00347522010738099,      !- Conductivity
    9.61107175253399,         !- Density
    836.800006332062,         !- Specific Heat
    0.9,                      !- Thermal Absorptance
    0.7,                      !- Solar Absorptance
    0.7;                      !- Visible Absorptance

Material,
    Lumber_2x4,               !- Name
    Rough,                    !- Roughness
    0.0890016,                !- Thickness
    0.1154577,                !- Conductivity
    512.64,                   !- Density
    767.58,                   !- Specific Heat
    0.9,                      !- Thermal Absorptance
    0.7,                      !- Solar Absorptance
    0.7;                      !- Visible Absorptance

Material,
    Carpet_n_pad,             !- Name
    MediumSmooth,             !- Roughness
    0.0254000514892096,       !- Thickness
    0.0601314018580031,       !- Conductivity
    32.03690584178,           !- Density
    836.800006332062,         !- Specific Heat
    0.9,                      !- Thermal Absorptance
    0.7,                      !- Solar Absorptance
    0.7;                      !- Visible Absorptance

Material,
    Batt_R13,                 !- Name
    MediumRough,              !- Roughness
    0.0889,                   !- Thickness
    0.03876,                  !- Conductivity
    9.61107175253399,         !- Density
```

```
    836.800006332062,         !- Specific Heat
    0.9,                      !- Thermal Absorptance
    0.7,                      !- Solar Absorptance
    0.7;                      !- Visible Absorptance

Material,
    OSB_1/2in,                !- Name
    MediumSmooth,             !- Roughness
    0.0127000257446048,       !- Thickness
    0.1163,                   !- Conductivity
    544.627399310259,         !- Density
    1213.36000918149,         !- Specific Heat
    0.9,                      !- Thermal Absorptance
    0.7,                      !- Solar Absorptance
    0.7;                      !- Visible Absorptance

Material,
    soil_12in,                !- Name
    Rough,                    !- Roughness
    0.3048,                   !- Thickness
    1.731,                    !- Conductivity
    1842.3,                   !- Density
    232.6,                    !- Specific Heat
    0.9,                      !- Thermal Absorptance
    0.7,                      !- Solar Absorptance
    0.7;                      !- Visible Absorptance

Material,
    door_const,               !- Name
    Smooth,                   !- Roughness
    0.0253617440918536,       !- Thickness
    0.0720096,                !- Conductivity
    512.64,                   !- Density
    767.58;                   !- Specific Heat

Material,
```

```
    Gyp_board_1/2in,          !- Name
    Rough,                    !- Roughness
    0.01271016,               !- Thickness
    0.15862,                  !- Conductivity
    640,                      !- Density
    1129.6,                   !- Specific Heat
    0.9,                      !- Thermal Absorptance
    0.4,                      !- Solar Absorptance
    0.1;                      !- Visible Absorptance

Material,
    Std Wood 6inch,           !- Name
    MediumSmooth,             !- Roughness
    0.15,                     !- Thickness
    0.12,                     !- Conductivity
    540,                      !- Density
    1210,                     !- Specific Heat
    0.9,                      !- Thermal Absorptance
    0.7,                      !- Solar Absorptance
    0.7;                      !- Visible Absorptance

Material,
    Pipe Insulation,          !- Name
    VeryRough,                !- Roughness
    0.0127032520325203,       !- Thickness
    0.03317175,               !- Conductivity
    91,                       !- Density
    836,                      !- Specific Heat
    0.9,                      !- Thermal Absorptance
    0.5,                      !- Solar Absorptance
    0.5;                      !- Visible Absorptance

Material:NoMass,
    Manf_wall_airgap,         !- Name
    Smooth,                   !- Roughness
    0.12;                     !- Thermal Resistance
```

```
Material:NoMass,
    Bldg_paper_felt,          !- Name
    Smooth,                   !- Roughness
    0.0105666113069662;       !- Thermal Resistance

Material:NoMass,
    R_high,                   !- Name
    MediumRough,              !- Roughness
    177;                      !- Thermal Resistance

Material:AirGap,
    Air_4_in_vert,            !- Name
    0.158499169604493;        !- Thermal Resistance

Material:AirGap,
    3/4in_air_space,          !- Name
    0.08513;                  !- Thermal Resistance

Material:AirGap,
    3/4in_Reflective_air_space,    !- Name
    0.246554;                 !- Thermal Resistance

WindowMaterial:SimpleGlazingSystem,
    Glass,                    !- Name
    2.8393,                   !- UFactor
    0.216875,                 !- Solar Heat Gain Coefficient
    0.88;                     !- Visible Transmittance

WindowMaterial:Glazing,
    Clear Acrylic Plastic,    !- Name
    SpectralAverage,          !- Optical Data Type
    ,                         !- Window Glass Spectral Data Set Name
    0.003,                    !- Thickness
    0.92,                     !- Solar Transmittance at Normal
   Incidence
```

```
    0.05,                    !- Front Side Solar Reflectance at
   Normal Incidence
    0.05,                    !- Back Side Solar Reflectance at
   Normal Incidence
    0.92,                    !- Visible Transmittance at Normal
   Incidence
    0.05,                    !- Front Side Visible Reflectance at
   Normal Incidence
    0.05,                    !- Back Side Visible Reflectance at
   Normal Incidence
    0,                       !- Infrared Transmittance at Normal
   Incidence
    0.9,                     !- Front Side Infrared Hemispherical
   Emissivity
    0.9,                     !- Back Side Infrared Hemispherical
   Emissivity
    0.9;                     !- Conductivity

WindowMaterial:Glazing,
    Diffusing Acrylic Plastic,    !- Name
    SpectralAverage,         !- Optical Data Type
    ,                        !- Window Glass Spectral Data Set Name
    0.0022,                  !- Thickness
    0.9,                     !- Solar Transmittance at Normal
   Incidence
    0.08,                    !- Front Side Solar Reflectance at
   Normal Incidence
    0.08,                    !- Back Side Solar Reflectance at
   Normal Incidence
    0.9,                     !- Visible Transmittance at Normal
   Incidence
    0.08,                    !- Front Side Visible Reflectance at
   Normal Incidence
    0.08,                    !- Back Side Visible Reflectance at
   Normal Incidence
    0,                       !- Infrared Transmittance at Normal
```

```
   Incidence
    0.9,                     !- Front Side Infrared Hemispherical
   Emissivity
    0.9,                     !- Back Side Infrared Hemispherical
   Emissivity
    0.9;                     !- Conductivity

WindowMaterial:Blind,
    int_blind,               !- Name
    Horizontal,              !- Slat Orientation
    0.025,                   !- Slat Width
    0.01875,                 !- Slat Separation
    0.001,                   !- Slat Thickness
    45,                      !- Slat Angle
    221,                     !- Slat Conductivity
    0,                       !- Slat Beam Solar Transmittance
    0.5,                     !- Front Side Slat Beam Solar
   Reflectance
    0.5,                     !- Back Side Slat Beam Solar
   Reflectance
    0,                       !- Slat Diffuse Solar Transmittance
    0.5,                     !- Front Side Slat Diffuse Solar
   Reflectance
    0.5,                     !- Back Side Slat Diffuse Solar
   Reflectance
    0,                       !- Slat Beam Visible Transmittance
    0.5,                     !- Front Side Slat Beam Visible
   Reflectance
    0.5,                     !- Back Side Slat Beam Visible
   Reflectance
    0,                       !- Slat Diffuse Visible Transmittance
    0.5,                     !- Front Side Slat Diffuse Visible
   Reflectance
    0.5,                     !- Back Side Slat Diffuse Visible
   Reflectance
    0,                       !- Slat Infrared Hemispherical
```

```
   Transmittance
    0.9,                     !- Front Side Slat Infrared
   Hemispherical Emissivity
    0.9,                     !- Back Side Slat Infrared
   Hemispherical Emissivity
    0.05,                    !- Blind to Glass Distance
    0.5,                     !- Blind Top Opening Multiplier
    0.5,                     !- Blind Bottom Opening Multiplier
    0.5,                     !- Blind Left Side Opening Multiplier
    0.5,                     !- Blind Right Side Opening Multiplier
    ,                        !- Minimum Slat Angle
    ;                        !- Maximum Slat Angle

Construction,
    Exterior Wall,           !- Name
    syn_stucco,              !- Outside Layer
    sheathing_consol_layer,   !- Layer 2
    OSB_7/16in,              !- Layer 3
    wall_consol_layer,       !- Layer 4
    Drywall_1/2in;           !- Layer 5

Construction,
    InteriorFurnishings,     !- Name
    Std Wood 6inch;          !- Outside Layer

Construction,
    ceiling-floor-layer,     !- Name
    Lumber_2x4;              !- Outside Layer

Construction,
    Exterior Floor,          !- Name
    floor_consol_layer,      !- Outside Layer
    Plywood_3/4in,           !- Layer 2
    Carpet_n_pad;            !- Layer 3

Construction,
```

```
    Interior Floor,           !- Name
    Plywood_3/4in,            !- Outside Layer
    Carpet_n_pad;             !- Layer 2

Construction,
    Interior Ceiling,         !- Name
    ceil_consol_layer,        !- Outside Layer
    Drywall_1/2in;            !- Layer 2

Construction,
    attic floor,              !- Name
    Drywall_1/2in,            !- Outside Layer
    ceil_consol_layer;        !- Layer 2

Construction,
    fndn_roof,                !- Name
    Carpet_n_pad,             !- Outside Layer
    Plywood_3/4in,            !- Layer 2
    ceil_consol_layer;        !- Layer 3

Construction,
    interiorwall,             !- Name
    Drywall_1/2in,            !- Outside Layer
    OSB_5/8in,                !- Layer 2
    Drywall_1/2in;            !- Layer 3

Construction,
    Interior Wall,            !- Name
    Drywall_1/2in,            !- Outside Layer
    Air_4_in_vert,            !- Layer 2
    Drywall_1/2in;            !- Layer 3

Construction,
    Exterior Roof,            !- Name
    Asphalt_shingle,          !- Outside Layer
    OSB_1/2in;                !- Layer 2
```

```
Construction,
    Exterior Window,          !- Name
    Glass;                    !- Outside Layer

Construction,
    Interior Window,          !- Name
    Glass;                    !- Outside Layer

Construction,
    Exterior Door,            !- Name
    door_const;               !- Outside Layer

Construction,
    Interior Door,            !- Name
    door_const;               !- Outside Layer

Construction,
    Gable_end,                !- Name
    cement_stucco,            !- Outside Layer
    Bldg_paper_felt,          !- Layer 2
    OSB_5/8in,                !- Layer 3
    Air_4_in_vert,            !- Layer 4
    Drywall_1/2in;            !- Layer 5

Construction,
    crawl_floor,              !- Name
    R_high,                   !- Outside Layer
    soil_12in;                !- Layer 2

Construction,
    window_w_blinds,          !- Name
    Glass,                    !- Outside Layer
    int_blind;                !- Layer 2

Construction,
```

```
    Insulated Pipe,           !- Name
    Pipe Insulation,          !- Outside Layer
    CopperPipe;               !- Layer 2

Construction,
    Plain Pipe,               !- Name
    CopperPipe;               !- Outside Layer

Construction,
    TDD Pipe,                 !- Name
    Very High Reflectivity Surface;    !- Outside Layer

Construction,
    TDD Dome,                 !- Name
    Clear Acrylic Plastic;    !- Outside Layer

Construction,
    TDD Diffuser,             !- Name
    Diffusing Acrylic Plastic;    !- Outside Layer

GlobalGeometryRules,
    LowerLeftCorner,          !- Starting Vertex Position
    Counterclockwise,         !- Vertex Entry Direction
    World;                    !- Coordinate System

Zone,
    living_unit1,             !- Name
    0,                        !- Direction of Relative North
    0,                        !- X Origin
    0,                        !- Y Origin
    0,                        !- Z Origin
    ,                         !- Type
    1;                        !- Multiplier

Zone,
    attic_unit1,              !- Name
```

```
    0,                          !- Direction of Relative North
    0,                          !- X Origin
    0,                          !- Y Origin
    0,                          !- Z Origin
    ,                           !- Type
    1;                          !- Multiplier

BuildingSurface:Detailed,
    Inter zone floor 1,         !- Name
    Floor,                      !- Surface Type
    Interior Floor,             !- Construction Name
    living_unit1,               !- Zone Name
    Adiabatic,                  !- Outside Boundary Condition
    ,                           !- Outside Boundary Condition Object
    NoSun,                      !- Sun Exposure
    NoWind,                     !- Wind Exposure
    0,                          !- View Factor to Ground
    4,                          !- Number of Vertices
    0,                          !- Vertex 1 Xcoordinate
    0,                          !- Vertex 1 Ycoordinate
    2.60156341463415,           !- Vertex 1 Zcoordinate
    0,                          !- Vertex 2 Xcoordinate
    9.09981820971244,           !- Vertex 2 Ycoordinate
    2.60156341463415,           !- Vertex 2 Zcoordinate
    12.1330909462833,           !- Vertex 3 Xcoordinate
    9.09981820971244,           !- Vertex 3 Ycoordinate
    2.60156341463415,           !- Vertex 3 Zcoordinate
    12.1330909462833,           !- Vertex 4 Xcoordinate
    0,                          !- Vertex 4 Ycoordinate
    2.60156341463415;           !- Vertex 4 Zcoordinate

BuildingSurface:Detailed,
    ceiling_unit1,              !- Name
    Ceiling,                    !- Surface Type
    Interior Ceiling,           !- Construction Name
    living_unit1,               !- Zone Name
```

```
    Zone,                    !- Outside Boundary Condition
    attic_unit1,             !- Outside Boundary Condition Object
    NoSun,                   !- Sun Exposure
    NoWind,                  !- Wind Exposure
    0,                       !- View Factor to Ground
    4,                       !- Number of Vertices
    0,                       !- Vertex 1 Xcoordinate
    0,                       !- Vertex 1 Ycoordinate
    5.19302682926829,        !- Vertex 1 Zcoordinate
    12.1330909462833,        !- Vertex 2 Xcoordinate
    0,                       !- Vertex 2 Ycoordinate
    5.19302682926829,        !- Vertex 2 Zcoordinate
    12.1330909462833,        !- Vertex 3 Xcoordinate
    9.09981820971244,        !- Vertex 3 Ycoordinate
    5.19302682926829,        !- Vertex 3 Zcoordinate
    0,                       !- Vertex 4 Xcoordinate
    9.09981820971244,        !- Vertex 4 Ycoordinate
    5.19302682926829;        !- Vertex 4 Zcoordinate

BuildingSurface:Detailed,
    Roof_front_unit1,        !- Name
    Roof,                    !- Surface Type
    Exterior Roof,           !- Construction Name
    attic_unit1,             !- Zone Name
    Outdoors,                !- Outside Boundary Condition
    ,                        !- Outside Boundary Condition Object
    SunExposed,              !- Sun Exposure
    WindExposed,             !- Wind Exposure
    0,                       !- View Factor to Ground
    4,                       !- Number of Vertices
    0,                       !- Vertex 1 Xcoordinate
    0,                       !- Vertex 1 Ycoordinate
    5.19302682926829,        !- Vertex 1 Zcoordinate
    12.1330909462833,        !- Vertex 2 Xcoordinate
    0,                       !- Vertex 2 Ycoordinate
    5.19302682926829,        !- Vertex 2 Zcoordinate
```

```
    12.1330909462833,         !- Vertex 3 Xcoordinate
    4.54990910485622,         !- Vertex 3 Ycoordinate
    6.6995631975537,          !- Vertex 3 Zcoordinate
    0,                        !- Vertex 4 Xcoordinate
    4.54990910485622,         !- Vertex 4 Ycoordinate
    6.6995631975537;          !- Vertex 4 Zcoordinate

BuildingSurface:Detailed,
    Roof_back_unit1,          !- Name
    Roof,                     !- Surface Type
    Exterior Roof,            !- Construction Name
    attic_unit1,              !- Zone Name
    Outdoors,                 !- Outside Boundary Condition
    ,                         !- Outside Boundary Condition Object
    SunExposed,               !- Sun Exposure
    WindExposed,              !- Wind Exposure
    0,                        !- View Factor to Ground
    4,                        !- Number of Vertices
    12.1330909462833,         !- Vertex 1 Xcoordinate
    9.09981820971244,         !- Vertex 1 Ycoordinate
    5.19302682926829,         !- Vertex 1 Zcoordinate
    0,                        !- Vertex 2 Xcoordinate
    9.09981820971244,         !- Vertex 2 Ycoordinate
    5.19302682926829,         !- Vertex 2 Zcoordinate
    0,                        !- Vertex 3 Xcoordinate
    4.54990910485622,         !- Vertex 3 Ycoordinate
    6.6995631975537,          !- Vertex 3 Zcoordinate
    12.1330909462833,         !- Vertex 4 Xcoordinate
    4.54990910485622,         !- Vertex 4 Ycoordinate
    6.6995631975537;          !- Vertex 4 Zcoordinate

BuildingSurface:Detailed,
    Roof_right_unit1,         !- Name
    Wall,                     !- Surface Type
    Gable_end,                !- Construction Name
    attic_unit1,              !- Zone Name
```

```
    Outdoors,                 !- Outside Boundary Condition
    ,                         !- Outside Boundary Condition Object
    SunExposed,               !- Sun Exposure
    WindExposed,              !- Wind Exposure
    ,                         !- View Factor to Ground
    3,                        !- Number of Vertices
    12.1330909462833,         !- Vertex 1 Xcoordinate
    0,                        !- Vertex 1 Ycoordinate
    5.19302682926829,         !- Vertex 1 Zcoordinate
    12.1330909462833,         !- Vertex 2 Xcoordinate
    9.09981820971244,         !- Vertex 2 Ycoordinate
    5.19302682926829,         !- Vertex 2 Zcoordinate
    12.1330909462833,         !- Vertex 3 Xcoordinate
    4.54990910485622,         !- Vertex 3 Ycoordinate
    6.6995631975537;          !- Vertex 3 Zcoordinate

BuildingSurface:Detailed,
    Roof_left_unit1,          !- Name
    Wall,                     !- Surface Type
    Gable_end,                !- Construction Name
    attic_unit1,              !- Zone Name
    Outdoors,                 !- Outside Boundary Condition
    ,                         !- Outside Boundary Condition Object
    SunExposed,               !- Sun Exposure
    WindExposed,              !- Wind Exposure
    ,                         !- View Factor to Ground
    3,                        !- Number of Vertices
    0,                        !- Vertex 1 Xcoordinate
    9.09981820971244,         !- Vertex 1 Ycoordinate
    5.19302682926829,         !- Vertex 1 Zcoordinate
    0,                        !- Vertex 2 Xcoordinate
    0,                        !- Vertex 2 Ycoordinate
    5.19302682926829,         !- Vertex 2 Zcoordinate
    0,                        !- Vertex 3 Xcoordinate
    4.54990910485622,         !- Vertex 3 Ycoordinate
    6.6995631975537;          !- Vertex 3 Zcoordinate
```

```
BuildingSurface:Detailed,
    Wall_ldf_1.unit1,         !- Name
    Wall,                     !- Surface Type
    Exterior Wall,            !- Construction Name
    living_unit1,             !- Zone Name
    Outdoors,                 !- Outside Boundary Condition
    ,                         !- Outside Boundary Condition Object
    SunExposed,               !- Sun Exposure
    WindExposed,              !- Wind Exposure
    ,                         !- View Factor to Ground
    4,                        !- Number of Vertices
    0,                        !- Vertex 1 Xcoordinate
    0,                        !- Vertex 1 Ycoordinate
    0.0101,                   !- Vertex 1 Zcoordinate
    12.1330909462833,         !- Vertex 2 Xcoordinate
    0,                        !- Vertex 2 Ycoordinate
    0.0101,                   !- Vertex 2 Zcoordinate
    12.1330909462833,         !- Vertex 3 Xcoordinate
    0,                        !- Vertex 3 Ycoordinate
    2.60156341463415,         !- Vertex 3 Zcoordinate
    0,                        !- Vertex 4 Xcoordinate
    0,                        !- Vertex 4 Ycoordinate
    2.60156341463415;         !- Vertex 4 Zcoordinate

BuildingSurface:Detailed,
    Wall_sdr_1.unit1,         !- Name
    Wall,                     !- Surface Type
    Exterior Wall,            !- Construction Name
    living_unit1,             !- Zone Name
    Outdoors,                 !- Outside Boundary Condition
    ,                         !- Outside Boundary Condition Object
    SunExposed,               !- Sun Exposure
    WindExposed,              !- Wind Exposure
    ,                         !- View Factor to Ground
    4,                        !- Number of Vertices
```

```
    12.1330909462833,         !- Vertex 1 Xcoordinate
    0,                        !- Vertex 1 Ycoordinate
    0.0101,                   !- Vertex 1 Zcoordinate
    12.1330909462833,         !- Vertex 2 Xcoordinate
    9.09981820971244,         !- Vertex 2 Ycoordinate
    0.0101,                   !- Vertex 2 Zcoordinate
    12.1330909462833,         !- Vertex 3 Xcoordinate
    9.09981820971244,         !- Vertex 3 Ycoordinate
    2.60156341463415,         !- Vertex 3 Zcoordinate
    12.1330909462833,         !- Vertex 4 Xcoordinate
    0,                        !- Vertex 4 Ycoordinate
    2.60156341463415;         !- Vertex 4 Zcoordinate

BuildingSurface:Detailed,
    Wall_ldb_1.unit1,         !- Name
    Wall,                     !- Surface Type
    Exterior Wall,            !- Construction Name
    living_unit1,             !- Zone Name
    Outdoors,                 !- Outside Boundary Condition
    ,                         !- Outside Boundary Condition Object
    SunExposed,               !- Sun Exposure
    WindExposed,              !- Wind Exposure
    ,                         !- View Factor to Ground
    4,                        !- Number of Vertices
    12.1330909462833,         !- Vertex 1 Xcoordinate
    9.09981820971244,         !- Vertex 1 Ycoordinate
    0.0101,                   !- Vertex 1 Zcoordinate
    0,                        !- Vertex 2 Xcoordinate
    9.09981820971244,         !- Vertex 2 Ycoordinate
    0.0101,                   !- Vertex 2 Zcoordinate
    0,                        !- Vertex 3 Xcoordinate
    9.09981820971244,         !- Vertex 3 Ycoordinate
    2.60156341463415,         !- Vertex 3 Zcoordinate
    12.1330909462833,         !- Vertex 4 Xcoordinate
    9.09981820971244,         !- Vertex 4 Ycoordinate
    2.60156341463415;         !- Vertex 4 Zcoordinate
```

```
BuildingSurface:Detailed,
    Wall_sdl_1.unit1,         !- Name
    Wall,                     !- Surface Type
    Exterior Wall,            !- Construction Name
    living_unit1,             !- Zone Name
    Outdoors,                 !- Outside Boundary Condition
    ,                         !- Outside Boundary Condition Object
    SunExposed,               !- Sun Exposure
    WindExposed,              !- Wind Exposure
    ,                         !- View Factor to Ground
    4,                        !- Number of Vertices
    0,                        !- Vertex 1 Xcoordinate
    9.09981820971244,         !- Vertex 1 Ycoordinate
    0.0101,                   !- Vertex 1 Zcoordinate
    0,                        !- Vertex 2 Xcoordinate
    0,                        !- Vertex 2 Ycoordinate
    0.0101,                   !- Vertex 2 Zcoordinate
    0,                        !- Vertex 3 Xcoordinate
    0,                        !- Vertex 3 Ycoordinate
    2.60156341463415,         !- Vertex 3 Zcoordinate
    0,                        !- Vertex 4 Xcoordinate
    9.09981820971244,         !- Vertex 4 Ycoordinate
    2.60156341463415;         !- Vertex 4 Zcoordinate

BuildingSurface:Detailed,
    Wall_ldf_2.unit1,         !- Name
    Wall,                     !- Surface Type
    Exterior Wall,            !- Construction Name
    living_unit1,             !- Zone Name
    Outdoors,                 !- Outside Boundary Condition
    ,                         !- Outside Boundary Condition Object
    SunExposed,               !- Sun Exposure
    WindExposed,              !- Wind Exposure
    ,                         !- View Factor to Ground
    4,                        !- Number of Vertices
```

```
    0,                        !- Vertex 1 Xcoordinate
    0,                        !- Vertex 1 Ycoordinate
    2.60156341463415,         !- Vertex 1 Zcoordinate
    12.1330909462833,         !- Vertex 2 Xcoordinate
    0,                        !- Vertex 2 Ycoordinate
    2.60156341463415,         !- Vertex 2 Zcoordinate
    12.1330909462833,         !- Vertex 3 Xcoordinate
    0,                        !- Vertex 3 Ycoordinate
    5.19302682926829,         !- Vertex 3 Zcoordinate
    0,                        !- Vertex 4 Xcoordinate
    0,                        !- Vertex 4 Ycoordinate
    5.19302682926829;         !- Vertex 4 Zcoordinate

BuildingSurface:Detailed,
    Wall_sdr_2.unit1,         !- Name
    Wall,                     !- Surface Type
    Exterior Wall,            !- Construction Name
    living_unit1,             !- Zone Name
    Outdoors,                 !- Outside Boundary Condition
    ,                         !- Outside Boundary Condition Object
    SunExposed,               !- Sun Exposure
    WindExposed,              !- Wind Exposure
    ,                         !- View Factor to Ground
    4,                        !- Number of Vertices
    12.1330909462833,         !- Vertex 1 Xcoordinate
    0,                        !- Vertex 1 Ycoordinate
    2.60156341463415,         !- Vertex 1 Zcoordinate
    12.1330909462833,         !- Vertex 2 Xcoordinate
    9.09981820971244,         !- Vertex 2 Ycoordinate
    2.60156341463415,         !- Vertex 2 Zcoordinate
    12.1330909462833,         !- Vertex 3 Xcoordinate
    9.09981820971244,         !- Vertex 3 Ycoordinate
    5.19302682926829,         !- Vertex 3 Zcoordinate
    12.1330909462833,         !- Vertex 4 Xcoordinate
    0,                        !- Vertex 4 Ycoordinate
    5.19302682926829;         !- Vertex 4 Zcoordinate
```

```
BuildingSurface:Detailed,
    Wall_ldb_2.unit1,         !- Name
    Wall,                     !- Surface Type
    Exterior Wall,            !- Construction Name
    living_unit1,             !- Zone Name
    Outdoors,                 !- Outside Boundary Condition
    ,                         !- Outside Boundary Condition Object
    SunExposed,               !- Sun Exposure
    WindExposed,              !- Wind Exposure
    ,                         !- View Factor to Ground
    4,                        !- Number of Vertices
    12.1330909462833,         !- Vertex 1 Xcoordinate
    9.09981820971244,         !- Vertex 1 Ycoordinate
    2.60156341463415,         !- Vertex 1 Zcoordinate
    0,                        !- Vertex 2 Xcoordinate
    9.09981820971244,         !- Vertex 2 Ycoordinate
    2.60156341463415,         !- Vertex 2 Zcoordinate
    0,                        !- Vertex 3 Xcoordinate
    9.09981820971244,         !- Vertex 3 Ycoordinate
    5.19302682926829,         !- Vertex 3 Zcoordinate
    12.1330909462833,         !- Vertex 4 Xcoordinate
    9.09981820971244,         !- Vertex 4 Ycoordinate
    5.19302682926829;         !- Vertex 4 Zcoordinate

BuildingSurface:Detailed,
    Wall_sdl_2.unit1,         !- Name
    Wall,                     !- Surface Type
    Exterior Wall,            !- Construction Name
    living_unit1,             !- Zone Name
    Outdoors,                 !- Outside Boundary Condition
    ,                         !- Outside Boundary Condition Object
    SunExposed,               !- Sun Exposure
    WindExposed,              !- Wind Exposure
    ,                         !- View Factor to Ground
    4,                        !- Number of Vertices
```

```
    0,                        !- Vertex 1 Xcoordinate
    9.09981820971244,         !- Vertex 1 Ycoordinate
    2.60156341463415,         !- Vertex 1 Zcoordinate
    0,                        !- Vertex 2 Xcoordinate
    0,                        !- Vertex 2 Ycoordinate
    2.60156341463415,         !- Vertex 2 Zcoordinate
    0,                        !- Vertex 3 Xcoordinate
    0,                        !- Vertex 3 Ycoordinate
    5.19302682926829,         !- Vertex 3 Zcoordinate
    0,                        !- Vertex 4 Xcoordinate
    9.09981820971244,         !- Vertex 4 Ycoordinate
    5.19302682926829;         !- Vertex 4 Zcoordinate

BuildingSurface:Detailed,
    Floor_unit1,              !- Name
    Floor,                    !- Surface Type
    Interior Floor,           !- Construction Name
    living_unit1,             !- Zone Name
    Ground,                   !- Outside Boundary Condition
    ,                         !- Outside Boundary Condition Object
    NoSun,                    !- Sun Exposure
    NoWind,                   !- Wind Exposure
    0,                        !- View Factor to Ground
    4,                        !- Number of Vertices
    0,                        !- Vertex 1 Xcoordinate
    0,                        !- Vertex 1 Ycoordinate
    0.0101,                   !- Vertex 1 Zcoordinate
    0,                        !- Vertex 2 Xcoordinate
    9.09981820971244,         !- Vertex 2 Ycoordinate
    0.0101,                   !- Vertex 2 Zcoordinate
    12.1330909462833,         !- Vertex 3 Xcoordinate
    9.09981820971244,         !- Vertex 3 Ycoordinate
    0.0101,                   !- Vertex 3 Zcoordinate
    12.1330909462833,         !- Vertex 4 Xcoordinate
    0,                        !- Vertex 4 Ycoordinate
    0.0101;                   !- Vertex 4 Zcoordinate
```

```
Window,
    Window_ldf_1.unit1,       !- Name
    Exterior Window,          !- Construction Name
    Wall_ldf_1.unit1,         !- Building Surface Name
    ,                         !- Frame and Divider Name
    1,                        !- Multiplier
    1,                        !- Starting X Coordinate
    0.914634146341463,        !- Starting Z Coordinate
    2.70719591738945,         !- Length
    1.52439024390244;         !- Height

Window,
    Window_ldb_1.unit1,       !- Name
    Exterior Window,          !- Construction Name
    Wall_ldb_1.unit1,         !- Building Surface Name
    ,                         !- Frame and Divider Name
    1,                        !- Multiplier
    2.74190122145512,         !- Starting X Coordinate
    0.914634146341463,        !- Starting Z Coordinate
    2.70719591738945,         !- Length
    1.52439024390244;         !- Height

Window,
    Window_sdr_1.unit1,       !- Name
    Exterior Window,          !- Construction Name
    Wall_sdr_1.unit1,         !- Building Surface Name
    ,                         !- Frame and Divider Name
    1,                        !- Multiplier
    1,                        !- Starting X Coordinate
    0.914634146341463,        !- Starting Z Coordinate
    2.70719591738945,         !- Length
    1.52439024390244;         !- Height

Window,
    Window_sdl_1.unit1,       !- Name
```

```
    Exterior Window,          !- Construction Name
    Wall_sdl_1.unit1,         !- Building Surface Name
    ,                         !- Frame and Divider Name
    1,                        !- Multiplier
    1,                        !- Starting X Coordinate
    0.914634146341463,        !- Starting Z Coordinate
    2.70719591738945,         !- Length
    1.52439024390244;         !- Height

Window,
    Window_ldf_2.unit1,       !- Name
    Exterior Window,          !- Construction Name
    Wall_ldf_2.unit1,         !- Building Surface Name
    ,                         !- Frame and Divider Name
    1,                        !- Multiplier
    1,                        !- Starting X Coordinate
    0.914634146341463,        !- Starting Z Coordinate
    2.70719591738945,         !- Length
    1.52439024390244;         !- Height

Window,
    Window_ldb_2.unit1,       !- Name
    Exterior Window,          !- Construction Name
    Wall_ldb_2.unit1,         !- Building Surface Name
    ,                         !- Frame and Divider Name
    1,                        !- Multiplier
    2.74190122145512,         !- Starting X Coordinate
    0.914634146341463,        !- Starting Z Coordinate
    2.70719591738945,         !- Length
    1.52439024390244;         !- Height

Window,
    Window_sdr_2.unit1,       !- Name
    Exterior Window,          !- Construction Name
    Wall_sdr_2.unit1,         !- Building Surface Name
    ,                         !- Frame and Divider Name
```

```
    1,                          !- Multiplier
    1,                          !- Starting X Coordinate
    0.914634146341463,          !- Starting Z Coordinate
    2.70719591738945,           !- Length
    1.52439024390244;           !- Height

Window,
    Window_sdl_2.unit1,         !- Name
    Exterior Window,            !- Construction Name
    Wall_sdl_2.unit1,           !- Building Surface Name
    ,                           !- Frame and Divider Name
    1,                          !- Multiplier
    1,                          !- Starting X Coordinate
    0.914634146341463,          !- Starting Z Coordinate
    2.70719591738945,           !- Length
    1.52439024390244;           !- Height

Door,
    Door_ldb_unit1,             !- Name
    Exterior Door,              !- Construction Name
    Wall_ldb_1.unit1,           !- Building Surface Name
    1,                          !- Multiplier
    0.5,                        !- Starting X Coordinate
    0,                          !- Starting Z Coordinate
    1.74190122145513,           !- Length
    2.13414634146341;           !- Height

WindowShadingControl,
    Shades-living_unit1,        !- Name
    living_unit1,               !- Zone Name
    1,                          !- Shading Control Sequence Number
    InteriorBlind,              !- Shading Type
    window_w_blinds,            !- Construction with Shading Name
    OnIfScheduleAllows,         !- Shading Control Type
    shading_2012iecc,           !- Schedule Name
    ,                           !- Setpoint
```

```
    Yes,                      !- Shading Control Is Scheduled
    No,                       !- Glare Control Is Active
    ,                         !- Shading Device Material Name
    ,                         !- Type of Slat Angle Control for
   Blinds
    ,                         !- Slat Angle Schedule Name
    ,                         !- Setpoint 2
    ,                         !- Daylighting Control Object Name
    Sequential,               !- Multiple Surface Control Type
    Window_ldf_1.unit1,       !- Fenestration Surface 1 Name
    Window_ldb_1.unit1,       !- Fenestration Surface 2 Name
    Window_sdr_1.unit1,       !- Fenestration Surface 3 Name
    Window_sdl_1.unit1,       !- Fenestration Surface 4 Name
    Window_ldf_2.unit1,       !- Fenestration Surface 5 Name
    Window_ldb_2.unit1,       !- Fenestration Surface 6 Name
    Window_sdr_2.unit1,       !- Fenestration Surface 7 Name
    Window_sdl_2.unit1;       !- Fenestration Surface 8 Name

InternalMass,
    Internalmass_unit1,       !- Name
    InteriorFurnishings,      !- Construction Name
    living_unit1,             !- Zone or ZoneList Name
    9.89591078066915;         !- Surface Area

Shading:Overhang,
    Overhang_sdr_1.unit1,     !- Name
    Window_sdr_1.unit1,       !- Window or Door Name
    0,                        !- Height above Window or Door
    90,                       !- Tilt Angle from WindowDoor
    0,                        !- Left extension from WindowDoor
   Width
    0,                        !- Right extension from WindowDoor
   Width
    0.0152439024390244;       !- Depth

Shading:Overhang,
```

```
    Overhang_sdr_2.unit1,     !- Name
    Window_sdr_2.unit1,       !- Window or Door Name
    0,                        !- Height above Window or Door
    90,                       !- Tilt Angle from WindowDoor
    0,                        !- Left extension from WindowDoor
   Width
    0,                        !- Right extension from WindowDoor
   Width
    0.0152439024390244;       !- Depth

GroundHeatTransfer:Control,
    gtp_control,              !- Name
    no,                       !- Run Basement Preprocessor
    yes;                      !- Run Slab Preprocessor

GroundHeatTransfer:Slab:Materials,
    2,                        !- NMAT Number of materials
    0.16,                     !- ALBEDO Surface Albedo No Snow
    0.4,                      !- ALBEDO Surface Albedo Snow
    0.9,                      !- EPSLW Surface Emissivity No Snow
    0.9,                      !- EPSLW Surface Emissivity Snow
    0.75,                     !- Z0 Surface Roughness No Snow
    0.05,                     !- Z0 Surface Roughness Snow
    6,                        !- HIN Indoor HConv Downward Flow
    9;                        !- HIN Indoor HConv Upward

GroundHeatTransfer:Slab:MatlProps,
    2300,                     !- RHO Slab Material density
    1200,                     !- RHO Soil Density
    650,                      !- CP Slab CP
    1200,                     !- CP Soil CP
    0.9,                      !- TCON Slab k
    1;                        !- TCON Soil k

GroundHeatTransfer:Slab:BoundConds,
    FALSE,                    !- EVTR Is surface evapotranspiration
```

```
   modeled
    TRUE,                    !- FIXBC is the lower boundary at a
   fixed temperature
    10,                      !- TDEEPin
    FALSE;                   !- USRHflag Is the ground surface h
   specified by the user

GroundHeatTransfer:Slab:BldgProps,
    10,                      !- IYRS Number of years to iterate
    0,                       !- Shape Slab shape
    4,                       !- HBLDG Building height
    22.22,                   !- TIN1 January Indoor Average
   Temperature Setpoint
    22.22,                   !- TIN2 February Indoor Average
   Temperature Setpoint
    22.22,                   !- TIN3 March Indoor Average
   Temperature Setpoint
    22.22,                   !- TIN4 April Indoor Average
   Temperature Setpoint
    22.22,                   !- TIN5 May Indoor Average Temperature
    Setpoint
    23.88,                   !- TIN6 June Indoor Average
   Temperature Setpoint
    23.88,                   !- TIN7 July Indoor Average
   Temperature Setpoint
    23.88,                   !- TIN8 August Indoor Average
   Temperature Setpoint
    23.88,                   !- TIN9 September Indoor Average
   Temperature Setpoint
    22.22,                   !- TIN10 October Indoor Average
   Temperature Setpoint
    22.22,                   !- TIN11 November Indoor Average
   Temperature Setpoint
    22.22,                   !- TIN12 December Indoor Average
   Temperature Setpoint
    0,                       !- TINAmp Daily Indoor sine wave
```

```
   variation amplitude
    0.1;                        !- ConvTol Convergence Tolerance

GroundHeatTransfer:Slab:Insulation,
    0,                          !- RINS R value of under slab
   insulation
    0,                          !- DINS Width of strip of under slab
   insulation
    0,                          !- RVINS R value of vertical
   insulation
    0.6,                        !- ZVINS Depth of vertical insulation
    0;                          !- IVINS Flag Is there vertical
   insulation

GroundHeatTransfer:Slab:EquivalentSlab,
    2.59994805991784,           !- APRatio The area to perimeter ratio
    for this slab
    0.1,                        !- SLABDEPTH Thickness of slab on
   grade
    15,                         !- CLEARANCE Distance from edge of
   slab to domain edge
    15;                         !- ZCLEARANCE Distance from bottom of
   slab to domain bottom

GroundHeatTransfer:Basement:SimParameters,
    0.1,                        !- F Multiplier for the ADI solution
    15;                         !- IYRS Maximum number of yearly
   iterations

GroundHeatTransfer:Basement:MatlProps,
    6,                          !- NMAT Number of materials in this
   domain
    2243,                       !- Density for Foundation Wall
    2243,                       !- density for Floor Slab
    311,                        !- density for Ceiling
    1500,                       !- density for Soil
```

```
    2000,                    !- density for Gravel
    449,                     !- density for Wood
    880,                     !- Specific heat for foundation wall
    880,                     !- Specific heat for floor slab
    1530,                    !- Specific heat for ceiling
    840,                     !- Specific heat for soil
    720,                     !- Specific heat for gravel
    1530,                    !- Specific heat for wood
    1.4,                     !- Thermal conductivity for foundation
    wall
    1.4,                     !- Thermal conductivity for floor slab
    0.09,                    !- Thermal conductivity for ceiling
    1.1,                     !- thermal conductivity for soil
    1.9,                     !- thermal conductivity for gravel
    0.12;                    !- thermal conductivity for wood

GroundHeatTransfer:Basement:Insulation,
    1.76099742894375e-05,    !- REXT R Value of any exterior
   insulation
    True;                    !- INSFULL Flag Is the wall fully
   insulated

GroundHeatTransfer:Basement:SurfaceProps,
    0.16,                    !- ALBEDO Surface albedo for No snow
   conditions
    0.4,                     !- ALBEDO Surface albedo for snow
   conditions
    0.94,                    !- EPSLN Surface emissivity No Snow
    0.86,                    !- EPSLN Surface emissivity with Snow
    6,                       !- VEGHT Surface roughness No snow
   conditions
    0.25,                    !- VEGHT Surface roughness Snow
   conditions
    False;                   !- PET Flag Potential
   evapotranspiration on
```

```
GroundHeatTransfer:Basement:BldgData,
    0.200000006162114,        !- DWALL Wall thickness
    0.243828108701145,        !- DSLAB Floor slab thickness
    0.3,                      !- DGRAVXY Width of gravel pit beside
   basement wall
    0.2,                      !- DGRAVZN Gravel depth extending
   above the floor slab
    0.1;                      !- DGRAVZP Gravel depth below the
   floor slab

GroundHeatTransfer:Basement:Interior,
    True,                     !- COND Flag Is the basement
   conditioned
    0.92,                     !- HIN Downward convection only heat
   transfer coefficient
    4.04,                     !- HIN Upward convection only heat
   transfer coefficient
    3.08,                     !- HIN Horizontal convection only heat
    transfer coefficient
    6.13,                     !- HIN Downward combined convection
   and radiation heat transfer coefficient
    9.26,                     !- HIN Upward combined convection and
   radiation heat transfer coefficient
    8.29;                     !- HIN Horizontal combined convection
   and radiation heat transfer coefficient

GroundHeatTransfer:Basement:ComBldg,
    21,                       !- January average temperature
    21,                       !- February average temperature
    21,                       !- March average temperature
    21,                       !- April average temperature
    24,                       !- May average temperature
    24,                       !- June average temperature
    24,                       !- July average temperature
    24,                       !- August average temperature
    24,                       !- September average temperature
```

```
    24,                       !- October average temperature
    21,                       !- November average temperature
    21,                       !- December average temperature
    21;                       !- Daily variation sine wave amplitude

GroundHeatTransfer:Basement:EquivSlab,
    2.59994805991784,         !- APRatio The area to perimeter ratio
    for this slab
    True;                     !- EquivSizing Flag

GroundHeatTransfer:Basement:EquivAutoGrid,
    15,                       !- CLEARANCE Distance from outside of
   wall to edge of 3D ground domain
    0.1,                      !- SlabDepth Thickness of the floor
   slab
    1.21914054350572;         !- BaseDepth Depth of the basement
   wall below grade

People,
    people_unit1,             !- Name
    living_unit1,             !- Zone or ZoneList Name
    Occupancy,                !- Number of People Schedule Name
    People,                   !- Number of People Calculation Method
    3,                        !- Number of People
    ,                         !- People per Zone Floor Area
    ,                         !- Zone Floor Area per Person
    0,                        !- Fraction Radiant
    autocalculate,            !- Sensible Heat Fraction
    activity_sch,             !- Activity Level Schedule Name
    ,                         !- Carbon Dioxide Generation Rate
    No,                       !- Enable ASHRAE 55 Comfort Warnings
    ZoneAveraged,             !- Mean Radiant Temperature
   Calculation Type
    ,                         !- Surface NameAngle Factor List Name
    Work Eff Sch,             !- Work Efficiency Schedule Name
    ClothingInsulationSchedule,    !- Clothing Insulation
```

```
   Calculation Method
    ,                         !- Clothing Insulation Calculation
   Method Schedule Name
    Clothing Sch,             !- Clothing Insulation Schedule Name
    Air Velo Sch,             !- Air Velocity Schedule Name
    Fanger,                   !- Thermal Comfort Model 1 Type
    Pierce,                   !- Thermal Comfort Model 2 Type
    AdaptiveASH55,            !- Thermal Comfort Model 3 Type
    KSU;                      !- Thermal Comfort Model 4 Type

Lights,
    Living Hardwired Lighting1,    !- Name
    living_unit1,             !- Zone or ZoneList Name
    InteriorLightingHE,       !- Schedule Name
    Watts/Area,               !- Design Level Calculation Method
    ,                         !- Lighting Level
    1.05216214401829,         !- Watts per Zone Floor Area
    ,                         !- Watts per Person
    0,                        !- Return Air Fraction
    0.6,                      !- Fraction Radiant
    0.2,                      !- Fraction Visible
    0;                        !- Fraction Replaceable

Lights,
    Living Plug-in Lighting1,    !- Name
    living_unit1,             !- Zone or ZoneList Name
    InteriorLightingHE,       !- Schedule Name
    Watts/Area,               !- Design Level Calculation Method
    ,                         !- Lighting Level
    0.478467682251396,        !- Watts per Zone Floor Area
    ,                         !- Watts per Person
    0,                        !- Return Air Fraction
    0.6,                      !- Fraction Radiant
    0.2,                      !- Fraction Visible
    0;                        !- Fraction Replaceable
```

```
ElectricEquipment,
    ceiling_fan,              !- Name
    living_unit1,             !- Zone or ZoneList Name
    fan_sch,                  !- Schedule Name
    EquipmentLevel,           !- Design Level Calculation Method
    230,                      !- Design Level
    ,                         !- Watts per Zone Floor Area
    ,                         !- Watts per Person
    0,                        !- Fraction Latent
    0.4,                      !- Fraction Radiant
    0,                        !- Fraction Lost
    General;                  !- EndUse Subcategory

ElectricEquipment,
    dishwasher1,              !- Name
    living_unit1,             !- Zone or ZoneList Name
    DishWasher,               !- Schedule Name
    EquipmentLevel,           !- Design Level Calculation Method
    65.698787492023,          !- Design Level
    ,                         !- Watts per Zone Floor Area
    ,                         !- Watts per Person
    0.15,                     !- Fraction Latent
    0.6,                      !- Fraction Radiant
    0.25,                     !- Fraction Lost
    dishwasher;               !- EndUse Subcategory

ElectricEquipment,
    refrigerator1,            !- Name
    living_unit1,             !- Zone or ZoneList Name
    Refrigerator,             !- Schedule Name
    EquipmentLevel,           !- Design Level Calculation Method
    91.0575745202123,         !- Design Level
    ,                         !- Watts per Zone Floor Area
    ,                         !- Watts per Person
    0,                        !- Fraction Latent
    1,                        !- Fraction Radiant
```

```
    0,                          !- Fraction Lost
    refrigerator;               !- EndUse Subcategory

ElectricEquipment,
    clotheswasher1,             !- Name
    living_unit1,               !- Zone or ZoneList Name
    ClothesWasher,              !- Schedule Name
    EquipmentLevel,             !- Design Level Calculation Method
    28.4784377542718,           !- Design Level
    ,                           !- Watts per Zone Floor Area
    ,                           !- Watts per Person
    0,                          !- Fraction Latent
    0.8,                        !- Fraction Radiant
    0.2,                        !- Fraction Lost
    clotheswasher;              !- EndUse Subcategory

ElectricEquipment,
    electric_dryer1,            !- Name
    living_unit1,               !- Zone or ZoneList Name
    ClothesDryer,               !- Schedule Name
    EquipmentLevel,             !- Design Level Calculation Method
    213.064557285022,           !- Design Level
    ,                           !- Watts per Zone Floor Area
    ,                           !- Watts per Person
    0.05,                       !- Fraction Latent
    0.15,                       !- Fraction Radiant
    0.8,                        !- Fraction Lost
    electric_dryer;             !- EndUse Subcategory

ElectricEquipment,
    electric_range1,            !- Name
    living_unit1,               !- Zone or ZoneList Name
    CookingRange,               !- Schedule Name
    EquipmentLevel,             !- Design Level Calculation Method
    248.154224774405,           !- Design Level
    ,                           !- Watts per Zone Floor Area
```

```
    ,                         !- Watts per Person
    0.3,                      !- Fraction Latent
    0.4,                      !- Fraction Radiant
    0.3,                      !- Fraction Lost
    electric_range;           !- EndUse Subcategory

ElectricEquipment,
    television1,              !- Name
    living_unit1,             !- Zone or ZoneList Name
    InteriorLighting,         !- Schedule Name
    EquipmentLevel,           !- Design Level Calculation Method
    0,                        !- Design Level
    ,                         !- Watts per Zone Floor Area
    ,                         !- Watts per Person
    0,                        !- Fraction Latent
    1,                        !- Fraction Radiant
    0,                        !- Fraction Lost
    television;               !- EndUse Subcategory

ElectricEquipment,
    electric_mels1,           !- Name
    living_unit1,             !- Zone or ZoneList Name
    MiscPlugLoad,             !- Schedule Name
    EquipmentLevel,           !- Design Level Calculation Method
    567.464237516869,         !- Design Level
    ,                         !- Watts per Zone Floor Area
    ,                         !- Watts per Person
    0.06,                     !- Fraction Latent
    0.69,                     !- Fraction Radiant
    0.25,                     !- Fraction Lost
    electric_mels;            !- EndUse Subcategory

ElectricEquipment,
    IECC_Adj1,                !- Name
    living_unit1,             !- Zone or ZoneList Name
    MiscPlugLoad,             !- Schedule Name
```

```
    Watts/Area,               !- Design Level Calculation Method
    ,                         !- Design Level
    1.54356736989469,         !- Watts per Zone Floor Area
    ,                         !- Watts per Person
    0.0624390461422629,       !- Fraction Latent
    0.41190936353998,         !- Fraction Radiant
    0.251045347957769,        !- Fraction Lost
    IECC_adj;                 !- EndUse Subcategory

ZoneVentilation:DesignFlowRate,
    Ventilation_unit1,        !- Name
    living_unit1,             !- Zone or ZoneList Name
    always_avail,             !- Schedule Name
    Flow/Zone,                !- Design Flow Rate Calculation Method
    0,                        !- Design Flow Rate
    ,                         !- Flow Rate per Zone Floor Area
    ,                         !- Flow Rate per Person
    ,                         !- Air Changes per Hour
    Exhaust,                  !- Ventilation Type
    0,                        !- Fan Pressure Rise
    0.6,                      !- Fan Total Efficiency
    1,                        !- Constant Term Coefficient
    0,                        !- Temperature Term Coefficient
    0,                        !- Velocity Term Coefficient
    0,                        !- Velocity Squared Term Coefficient
    -100,                     !- Minimum Indoor Temperature
    ,                         !- Minimum Indoor Temperature Schedule
    Name
    100,                      !- Maximum Indoor Temperature
    ,                         !- Maximum Indoor Temperature Schedule
    Name
    -100,                     !- Delta Temperature
    ,                         !- Delta Temperature Schedule Name
    -100,                     !- Minimum Outdoor Temperature
    ,                         !- Minimum Outdoor Temperature
   Schedule Name
```

```
    100,                      !- Maximum Outdoor Temperature
    ,                         !- Maximum Outdoor Temperature
   Schedule Name
    40;                       !- Maximum Wind Speed

AirflowNetwork:SimulationControl,
    House AirflowNetwork,     !- Name
    MultizoneWithDistribution,    !- AirflowNetwork Control
    SurfaceAverageCalculation,    !- Wind Pressure Coefficient Type
    ,                         !- Height Selection for Local Wind
   Pressure Calculation
    LOWRISE,                  !- Building Type
    500,                      !- Maximum Number of Iterations
    ,                         !- Initialization Type
    0.001,                    !- Relative Airflow Convergence
   Tolerance
    1e-05,                    !- Absolute Airflow Convergence
   Tolerance
    0,                        !- Convergence Acceleration Limit
    0,                        !- Azimuth Angle of Long Axis of
   Building
    0.75,                     !- Ratio of Building Width Along Short
    Axis to Width Along Long Axis
    ,                         !- Height Dependence of External Node
   Temperature
    ,                         !- Solver
    Yes;                      !- Allow Unsupported Zone Equipment

AirflowNetwork:MultiZone:Zone,
    living_unit1,             !- Zone Name
    NoVent,                   !- Ventilation Control Mode
    ,                         !- Ventilation Control Zone
   Temperature Setpoint Schedule Name
    0,                        !- Minimum Venting Open Factor
    0,                        !- Indoor and Outdoor Temperature
   Difference Lower Limit For Maximum Venting Open Factor
```

```
    100,                      !- Indoor and Outdoor Temperature
   Difference Upper Limit for Minimum Venting Open Factor
    0,                        !- Indoor and Outdoor Enthalpy
   Difference Lower Limit For Maximum Venting Open Factor
    300000;                   !- Indoor and Outdoor Enthalpy
   Difference Upper Limit for Minimum Venting Open Factor

AirflowNetwork:MultiZone:Zone,
    attic_unit1,              !- Zone Name
    Constant,                 !- Ventilation Control Mode
    ,                         !- Ventilation Control Zone
   Temperature Setpoint Schedule Name
    ,                         !- Minimum Venting Open Factor
    ,                         !- Indoor and Outdoor Temperature
   Difference Lower Limit For Maximum Venting Open Factor
    100,                      !- Indoor and Outdoor Temperature
   Difference Upper Limit for Minimum Venting Open Factor
    ,                         !- Indoor and Outdoor Enthalpy
   Difference Lower Limit For Maximum Venting Open Factor
    300000,                   !- Indoor and Outdoor Enthalpy
   Difference Upper Limit for Minimum Venting Open Factor
    inf_sch;                  !- Venting Availability Schedule Name

AirflowNetwork:MultiZone:Surface,
    Roof_front_unit1,         !- Surface Name
    AtticVent,                !- Leakage Component Name
    ,                         !- External Node Name
    1,                        !- WindowDoor Opening Factor or Crack
   Factor
    Constant,                 !- Ventilation Control Mode
    ,                         !- Ventilation Control Zone
   Temperature Setpoint Schedule Name
    0,                        !- Minimum Venting Open Factor
    ,                         !- Indoor and Outdoor Temperature
   Difference Lower Limit For Maximum Venting Open Factor
    100,                      !- Indoor and Outdoor Temperature
```

```
   Difference Upper Limit for Minimum Venting Open Factor
    ,                         !- Indoor and Outdoor Enthalpy
   Difference Lower Limit For Maximum Venting Open Factor
    300000,                   !- Indoor and Outdoor Enthalpy
   Difference Upper Limit for Minimum Venting Open Factor
    inf_sch;                  !- Venting Availability Schedule Name

AirflowNetwork:MultiZone:Surface,
    Roof_back_unit1,          !- Surface Name
    AtticVent,                !- Leakage Component Name
    ,                         !- External Node Name
    1,                        !- WindowDoor Opening Factor or Crack
   Factor
    Constant,                 !- Ventilation Control Mode
    ,                         !- Ventilation Control Zone
   Temperature Setpoint Schedule Name
    ,                         !- Minimum Venting Open Factor
    ,                         !- Indoor and Outdoor Temperature
   Difference Lower Limit For Maximum Venting Open Factor
    100,                      !- Indoor and Outdoor Temperature
   Difference Upper Limit for Minimum Venting Open Factor
    ,                         !- Indoor and Outdoor Enthalpy
   Difference Lower Limit For Maximum Venting Open Factor
    300000,                   !- Indoor and Outdoor Enthalpy
   Difference Upper Limit for Minimum Venting Open Factor
    inf_sch;                  !- Venting Availability Schedule Name

AirflowNetwork:MultiZone:Surface,
    Roof_right_unit1,         !- Surface Name
    AtticVent,                !- Leakage Component Name
    ,                         !- External Node Name
    1,                        !- WindowDoor Opening Factor or Crack
   Factor
    Constant,                 !- Ventilation Control Mode
    ,                         !- Ventilation Control Zone
   Temperature Setpoint Schedule Name
```

```
    ,                         !- Minimum Venting Open Factor
    ,                         !- Indoor and Outdoor Temperature
   Difference Lower Limit For Maximum Venting Open Factor
    100,                      !- Indoor and Outdoor Temperature
   Difference Upper Limit for Minimum Venting Open Factor
    ,                         !- Indoor and Outdoor Enthalpy
   Difference Lower Limit For Maximum Venting Open Factor
    300000,                   !- Indoor and Outdoor Enthalpy
   Difference Upper Limit for Minimum Venting Open Factor
    inf_sch;                  !- Venting Availability Schedule Name

AirflowNetwork:MultiZone:Surface,
    Roof_left_unit1,          !- Surface Name
    AtticVent,                !- Leakage Component Name
    ,                         !- External Node Name
    1,                        !- WindowDoor Opening Factor or Crack
   Factor
    Constant,                 !- Ventilation Control Mode
    ,                         !- Ventilation Control Zone
   Temperature Setpoint Schedule Name
    ,                         !- Minimum Venting Open Factor
    ,                         !- Indoor and Outdoor Temperature
   Difference Lower Limit For Maximum Venting Open Factor
    100,                      !- Indoor and Outdoor Temperature
   Difference Upper Limit for Minimum Venting Open Factor
    ,                         !- Indoor and Outdoor Enthalpy
   Difference Lower Limit For Maximum Venting Open Factor
    300000,                   !- Indoor and Outdoor Enthalpy
   Difference Upper Limit for Minimum Venting Open Factor
    inf_sch;                  !- Venting Availability Schedule Name

AirflowNetwork:MultiZone:Surface,
    ceiling_unit1,            !- Surface Name
    ZoneLeak_Ceiling,         !- Leakage Component Name
    ,                         !- External Node Name
    1,                        !- WindowDoor Opening Factor or Crack
```

```
   Factor
    NoVent;                  !- Ventilation Control Mode

AirflowNetwork:MultiZone:Surface,
    Wall_ldf_1.unit1,        !- Surface Name
    ZoneLeak_LongWall,       !- Leakage Component Name
    ,                        !- External Node Name
    1,                       !- WindowDoor Opening Factor or Crack
   Factor
    NoVent;                  !- Ventilation Control Mode

AirflowNetwork:MultiZone:Surface,
    Wall_ldb_1.unit1,        !- Surface Name
    ZoneLeak_LongWall,       !- Leakage Component Name
    ,                        !- External Node Name
    1,                       !- WindowDoor Opening Factor or Crack
   Factor
    NoVent;                  !- Ventilation Control Mode

AirflowNetwork:MultiZone:Surface,
    Wall_sdl_1.unit1,        !- Surface Name
    ZoneLeak_ShortWall,      !- Leakage Component Name
    ,                        !- External Node Name
    1,                       !- WindowDoor Opening Factor or Crack
   Factor
    NoVent;                  !- Ventilation Control Mode

AirflowNetwork:MultiZone:Surface,
    Wall_sdr_1.unit1,        !- Surface Name
    ZoneLeak_ShortWall,      !- Leakage Component Name
    ,                        !- External Node Name
    1,                       !- WindowDoor Opening Factor or Crack
   Factor
    NoVent;                  !- Ventilation Control Mode

AirflowNetwork:MultiZone:Surface,
```

```
    Wall_ldf_2.unit1,         !- Surface Name
    ZoneLeak_LongWall,        !- Leakage Component Name
    ,                         !- External Node Name
    1,                        !- WindowDoor Opening Factor or Crack
   Factor
    NoVent;                   !- Ventilation Control Mode

AirflowNetwork:MultiZone:Surface,
    Wall_ldb_2.unit1,         !- Surface Name
    ZoneLeak_LongWall,        !- Leakage Component Name
    ,                         !- External Node Name
    1,                        !- WindowDoor Opening Factor or Crack
   Factor
    NoVent;                   !- Ventilation Control Mode

AirflowNetwork:MultiZone:Surface,
    Wall_sdr_2.unit1,         !- Surface Name
    ZoneLeak_ShortWall,       !- Leakage Component Name
    ,                         !- External Node Name
    1,                        !- WindowDoor Opening Factor or Crack
   Factor
    NoVent;                   !- Ventilation Control Mode

AirflowNetwork:MultiZone:Surface,
    Wall_sdl_2.unit1,         !- Surface Name
    ZoneLeak_ShortWall,       !- Leakage Component Name
    ,                         !- External Node Name
    1,                        !- WindowDoor Opening Factor or Crack
   Factor
    NoVent;                   !- Ventilation Control Mode

AirflowNetwork:MultiZone:Surface:EffectiveLeakageArea,
    ZoneLeak_LongWall,        !- Name
    0.00566687461767392,      !- Effective Leakage Area
    1.15,                     !- Discharge Coefficient
    4,                        !- Reference Pressure Difference
```

```
    0.65;                    !- Air Mass Flow Exponent

AirflowNetwork:MultiZone:Surface:EffectiveLeakageArea,
    ZoneLeak_ShortWall,      !- Name
    0.00425015596325544,     !- Effective Leakage Area
    1.15,                    !- Discharge Coefficient
    4,                       !- Reference Pressure Difference
    0.65;                    !- Air Mass Flow Exponent

AirflowNetwork:MultiZone:Surface:EffectiveLeakageArea,
    ZoneLeak_Ceiling,        !- Name
    0.019898999363395,       !- Effective Leakage Area
    1.15,                    !- Discharge Coefficient
    4,                       !- Reference Pressure Difference
    0.65;                    !- Air Mass Flow Exponent

AirflowNetwork:MultiZone:Surface:EffectiveLeakageArea,
    ZoneLeak_Floor,          !- Name
    1e-05,                   !- Effective Leakage Area
    1.15,                    !- Discharge Coefficient
    4,                       !- Reference Pressure Difference
    0.65;                    !- Air Mass Flow Exponent

AirflowNetwork:MultiZone:Surface:EffectiveLeakageArea,
    AtticVent,               !- Name
    0.37,                    !- Effective Leakage Area
    1.15,                    !- Discharge Coefficient
    4,                       !- Reference Pressure Difference
    0.65;                    !- Air Mass Flow Exponent

AirflowNetwork:MultiZone:Surface:EffectiveLeakageArea,
    CrawlVent,               !- Name
    0.37,                    !- Effective Leakage Area
    1.15,                    !- Discharge Coefficient
    4,                       !- Reference Pressure Difference
    0.65;                    !- Air Mass Flow Exponent
```

```
AirflowNetwork:Distribution:Node,
    EquipmentInletNode_unit1,    !- Name
    Zone Equipment Inlet Node_unit1,    !- Component Name or Node
   Name
    Other,                    !- Component Object Type or Node Type
    3;                        !- Node Height

AirflowNetwork:Distribution:Node,
    SplitterNode_unit1,       !- Name
    ,                         !- Component Name or Node Name
    AirLoopHVAC:ZoneSplitter,    !- Component Object Type or Node
   Type
    3;                        !- Node Height

AirflowNetwork:Distribution:Node,
    ZoneSupplyNode_unit1,     !- Name
    ,                         !- Component Name or Node Name
    Other,                    !- Component Object Type or Node Type
    3;                        !- Node Height

AirflowNetwork:Distribution:Node,
    ZoneSupplyRegisterNode_unit1 ATInlet,    !- Name
    Zone Inlet Node_unit1 ATInlet,    !- Component Name or Node Name
    Other,                    !- Component Object Type or Node Type
    3;                        !- Node Height

AirflowNetwork:Distribution:Node,
    ZoneSupplyRegisterNode_unit1,    !- Name
    Zone Inlet Node_unit1,    !- Component Name or Node Name
    Other,                    !- Component Object Type or Node Type
    3;                        !- Node Height

AirflowNetwork:Distribution:Node,
    ZoneOutletNode_unit1,     !- Name
    Zone Outlet node_unit1,    !- Component Name or Node Name
```

```
    Other,                    !- Component Object Type or Node Type
    3;                        !- Node Height

AirflowNetwork:Distribution:Node,
    ZoneReturnNode_unit1,     !- Name
    ,                         !- Component Name or Node Name
    Other,                    !- Component Object Type or Node Type
    3;                        !- Node Height

AirflowNetwork:Distribution:Node,
    MixerNode_unit1,          !- Name
    ,                         !- Component Name or Node Name
    AirLoopHVAC:ZoneMixer,    !- Component Object Type or Node Type
    3;                        !- Node Height

AirflowNetwork:Distribution:Node,
    MainReturnNode_unit1,     !- Name
    Return Air Mixer Outlet_unit1,    !- Component Name or Node Name
    Other,                    !- Component Object Type or Node Type
    3;                        !- Node Height

AirflowNetwork:Distribution:Node,
    MainInletNode_unit1,      !- Name
    Air Loop Inlet Node_unit1,    !- Component Name or Node Name
    Other,                    !- Component Object Type or Node Type
    3;                        !- Node Height

AirflowNetwork:Distribution:Node,
    FanOutletNode_unit1,      !- Name
    Cooling Coil Air Inlet Node_unit1,    !- Component Name or Node
   Name
    Other,                    !- Component Object Type or Node Type
    3;                        !- Node Height

AirflowNetwork:Distribution:Node,
    HeatingInletNode_unit1,    !- Name
```

```
    Heating Coil Air Inlet Node_unit1,    !- Component Name or Node
   Name
    Other,                    !- Component Object Type or Node Type
    3;                        !- Node Height

AirflowNetwork:Distribution:Node,
    HeatingOutletNode_unit1,    !- Name
    Air Loop Outlet Node_unit1,    !- Component Name or Node Name
    Other,                    !- Component Object Type or Node Type
    3;                        !- Node Height

AirflowNetwork:Distribution:Node,
    SuppHeatingInletNode_unit1,    !- Name
    Supp Heating coil air inlet Node_unit1,    !- Component Name or
   Node Name
    Other,                    !- Component Object Type or Node Type
    3;                        !- Node Height

AirflowNetwork:Distribution:Component:LeakageRatio,
    SupplyLeak,               !- Name
    0.0396,                   !- Effective Leakage Ratio
    0.56034,                  !- Maximum Flow Rate
    25,                       !- Reference Pressure Difference
    0.65;                     !- Air Mass Flow Exponent

AirflowNetwork:Distribution:Component:LeakageRatio,
    ReturnLeak,               !- Name
    0.0396,                   !- Effective Leakage Ratio
    0.56034,                  !- Maximum Flow Rate
    25,                       !- Reference Pressure Difference
    0.65;                     !- Air Mass Flow Exponent

AirflowNetwork:Distribution:Component:Duct,
    MainTrunk_unit1,          !- Name
    2,                        !- Duct Length
    0.591921113608382,        !- Hydraulic Diameter
```

```
    0.275216110019646,        !- Cross Section Area
    0.0009,                   !- Surface Roughness
    0.01,                     !- Coefficient for Local Dynamic Loss
   Due to Fitting
    0.709825,                 !- Heat Transmittance Coefficient
   UFactor for Duct Wall Construction
    1e-07;                    !- Overall Moisture Transmittance
   Coefficient from Air to Air

AirflowNetwork:Distribution:Component:Duct,
    ZoneSupply_unit1,         !- Name
    15,                       !- Duct Length
    0.591921113608382,        !- Hydraulic Diameter
    0.275216110019646,        !- Cross Section Area
    0.0009,                   !- Surface Roughness
    10,                       !- Coefficient for Local Dynamic Loss
   Due to Fitting
    0.709825,                 !- Heat Transmittance Coefficient
   UFactor for Duct Wall Construction
    1e-07;                    !- Overall Moisture Transmittance
   Coefficient from Air to Air

AirflowNetwork:Distribution:Component:Duct,
    ZoneSupplyLink2_unit1 ATInlet Duct,    !- Name
    0.0001,                   !- Duct Length
    0.591921113608382,        !- Hydraulic Diameter
    0.275216110019646,        !- Cross Section Area
    0.0009,                   !- Surface Roughness
    0,                        !- Coefficient for Local Dynamic Loss
   Due to Fitting
    0.709825,                 !- Heat Transmittance Coefficient
   UFactor for Duct Wall Construction
    1e-07;                    !- Overall Moisture Transmittance
   Coefficient from Air to Air

AirflowNetwork:Distribution:Component:Duct,
```

```
    ZoneReturn_unit1,         !- Name
    8,                        !- Duct Length
    0.529430338938287,        !- Hydraulic Diameter
    0.220172888015717,        !- Cross Section Area
    0.0009,                   !- Surface Roughness
    9,                        !- Coefficient for Local Dynamic Loss
   Due to Fitting
    0.709825,                 !- Heat Transmittance Coefficient
   UFactor for Duct Wall Construction
    1e-07;                    !- Overall Moisture Transmittance
   Coefficient from Air to Air

AirflowNetwork:Distribution:Component:Duct,
    ZoneConnectionDuct_unit1,    !- Name
    0.1,                      !- Duct Length
    0.591921113608382,        !- Hydraulic Diameter
    0.275216110019646,        !- Cross Section Area
    0.0001,                   !- Surface Roughness
    0,                        !- Coefficient for Local Dynamic Loss
   Due to Fitting
    0.709825,                 !- Heat Transmittance Coefficient
   UFactor for Duct Wall Construction
    1e-07;                    !- Overall Moisture Transmittance
   Coefficient from Air to Air

AirflowNetwork:Distribution:Component:Duct,
    MainReturn_unit1,         !- Name
    1,                        !- Duct Length
    0.529430338938287,        !- Hydraulic Diameter
    0.220172888015717,        !- Cross Section Area
    0.0009,                   !- Surface Roughness
    0.01,                     !- Coefficient for Local Dynamic Loss
   Due to Fitting
    0.709825,                 !- Heat Transmittance Coefficient
   UFactor for Duct Wall Construction
    1e-07;                    !- Overall Moisture Transmittance
```

```
   Coefficient from Air to Air

AirflowNetwork:Distribution:Component:Duct,
    AirLoopReturn_unit1,      !- Name
    0.1,                      !- Duct Length
    0.529430338938287,        !- Hydraulic Diameter
    0.220172888015717,        !- Cross Section Area
    0.0001,                   !- Surface Roughness
    0,                        !- Coefficient for Local Dynamic Loss
   Due to Fitting
    0.709825,                 !- Heat Transmittance Coefficient
   UFactor for Duct Wall Construction
    1e-07;                    !- Overall Moisture Transmittance
   Coefficient from Air to Air

AirflowNetwork:Distribution:Component:Duct,
    AirLoopSupply_unit1,      !- Name
    0.1,                      !- Duct Length
    0.591921113608382,        !- Hydraulic Diameter
    0.275216110019646,        !- Cross Section Area
    0.0001,                   !- Surface Roughness
    0,                        !- Coefficient for Local Dynamic Loss
   Due to Fitting
    0.709825,                 !- Heat Transmittance Coefficient
   UFactor for Duct Wall Construction
    1e-07;                    !- Overall Moisture Transmittance
   Coefficient from Air to Air

AirflowNetwork:Distribution:Component:Fan,
    Supply Fan_unit1,         !- Fan Name
    Fan:OnOff;                !- Supply Fan Object Type

AirflowNetwork:Distribution:Component:Coil,
    DX Cooling Coil_unit1,    !- Coil Name
    Coil:Cooling:DX:SingleSpeed,    !- Coil Object Type
    0.1,                      !- Air Path Length
```

```
    1;                          !- Air Path Hydraulic Diameter

AirflowNetwork:Distribution:Component:Coil,
    Main DX Heating Coil_unit1,    !- Coil Name
    Coil:Heating:DX:Singlespeed,    !- Coil Object Type
    0.1,                        !- Air Path Length
    1;                          !- Air Path Hydraulic Diameter

AirflowNetwork:Distribution:Component:Coil,
    Supp Heating Coil_unit1,    !- Coil Name
    Coil:Heating:Electric,    !- Coil Object Type
    0.1,                        !- Air Path Length
    1;                          !- Air Path Hydraulic Diameter

AirflowNetwork:Distribution:Linkage,
    MainSupplyLink_unit1,     !- Name
    EquipmentInletNode_unit1,    !- Node 1 Name
    SplitterNode_unit1,       !- Node 2 Name
    MainTrunk_unit1,          !- Component Name
    attic_unit1;              !- Thermal Zone Name

AirflowNetwork:Distribution:Linkage,
    ZoneSupplyLink_unit1,     !- Name
    SplitterNode_unit1,       !- Node 1 Name
    ZoneSupplyNode_unit1,     !- Node 2 Name
    ZoneSupply_unit1,         !- Component Name
    attic_unit1;              !- Thermal Zone Name

AirflowNetwork:Distribution:Linkage,
    ZoneSupplyLink2_unit1 ATInlet,    !- Name
    ZoneSupplyRegisterNode_unit1 ATInlet,    !- Node 1 Name
    ZoneSupplyRegisterNode_unit1,    !- Node 2 Name
    ZoneSupplyLink2_unit1 ATInlet Duct,    !- Component Name
    attic_unit1;              !- Thermal Zone Name

AirflowNetwork:Distribution:Linkage,
```

```
    ZoneSupplyLink2_unit1,    !- Name
    ZoneSupplyNode_unit1,     !- Node 1 Name
    ZoneSupplyRegisterNode_unit1 ATInlet,    !- Node 2 Name
    ZoneSupply_unit1,         !- Component Name
    attic_unit1;              !- Thermal Zone Name

AirflowNetwork:Distribution:Linkage,
    ZoneSupplyConnectionLink_unit1,    !- Name
    ZoneSupplyRegisterNode_unit1,    !- Node 1 Name
    living_unit1,             !- Node 2 Name
    ZoneConnectionDuct_unit1;    !- Component Name

AirflowNetwork:Distribution:Linkage,
    ZoneReturnConnectionLink_unit1,    !- Name
    living_unit1,             !- Node 1 Name
    ZoneOutletNode_unit1,     !- Node 2 Name
    ZoneConnectionDuct_unit1;    !- Component Name

AirflowNetwork:Distribution:Linkage,
    ZoneReturnLink1_unit1,    !- Name
    Zoneoutletnode_unit1,     !- Node 1 Name
    ZoneReturnNode_unit1,     !- Node 2 Name
    ZoneReturn_unit1,         !- Component Name
    attic_unit1;              !- Thermal Zone Name

AirflowNetwork:Distribution:Linkage,
    ZoneReturnLink2_unit1,    !- Name
    ZoneReturnNode_unit1,     !- Node 1 Name
    MixerNode_unit1,          !- Node 2 Name
    ZoneReturn_unit1,         !- Component Name
    attic_unit1;              !- Thermal Zone Name

AirflowNetwork:Distribution:Linkage,
    MainReturnLink_unit1,     !- Name
    MixerNode_unit1,          !- Node 1 Name
    MainReturnNode_unit1,     !- Node 2 Name
```

```
    MainReturn_unit1,          !- Component Name
    attic_unit1;               !- Thermal Zone Name

AirflowNetwork:Distribution:Linkage,
    SystemReturnLink_unit1,    !- Name
    MainReturnNode_unit1,      !- Node 1 Name
    MainInletNode_unit1,       !- Node 2 Name
    AirLoopReturn_unit1;       !- Component Name

AirflowNetwork:Distribution:Linkage,
    SupplyFanLink_unit1,       !- Name
    MainInletNode_unit1,       !- Node 1 Name
    FanOutletNode_unit1,       !- Node 2 Name
    Supply Fan_unit1;          !- Component Name

AirflowNetwork:Distribution:Linkage,
    CoolingCoilLink_unit1,     !- Name
    FanOutletNode_unit1,       !- Node 1 Name
    HeatingInletNode_unit1,    !- Node 2 Name
    DX Cooling Coil_unit1;     !- Component Name

AirflowNetwork:Distribution:Linkage,
    EquipmentAirLoopLink_unit1,    !- Name
    HeatingOutletNode_unit1,    !- Node 1 Name
    EquipmentInletNode_unit1,    !- Node 2 Name
    AirLoopSupply_unit1;       !- Component Name

AirflowNetwork:Distribution:Linkage,
    HeatingCoilLink_unit1,     !- Name
    HeatingInletNode_unit1,    !- Node 1 Name
    SuppHeatingInletNode_unit1,    !- Node 2 Name
    Main DX Heating Coil_unit1;    !- Component Name

AirflowNetwork:Distribution:Linkage,
    SuppHeatingCoilLink_unit1,    !- Name
    SuppHeatingInletNode_unit1,    !- Node 1 Name
```

```
    HeatingOutletNode_unit1,    !- Node 2 Name
    Supp Heating Coil_unit1;    !- Component Name

AirflowNetwork:Distribution:Linkage,
    ZoneSupplyLeakLink_unit1,    !- Name
    ZoneSupplyNode_unit1,     !- Node 1 Name
    attic_unit1,              !- Node 2 Name
    SupplyLeak;               !- Component Name

AirflowNetwork:Distribution:Linkage,
    ZoneReturnLeakLink_unit1,    !- Name
    attic_unit1,              !- Node 1 Name
    ZoneReturnNode_unit1,     !- Node 2 Name
    ReturnLeak;               !- Component Name

Exterior:Lights,
    Exterior-Lights_unit1,    !- Name
    ExteriorLighting,         !- Schedule Name
    43.2424607481559,         !- Design Level
    ,                         !- Control Option
    Exterior-Lights;          !- EndUse Subcategory

Exterior:Lights,
    Garage-Lights_unit1,      !- Name
    InteriorLightingHE,       !- Schedule Name
    7.16294617434682,         !- Design Level
    ,                         !- Control Option
    Garage-Lights;            !- EndUse Subcategory

DesignSpecification:OutdoorAir,
    SZ_DSOA_living_unit1,     !- Name
    Flow/Zone,                !- Outdoor Air Method
    0,                        !- Outdoor Air Flow per Person
    ,                         !- Outdoor Air Flow per Zone Floor
   Area
    0.0283168464628752;       !- Outdoor Air Flow per Zone
```

```
Sizing:Zone,
    living_unit1,             !- Zone or ZoneList Name
    SupplyAirTemperature,     !- Zone Cooling Design Supply Air
   Temperature Input Method
    12,                       !- Zone Cooling Design Supply Air
   Temperature
    ,                         !- Zone Cooling Design Supply Air
   Temperature Difference
    SupplyAirTemperature,     !- Zone Heating Design Supply Air
   Temperature Input Method
    50,                       !- Zone Heating Design Supply Air
   Temperature
    ,                         !- Zone Heating Design Supply Air
   Temperature Difference
    0.008,                    !- Zone Cooling Design Supply Air
   Humidity Ratio
    0.008,                    !- Zone Heating Design Supply Air
   Humidity Ratio
    SZ_DSOA_living_unit1,     !- Design Specification Outdoor Air
   Object Name
    ,                         !- Zone Heating Sizing Factor
    ,                         !- Zone Cooling Sizing Factor
    DesignDay,                !- Cooling Design Air Flow Method
    ,                         !- Cooling Design Air Flow Rate
    0.000762,                 !- Cooling Minimum Air Flow per Zone
   Floor Area
    ,                         !- Cooling Minimum Air Flow
    ,                         !- Cooling Minimum Air Flow Fraction
    DesignDay,                !- Heating Design Air Flow Method
    ,                         !- Heating Design Air Flow Rate
    0.002032,                 !- Heating Maximum Air Flow per Zone
   Floor Area
    0.1415762,                !- Heating Maximum Air Flow
    0.3,                      !- Heating Maximum Air Flow Fraction
    ,                         !- Design Specification Zone Air
```

```
   Distribution Object Name
    ,                         !- Account for Dedicated Outdoor Air
   System
    ,                         !- Dedicated Outdoor Air System
   Control Strategy
    ,                         !- Dedicated Outdoor Air Low Setpoint
   Temperature for Design
    ;                         !- Dedicated Outdoor Air High Setpoint
    Temperature for Design

Sizing:System,
    Central System_unit1,     !- AirLoop Name
    Sensible,                 !- Type of Load to Size On
    autosize,                 !- Design Outdoor Air Flow Rate
    1,                        !- Central Heating Maximum System Air
   Flow Ratio
    7,                        !- Preheat Design Temperature
    0.008,                    !- Preheat Design Humidity Ratio
    11,                       !- Precool Design Temperature
    0.008,                    !- Precool Design Humidity Ratio
    12,                       !- Central Cooling Design Supply Air
   Temperature
    50,                       !- Central Heating Design Supply Air
   Temperature
    NonCoincident,            !- Type of Zone Sum to Use
    No,                       !- 100 Outdoor Air in Cooling
    No,                       !- 100 Outdoor Air in Heating
    0.008,                    !- Central Cooling Design Supply Air
   Humidity Ratio
    0.008,                    !- Central Heating Design Supply Air
   Humidity Ratio
    DesignDay,                !- Cooling Supply Air Flow Rate Method
    ,                         !- Cooling Supply Air Flow Rate
    ,                         !- Cooling Supply Air Flow Rate Per
   Floor Area
    ,                         !- Cooling Fraction of Autosized
```

```
   Cooling Supply Air Flow Rate
    ,                         !- Cooling Supply Air Flow Rate Per
   Unit Cooling Capacity
    DesignDay,                !- Heating Supply Air Flow Rate Method
    ,                         !- Heating Supply Air Flow Rate
    ,                         !- Heating Supply Air Flow Rate Per
   Floor Area
    ,                         !- Heating Fraction of Autosized
   Heating Supply Air Flow Rate
    ,                         !- Heating Fraction of Autosized
   Cooling Supply Air Flow Rate
    ,                         !- Heating Supply Air Flow Rate Per
   Unit Heating Capacity
    ,                         !- System Outdoor Air Method
    1,                        !- Zone Maximum Outdoor Air Fraction
    CoolingDesignCapacity,    !- Cooling Design Capacity Method
    autosize,                 !- Cooling Design Capacity
    ,                         !- Cooling Design Capacity Per Floor
   Area
    ,                         !- Fraction of Autosized Cooling
   Design Capacity
    HeatingDesignCapacity,    !- Heating Design Capacity Method
    autosize,                 !- Heating Design Capacity
    ,                         !- Heating Design Capacity Per Floor
   Area
    ,                         !- Fraction of Autosized Heating
   Design Capacity
    OnOff;                    !- Central Cooling Capacity Control
   Method

Sizing:Plant,
    DHW Loop_unit1,           !- Plant or Condenser Loop Name
    Heating,                  !- Loop Type
    48.8888888888889,         !- Design Loop Exit Temperature
    5.55555555555556;         !- Loop Design Temperature Difference
```

```
ZoneControl:Thermostat,
    Zone Thermostat_unit1,    !- Name
    living_unit1,             !- Zone or ZoneList Name
    zone_control_type,        !- Control Type Schedule Name
    ThermostatSetpoint:DualSetpoint,    !- Control 1 Object Type
    thermostat_living Dual SP Control;    !- Control 1 Name

ThermostatSetpoint:DualSetpoint,
    thermostat_living Dual SP Control,    !- Name
    heating_sch,              !- Heating Setpoint Temperature
   Schedule Name
    cooling_sch;              !- Cooling Setpoint Temperature
   Schedule Name

ZoneHVAC:EnergyRecoveryVentilator,
    ERV_unit1,                !- Name
    always_avail,             !- Availability Schedule Name
    OA_Heat_Recovery_Unit1,    !- Heat Exchanger Name
    0.0283168464628752,       !- Supply Air Flow Rate
    0.0283168464628752,       !- Exhaust Air Flow Rate
    OASupplyFan_unit1,        !- Supply Air Fan Name
    OAExhaustFan_unit1;       !- Exhaust Air Fan Name

AirTerminal:SingleDuct:ConstantVolume:NoReheat,
    ZoneDirectAir_unit1,      !- Name
    always_avail,             !- Availability Schedule Name
    Zone Inlet Node_unit1 ATInlet,    !- Air Inlet Node Name
    Zone Inlet Node_unit1,    !- Air Outlet Node Name
    autosize;                 !- Maximum Air Flow Rate

ZoneHVAC:AirDistributionUnit,
    ZoneDirectAir_unit1 ADU,    !- Name
    Zone Inlet Node_unit1,    !- Air Distribution Unit Outlet Node
   Name
    AirTerminal:SingleDuct:ConstantVolume:NoReheat,    !- Air
   Terminal Object Type
```

```
    ZoneDirectAir_unit1;      !- Air Terminal Name

ZoneHVAC:EquipmentList,
    ZoneEquipment_unit1,      !- Name
    SequentialLoad,           !- Load Distribution Scheme
    ZoneHVAC:AirDistributionUnit,    !- Zone Equipment 1 Object Type
    ZoneDirectAir_unit1 ADU,    !- Zone Equipment 1 Name
    3,                        !- Zone Equipment 1 Cooling Sequence
    3,                        !- Zone Equipment 1 Heating or NoLoad
   Sequence
    ,                         !- Zone Equipment 1 Sequential Cooling
    Fraction Schedule Name
    ,                         !- Zone Equipment 1 Sequential Heating
    Fraction Schedule Name
    WaterHeater:HeatPump:WrappedCondenser,    !- Zone Equipment 2
   Object Type
    Water Heater_unit1,       !- Zone Equipment 2 Name
    1,                        !- Zone Equipment 2 Cooling Sequence
    1,                        !- Zone Equipment 2 Heating or NoLoad
   Sequence
    ,                         !- Zone Equipment 2 Sequential Cooling
    Fraction Schedule Name
    ,                         !- Zone Equipment 2 Sequential Heating
    Fraction Schedule Name
    ZoneHVAC:EnergyRecoveryVentilator,    !- Zone Equipment 3 Object
    Type
    ERV_unit1,                !- Zone Equipment 3 Name
    2,                        !- Zone Equipment 3 Cooling Sequence
    2;                        !- Zone Equipment 3 Heating or NoLoad
   Sequence

ZoneHVAC:EquipmentConnections,
    living_unit1,             !- Zone Name
    ZoneEquipment_unit1,      !- Zone Conditioning Equipment List
   Name
    zone inlet nodes_unit1,    !- Zone Air Inlet Node or NodeList
```

```
   Name
    Zone Exhaust Node_list_unit1,    !- Zone Air Exhaust Node or
   NodeList Name
    Zone Node_unit1,          !- Zone Air Node Name
    Zone Outlet Node_unit1;    !- Zone Return Air Node or NodeList
   Name

Fan:OnOff,
    Supply Fan_unit1,         !- Name
    always_avail,             !- Availability Schedule Name
    0.50054,                  !- Fan Total Efficiency
    400,                      !- Pressure Rise
    autosize,                 !- Maximum Flow Rate
    0.863,                    !- Motor Efficiency
    1,                        !- Motor In Airstream Fraction
    air loop inlet node_unit1,    !- Air Inlet Node Name
    cooling coil air inlet node_unit1,    !- Air Outlet Node Name
    ,                         !- Fan Power Ratio Function of Speed
   Ratio Curve Name
    ,                         !- Fan Efficiency Ratio Function of
   Speed Ratio Curve Name
    General;                  !- EndUse Subcategory

Fan:OnOff,
    OASupplyFan_unit1,        !- Name
    always_avail,             !- Availability Schedule Name
    0.6,                      !- Fan Total Efficiency
    227.022858530508,         !- Pressure Rise
    0.0283168464628752,       !- Maximum Flow Rate
    1,                        !- Motor Efficiency
    0,                        !- Motor In Airstream Fraction
    OA fan inlet node_unit1,    !- Air Inlet Node Name
    OA inlet node_unit1,      !- Air Outlet Node Name
    ,                         !- Fan Power Ratio Function of Speed
   Ratio Curve Name
    ,                         !- Fan Efficiency Ratio Function of
```

```
   Speed Ratio Curve Name
    Ventilation;              !- EndUse Subcategory

Fan:OnOff,
    OAExhaustFan_unit1,       !- Name
    always_avail,             !- Availability Schedule Name
    0.6,                      !- Fan Total Efficiency
    227.022858530508,         !- Pressure Rise
    0.0283168464628752,       !- Maximum Flow Rate
    1,                        !- Motor Efficiency
    0,                        !- Motor In Airstream Fraction
    ERVexhaustnode_unit1,     !- Air Inlet Node Name
    exhaust outlet node_unit1,    !- Air Outlet Node Name
    ,                         !- Fan Power Ratio Function of Speed
   Ratio Curve Name
    ,                         !- Fan Efficiency Ratio Function of
   Speed Ratio Curve Name
    Ventilation;              !- EndUse Subcategory

Fan:OnOff,
    Heat Pump Water Heater Fan_unit1,    !- Name
    always_avail,             !- Availability Schedule Name
    0.7,                      !- Fan Total Efficiency
    100,                      !- Pressure Rise
    autosize,                 !- Maximum Flow Rate
    0.9,                      !- Motor Efficiency
    1,                        !- Motor In Airstream Fraction
    Heat Pump Water Heater Fan Inlet Node_unit1,    !- Air Inlet
   Node Name
    HPWH zone inlet node_unit1,    !- Air Outlet Node Name
    ,                         !- Fan Power Ratio Function of Speed
   Ratio Curve Name
    ,                         !- Fan Efficiency Ratio Function of
   Speed Ratio Curve Name
    General;                  !- EndUse Subcategory
```

```
Coil:Cooling:DX:SingleSpeed,
    DX Cooling Coil_unit1,    !- Name
    always_avail,             !- Availability Schedule Name
    autosize,                 !- Gross Rated Total Cooling Capacity
    autosize,                 !- Gross Rated Sensible Heat Ratio
    4.06853019625951,         !- Gross Rated Cooling COP
    autosize,                 !- Rated Air Flow Rate
    ,                         !- Rated Evaporator Fan Power Per
   Volume Flow Rate
    Cooling Coil Air Inlet Node_unit1,    !- Air Inlet Node Name
    Heating Coil Air Inlet Node_unit1,    !- Air Outlet Node Name
    HPACCoolCapFT,            !- Total Cooling Capacity Function of
   Temperature Curve Name
    HPACCoolCapFFF,           !- Total Cooling Capacity Function of
   Flow Fraction Curve Name
    HPACCOOLEIRFT,            !- Energy Input Ratio Function of
   Temperature Curve Name
    HPACCOOLEIRFFF,           !- Energy Input Ratio Function of Flow
    Fraction Curve Name
    HPACCOOLPLFFPLR;          !- Part Load Fraction Correlation
   Curve Name

Coil:Heating:Electric,
    Supp Heating Coil_unit1,    !- Name
    always_avail,             !- Availability Schedule Name
    1,                        !- Efficiency
    autosize,                 !- Nominal Capacity
    Supp Heating Coil Air Inlet Node_unit1,    !- Air Inlet Node
   Name
    Air Loop Outlet Node_unit1;    !- Air Outlet Node Name

Coil:Heating:DX:SingleSpeed,
    Main DX Heating Coil_unit1,    !- Name
    always_avail,             !- Availability Schedule Name
    autosize,                 !- Gross Rated Heating Capacity
    3.69308080013886,         !- Gross Rated Heating COP
```

```
    autosize,                 !- Rated Air Flow Rate
    ,                         !- Rated Supply Fan Power Per Volume
   Flow Rate
    Heating Coil Air Inlet Node_unit1,    !- Air Inlet Node Name
    Supp Heating Coil Air Inlet Node_unit1,    !- Air Outlet Node
   Name
    HPACHeatCapFT,            !- Heating Capacity Function of
   Temperature Curve Name
    HPACHeatCapFFF,           !- Heating Capacity Function of Flow
   Fraction Curve Name
    HPACHeatEIRFT,            !- Energy Input Ratio Function of
   Temperature Curve Name
    HPACHeatEIRFFF,           !- Energy Input Ratio Function of Flow
    Fraction Curve Name
    HPACCOOLPLFFPLR,          !- Part Load Fraction Correlation
   Curve Name
    Defrost_EIR_FT,           !- Defrost Energy Input Ratio Function
    of Temperature Curve Name
    -17.78,                   !- Minimum Outdoor DryBulb Temperature
    for Compressor Operation
    ,                         !- Outdoor DryBulb Temperature to Turn
    On Compressor
    5,                        !- Maximum Outdoor DryBulb Temperature
    for Defrost Operation
    200,                      !- Crankcase Heater Capacity
    10,                       !- Maximum Outdoor DryBulb Temperature
    for Crankcase Heater Operation
    ReverseCycle,             !- Defrost Strategy
    OnDemand;                 !- Defrost Control

Coil:WaterHeating:AirToWaterHeatPump:Wrapped,
    Heat Pump Water Heater Evaporator_unit1,    !- Name
    1500,                     !- Rated Heating Capacity
    3,                        !- Rated COP
    0.981,                    !- Rated Sensible Heat Ratio
    19.7,                     !- Rated Evaporator Inlet Air DryBulb
```

```
    Temperature
     13.5,                    !- Rated Evaporator Inlet Air WetBulb
    Temperature
     48.89,                   !- Rated Condenser Water Temperature
     0.189,                   !- Rated Evaporator Air Flow Rate
     yes,                     !- Evaporator Fan Power Included in
    Rated COP
     Zone Exhaust Node1_unit1,    !- Evaporator Air Inlet Node Name
     Heat Pump Water Heater Fan Inlet Node_unit1,    !- Evaporator
    Air Outlet Node Name
     ,                        !- Crankcase Heater Capacity
     10,                      !- Maximum Ambient Temperature for
    Crankcase Heater Operation
     WetBulbTemperature,      !- Evaporator Air Temperature Type for
     Curve Objects
     HPWH-Htg-Cap-fT,         !- Heating Capacity Function of
    Temperature Curve Name
     ,                        !- Heating Capacity Function of Air
    Flow Fraction Curve Name
     HPWH-Htg-COP-fT,         !- Heating COP Function of Temperature
     Curve Name
     ,                        !- Heating COP Function of Air Flow
    Fraction Curve Name
     HPWH-COP-fPLR;           !- Part Load Fraction Correlation
    Curve Name

HeatExchanger:AirToAir:SensibleAndLatent,
     OA_Heat_Recovery_Unit1,    !- Name
     always_off,              !- Availability Schedule Name
     0.0283168464628752,      !- Nominal Supply Air Flow Rate
     0.65,                    !- Sensible Effectiveness at 100
    Heating Air Flow
     0,                       !- Latent Effectiveness at 100 Heating
     Air Flow
     0.65,                    !- Sensible Effectiveness at 75
    Heating Air Flow
```

```
    0,                          !- Latent Effectiveness at 75 Heating
   Air Flow
    0.65,                       !- Sensible Effectiveness at 100
   Cooling Air Flow
    0,                          !- Latent Effectiveness at 100 Cooling
    Air Flow
    0.65,                       !- Sensible Effectiveness at 75
   Cooling Air Flow
    0,                          !- Latent Effectiveness at 75 Cooling
   Air Flow
    outdoor air node_unit1,     !- Supply Air Inlet Node Name
    OA fan inlet node_unit1,    !- Supply Air Outlet Node Name
    Zone Exhaust Node_unit1,    !- Exhaust Air Inlet Node Name
    ERVexhaustnode_unit1,       !- Exhaust Air Outlet Node Name
    0,                          !- Nominal Electric Power
    No,                         !- Supply Air Outlet Temperature
   Control
    Plate,                      !- Heat Exchanger Type
    None,                       !- Frost Control Type
    -16.8333337792644,          !- Threshold Temperature
    0.083,                      !- Initial Defrost Time Fraction
    0.0215999989700318,         !- Rate of Defrost Time Fraction
   Increase
    No;                         !- Economizer Lockout

AirLoopHVAC:UnitaryHeatPump:AirToAir,
    Heat Pump_unit1,            !- Name
    always_avail,               !- Availability Schedule Name
    Air Loop Inlet node_unit1,    !- Air Inlet Node Name
    Air Loop Outlet Node_unit1,    !- Air Outlet Node Name
    autosize,                   !- Cooling Supply Air Flow Rate
    autosize,                   !- Heating Supply Air Flow Rate
    0,                          !- No Load Supply Air Flow Rate
    living_unit1,               !- Controlling Zone or Thermostat
   Location
    Fan:OnOff,                  !- Supply Air Fan Object Type
```

```
    Supply Fan_unit1,         !- Supply Air Fan Name
    Coil:Heating:DX:SingleSpeed,    !- Heating Coil Object Type
    Main DX Heating Coil_unit1,    !- Heating Coil Name
    Coil:Cooling:DX:SingleSpeed,    !- Cooling Coil Object Type
    DX Cooling Coil_unit1,    !- Cooling Coil Name
    Coil:Heating:Electric,    !- Supplemental Heating Coil Object
   Type
    Supp Heating Coil_unit1,    !- Supplemental Heating Coil Name
    50,                       !- Maximum Supply Air Temperature from
    Supplemental Heater
    10,                       !- Maximum Outdoor DryBulb Temperature
    for Supplemental Heater Operation
    BlowThrough,              !- Fan Placement
    fan_cycle;                !- Supply Air Fan Operating Mode
   Schedule Name

AirLoopHVAC,
    Central System_unit1,     !- Name
    ,                         !- Controller List Name
    availability list,        !- Availability Manager List Name
    autosize,                 !- Design Supply Air Flow Rate
    Air Loop Branches_unit1,    !- Branch List Name
    ,                         !- Connector List Name
    Air Loop Inlet Node_unit1,    !- Supply Side Inlet Node Name
    Return Air Mixer Outlet_unit1,    !- Demand Side Outlet Node
   Name
    Zone Equipment Inlet Node_unit1,    !- Demand Side Inlet Node
   Names
    Air Loop Outlet Node_unit1;    !- Supply Side Outlet Node Names

AirLoopHVAC:ZoneSplitter,
    Zone Supply Air Splitter_unit1,    !- Name
    Zone Equipment Inlet Node_unit1,    !- Inlet Node Name
    Zone Inlet Node_unit1 ATInlet;    !- Outlet 1 Node Name

AirLoopHVAC:SupplyPath,
```

```
    SupplyPath_unit1,         !- Name
    Zone Equipment Inlet Node_unit1,    !- Supply Air Path Inlet
   Node Name
    AirLoopHVAC:ZoneSplitter,    !- Component 1 Object Type
    Zone Supply Air Splitter_unit1;    !- Component 1 Name

AirLoopHVAC:ZoneMixer,
    Zone Return Air Mixer_unit1,    !- Name
    Return Air Mixer Outlet_unit1,    !- Outlet Node Name
    Zone Outlet Node_unit1;    !- Inlet 1 Node Name

AirLoopHVAC:ReturnPath,
    ReturnPath_unit1,         !- Name
    Return Air Mixer Outlet_unit1,    !- Return Air Path Outlet Node
    Name
    AirLoopHVAC:ZoneMixer,    !- Component 1 Object Type
    Zone Return Air Mixer_unit1;    !- Component 1 Name

Branch,
    Air Loop Main Branch_unit1,    !- Name
    ,                         !- Pressure Drop Curve Name
    AirLoopHVAC:UnitaryHeatPump:AirtoAir,    !- Component 1 Object
   Type
    Heat Pump_unit1,          !- Component 1 Name
    Air Loop Inlet Node_unit1,    !- Component 1 Inlet Node Name
    Air Loop Outlet Node_unit1;    !- Component 1 Outlet Node Name

Branch,
    Mains Inlet Branch_unit1,    !- Name
    ,                         !- Pressure Drop Curve Name
    Pump:VariableSpeed,       !- Component 1 Object Type
    Mains Pressure_unit1,     !- Component 1 Name
    Mains Inlet Node_unit1,    !- Component 1 Inlet Node Name
    Mains Pressure Outlet Node_unit1;    !- Component 1 Outlet Node
   Name
```

```
Branch,
    DHW Supply Outlet Branch_unit1,    !- Name
    ,                          !- Pressure Drop Curve Name
    Pipe:Adiabatic,            !- Component 1 Object Type
    DHW Supply Outlet Pipe_unit1,    !- Component 1 Name
    DHW Supply Outlet Pipe Inlet Node_unit1,    !- Component 1 Inlet
    Node Name
    DHW Supply Outlet Node_unit1;    !- Component 1 Outlet Node Name

Branch,
    DHW Demand Inlet Branch_unit1,    !- Name
    ,                          !- Pressure Drop Curve Name
    Pipe:Adiabatic,            !- Component 1 Object Type
    DHW Demand Inlet Pipe_unit1,    !- Component 1 Name
    DHW Demand Inlet Node_unit1,    !- Component 1 Inlet Node Name
    DHW Demand Inlet Pipe Outlet Node_unit1;    !- Component 1
   Outlet Node Name

Branch,
    Water Sink Branch_unit1,    !- Name
    ,                          !- Pressure Drop Curve Name
    WaterUse:Connections,      !- Component 1 Object Type
    DHW Sinks_unit1,           !- Component 1 Name
    Water Sink Inlet Node_unit1,    !- Component 1 Inlet Node Name
    Water Sink outlet Node_unit1;    !- Component 1 Outlet Node Name

Branch,
    Water Shower Branch_unit1,    !- Name
    ,                          !- Pressure Drop Curve Name
    WaterUse:Connections,      !- Component 1 Object Type
    DHW Showers_unit1,         !- Component 1 Name
    Water Shower Inlet Node_unit1,    !- Component 1 Inlet Node Name
    Water Shower Outlet Node_unit1;    !- Component 1 Outlet Node
   Name

Branch,
```

```
    Water ClothesWasher Branch_unit1,    !- Name
    ,                        !- Pressure Drop Curve Name
    WaterUse:Connections,     !- Component 1 Object Type
    DHW ClothesWasher_unit1,    !- Component 1 Name
    Water ClothesWasher Inlet Node_unit1,    !- Component 1 Inlet
   Node Name
    Water ClothesWasher Outlet Node_unit1;    !- Component 1 Outlet
   Node Name

Branch,
    Water Dishwasher Branch_unit1,    !- Name
    ,                        !- Pressure Drop Curve Name
    WaterUse:Connections,     !- Component 1 Object Type
    DHW DishWasher_unit1,     !- Component 1 Name
    Water DishWasher Inlet Node_unit1,    !- Component 1 Inlet Node
   Name
    Water DishWasher outlet Node_unit1;    !- Component 1 Outlet
   Node Name

Branch,
    Water Bath Branch_unit1,    !- Name
    ,                        !- Pressure Drop Curve Name
    WaterUse:Connections,     !- Component 1 Object Type
    DHW Baths_unit1,          !- Component 1 Name
    Water Bath Inlet Node_unit1,    !- Component 1 Inlet Node Name
    Water bath Outlet Node_unit1;    !- Component 1 Outlet Node Name

Branch,
    Mains Makeup Branch_unit1,    !- Name
    ,                        !- Pressure Drop Curve Name
    Pipe:Adiabatic,           !- Component 1 Object Type
    Mains Makeup Pipe_unit1,    !- Component 1 Name
    Mains Makeup Pipe Inlet Node_unit1,    !- Component 1 Inlet Node
    Name
    Mains Makeup Node_unit1;    !- Component 1 Outlet Node Name
```

```
Branch,
    Water Heater Branch_unit1,    !- Name
    ,                             !- Pressure Drop Curve Name
    WaterHeater:HeatPump:WrappedCondenser,    !- Component 1 Object
   Type
    Water Heater_unit1,       !- Component 1 Name
    Water Heater Use Inlet Node_unit1,    !- Component 1 Inlet Node
   Name
    Water Heater Use Outlet Node_unit1;    !- Component 1 Outlet
   Node Name

BranchList,
    Air Loop Branches_unit1,    !- Name
    Air Loop Main Branch_unit1;    !- Branch 1 Name

BranchList,
    DHW Supply Branches_unit1,    !- Name
    Mains Inlet Branch_unit1,    !- Branch 1 Name
    Water Heater Branch_unit1,    !- Branch 2 Name
    DHW Supply Outlet Branch_unit1;    !- Branch 3 Name

BranchList,
    DHW Demand Branches_unit1,    !- Name
    DHW Demand Inlet Branch_unit1,    !- Branch 1 Name
    Water Sink Branch_unit1,    !- Branch 2 Name
    Water Shower Branch_unit1,    !- Branch 3 Name
    Water ClothesWasher Branch_unit1,    !- Branch 4 Name
    Water Dishwasher Branch_unit1,    !- Branch 5 Name
    Water Bath Branch_unit1,    !- Branch 6 Name
    Mains Makeup Branch_unit1;    !- Branch 7 Name

Connector:Splitter,
    DHW Demand Splitter_unit1,    !- Name
    DHW Demand Inlet Branch_unit1,    !- Inlet Branch Name
    Water Sink Branch_unit1,    !- Outlet Branch 1 Name
    Water Shower Branch_unit1,    !- Outlet Branch 2 Name
```

```
    Water ClothesWasher Branch_unit1,    !- Outlet Branch 3 Name
    Water Dishwasher Branch_unit1,    !- Outlet Branch 4 Name
    Water Bath Branch_unit1;    !- Outlet Branch 5 Name

Connector:Splitter,
    DHW Supply Splitter_unit1,    !- Name
    Mains Inlet Branch_unit1,    !- Inlet Branch Name
    Water Heater Branch_unit1;    !- Outlet Branch 1 Name

Connector:Mixer,
    DHW Demand Mixer_unit1,    !- Name
    Mains Makeup Branch_unit1,    !- Outlet Branch Name
    Water Sink Branch_unit1,    !- Inlet Branch 1 Name
    Water Shower Branch_unit1,    !- Inlet Branch 2 Name
    Water ClothesWasher Branch_unit1,    !- Inlet Branch 3 Name
    Water Dishwasher Branch_unit1,    !- Inlet Branch 4 Name
    Water Bath Branch_unit1;    !- Inlet Branch 5 Name

Connector:Mixer,
    DHW Supply Mixer_unit1,    !- Name
    DHW Supply Outlet Branch_unit1,    !- Outlet Branch Name
    Water Heater Branch_unit1;    !- Inlet Branch 1 Name

ConnectorList,
    DHW Demand Connectors_unit1,    !- Name
    Connector:Splitter,       !- Connector 1 Object Type
    DHW Demand Splitter_unit1,    !- Connector 1 Name
    Connector:Mixer,          !- Connector 2 Object Type
    DHW Demand Mixer_unit1;    !- Connector 2 Name

ConnectorList,
    DHW Supply Connectors_unit1,    !- Name
    Connector:Splitter,       !- Connector 1 Object Type
    DHW Supply Splitter_unit1,    !- Connector 1 Name
    Connector:Mixer,          !- Connector 2 Object Type
    DHW Supply Mixer_unit1;    !- Connector 2 Name
```

```
NodeList,
    Zone Inlet Nodes_unit1,    !- Name
    Zone Inlet Node_unit1,    !- Node 1 Name
    HPWH Zone Inlet Node_unit1,    !- Node 2 Name
    OA Inlet Node_unit1;      !- Node 3 Name

NodeList,
    Zone Exhaust Node_list_unit1,    !- Name
    Zone Exhaust Node_unit1,    !- Node 1 Name
    Zone Exhaust Node1_unit1;    !- Node 2 Name

OutdoorAir:Node,
    outside air inlet node_unit1,    !- Name
    0.914355407629293;        !- Height Above Ground

OutdoorAir:NodeList,
    outdoor air node_unit1;    !- Node or NodeList Name 1

Pipe:Adiabatic,
    DHW Supply Outlet Pipe_unit1,    !- Name
    DHW Supply Outlet Pipe Inlet Node_unit1,    !- Inlet Node Name
    DHW Supply Outlet Node_unit1;    !- Outlet Node Name

Pipe:Adiabatic,
    Mains Makeup Pipe_unit1,    !- Name
    Mains Makeup Pipe Inlet Node_unit1,    !- Inlet Node Name
    Mains Makeup Node_unit1;    !- Outlet Node Name

Pipe:Adiabatic,
    DHW Demand Inlet Pipe_unit1,    !- Name
    DHW Demand Inlet Node_unit1,    !- Inlet Node Name
    DHW Demand Inlet Pipe Outlet Node_unit1;    !- Outlet Node Name

Pump:VariableSpeed,
    Mains Pressure_unit1,     !- Name
```

```
    Mains Inlet Node_unit1,    !- Inlet Node Name
    Mains Pressure Outlet Node_unit1,    !- Outlet Node Name
    autosize,                  !- Design Maximum Flow Rate
    1,                         !- Design Pump Head
    0,                         !- Design Power Consumption
    1,                         !- Motor Efficiency
    0,                         !- Fraction of Motor Inefficiencies to
    Fluid Stream
    0,                         !- Coefficient 1 of the Part Load
   Performance Curve
    1,                         !- Coefficient 2 of the Part Load
   Performance Curve
    0,                         !- Coefficient 3 of the Part Load
   Performance Curve
    0,                         !- Coefficient 4 of the Part Load
   Performance Curve
    0,                         !- Design Minimum Flow Rate
    Intermittent;              !- Pump Control Type

WaterHeater:Stratified,
    Water Heater_Tank_unit1,    !- Name
    Water Heater,              !- EndUse Subcategory
    0.196841372,               !- Tank Volume
    1.594,                     !- Tank Height
    VerticalCylinder,          !- Tank Shape
    ,                          !- Tank Perimeter
    51,                        !- Maximum Temperature Limit
    MasterSlave,               !- Heater Priority Control
    dhw_setpt_hpwh,            !- Heater 1 Setpoint Temperature
   Schedule Name
    2,                         !- Heater 1 Deadband Temperature
   Difference
    autosize,                  !- Heater 1 Capacity
    1.129,                     !- Heater 1 Height
    dhw_setpt_hpwh,            !- Heater 2 Setpoint Temperature
   Schedule Name
```

```
 2,                          !- Heater 2 Deadband Temperature
Difference
 0,                          !- Heater 2 Capacity
 0.266,                      !- Heater 2 Height
 electricity,                !- Heater Fuel Type
 1,                          !- Heater Thermal Efficiency
 8.3,                        !- Off Cycle Parasitic Fuel
Consumption Rate
 Electricity,                !- Off Cycle Parasitic Fuel Type
 0,                          !- Off Cycle Parasitic Heat Fraction
to Tank
 1,                          !- Off Cycle Parasitic Height
 8.3,                        !- On Cycle Parasitic Fuel Consumption
 Rate
 Electricity,                !- On Cycle Parasitic Fuel Type
 0,                          !- On Cycle Parasitic Heat Fraction to
 Tank
 1,                          !- On Cycle Parasitic Height
 Zone,                       !- Ambient Temperature Indicator
 ,                           !- Ambient Temperature Schedule Name
 living_unit1,               !- Ambient Temperature Zone Name
 ,                           !- Ambient Temperature Outdoor Air
Node Name
 0.730336050939686,          !- Uniform Skin Loss Coefficient per
Unit Area to Ambient Temperature
 1,                          !- Skin Loss Fraction to Zone
 ,                           !- Off Cycle Flue Loss Coefficient to
Ambient Temperature
 1,                          !- Off Cycle Flue Loss Fraction to
Zone
 ,                           !- Peak Use Flow Rate
 ,                           !- Use Flow Rate Fraction Schedule
Name
 ,                           !- Cold Water Supply Temperature
Schedule Name
 Water Heater use inlet node_unit1,    !- Use Side Inlet Node
```

```
   Name
    Water Heater use outlet node_unit1,    !- Use Side Outlet Node
   Name
    1,                        !- Use Side Effectiveness
    0,                        !- Use Side Inlet Height
    autocalculate,            !- Use Side Outlet Height
    ,                         !- Source Side Inlet Node Name
    ,                         !- Source Side Outlet Node Name
    1,                        !- Source Side Effectiveness
    0.7,                      !- Source Side Inlet Height
    0,                        !- Source Side Outlet Height
    Fixed,                    !- Inlet Mode
    autosize,                 !- Use Side Design Flow Rate
    autosize,                 !- Source Side Design Flow Rate
    1.5,                      !- Indirect Water Heating Recovery
   Time
    1;                        !- Number of Nodes

WaterHeater:Sizing,
    Water Heater_Tank_unit1,    !- WaterHeater Name
    ResidentialHUD-FHAMinimum,    !- Design Mode
    ,                         !- Time Storage Can Meet Peak Draw
    ,                         !- Time for Tank Recovery
    ,                         !- Nominal Tank Volume for Autosizing
   Plant Connections
    3,                        !- Number of Bedrooms
    3;                        !- Number of Bathrooms

WaterHeater:HeatPump:WrappedCondenser,
    Water Heater_unit1,       !- Name
    always_avail,             !- Availability Schedule Name
    Compressor Setpoint,      !- Compressor Setpoint Temperature
   Schedule Name
    5,                        !- Dead Band Temperature Difference
    0.0664166667,             !- Condenser Bottom Location
    0.8634166667,             !- Condenser Top Location
```

```
 autocalculate,            !- Evaporator Air Flow Rate
 ZoneAirOnly,              !- Inlet Air Configuration
 Zone Exhaust Node1_unit1,    !- Air Inlet Node Name
 HPWH Zone Inlet Node_unit1,    !- Air Outlet Node Name
 ,                         !- Outdoor Air Node Name
 ,                         !- Exhaust Air Node Name
 ,                         !- Inlet Air Temperature Schedule Name
 ,                         !- Inlet Air Humidity Schedule Name
 living_unit1,             !- Inlet Air Zone Name
 WaterHeater:Stratified,    !- Tank Object Type
 Water Heater_Tank_unit1,    !- Tank Name
 Water Heater use inlet node_unit1,    !- Tank Use Side Inlet
Node Name
 Water Heater use outlet node_unit1,    !- Tank Use Side Outlet
Node Name
 Coil:WaterHeating:AirToWaterHeatPump:Wrapped,    !- DX Coil
Object Type
 Heat Pump Water Heater Evaporator_unit1,    !- DX Coil Name
 10,                       !- Minimum Inlet Air Temperature for
Compressor Operation
 48.89,                    !- Maximum Inlet Air Temperature for
Compressor Operation
 Zone,                     !- Compressor Location
 ,                         !- Compressor Ambient Temperature
Schedule Name
 Fan:OnOff,                !- Fan Object Type
 Heat Pump Water Heater Fan_unit1,    !- Fan Name
 DrawThrough,              !- Fan Placement
 0,                        !- On Cycle Parasitic Electric Load
 0,                        !- Off Cycle Parasitic Electric Load
 ,                         !- Parasitic Heat Rejection Location
 ,                         !- Inlet Air Mixer Node Name
 ,                         !- Outlet Air Splitter Node Name
 ,                         !- Inlet Air Mixer Schedule Name
 MutuallyExclusive,        !- Tank Element Control Logic
 1.262,                    !- Control Sensor 1 Height In
```

```
   Stratified Tank
    0.75,                    !- Control Sensor 1 Weight
    0.464;                   !- Control Sensor 2 Height In
   Stratified Tank

PlantLoop,
    DHW Loop_unit1,          !- Name
    Water,                   !- Fluid Type
    ,                        !- User Defined Fluid Type
    DHW Loop Operation_unit1,    !- Plant Equipment Operation Scheme
    Name
    DHW Supply Outlet Node_unit1,    !- Loop Temperature Setpoint
   Node Name
    100,                     !- Maximum Loop Temperature
    0,                       !- Minimum Loop Temperature
    autosize,                !- Maximum Loop Flow Rate
    0,                       !- Minimum Loop Flow Rate
    autocalculate,           !- Plant Loop Volume
    Mains Inlet Node_unit1,    !- Plant Side Inlet Node Name
    DHW Supply Outlet Node_unit1,    !- Plant Side Outlet Node Name
    DHW Supply Branches_unit1,    !- Plant Side Branch List Name
    DHW Supply Connectors_unit1,    !- Plant Side Connector List
   Name
    DHW Demand Inlet Node_unit1,    !- Demand Side Inlet Node Name
    Mains Makeup Node_unit1,    !- Demand Side Outlet Node Name
    DHW Demand Branches_unit1,    !- Demand Side Branch List Name
    DHW Demand Connectors_unit1,    !- Demand Side Connector List
   Name
    Optimal;                 !- Load Distribution Scheme

PlantEquipmentList,
    DHW Plant Equipment_unit1,    !- Name
    WaterHeater:HeatPump:WrappedCondenser,    !- Equipment 1 Object
   Type
    Water Heater_unit1;      !- Equipment 1 Name
```

```
PlantEquipmentOperation:HeatingLoad,
    DHW Control Scheme_unit1,    !- Name
    0,                           !- Load Range 1 Lower Limit
    1000000000000000,            !- Load Range 1 Upper Limit
    DHW Plant Equipment_unit1;    !- Range 1 Equipment List Name

PlantEquipmentOperationSchemes,
    DHW Loop Operation_unit1,    !- Name
    PlantEquipmentOperation:HeatingLoad,    !- Control Scheme 1
   Object Type
    DHW Control Scheme_unit1,    !- Control Scheme 1 Name
    always_avail;                !- Control Scheme 1 Schedule Name

AvailabilityManager:Scheduled,
    System availability,         !- Name
    always_avail;                !- Schedule Name

AvailabilityManagerAssignmentList,
    availability list,           !- Name
    AvailabilityManager:Scheduled,    !- Availability Manager 1
   Object Type
    System availability;         !- Availability Manager 1 Name

SetpointManager:Scheduled,
    DHW Loop Setpoint Manager_unit1,    !- Name
    Temperature,                 !- Control Variable
    DHWSupplySetpoint,           !- Schedule Name
    DHW Supply Outlet Node_unit1;    !- Setpoint Node or NodeList
   Name

Generator:Photovoltaic,
    PV_roof_front,               !- Name
    Roof_front_unit1,            !- Surface Name
    PhotovoltaicPerformance:Simple,    !- Photovoltaic Performance
   Object Type
    20percentEffPVhalfArea,    !- Module Performance Name
```

```
    Decoupled,                !- Heat Transfer Integration Mode
    1,                        !- Number of Series Strings in
   Parallel
    1;                        !- Number of Modules in Series

Generator:Photovoltaic,
    PV_roof_back,             !- Name
    Roof_back_unit1,          !- Surface Name
    PhotovoltaicPerformance:Simple,    !- Photovoltaic Performance
   Object Type
    20percentEffPVhalfArea,    !- Module Performance Name
    Decoupled,                !- Heat Transfer Integration Mode
    1,                        !- Number of Series Strings in
   Parallel
    1;                        !- Number of Modules in Series

PhotovoltaicPerformance:Simple,
    20percentEffPVhalfArea,    !- Name
    0.9,                      !- Fraction of Surface Area with
   Active Solar Cells
    Fixed,                    !- Conversion Efficiency Input Mode
    0.2,                      !- Value for Cell Efficiency if Fixed
    ;                         !- Efficiency Schedule Name

ElectricLoadCenter:Generators,
    Generator List,           !- Name
    PV_roof_front,            !- Generator 1 Name
    Generator:Photovoltaic,    !- Generator 1 Object Type
    9000,                     !- Generator 1 Rated Electric Power
   Output
    ,                         !- Generator 1 Availability Schedule
   Name
    ,                         !- Generator 1 Rated Thermal to
   Electrical Power Ratio
    PV_roof_back,             !- Generator 2 Name
    Generator:Photovoltaic,    !- Generator 2 Object Type
```

```
    9000,                    !- Generator 2 Rated Electric Power
   Output
    ,                        !- Generator 2 Availability Schedule
   Name
    ;                        !- Generator 2 Rated Thermal to
   Electrical Power Ratio

ElectricLoadCenter:Inverter:LookUpTable,
    PV Inverter,             !- Name
    ALWAYS_ON,               !- Availability Schedule Name
    ,                        !- Zone Name
    0.25,                    !- Radiative Fraction
    14000,                   !- Rated Maximum Continuous Output
   Power
    200,                     !- Night Tare Loss Power
    368,                     !- Nominal Voltage Input
    0.839,                   !- Efficiency at 10 Power and Nominal
   Voltage
    0.897,                   !- Efficiency at 20 Power and Nominal
   Voltage
    0.916,                   !- Efficiency at 30 Power and Nominal
   Voltage
    0.931,                   !- Efficiency at 50 Power and Nominal
   Voltage
    0.934,                   !- Efficiency at 75 Power and Nominal
   Voltage
    0.93;                    !- Efficiency at 100 Power and Nominal
    Voltage

ElectricLoadCenter:Storage:LiIonNMCBattery,
    LiIonBattery,            !- Name
    ALWAYS_ON,               !- Availability Schedule Name
    ,                        !- Zone Name
    0,                       !- Radiative Fraction
    KandlerSmith,            !- Lifetime Model
    139,                     !- Number of Cells in Series
```

```
    5,                          !- Number of Strings in Parallel
    0.7,                        !- Initial Fractional State of Charge
    ,                           !- DC to DC Charging Efficiency
    342,                        !- Battery Mass
    4.26,                       !- Battery Surface Area
    ,                           !- Battery Specific Heat Capacity
    ;                           !- Heat Transfer Coefficient Between
   Battery and Ambient

ElectricLoadCenter:Distribution,
    PV Array Load Center,       !- Name
    Generator List,             !- Generator List Name
    TrackElectrical,            !- Generator Operation Scheme Type
    0,                          !- Generator Demand Limit Scheme
   Purchased Electric Demand Limit
    ,                           !- Generator Track Schedule Name
   Scheme Schedule Name
    ,                           !- Generator Track Meter Scheme Meter
   Name
    DirectCurrentWithInverterDCStorage,    !- Electrical Buss Type
    PV Inverter,                !- Inverter Name
    LiIonBattery,               !- Electrical Storage Object Name
    ,                           !- Transformer Object Name
    TrackChargeDischargeSchedules,    !- Storage Operation Scheme
    ,                           !- Storage Control Track Meter Name
    Storage Converter,          !- Storage Converter Object Name
    0.95,                       !- Maximum Storage State of Charge
   Fraction
    0.2,                        !- Minimum Storage State of Charge
   Fraction
    3706,                       !- Design Storage Control Charge Power
    charge_sch,                 !- Storage Charge Power Fraction
   Schedule Name
    2780,                       !- Design Storage Control Discharge
   Power
    discharge_sch,              !- Storage Discharge Power Fraction
```

```
   Schedule Name
    ,                         !- Storage Control Utility Demand
   Target
    ;                         !- Storage Control Utility Demand
   Target Fraction Schedule Name

ElectricLoadCenter:Storage:Converter,
    Storage Converter,        !- Name
    ALWAYS_ON,                !- Availability Schedule Name
    SimpleFixed,              !- Power Conversion Efficiency Method
    0.95,                     !- Simple Fixed Efficiency
    ,                         !- Design Maximum Continuous Input
   Power
    ,                         !- Efficiency Function of Power Curve
   Name
    ,                         !- Ancillary Power Consumed In Standby
    ,                         !- Zone Name
    ;                         !- Radiative Fraction

WaterUse:Equipment,
    Clothes Washer_unit1,     !- Name
    Domestic Hot Water,       !- EndUse Subcategory
    1.6219189818e-06,         !- Peak Flow Rate
    ClothesWasher,            !- Flow Rate Fraction Schedule Name
    CWWaterTempSchedule;      !- Target Temperature Schedule Name

WaterUse:Equipment,
    Dishwasher_unit1,         !- Name
    Domestic Hot Water,       !- EndUse Subcategory
    6.36685353e-07,           !- Peak Flow Rate
    Dishwasher,               !- Flow Rate Fraction Schedule Name
    DWWaterTempSchedule;      !- Target Temperature Schedule Name

WaterUse:Equipment,
    Sinks_unit1,              !- Name
    Domestic Hot Water,       !- EndUse Subcategory
```

```
    7.1934e-05,               !- Peak Flow Rate
    BA_sink_sch,              !- Flow Rate Fraction Schedule Name
    SSBWaterTempSchedule;     !- Target Temperature Schedule Name

WaterUse:Equipment,
    Showers_unit1,            !- Name
    Domestic Hot Water,       !- EndUse Subcategory
    0.000141975,              !- Peak Flow Rate
    BA_shower_sch,            !- Flow Rate Fraction Schedule Name
    SSBWaterTempSchedule;     !- Target Temperature Schedule Name

WaterUse:Equipment,
    Baths_unit1,              !- Name
    Domestic Hot Water,       !- EndUse Subcategory
    0.00027764,               !- Peak Flow Rate
    BA_bath_sch,              !- Flow Rate Fraction Schedule Name
    SSBWaterTempSchedule;     !- Target Temperature Schedule Name

WaterUse:Connections,
    DHW Sinks_unit1,          !- Name
    Water Sink Inlet Node_unit1,    !- Inlet Node Name
    Water Sink Outlet Node_unit1,    !- Outlet Node Name
    ,                         !- Supply Water Storage Tank Name
    ,                         !- Reclamation Water Storage Tank Name
    ,                         !- Hot Water Supply Temperature
   Schedule Name
    ,                         !- Cold Water Supply Temperature
   Schedule Name
    None,                     !- Drain Water Heat Exchanger Type
    ,                         !- Drain Water Heat Exchanger
   Destination
    ,                         !- Drain Water Heat Exchanger UFactor
   Times Area
    Sinks_unit1;              !- Water Use Equipment 1 Name

WaterUse:Connections,
```

```
    DHW Showers_unit1,        !- Name
    Water Shower Inlet Node_unit1,    !- Inlet Node Name
    Water Shower Outlet Node_unit1,    !- Outlet Node Name
    ,                         !- Supply Water Storage Tank Name
    ,                         !- Reclamation Water Storage Tank Name
    ,                         !- Hot Water Supply Temperature
   Schedule Name
    ,                         !- Cold Water Supply Temperature
   Schedule Name
    None,                     !- Drain Water Heat Exchanger Type
    ,                         !- Drain Water Heat Exchanger
   Destination
    ,                         !- Drain Water Heat Exchanger UFactor
   Times Area
    Showers_unit1;            !- Water Use Equipment 1 Name

WaterUse:Connections,
    DHW ClothesWasher_unit1,    !- Name
    Water ClothesWasher Inlet Node_unit1,    !- Inlet Node Name
    Water ClothesWasher Outlet Node_unit1,    !- Outlet Node Name
    ,                         !- Supply Water Storage Tank Name
    ,                         !- Reclamation Water Storage Tank Name
    ,                         !- Hot Water Supply Temperature
   Schedule Name
    ,                         !- Cold Water Supply Temperature
   Schedule Name
    None,                     !- Drain Water Heat Exchanger Type
    ,                         !- Drain Water Heat Exchanger
   Destination
    ,                         !- Drain Water Heat Exchanger UFactor
   Times Area
    Clothes Washer_unit1;     !- Water Use Equipment 1 Name

WaterUse:Connections,
    DHW DishWasher_unit1,     !- Name
    Water DishWasher Inlet Node_unit1,    !- Inlet Node Name
```

```
    Water DishWasher Outlet Node_unit1,    !- Outlet Node Name
    ,                          !- Supply Water Storage Tank Name
    ,                          !- Reclamation Water Storage Tank Name
    ,                          !- Hot Water Supply Temperature
   Schedule Name
    ,                          !- Cold Water Supply Temperature
   Schedule Name
    None,                      !- Drain Water Heat Exchanger Type
    ,                          !- Drain Water Heat Exchanger
   Destination
    ,                          !- Drain Water Heat Exchanger UFactor
   Times Area
    Dishwasher_unit1;          !- Water Use Equipment 1 Name

WaterUse:Connections,
    DHW Baths_unit1,           !- Name
    Water Bath Inlet Node_unit1,    !- Inlet Node Name
    Water Bath Outlet Node_unit1,    !- Outlet Node Name
    ,                          !- Supply Water Storage Tank Name
    ,                          !- Reclamation Water Storage Tank Name
    ,                          !- Hot Water Supply Temperature
   Schedule Name
    ,                          !- Cold Water Supply Temperature
   Schedule Name
    None,                      !- Drain Water Heat Exchanger Type
    ,                          !- Drain Water Heat Exchanger
   Destination
    ,                          !- Drain Water Heat Exchanger UFactor
   Times Area
    Baths_unit1;               !- Water Use Equipment 1 Name

Curve:Quadratic,
    HPWH-COP-fPLR,             !- Name
    1,                         !- Coefficient1 Constant
    0,                         !- Coefficient2 x
    0,                         !- Coefficient3 x2
```

```
    0,                          !- Minimum Value of x
    1;                          !- Maximum Value of x

Curve:Quadratic,
    HPACCoolCapFFF,             !- Name
    0.8,                        !- Coefficient1 Constant
    0.2,                        !- Coefficient2 x
    0,                          !- Coefficient3 x2
    0.5,                        !- Minimum Value of x
    1.5;                        !- Maximum Value of x

Curve:Quadratic,
    HPACCOOLEIRFFF,             !- Name
    1.156,                      !- Coefficient1 Constant
    -0.1816,                    !- Coefficient2 x
    0.0256,                     !- Coefficient3 x2
    0.5,                        !- Minimum Value of x
    1.5;                        !- Maximum Value of x

Curve:Quadratic,
    HPACCOOLPLFFPLR,            !- Name
    0.85,                       !- Coefficient1 Constant
    0.15,                       !- Coefficient2 x
    0,                          !- Coefficient3 x2
    0,                          !- Minimum Value of x
    1;                          !- Maximum Value of x

Curve:Quadratic,
    HPACHeatEIRFFF,             !- Name
    1.3824,                     !- Coefficient1 Constant
    -0.4336,                    !- Coefficient2 x
    0.0512,                     !- Coefficient3 x2
    0,                          !- Minimum Value of x
    1;                          !- Maximum Value of x

Curve:Quadratic,
```

```
    ACCoolingCAPFFF,          !- Name
    0.718605468,              !- Coefficient1 Constant
    0.410099989,              !- Coefficient2 x
    -0.128705457,             !- Coefficient3 x2
    0,                        !- Minimum Value of x
    1.5,                      !- Maximum Value of x
    0,                        !- Minimum Curve Output
    2,                        !- Maximum Curve Output
    Dimensionless,            !- Input Unit Type for X
    Dimensionless;            !- Output Unit Type

Curve:Quadratic,
    ACCoolingEIRFFF,          !- Name
    1.32299905,               !- Coefficient1 Constant
    -0.477711207,             !- Coefficient2 x
    0.154712157,              !- Coefficient3 x2
    0,                        !- Minimum Value of x
    1.5,                      !- Maximum Value of x
    0,                        !- Minimum Curve Output
    2,                        !- Maximum Curve Output
    Dimensionless,            !- Input Unit Type for X
    Dimensionless;            !- Output Unit Type

Curve:Quadratic,
    ACCoolingPLFFPLR,         !- Name
    0.9,                      !- Coefficient1 Constant
    0.1,                      !- Coefficient2 x
    0,                        !- Coefficient3 x2
    0,                        !- Minimum Value of x
    1;                        !- Maximum Value of x

Curve:Quadratic,
    HPCoolingCAPFFF,          !- Name
    0.718664047,              !- Coefficient1 Constant
    0.41797409,               !- Coefficient2 x
    -0.136638137,             !- Coefficient3 x2
```

```
    0,                        !- Minimum Value of x
    1.5,                      !- Maximum Value of x
    0,                        !- Minimum Curve Output
    2,                        !- Maximum Curve Output
    Dimensionless,            !- Input Unit Type for X
    Dimensionless;            !- Output Unit Type

Curve:Quadratic,
    HPCoolingEIRFFF,          !- Name
    1.143487507,              !- Coefficient1 Constant
    -0.13943972,              !- Coefficient2 x
    -0.004047787,             !- Coefficient3 x2
    0,                        !- Minimum Value of x
    1.5,                      !- Maximum Value of x
    0,                        !- Minimum Curve Output
    2,                        !- Maximum Curve Output
    Dimensionless,            !- Input Unit Type for X
    Dimensionless;            !- Output Unit Type

Curve:Quadratic,
    HPCOOLPLFFPLR,            !- Name
    0.9,                      !- Coefficient1 Constant
    0.1,                      !- Coefficient2 x
    0,                        !- Coefficient3 x2
    0,                        !- Minimum Value of x
    1;                        !- Maximum Value of x

Curve:Quadratic,
    HPHeatingCAPFFF,          !- Name
    0.694045465,              !- Coefficient1 Constant
    0.474207981,              !- Coefficient2 x
    -0.168253446,             !- Coefficient3 x2
    0,                        !- Minimum Value of x
    1.5,                      !- Maximum Value of x
    0,                        !- Minimum Curve Output
    2,                        !- Maximum Curve Output
```

```
    Dimensionless,            !- Input Unit Type for X
    Dimensionless;            !- Output Unit Type

Curve:Quadratic,
    HPHeatingEIRFFF,          !- Name
    2.185418751,              !- Coefficient1 Constant
    -1.942827919,             !- Coefficient2 x
    0.757409168,              !- Coefficient3 x2
    0,                        !- Minimum Value of x
    1.5,                      !- Maximum Value of x
    0,                        !- Minimum Curve Output
    2,                        !- Maximum Curve Output
    Dimensionless,            !- Input Unit Type for X
    Dimensionless;            !- Output Unit Type

Curve:Quadratic,
    HPHeatPLFFPLR,            !- Name
    0.9,                      !- Coefficient1 Constant
    0.1,                      !- Coefficient2 x
    0,                        !- Coefficient3 x2
    0,                        !- Minimum Value of x
    1;                        !- Maximum Value of x

Curve:Quadratic,
    HPLowStageHeatingCAPFFF,    !- Name
    0.741466907,              !- Coefficient1 Constant
    0.378645444,              !- Coefficient2 x
    -0.119754733,             !- Coefficient3 x2
    0,                        !- Minimum Value of x
    1.5,                      !- Maximum Value of x
    0,                        !- Minimum Curve Output
    2,                        !- Maximum Curve Output
    Dimensionless,            !- Input Unit Type for X
    Dimensionless;            !- Output Unit Type

Curve:Quadratic,
```

```
    HPLowStageHeatingEIRFFF,    !- Name
    2.153618211,              !- Coefficient1 Constant
    -1.737190609,             !- Coefficient2 x
    0.584269478,              !- Coefficient3 x2
    0,                        !- Minimum Value of x
    1.5,                      !- Maximum Value of x
    0,                        !- Minimum Curve Output
    2,                        !- Maximum Curve Output
    Dimensionless,            !- Input Unit Type for X
    Dimensionless;            !- Output Unit Type

Curve:Quadratic,
    HPHighStageHeatingCAPFFF,    !- Name
    0.76634609,               !- Coefficient1 Constant
    0.32840943,               !- Coefficient2 x
    -0.094701495,             !- Coefficient3 x2
    0,                        !- Minimum Value of x
    1.5,                      !- Maximum Value of x
    0,                        !- Minimum Curve Output
    2,                        !- Maximum Curve Output
    Dimensionless,            !- Input Unit Type for X
    Dimensionless;            !- Output Unit Type

Curve:Quadratic,
    HPHighStageHeatingEIRFFF,    !- Name
    2.001041353,              !- Coefficient1 Constant
    -1.58869128,              !- Coefficient2 x
    0.587593517,              !- Coefficient3 x2
    0,                        !- Minimum Value of x
    1.5,                      !- Maximum Value of x
    0,                        !- Minimum Curve Output
    2,                        !- Maximum Curve Output
    Dimensionless,            !- Input Unit Type for X
    Dimensionless;            !- Output Unit Type

Curve:Quadratic,
```

```
    HP2StageHeatingPLFFPLR,    !- Name
    0.93,                      !- Coefficient1 Constant
    0.07,                      !- Coefficient2 x
    0,                         !- Coefficient3 x2
    0,                         !- Minimum Value of x
    1;                         !- Maximum Value of x

Curve:Quadratic,
    HPLowStageCoolingCAPFFF,   !- Name
    0.655239515,               !- Coefficient1 Constant
    0.511655216,               !- Coefficient2 x
    -0.166894731,              !- Coefficient3 x2
    0,                         !- Minimum Value of x
    1.5,                       !- Maximum Value of x
    0,                         !- Minimum Curve Output
    2,                         !- Maximum Curve Output
    Dimensionless,             !- Input Unit Type for X
    Dimensionless;             !- Output Unit Type

Curve:Quadratic,
    HPLowStageCoolingEIRFFF,   !- Name
    1.639108268,               !- Coefficient1 Constant
    -0.998953996,              !- Coefficient2 x
    0.359845728,               !- Coefficient3 x2
    0,                         !- Minimum Value of x
    1.5,                       !- Maximum Value of x
    0,                         !- Minimum Curve Output
    2,                         !- Maximum Curve Output
    Dimensionless,             !- Input Unit Type for X
    Dimensionless;             !- Output Unit Type

Curve:Quadratic,
    HPHighStageCoolingCAPFFF,  !- Name
    0.618281092,               !- Coefficient1 Constant
    0.569060264,               !- Coefficient2 x
    -0.187341356,              !- Coefficient3 x2
```

```
    0,                          !- Minimum Value of x
    1.5,                        !- Maximum Value of x
    0,                          !- Minimum Curve Output
    2,                          !- Maximum Curve Output
    Dimensionless,              !- Input Unit Type for X
    Dimensionless;              !- Output Unit Type

Curve:Quadratic,
    HPHighStageCoolingEIRFFF,    !- Name
    1.570774717,                !- Coefficient1 Constant
    -0.914152018,               !- Coefficient2 x
    0.343377302,                !- Coefficient3 x2
    0,                          !- Minimum Value of x
    1.5,                        !- Maximum Value of x
    0,                          !- Minimum Curve Output
    2,                          !- Maximum Curve Output
    Dimensionless,              !- Input Unit Type for X
    Dimensionless;              !- Output Unit Type

Curve:Quadratic,
    HP2StageCoolingPLFFPLR,     !- Name
    0.93,                       !- Coefficient1 Constant
    0.07,                       !- Coefficient2 x
    0,                          !- Coefficient3 x2
    0,                          !- Minimum Value of x
    1;                          !- Maximum Value of x

Curve:Quadratic,
    ACLowStageCoolingCAPFFF,    !- Name
    0.65673024,                 !- Coefficient1 Constant
    0.516470835,                !- Coefficient2 x
    -0.172887149,               !- Coefficient3 x2
    0,                          !- Minimum Value of x
    1.5,                        !- Maximum Value of x
    0,                          !- Minimum Curve Output
    2,                          !- Maximum Curve Output
```

```
    Dimensionless,            !- Input Unit Type for X
    Dimensionless;            !- Output Unit Type

Curve:Quadratic,
    ACLowStageCoolingEIRFFF,    !- Name
    1.562945114,              !- Coefficient1 Constant
    -0.791859997,             !- Coefficient2 x
    0.230030877,              !- Coefficient3 x2
    0,                        !- Minimum Value of x
    1.5,                      !- Maximum Value of x
    0,                        !- Minimum Curve Output
    2,                        !- Maximum Curve Output
    Dimensionless,            !- Input Unit Type for X
    Dimensionless;            !- Output Unit Type

Curve:Quadratic,
    ACHighStageCoolingCAPFFF,    !- Name
    0.690334551,              !- Coefficient1 Constant
    0.464383753,              !- Coefficient2 x
    -0.154507638,             !- Coefficient3 x2
    0,                        !- Minimum Value of x
    1.5,                      !- Maximum Value of x
    0,                        !- Minimum Curve Output
    2,                        !- Maximum Curve Output
    Dimensionless,            !- Input Unit Type for X
    Dimensionless;            !- Output Unit Type

Curve:Quadratic,
    ACHighStageCoolingEIRFFF,    !- Name
    1.31565404,               !- Coefficient1 Constant
    -0.482467162,             !- Coefficient2 x
    0.166239001,              !- Coefficient3 x2
    0,                        !- Minimum Value of x
    1.5,                      !- Maximum Value of x
    0,                        !- Minimum Curve Output
    2,                        !- Maximum Curve Output
```

```
    Dimensionless,            !- Input Unit Type for X
    Dimensionless;            !- Output Unit Type

Curve:Quadratic,
    AC2StageCoolingPLFFPLR,    !- Name
    0.93,                     !- Coefficient1 Constant
    0.07,                     !- Coefficient2 x
    0,                        !- Coefficient3 x2
    0,                        !- Minimum Value of x
    1;                        !- Maximum Value of x

Curve:Quadratic,
    Cool-PLF-fPLR,            !- Name
    0.80141423,               !- Coefficient1 Constant
    0.23744685,               !- Coefficient2 x
    -0.0393773,               !- Coefficient3 x2
    0,                        !- Minimum Value of x
    1,                        !- Maximum Value of x
    0.7,                      !- Minimum Curve Output
    1;                        !- Maximum Curve Output

Curve:Cubic,
    HPACHeatCapFT,            !- Name
    0.758746,                 !- Coefficient1 Constant
    0.027626,                 !- Coefficient2 x
    0.000148716,              !- Coefficient3 x2
    3.4992e-06,               !- Coefficient4 x3
    -20,                      !- Minimum Value of x
    20;                       !- Maximum Value of x

Curve:Cubic,
    HPACHeatCapFFF,           !- Name
    0.84,                     !- Coefficient1 Constant
    0.16,                     !- Coefficient2 x
    0,                        !- Coefficient3 x2
    0,                        !- Coefficient4 x3
```

```
    0.5,                        !- Minimum Value of x
    1.5;                        !- Maximum Value of x

Curve:Cubic,
    HPACHeatEIRFT,              !- Name
    1.19248,                    !- Coefficient1 Constant
    -0.0300438,                 !- Coefficient2 x
    0.00103745,                 !- Coefficient3 x2
    -2.3328e-05,                !- Coefficient4 x3
    -20,                        !- Minimum Value of x
    20;                         !- Maximum Value of x

Curve:Cubic,
    Fan-EIR-fPLR,               !- Name
    0,                          !- Coefficient1 Constant
    1,                          !- Coefficient2 x
    0,                          !- Coefficient3 x2
    0,                          !- Coefficient4 x3
    0,                          !- Minimum Value of x
    1,                          !- Maximum Value of x
    0,                          !- Minimum Curve Output
    1;                          !- Maximum Curve Output

Curve:Cubic,
    ConstantCubic,              !- Name
    1,                          !- Coefficient1 Constant
    0,                          !- Coefficient2 x
    0,                          !- Coefficient3 x2
    0,                          !- Coefficient4 x3
    -100,                       !- Minimum Value of x
    100;                        !- Maximum Value of x

Curve:Biquadratic,
    HPWH-Htg-Cap-fT,            !- Name
    0.563,                      !- Coefficient1 Constant
    0.0437,                     !- Coefficient2 x
```

```
    3.9e-05,                  !- Coefficient3 x2
    0.0055,                   !- Coefficient4 y
    -0.000148,                !- Coefficient5 y2
    -0.000145,                !- Coefficient6 xy
    0,                        !- Minimum Value of x
    100,                      !- Maximum Value of x
    0,                        !- Minimum Value of y
    100,                      !- Maximum Value of y
    0;                        !- Minimum Curve Output

Curve:Biquadratic,
    HPWH-Htg-COP-fT,          !- Name
    1.1332,                   !- Coefficient1 Constant
    0.063,                    !- Coefficient2 x
    -9.79e-05,                !- Coefficient3 x2
    -0.00972,                 !- Coefficient4 y
    -2.14e-05,                !- Coefficient5 y2
    -0.000686,                !- Coefficient6 xy
    0,                        !- Minimum Value of x
    100,                      !- Maximum Value of x
    0,                        !- Minimum Value of y
    100;                      !- Maximum Value of y

Curve:Biquadratic,
    HPWHHeatingCapFTemp,      !- Name
    0.369827,                 !- Coefficient1 Constant
    0.043341,                 !- Coefficient2 x
    -0.00023,                 !- Coefficient3 x2
    0.000466,                 !- Coefficient4 y
    2.6e-05,                  !- Coefficient5 y2
    -0.00027,                 !- Coefficient6 xy
    0,                        !- Minimum Value of x
    40,                       !- Maximum Value of x
    20,                       !- Minimum Value of y
    90,                       !- Maximum Value of y
    ,                         !- Minimum Curve Output
```

```
    ,                         !- Maximum Curve Output
    Temperature,              !- Input Unit Type for X
    Temperature,              !- Input Unit Type for Y
    Dimensionless;            !- Output Unit Type

Curve:Biquadratic,
    HPWHHeatingCOPFTemp,      !- Name
    1.19713,                  !- Coefficient1 Constant
    0.077849,                 !- Coefficient2 x
    -1.6e-06,                 !- Coefficient3 x2
    -0.02675,                 !- Coefficient4 y
    0.000296,                 !- Coefficient5 y2
    -0.00112,                 !- Coefficient6 xy
    0,                        !- Minimum Value of x
    40,                       !- Maximum Value of x
    20,                       !- Minimum Value of y
    90,                       !- Maximum Value of y
    ,                         !- Minimum Curve Output
    ,                         !- Maximum Curve Output
    Temperature,              !- Input Unit Type for X
    Temperature,              !- Input Unit Type for Y
    Dimensionless;            !- Output Unit Type

Curve:Biquadratic,
    HPACCoolCapFT,            !- Name
    0.766956,                 !- Coefficient1 Constant
    0.0107756,                !- Coefficient2 x
    -4.14703e-05,             !- Coefficient3 x2
    0.00134961,               !- Coefficient4 y
    -0.000261144,             !- Coefficient5 y2
    0.000457488,              !- Coefficient6 xy
    12.77778,                 !- Minimum Value of x
    23.88889,                 !- Maximum Value of x
    21.11111,                 !- Minimum Value of y
    46.11111;                 !- Maximum Value of y
```

```
Curve:Biquadratic,
    HPACCOOLEIRFT,           !- Name
    0.297145,                !- Coefficient1 Constant
    0.0430933,               !- Coefficient2 x
    -0.000748766,            !- Coefficient3 x2
    0.00597727,              !- Coefficient4 y
    0.000482112,             !- Coefficient5 y2
    -0.000956448,            !- Coefficient6 xy
    12.77778,                !- Minimum Value of x
    23.88889,                !- Maximum Value of x
    21.11111,                !- Minimum Value of y
    46.11111;                !- Maximum Value of y

Curve:Biquadratic,
    Defrost_EIR_FT,          !- Name
    1,                       !- Coefficient1 Constant
    0,                       !- Coefficient2 x
    0,                       !- Coefficient3 x2
    0,                       !- Coefficient4 y
    0,                       !- Coefficient5 y2
    0,                       !- Coefficient6 xy
    0,                       !- Minimum Value of x
    100,                     !- Maximum Value of x
    0,                       !- Minimum Value of y
    100;                     !- Maximum Value of y

Curve:Biquadratic,
    dummy-waste-heat-curve,   !- Name
    1,                       !- Coefficient1 Constant
    0,                       !- Coefficient2 x
    0,                       !- Coefficient3 x2
    0,                       !- Coefficient4 y
    0,                       !- Coefficient5 y2
    0,                       !- Coefficient6 xy
    0,                       !- Minimum Value of x
    50,                      !- Maximum Value of x
```

```
    0,                        !- Minimum Value of y
    50,                       !- Maximum Value of y
    1,                        !- Minimum Curve Output
    1,                        !- Maximum Curve Output
    Dimensionless,            !- Input Unit Type for X
    Dimensionless,            !- Input Unit Type for Y
    Dimensionless;            !- Output Unit Type

Curve:Biquadratic,
    ACCoolingCAPFTemp,        !- Name
    1.5509,                   !- Coefficient1 Constant
    -0.07505,                 !- Coefficient2 x
    0.0031,                   !- Coefficient3 x2
    0.0024,                   !- Coefficient4 y
    -5e-05,                   !- Coefficient5 y2
    -0.00043,                 !- Coefficient6 xy
    0,                        !- Minimum Value of x
    50,                       !- Maximum Value of x
    0,                        !- Minimum Value of y
    50,                       !- Maximum Value of y
    0,                        !- Minimum Curve Output
    5,                        !- Maximum Curve Output
    Temperature,              !- Input Unit Type for X
    Temperature,              !- Input Unit Type for Y
    Dimensionless;            !- Output Unit Type

Curve:Biquadratic,
    ACCoolingEIRFTemp,        !- Name
    -0.30428,                 !- Coefficient1 Constant
    0.11805,                  !- Coefficient2 x
    -0.00342,                 !- Coefficient3 x2
    -0.00626,                 !- Coefficient4 y
    0.0007,                   !- Coefficient5 y2
    -0.00047,                 !- Coefficient6 xy
    0,                        !- Minimum Value of x
    50,                       !- Maximum Value of x
```

```
    0,                        !- Minimum Value of y
    50,                       !- Maximum Value of y
    0,                        !- Minimum Curve Output
    5,                        !- Maximum Curve Output
    Temperature,              !- Input Unit Type for X
    Temperature,              !- Input Unit Type for Y
    Dimensionless;            !- Output Unit Type

Curve:Biquadratic,
    HPCoolingCAPFTemp,        !- Name
    1.55736,                  !- Coefficient1 Constant
    -0.074448,                !- Coefficient2 x
    0.003099,                 !- Coefficient3 x2
    0.00146,                  !- Coefficient4 y
    -4.1e-05,                 !- Coefficient5 y2
    -0.000427,                !- Coefficient6 xy
    0,                        !- Minimum Value of x
    50,                       !- Maximum Value of x
    0,                        !- Minimum Value of y
    50,                       !- Maximum Value of y
    0,                        !- Minimum Curve Output
    5,                        !- Maximum Curve Output
    Temperature,              !- Input Unit Type for X
    Temperature,              !- Input Unit Type for Y
    Dimensionless;            !- Output Unit Type

Curve:Biquadratic,
    HPCoolingEIRFTemp,        !- Name
    -0.350448,                !- Coefficient1 Constant
    0.11681,                  !- Coefficient2 x
    -0.0034,                  !- Coefficient3 x2
    -0.001226,                !- Coefficient4 y
    0.000601,                 !- Coefficient5 y2
    -0.000467,                !- Coefficient6 xy
    0,                        !- Minimum Value of x
    50,                       !- Maximum Value of x
```

```
    0,                        !- Minimum Value of y
    50,                       !- Maximum Value of y
    0,                        !- Minimum Curve Output
    5,                        !- Maximum Curve Output
    Temperature,              !- Input Unit Type for X
    Temperature,              !- Input Unit Type for Y
    Dimensionless;            !- Output Unit Type

Curve:Biquadratic,
    HPHeatingCAPFTemp,        !- Name
    0.876825,                 !- Coefficient1 Constant
    -0.002955,                !- Coefficient2 x
    -5.8e-05,                 !- Coefficient3 x2
    0.025335,                 !- Coefficient4 y
    0.000196,                 !- Coefficient5 y2
    -4.3e-05,                 !- Coefficient6 xy
    0,                        !- Minimum Value of x
    50,                       !- Maximum Value of x
    0,                        !- Minimum Value of y
    50,                       !- Maximum Value of y
    0,                        !- Minimum Curve Output
    5,                        !- Maximum Curve Output
    Temperature,              !- Input Unit Type for X
    Temperature,              !- Input Unit Type for Y
    Dimensionless;            !- Output Unit Type

Curve:Biquadratic,
    HPHeatingEIRFTemp,        !- Name
    0.704658,                 !- Coefficient1 Constant
    0.008767,                 !- Coefficient2 x
    0.000625,                 !- Coefficient3 x2
    -0.009037,                !- Coefficient4 y
    0.000738,                 !- Coefficient5 y2
    -0.001025,                !- Coefficient6 xy
    0,                        !- Minimum Value of x
    50,                       !- Maximum Value of x
```

```
    0,                          !- Minimum Value of y
    50,                         !- Maximum Value of y
    0,                          !- Minimum Curve Output
    5,                          !- Maximum Curve Output
    Temperature,                !- Input Unit Type for X
    Temperature,                !- Input Unit Type for Y
    Dimensionless;              !- Output Unit Type

Curve:Biquadratic,
    HPLowStageHeatingCAPFTemp,    !- Name
    0.84613,                    !- Coefficient1 Constant
    -0.002279,                  !- Coefficient2 x
    -4.7e-05,                   !- Coefficient3 x2
    0.026703,                   !- Coefficient4 y
    0.000201,                   !- Coefficient5 y2
    -7.9e-05,                   !- Coefficient6 xy
    0,                          !- Minimum Value of x
    50,                         !- Maximum Value of x
    0,                          !- Minimum Value of y
    50,                         !- Maximum Value of y
    0,                          !- Minimum Curve Output
    5,                          !- Maximum Curve Output
    Temperature,                !- Input Unit Type for X
    Temperature,                !- Input Unit Type for Y
    Dimensionless;              !- Output Unit Type

Curve:Biquadratic,
    HPLowStageHeatingEIRFTemp,    !- Name
    0.551837,                   !- Coefficient1 Constant
    0.02038,                    !- Coefficient2 x
    0.000546,                   !- Coefficient3 x2
    -0.009638,                  !- Coefficient4 y
    0.000785,                   !- Coefficient5 y2
    -0.00125,                   !- Coefficient6 xy
    0,                          !- Minimum Value of x
    50,                         !- Maximum Value of x
```

```
    0,                          !- Minimum Value of y
    50,                         !- Maximum Value of y
    0,                          !- Minimum Curve Output
    5,                          !- Maximum Curve Output
    Temperature,                !- Input Unit Type for X
    Temperature,                !- Input Unit Type for Y
    Dimensionless;              !- Output Unit Type

Curve:Biquadratic,
    HPHighStageHeatingCAPFTemp,    !- Name
    0.818223,                   !- Coefficient1 Constant
    0.001981,                   !- Coefficient2 x
    -0.000203,                  !- Coefficient3 x2
    0.028703,                   !- Coefficient4 y
    0.000207,                   !- Coefficient5 y2
    -7.1e-05,                   !- Coefficient6 xy
    0,                          !- Minimum Value of x
    50,                         !- Maximum Value of x
    0,                          !- Minimum Value of y
    50,                         !- Maximum Value of y
    0,                          !- Minimum Curve Output
    5,                          !- Maximum Curve Output
    Temperature,                !- Input Unit Type for X
    Temperature,                !- Input Unit Type for Y
    Dimensionless;              !- Output Unit Type

Curve:Biquadratic,
    HPHighStageHeatingEIRFTemp,    !- Name
    0.81584,                    !- Coefficient1 Constant
    -0.00615,                   !- Coefficient2 x
    0.001021,                   !- Coefficient3 x2
    -0.001301,                  !- Coefficient4 y
    0.001083,                   !- Coefficient5 y2
    -0.001487,                  !- Coefficient6 xy
    0,                          !- Minimum Value of x
    50,                         !- Maximum Value of x
```

```
    0,                          !- Minimum Value of y
    50,                         !- Maximum Value of y
    0,                          !- Minimum Curve Output
    5,                          !- Maximum Curve Output
    Temperature,                !- Input Unit Type for X
    Temperature,                !- Input Unit Type for Y
    Dimensionless;              !- Output Unit Type

Curve:Biquadratic,
    HPLowStageCoolingCAPFTemp,    !- Name
    1.658788,                   !- Coefficient1 Constant
    -0.083453,                  !- Coefficient2 x
    0.003424,                   !- Coefficient3 x2
    0.002433,                   !- Coefficient4 y
    -4.5e-05,                   !- Coefficient5 y2
    -0.000534,                  !- Coefficient6 xy
    0,                          !- Minimum Value of x
    50,                         !- Maximum Value of x
    0,                          !- Minimum Value of y
    50,                         !- Maximum Value of y
    0,                          !- Minimum Curve Output
    5,                          !- Maximum Curve Output
    Temperature,                !- Input Unit Type for X
    Temperature,                !- Input Unit Type for Y
    Dimensionless;              !- Output Unit Type

Curve:Biquadratic,
    HPLowStageCoolingEIRFTemp,    !- Name
    -0.582916,                  !- Coefficient1 Constant
    0.158101,                   !- Coefficient2 x
    -0.004398,                  !- Coefficient3 x2
    -0.020335,                  !- Coefficient4 y
    0.00108,                    !- Coefficient5 y2
    -0.00064,                   !- Coefficient6 xy
    0,                          !- Minimum Value of x
    50,                         !- Maximum Value of x
```

```
    0,                          !- Minimum Value of y
    50,                         !- Maximum Value of y
    0,                          !- Minimum Curve Output
    5,                          !- Maximum Curve Output
    Temperature,                !- Input Unit Type for X
    Temperature,                !- Input Unit Type for Y
    Dimensionless;              !- Output Unit Type

Curve:Biquadratic,
    HPHighStageCoolingCAPFTemp,    !- Name
    1.472738,                   !- Coefficient1 Constant
    -0.067222,                  !- Coefficient2 x
    0.00292,                    !- Coefficient3 x2
    5.2e-05,                    !- Coefficient4 y
    -3e-05,                     !- Coefficient5 y2
    -0.000359,                  !- Coefficient6 xy
    0,                          !- Minimum Value of x
    50,                         !- Maximum Value of x
    0,                          !- Minimum Value of y
    50,                         !- Maximum Value of y
    0,                          !- Minimum Curve Output
    5,                          !- Maximum Curve Output
    Temperature,                !- Input Unit Type for X
    Temperature,                !- Input Unit Type for Y
    Dimensionless;              !- Output Unit Type

Curve:Biquadratic,
    HPHighStageCoolingEIRFTemp,    !- Name
    -0.488196,                  !- Coefficient1 Constant
    0.099162,                   !- Coefficient2 x
    -0.00237,                   !- Coefficient3 x2
    0.019503,                   !- Coefficient4 y
    0.00043,                    !- Coefficient5 y2
    -0.001097,                  !- Coefficient6 xy
    0,                          !- Minimum Value of x
    50,                         !- Maximum Value of x
```

```
    0,                          !- Minimum Value of y
    50,                         !- Maximum Value of y
    0,                          !- Minimum Curve Output
    5,                          !- Maximum Curve Output
    Temperature,                !- Input Unit Type for X
    Temperature,                !- Input Unit Type for Y
    Dimensionless;              !- Output Unit Type

Curve:Biquadratic,
    ACLowStageCoolingCAPFTemp,    !- Name
    1.66458,                    !- Coefficient1 Constant
    -0.08039,                   !- Coefficient2 x
    0.0033,                     !- Coefficient3 x2
    0.00124,                    !- Coefficient4 y
    -3e-05,                     !- Coefficient5 y2
    -0.00052,                   !- Coefficient6 xy
    0,                          !- Minimum Value of x
    50,                         !- Maximum Value of x
    0,                          !- Minimum Value of y
    50,                         !- Maximum Value of y
    0,                          !- Minimum Curve Output
    5,                          !- Maximum Curve Output
    Temperature,                !- Input Unit Type for X
    Temperature,                !- Input Unit Type for Y
    Dimensionless;              !- Output Unit Type

Curve:Biquadratic,
    ACLowStageCoolingEIRFTemp,    !- Name
    -0.42738,                   !- Coefficient1 Constant
    0.14191,                    !- Coefficient2 x
    -0.00412,                   !- Coefficient3 x2
    -0.01406,                   !- Coefficient4 y
    0.00083,                    !- Coefficient5 y2
    -0.00043,                   !- Coefficient6 xy
    0,                          !- Minimum Value of x
    50,                         !- Maximum Value of x
```

```
    0,                          !- Minimum Value of y
    50,                         !- Maximum Value of y
    0,                          !- Minimum Curve Output
    5,                          !- Maximum Curve Output
    Temperature,                !- Input Unit Type for X
    Temperature,                !- Input Unit Type for Y
    Dimensionless;              !- Output Unit Type

Curve:Biquadratic,
    ACHighStageCoolingCAPFTemp,    !- Name
    1.36788,                    !- Coefficient1 Constant
    -0.06257,                   !- Coefficient2 x
    0.0028,                     !- Coefficient3 x2
    0.00504,                    !- Coefficient4 y
    -7e-05,                     !- Coefficient5 y2
    -0.00045,                   !- Coefficient6 xy
    0,                          !- Minimum Value of x
    50,                         !- Maximum Value of x
    0,                          !- Minimum Value of y
    50,                         !- Maximum Value of y
    0,                          !- Minimum Curve Output
    5,                          !- Maximum Curve Output
    Temperature,                !- Input Unit Type for X
    Temperature,                !- Input Unit Type for Y
    Dimensionless;              !- Output Unit Type

Curve:Biquadratic,
    ACHighStageCoolingEIRFTemp,    !- Name
    0.04232,                    !- Coefficient1 Constant
    0.07892,                    !- Coefficient2 x
    -0.00238,                   !- Coefficient3 x2
    -0.00304,                   !- Coefficient4 y
    0.00053,                    !- Coefficient5 y2
    -0.00032,                   !- Coefficient6 xy
    0,                          !- Minimum Value of x
    50,                         !- Maximum Value of x
```

```
    0,                        !- Minimum Value of y
    50,                       !- Maximum Value of y
    0,                        !- Minimum Curve Output
    5,                        !- Maximum Curve Output
    Temperature,              !- Input Unit Type for X
    Temperature,              !- Input Unit Type for Y
    Dimensionless;            !- Output Unit Type

Curve:Biquadratic,
    Cool-Cap-fT,              !- Name
    1.26489391,               !- Coefficient1 Constant
    -0.035054982,             !- Coefficient2 x
    0.00211086,               !- Coefficient3 x2
    -0.001526886,             !- Coefficient4 y
    -7.0308e-06,              !- Coefficient5 y2
    -0.0004691844,            !- Coefficient6 xy
    -100,                     !- Minimum Value of x
    100,                      !- Maximum Value of x
    -100,                     !- Minimum Value of y
    100;                      !- Maximum Value of y

Curve:Biquadratic,
    Cool-EIR-fT,              !- Name
    0.38402403,               !- Coefficient1 Constant
    0.029696724,              !- Coefficient2 x
    -0.0011329308,            !- Coefficient3 x2
    0.006490674,              !- Coefficient4 y
    0.0002626992,             !- Coefficient5 y2
    -0.0001207224,            !- Coefficient6 xy
    -100,                     !- Minimum Value of x
    100,                      !- Maximum Value of x
    -100,                     !- Minimum Value of y
    100;                      !- Maximum Value of y

Curve:DoubleExponentialDecay,
    Doubleexponential,        !- Name
```

```
    1380,                    !- Coefficient1 C1
    6834,                    !- Coefficient2 C2
    -8.75,                   !- Coefficient3 C3
    6747,                    !- Coefficient4 C4
    -6.22,                   !- Coefficient5 C5
    0,                       !- Minimum Value of x
    1,                       !- Maximum Value of x
    ,                        !- Minimum Curve Output
    ,                        !- Maximum Curve Output
    Dimensionless,           !- Input Unit Type for x
    Dimensionless;           !- Output Unit Type

ComponentCost:LineItem,
    PV_roof_front,           !- Name
    ,                        !- Type
    Generator:Photovoltaic,   !- Line Item Type
    PV_roof_front,           !- Item Name
    ,                        !- Object EndUse Key
    ,                        !- Cost per Each
    ,                        !- Cost per Area
    9000,                    !- Cost per Unit of Output Capacity
    ,                        !- Cost per Unit of Output Capacity
   per COP
    ,                        !- Cost per Volume
    ,                        !- Cost per Volume Rate
    ,                        !- Cost per Energy per Temperature
   Difference
    ;                        !- Quantity

ComponentCost:LineItem,
    PV_roof_back,            !- Name
    ,                        !- Type
    Generator:Photovoltaic,   !- Line Item Type
    PV_roof_back,            !- Item Name
    ,                        !- Object EndUse Key
    ,                        !- Cost per Each
```

```
    ,                         !- Cost per Area
    9000,                     !- Cost per Unit of Output Capacity
    ,                         !- Cost per Unit of Output Capacity
   per COP
    ,                         !- Cost per Volume
    ,                         !- Cost per Volume Rate
    ,                         !- Cost per Energy per Temperature
   Difference
    ;                         !- Quantity

Output:Variable,
    *,                        !- Key Value
    Electric Load Center Produced Electricity Rate,    !- Variable
   Name
    hourly;                   !- Reporting Frequency

Output:Variable,
    *,                        !- Key Value
    Electric Storage Charge Power,    !- Variable Name
    hourly;                   !- Reporting Frequency

Output:Variable,
    *,                        !- Key Value
    Electric Storage Discharge Power,    !- Variable Name
    hourly;                   !- Reporting Frequency

Output:Variable,
    *,                        !- Key Value
    Facility Total Purchased Electricity Rate,    !- Variable Name
    hourly;                   !- Reporting Frequency

Output:Variable,
    *,                        !- Key Value
    Facility Total Surplus Electricity Rate,    !- Variable Name
    hourly;                   !- Reporting Frequency
```

```
Output:Variable,
    *,                          !- Key Value
    Facility Net Purchased Electricity Rate,    !- Variable Name
    hourly;                     !- Reporting Frequency

Output:Variable,
    *,                          !- Key Value
    Facility Total Electricity Demand Rate,    !- Variable Name
    hourly;                     !- Reporting Frequency

Output:Variable,
    *,                          !- Key Value
    Site Outdoor Air Drybulb Temperature,    !- Variable Name
    hourly;                     !- Reporting Frequency

Output:Variable,
    *,                          !- Key Value
    Zone Thermostat Cooling Setpoint Temperature,    !- Variable
   Name
    hourly;                     !- Reporting Frequency

Output:Variable,
    *,                          !- Key Value
    Zone Thermal Comfort Pierce Model Standard Effective Temperature
   ,    !- Variable Name
    hourly;                     !- Reporting Frequency
```

D.3 Kuwait Residential idf

Multi-family residential model in Kuwait, developed by the research team members, Jonathon Brearley and David Birge.

```
Version,
  9.5;                                    !- Version Identifier

Timestep,
  6;                                      !- Number of Timesteps per
    Hour

LifeCycleCost:Parameters,
  Life Cycle Cost Parameters,             !- Name
  EndOfYear,                              !- Discounting Convention
  ConstantDollar,                         !- Inflation Approach
  0.03,                                   !- Real Discount Rate
  ,                                       !- Nominal Discount Rate
  ,                                       !- Inflation
  ,                                       !- Base Date Month
  2011,                                   !- Base Date Year
  ,                                       !- Service Date Month
  2011,                                   !- Service Date Year
  25,                                     !- Length of Study Period
   in Years
  ,                                       !- Tax rate
  None;                                   !- Depreciation Method

LifeCycleCost:UsePriceEscalation,
  U.S. Avg  Commercial-Electricity,       !- Name
  Electricity,                            !- Resource
  2011,                                   !- Escalation Start Year
  January,                                !- Escalation Start Month
  0.9838,                                 !- Year Escalation 1
  0.9730,                                 !- Year Escalation 2
  0.9632,                                 !- Year Escalation 3
  0.9611,                                 !- Year Escalation 4
  0.9571,                                 !- Year Escalation 5
  0.9553,                                 !- Year Escalation 6
  0.9539,                                 !- Year Escalation 7
```

```
  0.9521,                                 !- Year Escalation 8
  0.9546,                                 !- Year Escalation 9
  0.9550,                                 !- Year Escalation 10
  0.9553,                                 !- Year Escalation 11
  0.9564,                                 !- Year Escalation 12
  0.9575,                                 !- Year Escalation 13
  0.9596,                                 !- Year Escalation 14
  0.9618,                                 !- Year Escalation 15
  0.9614,                                 !- Year Escalation 16
  0.9618,                                 !- Year Escalation 17
  0.9618,                                 !- Year Escalation 18
  0.9593,                                 !- Year Escalation 19
  0.9589,                                 !- Year Escalation 20
  0.9607,                                 !- Year Escalation 21
  0.9625,                                 !- Year Escalation 22
  0.9650,                                 !- Year Escalation 23
  0.9708,                                 !- Year Escalation 24
  0.9751,                                 !- Year Escalation 25
  0.9762,                                 !- Year Escalation 26
  0.9766,                                 !- Year Escalation 27
  0.9766,                                 !- Year Escalation 28
  0.9769,                                 !- Year Escalation 29
  0.9773;                                 !- Year Escalation 30

LifeCycleCost:UsePriceEscalation,
  U.S. Avg  Commercial-Distillate Oil,    !- Name
  FuelOilNo1,                             !- Resource
  2011,                                   !- Escalation Start Year
  January,                                !- Escalation Start Month
  0.9714,                                 !- Year Escalation 1
  0.9730,                                 !- Year Escalation 2
  0.9942,                                 !- Year Escalation 3
  1.0164,                                 !- Year Escalation 4
  1.0541,                                 !- Year Escalation 5
  1.0928,                                 !- Year Escalation 6
  1.1267,                                 !- Year Escalation 7
```

```
  1.1580,                                 !- Year Escalation 8
  1.1792,                                 !- Year Escalation 9
  1.1967,                                 !- Year Escalation 10
  1.2200,                                 !- Year Escalation 11
  1.2333,                                 !- Year Escalation 12
  1.2566,                                 !- Year Escalation 13
  1.2709,                                 !- Year Escalation 14
  1.2826,                                 !- Year Escalation 15
  1.2985,                                 !- Year Escalation 16
  1.3102,                                 !- Year Escalation 17
  1.3250,                                 !- Year Escalation 18
  1.3261,                                 !- Year Escalation 19
  1.3282,                                 !- Year Escalation 20
  1.3324,                                 !- Year Escalation 21
  1.3356,                                 !- Year Escalation 22
  1.3431,                                 !- Year Escalation 23
  1.3510,                                 !- Year Escalation 24
  1.3568,                                 !- Year Escalation 25
  1.3606,                                 !- Year Escalation 26
  1.3637,                                 !- Year Escalation 27
  1.3674,                                 !- Year Escalation 28
  1.3706,                                 !- Year Escalation 29
  1.3743;                                 !- Year Escalation 30

LifeCycleCost:UsePriceEscalation,
  U.S. Avg  Commercial-Residual Oil,      !- Name
  FuelOilNo2,                             !- Resource
  2011,                                   !- Escalation Start Year
  January,                                !- Escalation Start Month
  0.8469,                                 !- Year Escalation 1
  0.8257,                                 !- Year Escalation 2
  0.8681,                                 !- Year Escalation 3
  0.8988,                                 !- Year Escalation 4
  0.9289,                                 !- Year Escalation 5
  0.9604,                                 !- Year Escalation 6
  0.9897,                                 !- Year Escalation 7
```

```
  1.0075,                                 !- Year Escalation 8
  1.0314,                                 !- Year Escalation 9
  1.0554,                                 !- Year Escalation 10
  1.0861,                                 !- Year Escalation 11
  1.1278,                                 !- Year Escalation 12
  1.1497,                                 !- Year Escalation 13
  1.1620,                                 !- Year Escalation 14
  1.1743,                                 !- Year Escalation 15
  1.1852,                                 !- Year Escalation 16
  1.1948,                                 !- Year Escalation 17
  1.2037,                                 !- Year Escalation 18
  1.2071,                                 !- Year Escalation 19
  1.2119,                                 !- Year Escalation 20
  1.2139,                                 !- Year Escalation 21
  1.2194,                                 !- Year Escalation 22
  1.2276,                                 !- Year Escalation 23
  1.2365,                                 !- Year Escalation 24
  1.2420,                                 !- Year Escalation 25
  1.2461,                                 !- Year Escalation 26
  1.2509,                                 !- Year Escalation 27
  1.2550,                                 !- Year Escalation 28
  1.2591,                                 !- Year Escalation 29
  1.2638;                                 !- Year Escalation 30

LifeCycleCost:UsePriceEscalation,
  U.S. Avg  Commercial-Natural gas,       !- Name
  NaturalGas,                             !- Resource
  2011,                                   !- Escalation Start Year
  January,                                !- Escalation Start Month
  0.9823,                                 !- Year Escalation 1
  0.9557,                                 !- Year Escalation 2
  0.9279,                                 !- Year Escalation 3
  0.9257,                                 !- Year Escalation 4
  0.9346,                                 !- Year Escalation 5
  0.9412,                                 !- Year Escalation 6
  0.9512,                                 !- Year Escalation 7
```

```
  0.9645,                                 !- Year Escalation 8
  0.9856,                                 !- Year Escalation 9
  1.0067,                                 !- Year Escalation 10
  1.0222,                                 !- Year Escalation 11
  1.0410,                                 !- Year Escalation 12
  1.0610,                                 !- Year Escalation 13
  1.0787,                                 !- Year Escalation 14
  1.0942,                                 !- Year Escalation 15
  1.1098,                                 !- Year Escalation 16
  1.1220,                                 !- Year Escalation 17
  1.1308,                                 !- Year Escalation 18
  1.1386,                                 !- Year Escalation 19
  1.1486,                                 !- Year Escalation 20
  1.1619,                                 !- Year Escalation 21
  1.1763,                                 !- Year Escalation 22
  1.1918,                                 !- Year Escalation 23
  1.2118,                                 !- Year Escalation 24
  1.2284,                                 !- Year Escalation 25
  1.2439,                                 !- Year Escalation 26
  1.2605,                                 !- Year Escalation 27
  1.2772,                                 !- Year Escalation 28
  1.2938,                                 !- Year Escalation 29
  1.3115;                                 !- Year Escalation 30

LifeCycleCost:UsePriceEscalation,
  U.S. Avg  Commercial-Coal,              !- Name
  Coal,                                   !- Resource
  2011,                                   !- Escalation Start Year
  January,                                !- Escalation Start Month
  0.9970,                                 !- Year Escalation 1
  1.0089,                                 !- Year Escalation 2
  1.0089,                                 !- Year Escalation 3
  0.9941,                                 !- Year Escalation 4
  0.9941,                                 !- Year Escalation 5
  1.0000,                                 !- Year Escalation 6
  1.0030,                                 !- Year Escalation 7
```

```
  1.0059,                                 !- Year Escalation 8
  1.0089,                                 !- Year Escalation 9
  1.0119,                                 !- Year Escalation 10
  1.0148,                                 !- Year Escalation 11
  1.0178,                                 !- Year Escalation 12
  1.0208,                                 !- Year Escalation 13
  1.0267,                                 !- Year Escalation 14
  1.0297,                                 !- Year Escalation 15
  1.0356,                                 !- Year Escalation 16
  1.0415,                                 !- Year Escalation 17
  1.0534,                                 !- Year Escalation 18
  1.0564,                                 !- Year Escalation 19
  1.0593,                                 !- Year Escalation 20
  1.0653,                                 !- Year Escalation 21
  1.0712,                                 !- Year Escalation 22
  1.0742,                                 !- Year Escalation 23
  1.0801,                                 !- Year Escalation 24
  1.0831,                                 !- Year Escalation 25
  1.0831,                                 !- Year Escalation 26
  1.0861,                                 !- Year Escalation 27
  1.0890,                                 !- Year Escalation 28
  1.0920,                                 !- Year Escalation 29
  1.0950;                                 !- Year Escalation 30

Building,
  Building 1,                             !- Name
  0,                                      !- North Axis {deg}
  Urban,                                  !- Terrain
  ,                                       !- Loads Convergence
   Tolerance Value {W}
  ,                                       !- Temperature Convergence
    Tolerance Value {deltaC}
  FullExteriorWithReflections,            !- Solar Distribution
  ,                                       !- Maximum Number of
   Warmup Days
```

```
  ;                                       !- Minimum Number of
   Warmup Days

Zone,
  Room_16_3d8c5364,                       !- Name
  0,                                      !- Direction of Relative
   North {deg}
  0,                                      !- X Origin {m}
  0,                                      !- Y Origin {m}
  0,                                      !- Z Origin {m}
  ,                                       !- Type
  1,                                      !- Multiplier
  ,                                       !- Ceiling Height {m}
  ,                                       !- Volume {m3}
  ,                                       !- Floor Area {m2}
  ,                                       !- Zone Inside Convection
   Algorithm
  ,                                       !- Zone Outside Convection
    Algorithm
  Yes;                                    !- Part of Total Floor
   Area

BuildingSurface:Detailed,
  Room_16_3d8c5364..Face0,                !- Name
  Wall,                                   !- Surface Type
  project_wall,                           !- Construction Name
  Room_16_3d8c5364,                       !- Zone Name
  Outdoors,                               !- Outside Boundary
   Condition
  ,                                       !- Outside Boundary
   Condition Object
  SunExposed,                             !- Sun Exposure
  WindExposed,                            !- Wind Exposure
  ,                                       !- View Factor to Ground
  ,                                       !- Number of Vertices
```

```
  23.1619451669316, 55.2819899121844, 3.24999999997549, !- X,Y,Z
   Vertex 1 {m}
  13.1619451669316, 55.2819899121844, 3.24999999995968, !- X,Y,Z
   Vertex 2 {m}
  13.161945166923, 55.2819899122047, -4.03238477771582e-11, !- X,Y,Z
    Vertex 3 {m}
  23.161945166923, 55.2819899122047, -2.45078148573979e-11; !- X,Y,Z
    Vertex 4 {m}

FenestrationSurface:Detailed,
  Room_16_3d8c5364..Face0_Glz0,           !- Name
  Window,                                 !- Surface Type
  project_window,                         !- Construction Name
  Room_16_3d8c5364..Face0,                !- Building Surface Name
  ,                                       !- Outside Boundary
   Condition Object
  ,                                       !- View Factor to Ground
  ,                                       !- Frame and Divider Name
  ,                                       !- Multiplier
  ,                                       !- Number of Vertices
  15.2348618335962, 55.2819899121872, 2.79999999996295, !- X,Y,Z
   Vertex 1 {m}
  14.4223618335973, 55.2819899121872, 2.79999999996167, !- X,Y,Z
   Vertex 2 {m}
  14.4223618336004, 55.2819899121997, 0.79999999996167, !- X,Y,Z
   Vertex 3 {m}
  15.2348618335993, 55.2819899121997, 0.799999999962955; !- X,Y,Z
   Vertex 4 {m}

FenestrationSurface:Detailed,
  Room_16_3d8c5364..Face0_Glz1,           !- Name
  Window,                                 !- Surface Type
  project_window,                         !- Construction Name
  Room_16_3d8c5364..Face0,                !- Building Surface Name
  ,                                       !- Outside Boundary
   Condition Object
```

```
  ,                                         !- View Factor to Ground
  ,                                         !- Frame and Divider Name
  ,                                         !- Multiplier
  ,                                         !- Number of Vertices
  18.5681951669249, 55.2819899121872, 2.79999999996823, !- X,Y,Z
   Vertex 1 {m}
  17.755695166926, 55.2819899121872, 2.79999999996694, !- X,Y,Z
   Vertex 2 {m}
  17.7556951669292, 55.2819899121997, 0.799999999966942, !- X,Y,Z
   Vertex 3 {m}
  18.5681951669281, 55.2819899121997, 0.799999999968227; !- X,Y,Z
   Vertex 4 {m}

FenestrationSurface:Detailed,
  Room_16_3d8c5364..Face0_Glz2,             !- Name
  Window,                                   !- Surface Type
  project_window,                           !- Construction Name
  Room_16_3d8c5364..Face0,                  !- Building Surface Name
  ,                                         !- Outside Boundary
   Condition Object
  ,                                         !- View Factor to Ground
  ,                                         !- Frame and Divider Name
  ,                                         !- Multiplier
  ,                                         !- Number of Vertices
  21.9015285002536, 55.2819899121872, 2.7999999999735, !- X,Y,Z
   Vertex 1 {m}
  21.0890285002548, 55.2819899121872, 2.79999999997221, !- X,Y,Z
   Vertex 2 {m}
  21.0890285002579, 55.2819899121997, 0.799999999972214, !- X,Y,Z
   Vertex 3 {m}
  21.9015285002568, 55.2819899121997, 0.799999999973499; !- X,Y,Z
   Vertex 4 {m}

BuildingSurface:Detailed,
  Room_16_3d8c5364..Face1,                  !- Name
  Wall,                                     !- Surface Type
```

```
  project_wall_int,                         !- Construction Name
  Room_16_3d8c5364,                         !- Zone Name
  Surface,                                  !- Outside Boundary
   Condition
  Room_27_0080b418..Face3,                  !- Outside Boundary
   Condition Object
  NoSun,                                    !- Sun Exposure
  NoWind,                                   !- Wind Exposure
  ,                                         !- View Factor to Ground
  ,                                         !- Number of Vertices
  23.1619451669316, 55.2819899121844, 3.24999999997549, !- X,Y,Z
   Vertex 1 {m}
  23.161945166923, 55.2819899122047, -2.45078148573979e-11, !- X,Y,Z
    Vertex 2 {m}
  19.8286118335897, 60.2819899122047, -6.55526866515655e-11, !- X,Y,
   Z Vertex 3 {m}
  19.8286118335983, 60.2819899121844, 3.24999999993445; !- X,Y,Z
   Vertex 4 {m}

BuildingSurface:Detailed,
  Room_16_3d8c5364..Face2,                  !- Name
  Wall,                                     !- Surface Type
  project_wall_int,                         !- Construction Name
  Room_16_3d8c5364,                         !- Zone Name
  Surface,                                  !- Outside Boundary
   Condition
  Room_21_4c523269..Face0,                  !- Outside Boundary
   Condition Object
  NoSun,                                    !- Sun Exposure
  NoWind,                                   !- Wind Exposure
  ,                                         !- View Factor to Ground
  ,                                         !- Number of Vertices
  19.8286118335983, 60.2819899121844, 3.24999999993445, !- X,Y,Z
   Vertex 1 {m}
  19.8286118335897, 60.2819899122047, -6.55526866515655e-11, !- X,Y,
   Z Vertex 2 {m}
```

```
  16.4952785002563, 60.2819899122047, -7.08246976248188e-11, !- X,Y,
   Z Vertex 3 {m}
  16.495278500265, 60.2819899121844, 3.24999999992918; !- X,Y,Z
   Vertex 4 {m}

BuildingSurface:Detailed,
  Room_16_3d8c5364..Face3,                !- Name
  Wall,                                   !- Surface Type
  project_wall_int,                       !- Construction Name
  Room_16_3d8c5364,                       !- Zone Name
  Surface,                                !- Outside Boundary
   Condition
  Room_24_159d21b7..Face0,                !- Outside Boundary
   Condition Object
  NoSun,                                  !- Sun Exposure
  NoWind,                                 !- Wind Exposure
  ,                                       !- View Factor to Ground
  ,                                       !- Number of Vertices
  13.1619451669316, 55.2819899121844, 3.24999999995968, !- X,Y,Z
   Vertex 1 {m}
  16.495278500265, 60.2819899121844, 3.24999999992918, !- X,Y,Z
   Vertex 2 {m}
  16.4952785002563, 60.2819899122047, -7.08246976248188e-11, !- X,Y,
   Z Vertex 3 {m}
  13.161945166923, 55.2819899122047, -4.03238477771582e-11; !- X,Y,Z
    Vertex 4 {m}

BuildingSurface:Detailed,
  Room_16_3d8c5364..Face4,                !- Name
  Floor,                                  !- Surface Type
  project_slab,                           !- Construction Name
  Room_16_3d8c5364,                       !- Zone Name
  Ground,                                 !- Outside Boundary
   Condition
  ,                                       !- Outside Boundary
   Condition Object
```

```
  NoSun,                                  !- Sun Exposure
  NoWind,                                 !- Wind Exposure
  ,                                       !- View Factor to Ground
  ,                                       !- Number of Vertices
  19.8286118335897, 60.2819899122047, -6.55526866515655e-11, !- X,Y,
   Z Vertex 1 {m}
  23.161945166923, 55.2819899122047, -2.45078148573979e-11, !- X,Y,Z
    Vertex 2 {m}
  13.161945166923, 55.2819899122047, -4.03238477771582e-11, !- X,Y,Z
    Vertex 3 {m}
  16.4952785002563, 60.2819899122047, -7.08246976248188e-11; !- X,Y,
   Z Vertex 4 {m}

BuildingSurface:Detailed,
  Room_16_3d8c5364..Face5,                !- Name
  Ceiling,                                !- Surface Type
  project_ceiling_int,                    !- Construction Name
  Room_16_3d8c5364,                       !- Zone Name
  Surface,                                !- Outside Boundary
   Condition
  Room_17_fb615533..Face4,                !- Outside Boundary
   Condition Object
  NoSun,                                  !- Sun Exposure
  NoWind,                                 !- Wind Exposure
  ,                                       !- View Factor to Ground
  ,                                       !- Number of Vertices
  23.1619451669316, 55.2819899121844, 3.24999999997549, !- X,Y,Z
   Vertex 1 {m}
  19.8286118335983, 60.2819899121844, 3.24999999993445, !- X,Y,Z
   Vertex 2 {m}
  16.495278500265, 60.2819899121844, 3.24999999992918, !- X,Y,Z
   Vertex 3 {m}
  13.1619451669316, 55.2819899121844, 3.24999999995968; !- X,Y,Z
   Vertex 4 {m}

ZoneControl:Thermostat,
```

```
  Room_16_3d8c5364 Thermostat,            !- Name
  Room_16_3d8c5364,                       !- Zone or ZoneList Name
  Room_16_3d8c5364 Thermostat Schedule,   !- Control Type Schedule
   Name
  ThermostatSetpoint:DualSetpoint,        !- Control 1 Object Type
  Thermostat Setpoint Dual Setpoint 1,    !- Control 1 Name
  ,                                       !- Control 2 Object Type
  ,                                       !- Control 2 Name
  ,                                       !- Control 3 Object Type
  ,                                       !- Control 3 Name
  ,                                       !- Control 4 Object Type
  ,                                       !- Control 4 Name
  0;                                      !- Temperature Difference
   Between Cutout And Setpoint {deltaC}
ScheduleTypeLimits,
    any number;              !- Name

Schedule:Compact,
ALWAYS_ON,               !- Name
On/Off,                  !- Schedule Type Limits Name
Through: 12/31,          !- Field 1
For: AllDays,            !- Field 2
Until: 24:00,1;          !- Field 3

Schedule:Compact,
    charge_sch,              !- Name
    Any Number,              !- Schedule Type Limits Name
    Through: 12/31,          !- Field 1
    For: AllDays,            !- Field 2
    Until: 1:00,             !- Field 3
    0,                       !- Field 4
    Until: 2:00,             !- Field 5
    0,                       !- Field 6
    Until: 3:00,             !- Field 7
    0,                       !- Field 8
    Until: 4:00,             !- Field 9
```

```
0,                          !- Field 10
Until: 5:00,                !- Field 11
0,                          !- Field 12
Until: 6:00,                !- Field 13
0,                          !- Field 14
Until: 7:00,                !- Field 15
0,                          !- Field 16
Until: 8:00,                !- Field 17
0,                          !- Field 18
Until: 9:00,                !- Field 19
0.20993163977729543,        !- Field 20
Until: 10:00,               !- Field 21
0.6063652250396501,         !- Field 22
Until: 11:00,               !- Field 23
0.82298326696258,           !- Field 24
Until: 12:00,               !- Field 25
0.811209619326249,          !- Field 26
Until: 13:00,               !- Field 27
1,                          !- Field 28
Until: 14:00,               !- Field 29
0.9365412179871627,         !- Field 30
Until: 15:00,               !- Field 31
0.7474753945294974,         !- Field 32
Until: 16:00,               !- Field 33
0.31017915474001695,        !- Field 34
Until: 17:00,               !- Field 35
0.0006572039008697994,      !- Field 36
Until: 18:00,               !- Field 37
0,                          !- Field 38
Until: 19:00,               !- Field 39
0,                          !- Field 40
Until: 20:00,               !- Field 41
0,                          !- Field 42
Until: 21:00,               !- Field 43
0,                          !- Field 44
Until: 22:00,               !- Field 45
```

```
    0,                          !- Field 46
    Until: 23:00,               !- Field 47
    0,                          !- Field 48
    Until: 24:00,               !- Field 49
    0;                          !- Field 50

Schedule:Compact,
    discharge_sch,              !- Name
    Any Number,                 !- Schedule Type Limits Name
    Through: 12/31,             !- Field 1
    For: AllDays,               !- Field 2
    Until: 1:00,                !- Field 3
    1.4859886047370414e-16,     !- Field 4
    Until: 2:00,                !- Field 5
    2.4412669934965675e-16,     !- Field 6
    Until: 3:00,                !- Field 7
    2.4412669934965675e-16,     !- Field 8
    Until: 4:00,                !- Field 9
    1.4859886047370407e-16,     !- Field 10
    Until: 5:00,                !- Field 11
    1.8044147343235496e-16,     !- Field 12
    Until: 6:00,                !- Field 13
    1.4859886047370407e-16,     !- Field 14
    Until: 7:00,                !- Field 15
    4.3518237710156196e-16,     !- Field 16
    Until: 8:00,                !- Field 17
    5.12135358418302e-16,       !- Field 18
    Until: 9:00,                !- Field 19
    0,                          !- Field 20
    Until: 10:00,               !- Field 21
    0,                          !- Field 22
    Until: 11:00,               !- Field 23
    0,                          !- Field 24
    Until: 12:00,               !- Field 25
    0,                          !- Field 26
    Until: 13:00,               !- Field 27
```

```
    0,                          !- Field 28
    Until: 14:00,               !- Field 29
    0,                          !- Field 30
    Until: 15:00,               !- Field 31
    0,                          !- Field 32
    Until: 16:00,               !- Field 33
    0,                          !- Field 34
    Until: 17:00,               !- Field 35
    0.17680191083590457,        !- Field 36
    Until: 18:00,               !- Field 37
    0.7298301024347349,         !- Field 38
    Until: 19:00,               !- Field 39
    0.9288259054679598,         !- Field 40
    Until: 20:00,               !- Field 41
    1,                          !- Field 42
    Until: 21:00,               !- Field 43
    0.9042389568206112,         !- Field 44
    Until: 22:00,               !- Field 45
    0.6622444643283896,         !- Field 46
    Until: 23:00,               !- Field 47
    2.1228408639100586e-17,     !- Field 48
    Until: 24:00,               !- Field 49
    1.4859886047370407e-16;     !- Field 50

Schedule:Compact,
    Clg-SetP-Sch,            !- Name
    Temperature, !- Schedule Type Limits Name
    Through: 12/31,          !- Field 1
    For: AllDays,            !- Field 2
    Until: 24:00,            !- Field 3
    28;                      !- Field 4

Schedule:Compact,
  Room_16_3d8c5364 Thermostat Schedule,   !- Name
  Room_16_3d8c5364 Thermostat Schedule Type Limits, !- Schedule Type
    Limits Name
```

```
  Through: 12/31,                         !- Field 1
  For: AllDays,                           !- Field 2
  Until: 24:00,                           !- Field 3
  4;                                      !- Field 4

ScheduleTypeLimits,
  Room_16_3d8c5364 Thermostat Schedule Type Limits, !- Name
  0,                                      !- Lower Limit Value {
   BasedOnField A3}
  4,                                      !- Upper Limit Value {
   BasedOnField A3}
  DISCRETE;                               !- Numeric Type

ThermostatSetpoint:DualSetpoint,
  Thermostat Setpoint Dual Setpoint 1,    !- Name
  project_heat,                           !- Heating Setpoint
   Temperature Schedule Name
  Clg-SetP-Sch;                        !- Cooling Setpoint
   Temperature Schedule Name

ScheduleTypeLimits,
  Temperature,                            !- Name
  -273.15,                                !- Lower Limit Value {
   BasedOnField A3}
  ,                                       !- Upper Limit Value {
   BasedOnField A3}
  Continuous,                             !- Numeric Type
  temperature;                            !- Unit Type

Schedule:File,
  project_heat,                           !- Name
  Temperature,                            !- Schedule Type Limits
   Name
  /content/drive/My Drive/Kuwait/reference_schedules/project_heat.
   csv, !- File Name
  1,                                      !- Column Number
```

```
  1,                                      !- Rows to Skip at Top
  ,                                       !- Number of Hours of Data
  Comma,                                  !- Column Separator
  No,                                     !- Interpolate to Timestep
  60;                                     !- Minutes per Item

Schedule:Day:Interval,
  Standard_Cooling_Sunday,                !- Name
  Temperature,                            !- Schedule Type Limits
   Name
  No,                                     !- Interpolate to Timestep
  24:00,                                  !- Time 1 {hh:mm}
  23;                                     !- Value Until Time 1



Schedule:Week:Daily,
  Standard_Cooling Week Rule - Jan1-Dec31, !- Name
  Standard_Cooling_Sunday,                !- Sunday Schedule:Day
   Name
  Standard_Cooling_Sunday,                !- Monday Schedule:Day
   Name
  Standard_Cooling_Sunday,                !- Tuesday Schedule:Day
   Name
  Standard_Cooling_Sunday,                !- Wednesday Schedule:Day
   Name
  Standard_Cooling_Sunday,                !- Thursday Schedule:Day
   Name
  Standard_Cooling_Sunday,                !- Friday Schedule:Day
   Name
  Standard_Cooling_Sunday,                !- Saturday Schedule:Day
   Name
  Standard_Cooling_Hol 1,                 !- Holiday Schedule:Day
   Name
  Standard_Cooling_SmrDsn 1,              !- SummerDesignDay
   Schedule:Day Name
```

```
  Standard_Cooling_WntrDsn 1,              !- WinterDesignDay
   Schedule:Day Name
  Standard_Cooling_Sunday,                 !- CustomDay1 Schedule:Day
    Name
  Standard_Cooling_Sunday;                 !- CustomDay2 Schedule:Day
    Name

Schedule:Year,
  Standard_Cooling,                        !- Name
  Temperature,                             !- Schedule Type Limits
   Name
  Standard_Cooling Week Rule - Jan1-Dec31, !- Schedule:Week Name 1
  1,                                       !- Start Month 1
  1,                                       !- Start Day 1
  12,                                      !- End Month 1
  31;                                      !- End Day 1

Schedule:Day:Interval,
  Standard_Cooling_SmrDsn 1,               !- Name
  Temperature,                             !- Schedule Type Limits
   Name
  No,                                      !- Interpolate to Timestep
  24:00,                                   !- Time 1 {hh:mm}
  23;                                      !- Value Until Time 1

Schedule:Day:Interval,
  Standard_Cooling_WntrDsn 1,              !- Name
  Temperature,                             !- Schedule Type Limits
   Name
  No,                                      !- Interpolate to Timestep
  24:00,                                   !- Time 1 {hh:mm}
  23;                                      !- Value Until Time 1

Schedule:Day:Interval,
  Standard_Cooling_Hol 1,                  !- Name
```

```
  Temperature,                            !- Schedule Type Limits
   Name
  No,                                     !- Interpolate to Timestep
  24:00,                                  !- Time 1 {hh:mm}
  23;                                     !- Value Until Time 1

ZoneHVAC:EquipmentConnections,
  Room_16_3d8c5364,                       !- Zone Name
  Room_16_3d8c5364 Equipment List,        !- Zone Conditioning
   Equipment List Name
  Room_16_3d8c5364 Inlet Node List,       !- Zone Air Inlet Node or
   NodeList Name
  Room_16_3d8c5364 Exhaust Node List,     !- Zone Air Exhaust Node
   or NodeList Name
  Room_16_3d8c5364 Zone Air Node,         !- Zone Air Node Name
  Room_16_3d8c5364 Return Node List;      !- Zone Return Air Node or
    NodeList Name

NodeList,
  Room_16_3d8c5364 Inlet Node List,       !- Name
  Room_16_3d8c5364 Air Terminal Outlet Air Node, !- Node Name 1
  Room_16_3d8c5364 VRF Terminal Unit Outlet Air Node; !- Node Name 2

NodeList,
  Room_16_3d8c5364 Exhaust Node List,     !- Name
  Room_16_3d8c5364 VRF Terminal Unit Inlet Air Node; !- Node Name 1

NodeList,
  Room_16_3d8c5364 Return Node List,      !- Name
  Room_16_3d8c5364 Return Air Node;       !- Node Name 1

AirTerminal:SingleDuct:ConstantVolume:NoReheat,
  Room_16_3d8c5364 Air Terminal,          !- Name
  Always On Discrete,                     !- Availability Schedule
   Name
```

```
  Room_16_3d8c5364 Air Terminal Inlet Air Node, !- Air Inlet Node
   Name
  Room_16_3d8c5364 Air Terminal Outlet Air Node, !- Air Outlet Node
   Name
  AutoSize;                               !- Maximum Air Flow Rate {
   m3/s}

ZoneHVAC:AirDistributionUnit,
  ADU Room_16_3d8c5364 Air Terminal,      !- Name
  Room_16_3d8c5364 Air Terminal Outlet Air Node, !- Air Distribution
    Unit Outlet Node Name
  AirTerminal:SingleDuct:ConstantVolume:NoReheat, !- Air Terminal
   Object Type
  Room_16_3d8c5364 Air Terminal;          !- Air Terminal Name

ZoneHVAC:TerminalUnit:VariableRefrigerantFlow,
  Room_16_3d8c5364 VRF Terminal Unit,     !- Zone Terminal Unit Name
  Always On Discrete,                     !- Terminal Unit
   Availability Schedule
  Room_16_3d8c5364 VRF Terminal Unit Inlet Air Node, !- Terminal
   Unit Air Inlet Node Name
  Room_16_3d8c5364 VRF Terminal Unit Outlet Air Node, !- Terminal
   Unit Air Outlet Node Name
  Autosize,                               !- Cooling Supply Air Flow
    Rate {m3/s}
  Autosize,                               !- No Cooling Supply Air
   Flow Rate {m3/s}
  Autosize,                               !- Heating Supply Air Flow
    Rate {m3/s}
  Autosize,                               !- No Heating Supply Air
   Flow Rate {m3/s}
  Autosize,                               !- Cooling Outdoor Air
   Flow Rate {m3/s}
  Autosize,                               !- Heating Outdoor Air
   Flow Rate {m3/s}
```

```
Autosize,                                 !- No Load Outdoor Air
 Flow Rate {m3/s}
Always Off Discrete,                      !- Supply Air Fan
 Operating Mode Schedule Name
DrawThrough,                              !- Supply Air Fan
 Placement
Fan:OnOff,                                !- Supply Air Fan Object
 Type
Room_16_3d8c5364 VRF Unit Cycling Fan,    !- Supply Air Fan Object
 Name
OutdoorAir:Mixer,                         !- Outside Air Mixer
 Object Type
Room_16_3d8c5364 VRF Terminal Unit OA Mixer, !- Outside Air Mixer
 Object Name
Coil:Cooling:DX:VariableRefrigerantFlow, !- Cooling Coil Object
 Type
Zone HVAC Terminal Unit Variable Refrigerant Flow 1 Cooling Coil,
 !- Cooling Coil Object Name
Coil:Heating:DX:VariableRefrigerantFlow, !- Heating Coil Object
 Type
Zone HVAC Terminal Unit Variable Refrigerant Flow 1 Heating Coil,
 !- Heating Coil Object Name
30,                                       !- Zone Terminal Unit On
 Parasitic Electric Energy Use {W}
20,                                       !- Zone Terminal Unit Off
 Parasitic Electric Energy Use {W}
1,                                        !- Rated Heating Capacity
 Sizing Ratio {W/W}
,                                         !- Availability Manager
 List Name
,                                         !- Design Specification
 ZoneHVAC Sizing Object Name
,                                         !- Supplemental Heating
 Coil Object Type
,                                         !- Supplemental Heating
 Coil Name
```

```
  Autosize,                                 !- Maximum Supply Air
   Temperature from Supplemental Heater {C}
  21;                                       !- Maximum Outdoor Dry-
   Bulb Temperature for Supplemental Heater Operation {C}

Schedule:Constant,
  Always On Discrete,                       !- Name
  OnOff,                                    !- Schedule Type Limits
   Name
  1;                                        !- Hourly Value

Schedule:Constant,
  Always Off Discrete,                      !- Name
  OnOff 1,                                  !- Schedule Type Limits
   Name
  0;                                        !- Hourly Value

OutdoorAir:Mixer,
  Room_16_3d8c5364 VRF Terminal Unit OA Mixer, !- Name
  Room_16_3d8c5364 VRF Terminal Unit Mixer Outlet Node, !- Mixed Air
    Node Name
  Room_16_3d8c5364 VRF Terminal Unit Outdoor Air Node, !- Outdoor
   Air Stream Node Name
  Room_16_3d8c5364 VRF Terminal Unit Relief Node Name, !- Relief Air
    Stream Node Name
  Room_16_3d8c5364 VRF Terminal Unit Inlet Air Node; !- Return Air
   Stream Node Name

OutdoorAir:NodeList,
  Room_16_3d8c5364 VRF Terminal Unit Outdoor Air Node; !- Node or
   NodeList Name 1

Coil:Cooling:DX:VariableRefrigerantFlow,
  Zone HVAC Terminal Unit Variable Refrigerant Flow 1 Cooling Coil,
   !- Name
```

```
  Always On Discrete,                     !- Availability Schedule
   Name
  Autosize,                               !- Gross Rated Total
   Cooling Capacity {W}
  Autosize,                               !- Gross Rated Sensible
   Heat Ratio
  Autosize,                               !- Rated Air Flow Rate {m3
   /s}
  VRFTUCoolCapFT,                         !- Cooling Capacity Ratio
   Modifier Function of Temperature Curve Name
  VRFACCoolCapFFF,                        !- Cooling Capacity
   Modifier Curve Function of Flow Fraction Name
  Room_16_3d8c5364 VRF Terminal Unit Mixer Outlet Node, !- Coil Air
   Inlet Node
  Room_16_3d8c5364 VRF Terminal Unit Cooling Coil Outlet Node; !-
   Coil Air Outlet Node

Curve:Biquadratic,
  VRFTUCoolCapFT,                         !- Name
  0.0585884077803259,                     !- Coefficient1 Constant
  0.0587396532718384,                     !- Coefficient2 x
  -0.000210274979759697,                  !- Coefficient3 x**2
  0.0109370473889647,                     !- Coefficient4 y
  -0.0001219549,                          !- Coefficient5 y**2
  -0.0005246615,                          !- Coefficient6 x*y
  15,                                     !- Minimum Value of x {
   BasedOnField A2}
  23.89,                                  !- Maximum Value of x {
   BasedOnField A2}
  20,                                     !- Minimum Value of y {
   BasedOnField A3}
  43.33,                                  !- Maximum Value of y {
   BasedOnField A3}
  0.8083,                                 !- Minimum Curve Output {
   BasedOnField A4}
```

```
  1.2583;                                 !- Maximum Curve Output {
   BasedOnField A4}

Curve:Quadratic,
  VRFACCoolCapFFF,                        !- Name
  0.8,                                    !- Coefficient1 Constant
  0.2,                                    !- Coefficient2 x
  0,                                      !- Coefficient3 x**2
  0.5,                                    !- Minimum Value of x {
   BasedOnField A2}
  1.5;                                    !- Maximum Value of x {
   BasedOnField A2}

Coil:Heating:DX:VariableRefrigerantFlow,
  Zone HVAC Terminal Unit Variable Refrigerant Flow 1 Heating Coil,
   !- Name
  Always On Discrete,                     !- Availability Schedule
  Autosize,                               !- Gross Rated Heating
   Capacity {W}
  Autosize,                               !- Rated Air Flow Rate {m3
   /s}
  Room_16_3d8c5364 VRF Terminal Unit Cooling Coil Outlet Node, !-
   Coil Air Inlet Node
  Room_16_3d8c5364 VRF Terminal Unit Heating Coil Outlet Node, !-
   Coil Air Outlet Node
  Coil Heating DX Variable Refrigerant Flow 1 VRFTUHeatCAPFT, !-
   Heating Capacity Ratio Modifier Function of Temperature Curve
   Name
  Coil Heating DX Variable Refrigerant Flow 1 VRFACCoolCapFFF; !-
   Heating Capacity Modifier Function of Flow Fraction Curve Name

Curve:Biquadratic,
  Coil Heating DX Variable Refrigerant Flow 1 VRFTUHeatCAPFT, !-
   Name
  0.375443994956127,                      !- Coefficient1 Constant
  0.0668190645147821,                     !- Coefficient2 x
```

```
  -0.00194171026482001,                   !- Coefficient3 x**2
  0.0442618420640187,                     !- Coefficient4 y
  -0.0004009578,                          !- Coefficient5 y**2
  -0.0014819801,                          !- Coefficient6 x*y
  21.11,                                  !- Minimum Value of x {
   BasedOnField A2}
  27.22,                                  !- Maximum Value of x {
   BasedOnField A2}
  -15,                                    !- Minimum Value of y {
   BasedOnField A3}
  18.33,                                  !- Maximum Value of y {
   BasedOnField A3}
  0.6074,                                 !- Minimum Curve Output {
   BasedOnField A4}
  1;                                      !- Maximum Curve Output {
   BasedOnField A4}

Curve:Quadratic,
  Coil Heating DX Variable Refrigerant Flow 1 VRFACCoolCapFFF, !-
   Name
  0.8,                                    !- Coefficient1 Constant
  0.2,                                    !- Coefficient2 x
  0,                                      !- Coefficient3 x**2
  0.5,                                    !- Minimum Value of x {
   BasedOnField A2}
  1.5;                                    !- Maximum Value of x {
   BasedOnField A2}

Fan:OnOff,
  Room_16_3d8c5364 VRF Unit Cycling Fan,  !- Name
  Always On Discrete,                     !- Availability Schedule
   Name
  0.6,                                    !- Fan Total Efficiency
  300,                                    !- Pressure Rise {Pa}
  Autosize,                               !- Maximum Flow Rate {m3/s
   }
```

```
  0.8,                                    !- Motor Efficiency
  1,                                      !- Motor In Airstream
   Fraction
  Room_16_3d8c5364 VRF Terminal Unit Heating Coil Outlet Node, !-
   Air Inlet Node Name
  Room_16_3d8c5364 VRF Terminal Unit Outlet Air Node, !- Air Outlet
   Node Name
  Fan On Off Power Curve,                 !- Fan Power Ratio
   Function of Speed Ratio Curve Name
  Fan On Off Efficiency Curve,            !- Fan Efficiency Ratio
   Function of Speed Ratio Curve Name
  General;                                !- End-Use Subcategory

Curve:Exponent,
  Fan On Off Power Curve,                 !- Name
  1,                                      !- Coefficient1 Constant
  0,                                      !- Coefficient2 Constant
  0,                                      !- Coefficient3 Constant
  0,                                      !- Minimum Value of x {
   BasedOnField A2}
  1;                                      !- Maximum Value of x {
   BasedOnField A2}

Curve:Cubic,
  Fan On Off Efficiency Curve,            !- Name
  1,                                      !- Coefficient1 Constant
  0,                                      !- Coefficient2 x
  0,                                      !- Coefficient3 x**2
  0,                                      !- Coefficient4 x**3
  0,                                      !- Minimum Value of x {
   BasedOnField A2}
  1;                                      !- Maximum Value of x {
   BasedOnField A2}

ZoneHVAC:EquipmentList,
  Room_16_3d8c5364 Equipment List,        !- Name
```

```
  SequentialLoad,                         !- Load Distribution
   Scheme
  ZoneHVAC:AirDistributionUnit,           !- Zone Equipment Object
   Type 1
  ADU Room_16_3d8c5364 Air Terminal,      !- Zone Equipment Name 1
  1,                                      !- Zone Equipment Cooling
   Sequence 1
  1,                                      !- Zone Equipment Heating
   or No-Load Sequence 1
  Schedule Constant 1,                    !- Zone Equipment
   Sequential Cooling Fraction Schedule Name 1
  Schedule Constant 2,                    !- Zone Equipment
   Sequential Heating Fraction Schedule Name 1
  ZoneHVAC:TerminalUnit:VariableRefrigerantFlow, !- Zone Equipment
   Object Type 2
  Room_16_3d8c5364 VRF Terminal Unit,     !- Zone Equipment Name 2
  2,                                      !- Zone Equipment Cooling
   Sequence 2
  2,                                      !- Zone Equipment Heating
   or No-Load Sequence 2
  ,                                       !- Zone Equipment
   Sequential Cooling Fraction Schedule Name 2
  ;                                       !- Zone Equipment
   Sequential Heating Fraction Schedule Name 2

Sizing:Zone,
  Room_16_3d8c5364,                       !- Zone or ZoneList Name
  SupplyAirTemperature,                   !- Zone Cooling Design
   Supply Air Temperature Input Method
  12.7777777777778,                       !- Zone Cooling Design
   Supply Air Temperature {C}
  11.11,                                  !- Zone Cooling Design
   Supply Air Temperature Difference {deltaC}
  SupplyAirTemperature,                   !- Zone Heating Design
   Supply Air Temperature Input Method
```

```
40.0000000000001,                       !- Zone Heating Design
 Supply Air Temperature {C}
11.11,                                  !- Zone Heating Design
 Supply Air Temperature Difference {deltaC}
0.0085,                                 !- Zone Cooling Design
 Supply Air Humidity Ratio {kgWater/kgDryAir}
0.008,                                  !- Zone Heating Design
 Supply Air Humidity Ratio {kgWater/kgDryAir}
ventilation,                            !- Design Specification
 Outdoor Air Object Name
,                                       !- Zone Heating Sizing
 Factor
,                                       !- Zone Cooling Sizing
 Factor
DesignDay,                              !- Cooling Design Air Flow
  Method
0,                                      !- Cooling Design Air Flow
  Rate {m3/s}
0.000762,                               !- Cooling Minimum Air
 Flow per Zone Floor Area {m3/s-m2}
0,                                      !- Cooling Minimum Air
 Flow {m3/s}
0,                                      !- Cooling Minimum Air
 Flow Fraction
DesignDay,                              !- Heating Design Air Flow
  Method
0,                                      !- Heating Design Air Flow
  Rate {m3/s}
0.002032,                               !- Heating Maximum Air
 Flow per Zone Floor Area {m3/s-m2}
0.1415762,                              !- Heating Maximum Air
 Flow {m3/s}
0.3,                                    !- Heating Maximum Air
 Flow Fraction
,                                       !- Design Specification
 Zone Air Distribution Object Name
```

```
  Yes,                                    !- Account for Dedicated
   Outdoor Air System
  NeutralSupplyAir,                       !- Dedicated Outdoor Air
   System Control Strategy
  15.5555555555556,                       !- Dedicated Outdoor Air
   Low Setpoint Temperature for Design {C}
  21.1111111111111;                       !- Dedicated Outdoor Air
   High Setpoint Temperature for Design {C}

ScheduleTypeLimits,
  On-Off,                                 !- Name
  0,                                      !- Lower Limit Value {
   BasedOnField A3}
  1,                                      !- Upper Limit Value {
   BasedOnField A3}
  Discrete,                               !- Numeric Type
  dimensionless;                          !- Unit Type

Schedule:Day:Interval,
  Standard_Ventilation_Sunday,            !- Name
  On-Off,                                 !- Schedule Type Limits
   Name
  No,                                     !- Interpolate to Timestep
  24:00,                                  !- Time 1 {hh:mm}
  1;                                      !- Value Until Time 1

Schedule:Week:Daily,
  Standard_Ventilation Week Rule - Jan1-Dec31, !- Name
  Standard_Ventilation_Sunday,            !- Sunday Schedule:Day
   Name
  Standard_Ventilation_Sunday,            !- Monday Schedule:Day
   Name
  Standard_Ventilation_Sunday,            !- Tuesday Schedule:Day
   Name
  Standard_Ventilation_Sunday,            !- Wednesday Schedule:Day
   Name
```

```
  Standard_Ventilation_Sunday,            !- Thursday Schedule:Day
   Name
  Standard_Ventilation_Sunday,            !- Friday Schedule:Day
   Name
  Standard_Ventilation_Sunday,            !- Saturday Schedule:Day
   Name
  Standard_Ventilation_Hol 1,             !- Holiday Schedule:Day
   Name
  Standard_Ventilation_SmrDsn 1,          !- SummerDesignDay
   Schedule:Day Name
  Standard_Ventilation_WntrDsn 1,         !- WinterDesignDay
   Schedule:Day Name
  Standard_Ventilation_Sunday,            !- CustomDay1 Schedule:Day
    Name
  Standard_Ventilation_Sunday;            !- CustomDay2 Schedule:Day
    Name

Schedule:Year,
  Standard_Ventilation,                   !- Name
  On-Off,                                 !- Schedule Type Limits
   Name
  Standard_Ventilation Week Rule - Jan1-Dec31, !- Schedule:Week Name
    1
  1,                                      !- Start Month 1
  1,                                      !- Start Day 1
  12,                                     !- End Month 1
  31;                                     !- End Day 1

Schedule:Day:Interval,
  Standard_Ventilation_SmrDsn 1,          !- Name
  On-Off,                                 !- Schedule Type Limits
   Name
  No,                                     !- Interpolate to Timestep
  24:00,                                  !- Time 1 {hh:mm}
  1;                                      !- Value Until Time 1
```

```
Schedule:Day:Interval,
  Standard_Ventilation_WntrDsn 1,         !- Name
  On-Off,                                 !- Schedule Type Limits
   Name
  No,                                     !- Interpolate to Timestep
  24:00,                                  !- Time 1 {hh:mm}
  1;                                      !- Value Until Time 1

Schedule:Day:Interval,
  Standard_Ventilation_Hol 1,             !- Name
  On-Off,                                 !- Schedule Type Limits
   Name
  No,                                     !- Interpolate to Timestep
  24:00,                                  !- Time 1 {hh:mm}
  1;                                      !- Value Until Time 1

Controller:MechanicalVentilation,
  15 Zone DOAS Mechanical Ventilation Controller, !- Name
  Standard_Ventilation,                   !- Availability Schedule
   Name
  No,                                     !- Demand Controlled
   Ventilation
  ZoneSum,                                !- System Outdoor Air
   Method
  ,                                       !- Zone Maximum Outdoor
   Air Fraction {dimensionless}
  Room_16_3d8c5364,                       !- Zone or ZoneList Name 1
  ventilation,                            !- Design Specification
   Outdoor Air Object Name 1
  ,                                       !- Design Specification
   Zone Air Distribution Object Name 1
  Room_17_fb615533,                       !- Zone or ZoneList Name 2
  ventilation,                            !- Design Specification
   Outdoor Air Object Name 2
  ,                                       !- Design Specification
   Zone Air Distribution Object Name 2
```

```
Room_18_6cc35095,                       !- Zone or ZoneList Name 3
ventilation,                            !- Design Specification
 Outdoor Air Object Name 3
,                                       !- Design Specification
 Zone Air Distribution Object Name 3
Room_19_6ae0f9a9,                       !- Zone or ZoneList Name 4
ventilation,                            !- Design Specification
 Outdoor Air Object Name 4
,                                       !- Design Specification
 Zone Air Distribution Object Name 4
Room_20_4d060559,                       !- Zone or ZoneList Name 5
ventilation,                            !- Design Specification
 Outdoor Air Object Name 5
,                                       !- Design Specification
 Zone Air Distribution Object Name 5
Room_21_4c523269,                       !- Zone or ZoneList Name 6
ventilation,                            !- Design Specification
 Outdoor Air Object Name 6
,                                       !- Design Specification
 Zone Air Distribution Object Name 6
Room_22_f3ee5a53,                       !- Zone or ZoneList Name 7
ventilation,                            !- Design Specification
 Outdoor Air Object Name 7
,                                       !- Design Specification
 Zone Air Distribution Object Name 7
Room_23_e751e71f,                       !- Zone or ZoneList Name 8
ventilation,                            !- Design Specification
 Outdoor Air Object Name 8
,                                       !- Design Specification
 Zone Air Distribution Object Name 8
Room_24_159d21b7,                       !- Zone or ZoneList Name 9
ventilation,                            !- Design Specification
 Outdoor Air Object Name 9
,                                       !- Design Specification
 Zone Air Distribution Object Name 9
```

```
Room_25_d27e0933,                       !- Zone or ZoneList Name
 10
ventilation,                            !- Design Specification
 Outdoor Air Object Name 10
,                                       !- Design Specification
 Zone Air Distribution Object Name 10
Room_26_f4ea3797,                       !- Zone or ZoneList Name
 11
ventilation,                            !- Design Specification
 Outdoor Air Object Name 11
,                                       !- Design Specification
 Zone Air Distribution Object Name 11
Room_27_0080b418,                       !- Zone or ZoneList Name
 12
ventilation,                            !- Design Specification
 Outdoor Air Object Name 12
,                                       !- Design Specification
 Zone Air Distribution Object Name 12
Room_28_d6ed2799,                       !- Zone or ZoneList Name
 13
ventilation,                            !- Design Specification
 Outdoor Air Object Name 13
,                                       !- Design Specification
 Zone Air Distribution Object Name 13
Room_29_2a634042,                       !- Zone or ZoneList Name
 14
ventilation,                            !- Design Specification
 Outdoor Air Object Name 14
,                                       !- Design Specification
 Zone Air Distribution Object Name 14
Room_30_98f1d6c8,                       !- Zone or ZoneList Name
 15
ventilation,                            !- Design Specification
 Outdoor Air Object Name 15
;                                       !- Design Specification
 Zone Air Distribution Object Name 15
```

```
DesignSpecification:OutdoorAir,
  ventilation,                            !- Name
  Sum,                                    !- Outdoor Air Method
  0.01,                                   !- Outdoor Air Flow per
   Person {m3/s-person}
  0,                                      !- Outdoor Air Flow per
   Zone Floor Area {m3/s-m2}
  0,                                      !- Outdoor Air Flow per
   Zone {m3/s}
  0,                                      !- Outdoor Air Flow Air
   Changes per Hour {1/hr}
  Standard_Ventilation;                   !- Outdoor Air Schedule
   Name

Zone,
  Room_17_fb615533,                       !- Name
  0,                                      !- Direction of Relative
   North {deg}
  0,                                      !- X Origin {m}
  0,                                      !- Y Origin {m}
  0,                                      !- Z Origin {m}
  ,                                       !- Type
  1,                                      !- Multiplier
  ,                                       !- Ceiling Height {m}
  ,                                       !- Volume {m3}
  ,                                       !- Floor Area {m2}
  ,                                       !- Zone Inside Convection
   Algorithm
  ,                                       !- Zone Outside Convection
    Algorithm
  Yes;                                    !- Part of Total Floor
   Area

BuildingSurface:Detailed,
  Room_17_fb615533..Face0,                !- Name
```

```
  Wall,                                     !- Surface Type
  project_wall,                             !- Construction Name
  Room_17_fb615533,                         !- Zone Name
  Outdoors,                                 !- Outside Boundary
   Condition
  ,                                         !- Outside Boundary
   Condition Object
  SunExposed,                               !- Sun Exposure
  WindExposed,                              !- Wind Exposure
  ,                                         !- View Factor to Ground
  ,                                         !- Number of Vertices
  23.1619451669403, 55.2819899121641, 6.49999999997549, !- X,Y,Z
   Vertex 1 {m}
  13.1619451669403, 55.2819899121641, 6.49999999995968, !- X,Y,Z
   Vertex 2 {m}
  13.1619451669316, 55.2819899121844, 3.24999999995968, !- X,Y,Z
   Vertex 3 {m}
  23.1619451669316, 55.2819899121844, 3.24999999997549; !- X,Y,Z
   Vertex 4 {m}

FenestrationSurface:Detailed,
  Room_17_fb615533..Face0_Glz0,             !- Name
  Window,                                   !- Surface Type
  project_window,                           !- Construction Name
  Room_17_fb615533..Face0,                  !- Building Surface Name
  ,                                         !- Outside Boundary
   Condition Object
  ,                                         !- View Factor to Ground
  ,                                         !- Frame and Divider Name
  ,                                         !- Multiplier
  ,                                         !- Number of Vertices
  15.2348618336048, 55.281989912167, 6.04999999996296, !- X,Y,Z
   Vertex 1 {m}
  14.4223618336059, 55.281989912167, 6.04999999996167, !- X,Y,Z
   Vertex 2 {m}
```

```
  14.4223618336091, 55.2819899121794, 4.04999999996167, !- X,Y,Z
   Vertex 3 {m}
  15.234861833608, 55.2819899121794, 4.04999999996296; !- X,Y,Z
   Vertex 4 {m}

FenestrationSurface:Detailed,
  Room_17_fb615533..Face0_Glz1,           !- Name
  Window,                                 !- Surface Type
  project_window,                         !- Construction Name
  Room_17_fb615533..Face0,                !- Building Surface Name
  ,                                       !- Outside Boundary
   Condition Object
  ,                                       !- View Factor to Ground
  ,                                       !- Frame and Divider Name
  ,                                       !- Multiplier
  ,                                       !- Number of Vertices
  18.5681951669335, 55.281989912167, 6.04999999996823, !- X,Y,Z
   Vertex 1 {m}
  17.7556951669347, 55.281989912167, 6.04999999996694, !- X,Y,Z
   Vertex 2 {m}
  17.7556951669378, 55.2819899121794, 4.04999999996694, !- X,Y,Z
   Vertex 3 {m}
  18.5681951669367, 55.2819899121794, 4.04999999996823; !- X,Y,Z
   Vertex 4 {m}

FenestrationSurface:Detailed,
  Room_17_fb615533..Face0_Glz2,           !- Name
  Window,                                 !- Surface Type
  project_window,                         !- Construction Name
  Room_17_fb615533..Face0,                !- Building Surface Name
  ,                                       !- Outside Boundary
   Condition Object
  ,                                       !- View Factor to Ground
  ,                                       !- Frame and Divider Name
  ,                                       !- Multiplier
  ,                                       !- Number of Vertices
```

```
  21.9015285002623, 55.281989912167, 6.0499999999735, !- X,Y,Z
   Vertex 1 {m}
  21.0890285002634, 55.281989912167, 6.04999999997221, !- X,Y,Z
   Vertex 2 {m}
  21.0890285002666, 55.2819899121794, 4.04999999997221, !- X,Y,Z
   Vertex 3 {m}
  21.9015285002654, 55.2819899121794, 4.0499999999735; !- X,Y,Z
   Vertex 4 {m}

BuildingSurface:Detailed,
  Room_17_fb615533..Face1,                !- Name
  Wall,                                   !- Surface Type
  project_wall_int,                       !- Construction Name
  Room_17_fb615533,                       !- Zone Name
  Surface,                                !- Outside Boundary
   Condition
  Room_26_f4ea3797..Face3,                !- Outside Boundary
   Condition Object
  NoSun,                                  !- Sun Exposure
  NoWind,                                 !- Wind Exposure
  ,                                       !- View Factor to Ground
  ,                                       !- Number of Vertices
  23.1619451669403, 55.2819899121641, 6.49999999997549, !- X,Y,Z
   Vertex 1 {m}
  23.1619451669316, 55.2819899121844, 3.24999999997549, !- X,Y,Z
   Vertex 2 {m}
  19.8286118335983, 60.2819899121844, 3.24999999993445, !- X,Y,Z
   Vertex 3 {m}
  19.8286118336069, 60.2819899121641, 6.49999999993444; !- X,Y,Z
   Vertex 4 {m}

BuildingSurface:Detailed,
  Room_17_fb615533..Face2,                !- Name
  Wall,                                   !- Surface Type
  project_wall_int,                       !- Construction Name
  Room_17_fb615533,                       !- Zone Name
```

```
  Surface,                                !- Outside Boundary
   Condition
  Room_20_4d060559..Face0,                !- Outside Boundary
   Condition Object
  NoSun,                                  !- Sun Exposure
  NoWind,                                 !- Wind Exposure
  ,                                       !- View Factor to Ground
  ,                                       !- Number of Vertices
  19.8286118336069, 60.2819899121641, 6.49999999993444, !- X,Y,Z
   Vertex 1 {m}
  19.8286118335983, 60.2819899121844, 3.24999999993445, !- X,Y,Z
   Vertex 2 {m}
  16.495278500265, 60.2819899121844, 3.24999999992918, !- X,Y,Z
   Vertex 3 {m}
  16.4952785002736, 60.2819899121641, 6.49999999992917; !- X,Y,Z
   Vertex 4 {m}

BuildingSurface:Detailed,
  Room_17_fb615533..Face3,                !- Name
  Wall,                                   !- Surface Type
  project_wall_int,                       !- Construction Name
  Room_17_fb615533,                       !- Zone Name
  Surface,                                !- Outside Boundary
   Condition
  Room_23_e751e71f..Face0,                !- Outside Boundary
   Condition Object
  NoSun,                                  !- Sun Exposure
  NoWind,                                 !- Wind Exposure
  ,                                       !- View Factor to Ground
  ,                                       !- Number of Vertices
  13.1619451669403, 55.2819899121641, 6.49999999995968, !- X,Y,Z
   Vertex 1 {m}
  16.4952785002736, 60.2819899121641, 6.49999999992917, !- X,Y,Z
   Vertex 2 {m}
  16.495278500265, 60.2819899121844, 3.24999999992918, !- X,Y,Z
   Vertex 3 {m}
```

```
  13.1619451669316, 55.2819899121844, 3.24999999995968; !- X,Y,Z
   Vertex 4 {m}

BuildingSurface:Detailed,
  Room_17_fb615533..Face4,                !- Name
  Floor,                                  !- Surface Type
  project_floor,                          !- Construction Name
  Room_17_fb615533,                       !- Zone Name
  Surface,                                !- Outside Boundary
   Condition
  Room_16_3d8c5364..Face5,                !- Outside Boundary
   Condition Object
  NoSun,                                  !- Sun Exposure
  NoWind,                                 !- Wind Exposure
  ,                                       !- View Factor to Ground
  ,                                       !- Number of Vertices
  19.8286118335983, 60.2819899121844, 3.24999999993445, !- X,Y,Z
   Vertex 1 {m}
  23.1619451669316, 55.2819899121844, 3.24999999997549, !- X,Y,Z
   Vertex 2 {m}
  13.1619451669316, 55.2819899121844, 3.24999999995968, !- X,Y,Z
   Vertex 3 {m}
  16.495278500265, 60.2819899121844, 3.24999999992918; !- X,Y,Z
   Vertex 4 {m}

BuildingSurface:Detailed,
  Room_17_fb615533..Face5,                !- Name
  Ceiling,                                !- Surface Type
  project_ceiling_int,                    !- Construction Name
  Room_17_fb615533,                       !- Zone Name
  Surface,                                !- Outside Boundary
   Condition
  Room_18_6cc35095..Face4,                !- Outside Boundary
   Condition Object
  NoSun,                                  !- Sun Exposure
  NoWind,                                 !- Wind Exposure
```

```
  ,                                       !- View Factor to Ground
  ,                                       !- Number of Vertices
  23.1619451669403, 55.2819899121641, 6.49999999997549, !- X,Y,Z
   Vertex 1 {m}
  19.8286118336069, 60.2819899121641, 6.49999999993444, !- X,Y,Z
   Vertex 2 {m}
  16.4952785002736, 60.2819899121641, 6.49999999992917, !- X,Y,Z
   Vertex 3 {m}
  13.1619451669403, 55.2819899121641, 6.49999999995968; !- X,Y,Z
   Vertex 4 {m}

ZoneControl:Thermostat,
  Room_17_fb615533 Thermostat,            !- Name
  Room_17_fb615533,                       !- Zone or ZoneList Name
  Room_17_fb615533 Thermostat Schedule,   !- Control Type Schedule
   Name
  ThermostatSetpoint:DualSetpoint,        !- Control 1 Object Type
  Thermostat Setpoint Dual Setpoint 2,    !- Control 1 Name
  ,                                       !- Control 2 Object Type
  ,                                       !- Control 2 Name
  ,                                       !- Control 3 Object Type
  ,                                       !- Control 3 Name
  ,                                       !- Control 4 Object Type
  ,                                       !- Control 4 Name
  0;                                      !- Temperature Difference
   Between Cutout And Setpoint {deltaC}

Schedule:Compact,
  Room_17_fb615533 Thermostat Schedule,   !- Name
  Room_17_fb615533 Thermostat Schedule Type Limits, !- Schedule Type
    Limits Name
  Through: 12/31,                         !- Field 1
  For: AllDays,                           !- Field 2
  Until: 24:00,                           !- Field 3
  4;                                      !- Field 4
```

```
ScheduleTypeLimits,
  Room_17_fb615533 Thermostat Schedule Type Limits, !- Name
  0,                                      !- Lower Limit Value {
   BasedOnField A3}
  4,                                      !- Upper Limit Value {
   BasedOnField A3}
  DISCRETE;                               !- Numeric Type

ThermostatSetpoint:DualSetpoint,
  Thermostat Setpoint Dual Setpoint 2,    !- Name
  project_heat,                           !- Heating Setpoint
   Temperature Schedule Name
  Clg-SetP-Sch;                        !- Cooling Setpoint
   Temperature Schedule Name

ZoneHVAC:EquipmentConnections,
  Room_17_fb615533,                       !- Zone Name
  Room_17_fb615533 Equipment List,        !- Zone Conditioning
   Equipment List Name
  Room_17_fb615533 Inlet Node List,       !- Zone Air Inlet Node or
   NodeList Name
  Room_17_fb615533 Exhaust Node List,     !- Zone Air Exhaust Node
   or NodeList Name
  Room_17_fb615533 Zone Air Node,         !- Zone Air Node Name
  Room_17_fb615533 Return Node List;      !- Zone Return Air Node or
    NodeList Name

NodeList,
  Room_17_fb615533 Inlet Node List,       !- Name
  Room_17_fb615533 Air Terminal Outlet Air Node, !- Node Name 1
  Room_17_fb615533 VRF Terminal Unit Outlet Air Node; !- Node Name 2

NodeList,
  Room_17_fb615533 Exhaust Node List,     !- Name
  Room_17_fb615533 VRF Terminal Unit Inlet Air Node; !- Node Name 1
```

```
NodeList,
  Room_17_fb615533 Return Node List,      !- Name
  Room_17_fb615533 Return Air Node;       !- Node Name 1

AirTerminal:SingleDuct:ConstantVolume:NoReheat,
  Room_17_fb615533 Air Terminal,          !- Name
  Always On Discrete,                     !- Availability Schedule
   Name
  Room_17_fb615533 Air Terminal Inlet Air Node, !- Air Inlet Node
   Name
  Room_17_fb615533 Air Terminal Outlet Air Node, !- Air Outlet Node
   Name
  AutoSize;                               !- Maximum Air Flow Rate {
   m3/s}

ZoneHVAC:AirDistributionUnit,
  ADU Room_17_fb615533 Air Terminal,      !- Name
  Room_17_fb615533 Air Terminal Outlet Air Node, !- Air Distribution
    Unit Outlet Node Name
  AirTerminal:SingleDuct:ConstantVolume:NoReheat, !- Air Terminal
   Object Type
  Room_17_fb615533 Air Terminal;          !- Air Terminal Name

ZoneHVAC:TerminalUnit:VariableRefrigerantFlow,
  Room_17_fb615533 VRF Terminal Unit,     !- Zone Terminal Unit Name
  Always On Discrete,                     !- Terminal Unit
   Availability Schedule
  Room_17_fb615533 VRF Terminal Unit Inlet Air Node, !- Terminal
   Unit Air Inlet Node Name
  Room_17_fb615533 VRF Terminal Unit Outlet Air Node, !- Terminal
   Unit Air Outlet Node Name
  Autosize,                               !- Cooling Supply Air Flow
    Rate {m3/s}
  Autosize,                               !- No Cooling Supply Air
   Flow Rate {m3/s}
```

```
Autosize,                                 !- Heating Supply Air Flow
  Rate {m3/s}
Autosize,                                 !- No Heating Supply Air
 Flow Rate {m3/s}
Autosize,                                 !- Cooling Outdoor Air
 Flow Rate {m3/s}
Autosize,                                 !- Heating Outdoor Air
 Flow Rate {m3/s}
Autosize,                                 !- No Load Outdoor Air
 Flow Rate {m3/s}
Always Off Discrete,                      !- Supply Air Fan
 Operating Mode Schedule Name
DrawThrough,                              !- Supply Air Fan
 Placement
Fan:OnOff,                                !- Supply Air Fan Object
 Type
Room_17_fb615533 VRF Unit Cycling Fan,    !- Supply Air Fan Object
 Name
OutdoorAir:Mixer,                         !- Outside Air Mixer
 Object Type
Room_17_fb615533 VRF Terminal Unit OA Mixer, !- Outside Air Mixer
 Object Name
Coil:Cooling:DX:VariableRefrigerantFlow, !- Cooling Coil Object
 Type
Zone HVAC Terminal Unit Variable Refrigerant Flow 1 Cooling Coil
 1, !- Cooling Coil Object Name
Coil:Heating:DX:VariableRefrigerantFlow, !- Heating Coil Object
 Type
Zone HVAC Terminal Unit Variable Refrigerant Flow 1 Heating Coil
 1, !- Heating Coil Object Name
30,                                       !- Zone Terminal Unit On
 Parasitic Electric Energy Use {W}
20,                                       !- Zone Terminal Unit Off
 Parasitic Electric Energy Use {W}
1,                                        !- Rated Heating Capacity
 Sizing Ratio {W/W}
```

```
  ,                                       !- Availability Manager
   List Name
  ,                                       !- Design Specification
   ZoneHVAC Sizing Object Name
  ,                                       !- Supplemental Heating
   Coil Object Type
  ,                                       !- Supplemental Heating
   Coil Name
  Autosize,                               !- Maximum Supply Air
   Temperature from Supplemental Heater {C}
  21;                                     !- Maximum Outdoor Dry-
   Bulb Temperature for Supplemental Heater Operation {C}

OutdoorAir:Mixer,
  Room_17_fb615533 VRF Terminal Unit OA Mixer, !- Name
  Room_17_fb615533 VRF Terminal Unit Mixer Outlet Node, !- Mixed Air
    Node Name
  Room_17_fb615533 VRF Terminal Unit Outdoor Air Node, !- Outdoor
   Air Stream Node Name
  Room_17_fb615533 VRF Terminal Unit Relief Node Name, !- Relief Air
    Stream Node Name
  Room_17_fb615533 VRF Terminal Unit Inlet Air Node; !- Return Air
   Stream Node Name

OutdoorAir:NodeList,
  Room_17_fb615533 VRF Terminal Unit Outdoor Air Node; !- Node or
   NodeList Name 1

Coil:Cooling:DX:VariableRefrigerantFlow,
  Zone HVAC Terminal Unit Variable Refrigerant Flow 1 Cooling Coil
   1, !- Name
  Always On Discrete,                     !- Availability Schedule
   Name
  Autosize,                               !- Gross Rated Total
   Cooling Capacity {W}
```

```
  Autosize,                               !- Gross Rated Sensible
   Heat Ratio
  Autosize,                               !- Rated Air Flow Rate {m3
   /s}
  VRFTUCoolCapFT 1,                       !- Cooling Capacity Ratio
   Modifier Function of Temperature Curve Name
  VRFACCoolCapFFF 1,                      !- Cooling Capacity
   Modifier Curve Function of Flow Fraction Name
  Room_17_fb615533 VRF Terminal Unit Mixer Outlet Node, !- Coil Air
   Inlet Node
  Room_17_fb615533 VRF Terminal Unit Cooling Coil Outlet Node; !-
   Coil Air Outlet Node

Curve:Biquadratic,
  VRFTUCoolCapFT 1,                       !- Name
  0.0585884077803259,                     !- Coefficient1 Constant
  0.0587396532718384,                     !- Coefficient2 x
  -0.000210274979759697,                  !- Coefficient3 x**2
  0.0109370473889647,                     !- Coefficient4 y
  -0.0001219549,                          !- Coefficient5 y**2
  -0.0005246615,                          !- Coefficient6 x*y
  15,                                     !- Minimum Value of x {
   BasedOnField A2}
  23.89,                                  !- Maximum Value of x {
   BasedOnField A2}
  20,                                     !- Minimum Value of y {
   BasedOnField A3}
  43.33,                                  !- Maximum Value of y {
   BasedOnField A3}
  0.8083,                                 !- Minimum Curve Output {
   BasedOnField A4}
  1.2583;                                 !- Maximum Curve Output {
   BasedOnField A4}

Curve:Quadratic,
  VRFACCoolCapFFF 1,                      !- Name
```

```
  0.8,                                    !- Coefficient1 Constant
  0.2,                                    !- Coefficient2 x
  0,                                      !- Coefficient3 x**2
  0.5,                                    !- Minimum Value of x {
   BasedOnField A2}
  1.5;                                    !- Maximum Value of x {
   BasedOnField A2}

Coil:Heating:DX:VariableRefrigerantFlow,
  Zone HVAC Terminal Unit Variable Refrigerant Flow 1 Heating Coil
   1, !- Name
  Always On Discrete,                     !- Availability Schedule
  Autosize,                               !- Gross Rated Heating
   Capacity {W}
  Autosize,                               !- Rated Air Flow Rate {m3
   /s}
  Room_17_fb615533 VRF Terminal Unit Cooling Coil Outlet Node, !-
   Coil Air Inlet Node
  Room_17_fb615533 VRF Terminal Unit Heating Coil Outlet Node, !-
   Coil Air Outlet Node
  Coil Heating DX Variable Refrigerant Flow 1 VRFTUHeatCAPFT 1, !-
   Heating Capacity Ratio Modifier Function of Temperature Curve
   Name
  Coil Heating DX Variable Refrigerant Flow 1 VRFACCoolCapFFF 1; !-
   Heating Capacity Modifier Function of Flow Fraction Curve Name

Curve:Biquadratic,
  Coil Heating DX Variable Refrigerant Flow 1 VRFTUHeatCAPFT 1, !-
   Name
  0.375443994956127,                      !- Coefficient1 Constant
  0.0668190645147821,                     !- Coefficient2 x
  -0.00194171026482001,                   !- Coefficient3 x**2
  0.0442618420640187,                     !- Coefficient4 y
  -0.0004009578,                          !- Coefficient5 y**2
  -0.0014819801,                          !- Coefficient6 x*y
```

```
  21.11,                                  !- Minimum Value of x {
   BasedOnField A2}
  27.22,                                  !- Maximum Value of x {
   BasedOnField A2}
  -15,                                    !- Minimum Value of y {
   BasedOnField A3}
  18.33,                                  !- Maximum Value of y {
   BasedOnField A3}
  0.6074,                                 !- Minimum Curve Output {
   BasedOnField A4}
  1;                                      !- Maximum Curve Output {
   BasedOnField A4}

Curve:Quadratic,
  Coil Heating DX Variable Refrigerant Flow 1 VRFACCoolCapFFF 1, !-
   Name
  0.8,                                    !- Coefficient1 Constant
  0.2,                                    !- Coefficient2 x
  0,                                      !- Coefficient3 x**2
  0.5,                                    !- Minimum Value of x {
   BasedOnField A2}
  1.5;                                    !- Maximum Value of x {
   BasedOnField A2}

Fan:OnOff,
  Room_17_fb615533 VRF Unit Cycling Fan,  !- Name
  Always On Discrete,                     !- Availability Schedule
   Name
  0.6,                                    !- Fan Total Efficiency
  300,                                    !- Pressure Rise {Pa}
  Autosize,                               !- Maximum Flow Rate {m3/s
   }
  0.8,                                    !- Motor Efficiency
  1,                                      !- Motor In Airstream
   Fraction
```

```
  Room_17_fb615533 VRF Terminal Unit Heating Coil Outlet Node, !-
   Air Inlet Node Name
  Room_17_fb615533 VRF Terminal Unit Outlet Air Node, !- Air Outlet
   Node Name
  Fan On Off Power Curve 1,                !- Fan Power Ratio
   Function of Speed Ratio Curve Name
  Fan On Off Efficiency Curve 1,           !- Fan Efficiency Ratio
   Function of Speed Ratio Curve Name
  General;                                 !- End-Use Subcategory

Curve:Exponent,
  Fan On Off Power Curve 1,                !- Name
  1,                                       !- Coefficient1 Constant
  0,                                       !- Coefficient2 Constant
  0,                                       !- Coefficient3 Constant
  0,                                       !- Minimum Value of x {
   BasedOnField A2}
  1;                                       !- Maximum Value of x {
   BasedOnField A2}

Curve:Cubic,
  Fan On Off Efficiency Curve 1,           !- Name
  1,                                       !- Coefficient1 Constant
  0,                                       !- Coefficient2 x
  0,                                       !- Coefficient3 x**2
  0,                                       !- Coefficient4 x**3
  0,                                       !- Minimum Value of x {
   BasedOnField A2}
  1;                                       !- Maximum Value of x {
   BasedOnField A2}

ZoneHVAC:EquipmentList,
  Room_17_fb615533 Equipment List,         !- Name
  SequentialLoad,                          !- Load Distribution
   Scheme
```

```
  ZoneHVAC:AirDistributionUnit,           !- Zone Equipment Object
   Type 1
  ADU Room_17_fb615533 Air Terminal,      !- Zone Equipment Name 1
  1,                                      !- Zone Equipment Cooling
   Sequence 1
  1,                                      !- Zone Equipment Heating
   or No-Load Sequence 1
  Schedule Constant 3,                    !- Zone Equipment
   Sequential Cooling Fraction Schedule Name 1
  Schedule Constant 4,                    !- Zone Equipment
   Sequential Heating Fraction Schedule Name 1
  ZoneHVAC:TerminalUnit:VariableRefrigerantFlow, !- Zone Equipment
   Object Type 2
  Room_17_fb615533 VRF Terminal Unit,     !- Zone Equipment Name 2
  2,                                      !- Zone Equipment Cooling
   Sequence 2
  2,                                      !- Zone Equipment Heating
   or No-Load Sequence 2
  ,                                       !- Zone Equipment
   Sequential Cooling Fraction Schedule Name 2
  ;                                       !- Zone Equipment
   Sequential Heating Fraction Schedule Name 2

Sizing:Zone,
  Room_17_fb615533,                       !- Zone or ZoneList Name
  SupplyAirTemperature,                   !- Zone Cooling Design
   Supply Air Temperature Input Method
  12.7777777777778,                       !- Zone Cooling Design
   Supply Air Temperature {C}
  11.11,                                  !- Zone Cooling Design
   Supply Air Temperature Difference {deltaC}
  SupplyAirTemperature,                   !- Zone Heating Design
   Supply Air Temperature Input Method
  40.0000000000001,                       !- Zone Heating Design
   Supply Air Temperature {C}
```

```
11.11,                                  !- Zone Heating Design
 Supply Air Temperature Difference {deltaC}
0.0085,                                 !- Zone Cooling Design
 Supply Air Humidity Ratio {kgWater/kgDryAir}
0.008,                                  !- Zone Heating Design
 Supply Air Humidity Ratio {kgWater/kgDryAir}
ventilation,                            !- Design Specification
 Outdoor Air Object Name
,                                       !- Zone Heating Sizing
 Factor
,                                       !- Zone Cooling Sizing
 Factor
DesignDay,                              !- Cooling Design Air Flow
  Method
0,                                      !- Cooling Design Air Flow
  Rate {m3/s}
0.000762,                               !- Cooling Minimum Air
 Flow per Zone Floor Area {m3/s-m2}
0,                                      !- Cooling Minimum Air
 Flow {m3/s}
0,                                      !- Cooling Minimum Air
 Flow Fraction
DesignDay,                              !- Heating Design Air Flow
  Method
0,                                      !- Heating Design Air Flow
  Rate {m3/s}
0.002032,                               !- Heating Maximum Air
 Flow per Zone Floor Area {m3/s-m2}
0.1415762,                              !- Heating Maximum Air
 Flow {m3/s}
0.3,                                    !- Heating Maximum Air
 Flow Fraction
,                                       !- Design Specification
 Zone Air Distribution Object Name
Yes,                                    !- Account for Dedicated
 Outdoor Air System
```

```
  NeutralSupplyAir,                       !- Dedicated Outdoor Air
   System Control Strategy
  15.5555555555556,                       !- Dedicated Outdoor Air
   Low Setpoint Temperature for Design {C}
  21.1111111111111;                       !- Dedicated Outdoor Air
   High Setpoint Temperature for Design {C}

Zone,
  Room_18_6cc35095,                       !- Name
  0,                                      !- Direction of Relative
   North {deg}
  0,                                      !- X Origin {m}
  0,                                      !- Y Origin {m}
  0,                                      !- Z Origin {m}
  ,                                       !- Type
  1,                                      !- Multiplier
  ,                                       !- Ceiling Height {m}
  ,                                       !- Volume {m3}
  ,                                       !- Floor Area {m2}
  ,                                       !- Zone Inside Convection
   Algorithm
  ,                                       !- Zone Outside Convection
    Algorithm
  Yes;                                    !- Part of Total Floor
   Area

BuildingSurface:Detailed,
  Room_18_6cc35095..Face0,                !- Name
  Wall,                                   !- Surface Type
  project_wall,                           !- Construction Name
  Room_18_6cc35095,                       !- Zone Name
  Outdoors,                               !- Outside Boundary
   Condition
  ,                                       !- Outside Boundary
   Condition Object
  SunExposed,                             !- Sun Exposure
```

```
  WindExposed,                            !- Wind Exposure
  ,                                       !- View Factor to Ground
  ,                                       !- Number of Vertices
  23.1619451669489, 55.2819899121439, 9.7499999999755, !- X,Y,Z
   Vertex 1 {m}
  13.1619451669489, 55.2819899121439, 9.74999999995968, !- X,Y,Z
   Vertex 2 {m}
  13.1619451669403, 55.2819899121641, 6.49999999995968, !- X,Y,Z
   Vertex 3 {m}
  23.1619451669403, 55.2819899121641, 6.49999999997549; !- X,Y,Z
   Vertex 4 {m}

FenestrationSurface:Detailed,
  Room_18_6cc35095..Face0_Glz0,           !- Name
  Window,                                 !- Surface Type
  project_window,                         !- Construction Name
  Room_18_6cc35095..Face0,                !- Building Surface Name
  ,                                       !- Outside Boundary
   Condition Object
  ,                                       !- View Factor to Ground
  ,                                       !- Frame and Divider Name
  ,                                       !- Multiplier
  ,                                       !- Number of Vertices
  15.2348618336134, 55.2819899121467, 9.29999999996296, !- X,Y,Z
   Vertex 1 {m}
  14.4223618336146, 55.2819899121467, 9.29999999996167, !- X,Y,Z
   Vertex 2 {m}
  14.4223618336177, 55.2819899121592, 7.29999999996167, !- X,Y,Z
   Vertex 3 {m}
  15.2348618336166, 55.2819899121592, 7.29999999996296; !- X,Y,Z
   Vertex 4 {m}

FenestrationSurface:Detailed,
  Room_18_6cc35095..Face0_Glz1,           !- Name
  Window,                                 !- Surface Type
  project_window,                         !- Construction Name
```

```
  Room_18_6cc35095..Face0,                !- Building Surface Name
  ,                                       !- Outside Boundary
   Condition Object
  ,                                       !- View Factor to Ground
  ,                                       !- Frame and Divider Name
  ,                                       !- Multiplier
  ,                                       !- Number of Vertices
  18.5681951669422, 55.2819899121467, 9.29999999996823, !- X,Y,Z
   Vertex 1 {m}
  17.7556951669433, 55.2819899121467, 9.29999999996694, !- X,Y,Z
   Vertex 2 {m}
  17.7556951669465, 55.2819899121592, 7.29999999996694, !- X,Y,Z
   Vertex 3 {m}
  18.5681951669453, 55.2819899121592, 7.29999999996823; !- X,Y,Z
   Vertex 4 {m}

FenestrationSurface:Detailed,
  Room_18_6cc35095..Face0_Glz2,           !- Name
  Window,                                 !- Surface Type
  project_window,                         !- Construction Name
  Room_18_6cc35095..Face0,                !- Building Surface Name
  ,                                       !- Outside Boundary
   Condition Object
  ,                                       !- View Factor to Ground
  ,                                       !- Frame and Divider Name
  ,                                       !- Multiplier
  ,                                       !- Number of Vertices
  21.9015285002709, 55.2819899121467, 9.2999999999735, !- X,Y,Z
   Vertex 1 {m}
  21.089028500272, 55.2819899121467, 9.29999999997221, !- X,Y,Z
   Vertex 2 {m}
  21.0890285002752, 55.2819899121592, 7.29999999997222, !- X,Y,Z
   Vertex 3 {m}
  21.9015285002741, 55.2819899121592, 7.2999999999735; !- X,Y,Z
   Vertex 4 {m}
```

```
BuildingSurface:Detailed,
  Room_18_6cc35095..Face1,                !- Name
  Wall,                                   !- Surface Type
  project_wall_int,                       !- Construction Name
  Room_18_6cc35095,                       !- Zone Name
  Surface,                                !- Outside Boundary
   Condition
  Room_25_d27e0933..Face3,                !- Outside Boundary
   Condition Object
  NoSun,                                  !- Sun Exposure
  NoWind,                                 !- Wind Exposure
  ,                                       !- View Factor to Ground
  ,                                       !- Number of Vertices
  23.1619451669489, 55.2819899121439, 9.7499999999755, !- X,Y,Z
   Vertex 1 {m}
  23.1619451669403, 55.2819899121641, 6.49999999997549, !- X,Y,Z
   Vertex 2 {m}
  19.8286118336069, 60.2819899121641, 6.49999999993444, !- X,Y,Z
   Vertex 3 {m}
  19.8286118336156, 60.2819899121439, 9.74999999993446; !- X,Y,Z
   Vertex 4 {m}

BuildingSurface:Detailed,
  Room_18_6cc35095..Face2,                !- Name
  Wall,                                   !- Surface Type
  project_wall_int,                       !- Construction Name
  Room_18_6cc35095,                       !- Zone Name
  Surface,                                !- Outside Boundary
   Condition
  Room_19_6ae0f9a9..Face0,                !- Outside Boundary
   Condition Object
  NoSun,                                  !- Sun Exposure
  NoWind,                                 !- Wind Exposure
  ,                                       !- View Factor to Ground
  ,                                       !- Number of Vertices
```

```
  19.8286118336156, 60.2819899121439, 9.74999999993446, !- X,Y,Z
   Vertex 1 {m}
  19.8286118336069, 60.2819899121641, 6.49999999993444, !- X,Y,Z
   Vertex 2 {m}
  16.4952785002736, 60.2819899121641, 6.49999999992917, !- X,Y,Z
   Vertex 3 {m}
  16.4952785002823, 60.2819899121439, 9.74999999992918; !- X,Y,Z
   Vertex 4 {m}

BuildingSurface:Detailed,
  Room_18_6cc35095..Face3,                !- Name
  Wall,                                   !- Surface Type
  project_wall_int,                       !- Construction Name
  Room_18_6cc35095,                       !- Zone Name
  Surface,                                !- Outside Boundary
   Condition
  Room_22_f3ee5a53..Face0,                !- Outside Boundary
   Condition Object
  NoSun,                                  !- Sun Exposure
  NoWind,                                 !- Wind Exposure
  ,                                       !- View Factor to Ground
  ,                                       !- Number of Vertices
  13.1619451669489, 55.2819899121439, 9.74999999995968, !- X,Y,Z
   Vertex 1 {m}
  16.4952785002823, 60.2819899121439, 9.74999999992918, !- X,Y,Z
   Vertex 2 {m}
  16.4952785002736, 60.2819899121641, 6.49999999992917, !- X,Y,Z
   Vertex 3 {m}
  13.1619451669403, 55.2819899121641, 6.49999999995968; !- X,Y,Z
   Vertex 4 {m}

BuildingSurface:Detailed,
  Room_18_6cc35095..Face4,                !- Name
  Floor,                                  !- Surface Type
  project_floor,                          !- Construction Name
  Room_18_6cc35095,                       !- Zone Name
```

```
  Surface,                                !- Outside Boundary
   Condition
  Room_17_fb615533..Face5,                !- Outside Boundary
   Condition Object
  NoSun,                                  !- Sun Exposure
  NoWind,                                 !- Wind Exposure
  ,                                       !- View Factor to Ground
  ,                                       !- Number of Vertices
  19.8286118336069, 60.2819899121641, 6.49999999993444, !- X,Y,Z
   Vertex 1 {m}
  23.1619451669403, 55.2819899121641, 6.49999999997549, !- X,Y,Z
   Vertex 2 {m}
  13.1619451669403, 55.2819899121641, 6.49999999995968, !- X,Y,Z
   Vertex 3 {m}
  16.4952785002736, 60.2819899121641, 6.49999999992917; !- X,Y,Z
   Vertex 4 {m}

BuildingSurface:Detailed,
  Room_18_6cc35095..Face5,                !- Name
  Roof,                                   !- Surface Type
  project_roof,                           !- Construction Name
  Room_18_6cc35095,                       !- Zone Name
  Outdoors,                               !- Outside Boundary
   Condition
  ,                                       !- Outside Boundary
   Condition Object
  SunExposed,                             !- Sun Exposure
  WindExposed,                            !- Wind Exposure
  ,                                       !- View Factor to Ground
  ,                                       !- Number of Vertices
  23.1619451669489, 55.2819899121439, 9.7499999999755, !- X,Y,Z
   Vertex 1 {m}
  19.8286118336156, 60.2819899121439, 9.74999999993446, !- X,Y,Z
   Vertex 2 {m}
  16.4952785002823, 60.2819899121439, 9.74999999992918, !- X,Y,Z
   Vertex 3 {m}
```

```
  13.1619451669489, 55.2819899121439, 9.74999999995968; !- X,Y,Z
   Vertex 4 {m}

ZoneControl:Thermostat,
  Room_18_6cc35095 Thermostat,            !- Name
  Room_18_6cc35095,                       !- Zone or ZoneList Name
  Room_18_6cc35095 Thermostat Schedule,   !- Control Type Schedule
   Name
  ThermostatSetpoint:DualSetpoint,        !- Control 1 Object Type
  Thermostat Setpoint Dual Setpoint 3,    !- Control 1 Name
  ,                                       !- Control 2 Object Type
  ,                                       !- Control 2 Name
  ,                                       !- Control 3 Object Type
  ,                                       !- Control 3 Name
  ,                                       !- Control 4 Object Type
  ,                                       !- Control 4 Name
  0;                                      !- Temperature Difference
   Between Cutout And Setpoint {deltaC}

Schedule:Compact,
  Room_18_6cc35095 Thermostat Schedule,   !- Name
  Room_18_6cc35095 Thermostat Schedule Type Limits, !- Schedule Type
    Limits Name
  Through: 12/31,                         !- Field 1
  For: AllDays,                           !- Field 2
  Until: 24:00,                           !- Field 3
  4;                                      !- Field 4

ScheduleTypeLimits,
  Room_18_6cc35095 Thermostat Schedule Type Limits, !- Name
  0,                                      !- Lower Limit Value {
   BasedOnField A3}
  4,                                      !- Upper Limit Value {
   BasedOnField A3}
  DISCRETE;                               !- Numeric Type
```

```
ThermostatSetpoint:DualSetpoint,
  Thermostat Setpoint Dual Setpoint 3,    !- Name
  project_heat,                           !- Heating Setpoint
   Temperature Schedule Name
  Clg-SetP-Sch;                        !- Cooling Setpoint
   Temperature Schedule Name

ZoneHVAC:EquipmentConnections,
  Room_18_6cc35095,                       !- Zone Name
  Room_18_6cc35095 Equipment List,        !- Zone Conditioning
   Equipment List Name
  Room_18_6cc35095 Inlet Node List,       !- Zone Air Inlet Node or
   NodeList Name
  Room_18_6cc35095 Exhaust Node List,     !- Zone Air Exhaust Node
   or NodeList Name
  Room_18_6cc35095 Zone Air Node,         !- Zone Air Node Name
  Room_18_6cc35095 Return Node List;      !- Zone Return Air Node or
    NodeList Name

NodeList,
  Room_18_6cc35095 Inlet Node List,       !- Name
  Room_18_6cc35095 Air Terminal Outlet Air Node, !- Node Name 1
  Room_18_6cc35095 VRF Terminal Unit Outlet Air Node; !- Node Name 2

NodeList,
  Room_18_6cc35095 Exhaust Node List,     !- Name
  Room_18_6cc35095 VRF Terminal Unit Inlet Air Node; !- Node Name 1

NodeList,
  Room_18_6cc35095 Return Node List,      !- Name
  Room_18_6cc35095 Return Air Node;       !- Node Name 1

AirTerminal:SingleDuct:ConstantVolume:NoReheat,
  Room_18_6cc35095 Air Terminal,          !- Name
  Always On Discrete,                     !- Availability Schedule
   Name
```

```
  Room_18_6cc35095 Air Terminal Inlet Air Node, !- Air Inlet Node
   Name
  Room_18_6cc35095 Air Terminal Outlet Air Node, !- Air Outlet Node
   Name
  AutoSize;                               !- Maximum Air Flow Rate {
   m3/s}

ZoneHVAC:AirDistributionUnit,
  ADU Room_18_6cc35095 Air Terminal,      !- Name
  Room_18_6cc35095 Air Terminal Outlet Air Node, !- Air Distribution
    Unit Outlet Node Name
  AirTerminal:SingleDuct:ConstantVolume:NoReheat, !- Air Terminal
   Object Type
  Room_18_6cc35095 Air Terminal;          !- Air Terminal Name

ZoneHVAC:TerminalUnit:VariableRefrigerantFlow,
  Room_18_6cc35095 VRF Terminal Unit,     !- Zone Terminal Unit Name
  Always On Discrete,                     !- Terminal Unit
   Availability Schedule
  Room_18_6cc35095 VRF Terminal Unit Inlet Air Node, !- Terminal
   Unit Air Inlet Node Name
  Room_18_6cc35095 VRF Terminal Unit Outlet Air Node, !- Terminal
   Unit Air Outlet Node Name
  Autosize,                               !- Cooling Supply Air Flow
    Rate {m3/s}
  Autosize,                               !- No Cooling Supply Air
   Flow Rate {m3/s}
  Autosize,                               !- Heating Supply Air Flow
    Rate {m3/s}
  Autosize,                               !- No Heating Supply Air
   Flow Rate {m3/s}
  Autosize,                               !- Cooling Outdoor Air
   Flow Rate {m3/s}
  Autosize,                               !- Heating Outdoor Air
   Flow Rate {m3/s}
```

```
Autosize,                                 !- No Load Outdoor Air
 Flow Rate {m3/s}
Always Off Discrete,                      !- Supply Air Fan
 Operating Mode Schedule Name
DrawThrough,                              !- Supply Air Fan
 Placement
Fan:OnOff,                                !- Supply Air Fan Object
 Type
Room_18_6cc35095 VRF Unit Cycling Fan,    !- Supply Air Fan Object
 Name
OutdoorAir:Mixer,                         !- Outside Air Mixer
 Object Type
Room_18_6cc35095 VRF Terminal Unit OA Mixer, !- Outside Air Mixer
 Object Name
Coil:Cooling:DX:VariableRefrigerantFlow, !- Cooling Coil Object
 Type
Zone HVAC Terminal Unit Variable Refrigerant Flow 1 Cooling Coil
 2, !- Cooling Coil Object Name
Coil:Heating:DX:VariableRefrigerantFlow, !- Heating Coil Object
 Type
Zone HVAC Terminal Unit Variable Refrigerant Flow 1 Heating Coil
 2, !- Heating Coil Object Name
30,                                       !- Zone Terminal Unit On
 Parasitic Electric Energy Use {W}
20,                                       !- Zone Terminal Unit Off
 Parasitic Electric Energy Use {W}
1,                                        !- Rated Heating Capacity
 Sizing Ratio {W/W}
,                                         !- Availability Manager
 List Name
,                                         !- Design Specification
 ZoneHVAC Sizing Object Name
,                                         !- Supplemental Heating
 Coil Object Type
,                                         !- Supplemental Heating
 Coil Name
```

```
  Autosize,                               !- Maximum Supply Air
   Temperature from Supplemental Heater {C}
  21;                                     !- Maximum Outdoor Dry-
   Bulb Temperature for Supplemental Heater Operation {C}

OutdoorAir:Mixer,
  Room_18_6cc35095 VRF Terminal Unit OA Mixer, !- Name
  Room_18_6cc35095 VRF Terminal Unit Mixer Outlet Node, !- Mixed Air
    Node Name
  Room_18_6cc35095 VRF Terminal Unit Outdoor Air Node, !- Outdoor
   Air Stream Node Name
  Room_18_6cc35095 VRF Terminal Unit Relief Node Name, !- Relief Air
    Stream Node Name
  Room_18_6cc35095 VRF Terminal Unit Inlet Air Node; !- Return Air
   Stream Node Name

OutdoorAir:NodeList,
  Room_18_6cc35095 VRF Terminal Unit Outdoor Air Node; !- Node or
   NodeList Name 1

Coil:Cooling:DX:VariableRefrigerantFlow,
  Zone HVAC Terminal Unit Variable Refrigerant Flow 1 Cooling Coil
   2, !- Name
  Always On Discrete,                     !- Availability Schedule
   Name
  Autosize,                               !- Gross Rated Total
   Cooling Capacity {W}
  Autosize,                               !- Gross Rated Sensible
   Heat Ratio
  Autosize,                               !- Rated Air Flow Rate {m3
   /s}
  VRFTUCoolCapFT 2,                       !- Cooling Capacity Ratio
   Modifier Function of Temperature Curve Name
  VRFACCoolCapFFF 2,                      !- Cooling Capacity
   Modifier Curve Function of Flow Fraction Name
```

```
  Room_18_6cc35095 VRF Terminal Unit Mixer Outlet Node, !- Coil Air
   Inlet Node
  Room_18_6cc35095 VRF Terminal Unit Cooling Coil Outlet Node; !-
   Coil Air Outlet Node

Curve:Biquadratic,
  VRFTUCoolCapFT 2,                       !- Name
  0.0585884077803259,                     !- Coefficient1 Constant
  0.0587396532718384,                     !- Coefficient2 x
  -0.000210274979759697,                  !- Coefficient3 x**2
  0.0109370473889647,                     !- Coefficient4 y
  -0.0001219549,                          !- Coefficient5 y**2
  -0.0005246615,                          !- Coefficient6 x*y
  15,                                     !- Minimum Value of x {
   BasedOnField A2}
  23.89,                                  !- Maximum Value of x {
   BasedOnField A2}
  20,                                     !- Minimum Value of y {
   BasedOnField A3}
  43.33,                                  !- Maximum Value of y {
   BasedOnField A3}
  0.8083,                                 !- Minimum Curve Output {
   BasedOnField A4}
  1.2583;                                 !- Maximum Curve Output {
   BasedOnField A4}

Curve:Quadratic,
  VRFACCoolCapFFF 2,                      !- Name
  0.8,                                    !- Coefficient1 Constant
  0.2,                                    !- Coefficient2 x
  0,                                      !- Coefficient3 x**2
  0.5,                                    !- Minimum Value of x {
   BasedOnField A2}
  1.5;                                    !- Maximum Value of x {
   BasedOnField A2}
```

```
Coil:Heating:DX:VariableRefrigerantFlow,
  Zone HVAC Terminal Unit Variable Refrigerant Flow 1 Heating Coil
   2, !- Name
  Always On Discrete,                     !- Availability Schedule
  Autosize,                               !- Gross Rated Heating
   Capacity {W}
  Autosize,                               !- Rated Air Flow Rate {m3
   /s}
  Room_18_6cc35095 VRF Terminal Unit Cooling Coil Outlet Node, !-
   Coil Air Inlet Node
  Room_18_6cc35095 VRF Terminal Unit Heating Coil Outlet Node, !-
   Coil Air Outlet Node
  Coil Heating DX Variable Refrigerant Flow 1 VRFTUHeatCAPFT 2, !-
   Heating Capacity Ratio Modifier Function of Temperature Curve
   Name
  Coil Heating DX Variable Refrigerant Flow 1 VRFACCoolCapFFF 2; !-
   Heating Capacity Modifier Function of Flow Fraction Curve Name

Curve:Biquadratic,
  Coil Heating DX Variable Refrigerant Flow 1 VRFTUHeatCAPFT 2, !-
   Name
  0.375443994956127,                      !- Coefficient1 Constant
  0.0668190645147821,                     !- Coefficient2 x
  -0.00194171026482001,                   !- Coefficient3 x**2
  0.0442618420640187,                     !- Coefficient4 y
  -0.0004009578,                          !- Coefficient5 y**2
  -0.0014819801,                          !- Coefficient6 x*y
  21.11,                                  !- Minimum Value of x {
   BasedOnField A2}
  27.22,                                  !- Maximum Value of x {
   BasedOnField A2}
  -15,                                    !- Minimum Value of y {
   BasedOnField A3}
  18.33,                                  !- Maximum Value of y {
   BasedOnField A3}
```

```
  0.6074,                                 !- Minimum Curve Output {
   BasedOnField A4}
  1;                                      !- Maximum Curve Output {
   BasedOnField A4}

Curve:Quadratic,
  Coil Heating DX Variable Refrigerant Flow 1 VRFACCoolCapFFF 2, !-
   Name
  0.8,                                    !- Coefficient1 Constant
  0.2,                                    !- Coefficient2 x
  0,                                      !- Coefficient3 x**2
  0.5,                                    !- Minimum Value of x {
   BasedOnField A2}
  1.5;                                    !- Maximum Value of x {
   BasedOnField A2}

Fan:OnOff,
  Room_18_6cc35095 VRF Unit Cycling Fan,  !- Name
  Always On Discrete,                     !- Availability Schedule
   Name
  0.6,                                    !- Fan Total Efficiency
  300,                                    !- Pressure Rise {Pa}
  Autosize,                               !- Maximum Flow Rate {m3/s
   }
  0.8,                                    !- Motor Efficiency
  1,                                      !- Motor In Airstream
   Fraction
  Room_18_6cc35095 VRF Terminal Unit Heating Coil Outlet Node, !-
   Air Inlet Node Name
  Room_18_6cc35095 VRF Terminal Unit Outlet Air Node, !- Air Outlet
   Node Name
  Fan On Off Power Curve 2,               !- Fan Power Ratio
   Function of Speed Ratio Curve Name
  Fan On Off Efficiency Curve 2,          !- Fan Efficiency Ratio
   Function of Speed Ratio Curve Name
  General;                                !- End-Use Subcategory
```

```
Curve:Exponent,
  Fan On Off Power Curve 2,               !- Name
  1,                                      !- Coefficient1 Constant
  0,                                      !- Coefficient2 Constant
  0,                                      !- Coefficient3 Constant
  0,                                      !- Minimum Value of x {
   BasedOnField A2}
  1;                                      !- Maximum Value of x {
   BasedOnField A2}

Curve:Cubic,
  Fan On Off Efficiency Curve 2,          !- Name
  1,                                      !- Coefficient1 Constant
  0,                                      !- Coefficient2 x
  0,                                      !- Coefficient3 x**2
  0,                                      !- Coefficient4 x**3
  0,                                      !- Minimum Value of x {
   BasedOnField A2}
  1;                                      !- Maximum Value of x {
   BasedOnField A2}

ZoneHVAC:EquipmentList,
  Room_18_6cc35095 Equipment List,        !- Name
  SequentialLoad,                         !- Load Distribution
   Scheme
  ZoneHVAC:AirDistributionUnit,           !- Zone Equipment Object
   Type 1
  ADU Room_18_6cc35095 Air Terminal,      !- Zone Equipment Name 1
  1,                                      !- Zone Equipment Cooling
   Sequence 1
  1,                                      !- Zone Equipment Heating
   or No-Load Sequence 1
  Schedule Constant 5,                    !- Zone Equipment
   Sequential Cooling Fraction Schedule Name 1
```

```
  Schedule Constant 6,                    !- Zone Equipment
   Sequential Heating Fraction Schedule Name 1
  ZoneHVAC:TerminalUnit:VariableRefrigerantFlow, !- Zone Equipment
   Object Type 2
  Room_18_6cc35095 VRF Terminal Unit,     !- Zone Equipment Name 2
  2,                                      !- Zone Equipment Cooling
   Sequence 2
  2,                                      !- Zone Equipment Heating
   or No-Load Sequence 2
  ,                                       !- Zone Equipment
   Sequential Cooling Fraction Schedule Name 2
  ;                                       !- Zone Equipment
   Sequential Heating Fraction Schedule Name 2

Sizing:Zone,
  Room_18_6cc35095,                       !- Zone or ZoneList Name
  SupplyAirTemperature,                   !- Zone Cooling Design
   Supply Air Temperature Input Method
  12.7777777777778,                       !- Zone Cooling Design
   Supply Air Temperature {C}
  11.11,                                  !- Zone Cooling Design
   Supply Air Temperature Difference {deltaC}
  SupplyAirTemperature,                   !- Zone Heating Design
   Supply Air Temperature Input Method
  40.0000000000001,                       !- Zone Heating Design
   Supply Air Temperature {C}
  11.11,                                  !- Zone Heating Design
   Supply Air Temperature Difference {deltaC}
  0.0085,                                 !- Zone Cooling Design
   Supply Air Humidity Ratio {kgWater/kgDryAir}
  0.008,                                  !- Zone Heating Design
   Supply Air Humidity Ratio {kgWater/kgDryAir}
  ventilation,                            !- Design Specification
   Outdoor Air Object Name
  ,                                       !- Zone Heating Sizing
   Factor
```

```
  ,                                       !- Zone Cooling Sizing
   Factor
  DesignDay,                              !- Cooling Design Air Flow
    Method
  0,                                      !- Cooling Design Air Flow
    Rate {m3/s}
  0.000762,                               !- Cooling Minimum Air
   Flow per Zone Floor Area {m3/s-m2}
  0,                                      !- Cooling Minimum Air
   Flow {m3/s}
  0,                                      !- Cooling Minimum Air
   Flow Fraction
  DesignDay,                              !- Heating Design Air Flow
    Method
  0,                                      !- Heating Design Air Flow
    Rate {m3/s}
  0.002032,                               !- Heating Maximum Air
   Flow per Zone Floor Area {m3/s-m2}
  0.1415762,                              !- Heating Maximum Air
   Flow {m3/s}
  0.3,                                    !- Heating Maximum Air
   Flow Fraction
  ,                                       !- Design Specification
   Zone Air Distribution Object Name
  Yes,                                    !- Account for Dedicated
   Outdoor Air System
  NeutralSupplyAir,                       !- Dedicated Outdoor Air
   System Control Strategy
  15.5555555555556,                       !- Dedicated Outdoor Air
   Low Setpoint Temperature for Design {C}
  21.1111111111111;                       !- Dedicated Outdoor Air
   High Setpoint Temperature for Design {C}

Zone,
  Room_19_6ae0f9a9,                       !- Name
```

```
  0,                                      !- Direction of Relative
   North {deg}
  0,                                      !- X Origin {m}
  0,                                      !- Y Origin {m}
  0,                                      !- Z Origin {m}
  ,                                       !- Type
  1,                                      !- Multiplier
  ,                                       !- Ceiling Height {m}
  ,                                       !- Volume {m3}
  ,                                       !- Floor Area {m2}
  ,                                       !- Zone Inside Convection
   Algorithm
  ,                                       !- Zone Outside Convection
    Algorithm
  Yes;                                    !- Part of Total Floor
   Area

BuildingSurface:Detailed,
  Room_19_6ae0f9a9..Face0,                !- Name
  Wall,                                   !- Surface Type
  project_wall_int,                       !- Construction Name
  Room_19_6ae0f9a9,                       !- Zone Name
  Surface,                                !- Outside Boundary
   Condition
  Room_18_6cc35095..Face2,                !- Outside Boundary
   Condition Object
  NoSun,                                  !- Sun Exposure
  NoWind,                                 !- Wind Exposure
  ,                                       !- View Factor to Ground
  ,                                       !- Number of Vertices
  19.8286118336156, 60.2819899121439, 9.74999999993446, !- X,Y,Z
   Vertex 1 {m}
  16.4952785002823, 60.2819899121439, 9.74999999992918, !- X,Y,Z
   Vertex 2 {m}
  16.4952785002736, 60.2819899121641, 6.49999999992917, !- X,Y,Z
   Vertex 3 {m}
```

```
  19.8286118336069, 60.2819899121641, 6.49999999993444; !- X,Y,Z
   Vertex 4 {m}

BuildingSurface:Detailed,
  Room_19_6ae0f9a9..Face1,                !- Name
  Wall,                                   !- Surface Type
  project_wall_int,                       !- Construction Name
  Room_19_6ae0f9a9,                       !- Zone Name
  Surface,                                !- Outside Boundary
   Condition
  Room_25_d27e0933..Face2,                !- Outside Boundary
   Condition Object
  NoSun,                                  !- Sun Exposure
  NoWind,                                 !- Wind Exposure
  ,                                       !- View Factor to Ground
  ,                                       !- Number of Vertices
  19.8286118336156, 60.2819899121439, 9.74999999993446, !- X,Y,Z
   Vertex 1 {m}
  19.8286118336069, 60.2819899121641, 6.49999999993444, !- X,Y,Z
   Vertex 2 {m}
  19.8286118336069, 65.2819899121641, 6.49999999989867, !- X,Y,Z
   Vertex 3 {m}
  19.8286118336156, 65.2819899121439, 9.74999999989868; !- X,Y,Z
   Vertex 4 {m}

BuildingSurface:Detailed,
  Room_19_6ae0f9a9..Face2,                !- Name
  Wall,                                   !- Surface Type
  project_wall_int,                       !- Construction Name
  Room_19_6ae0f9a9,                       !- Zone Name
  Surface,                                !- Outside Boundary
   Condition
  Room_28_d6ed2799..Face1,                !- Outside Boundary
   Condition Object
  NoSun,                                  !- Sun Exposure
  NoWind,                                 !- Wind Exposure
```

```
  ,                                       !- View Factor to Ground
  ,                                       !- Number of Vertices
  19.8286118336156, 65.2819899121439, 9.74999999989868, !- X,Y,Z
   Vertex 1 {m}
  19.8286118336069, 65.2819899121641, 6.49999999989867, !- X,Y,Z
   Vertex 2 {m}
  16.4952785002736, 65.2819899121641, 6.4999999998934, !- X,Y,Z
   Vertex 3 {m}
  16.4952785002823, 65.2819899121439, 9.74999999989341; !- X,Y,Z
   Vertex 4 {m}

BuildingSurface:Detailed,
  Room_19_6ae0f9a9..Face3,                !- Name
  Wall,                                   !- Surface Type
  project_wall_int,                       !- Construction Name
  Room_19_6ae0f9a9,                       !- Zone Name
  Surface,                                !- Outside Boundary
   Condition
  Room_22_f3ee5a53..Face1,                !- Outside Boundary
   Condition Object
  NoSun,                                  !- Sun Exposure
  NoWind,                                 !- Wind Exposure
  ,                                       !- View Factor to Ground
  ,                                       !- Number of Vertices
  16.4952785002823, 60.2819899121439, 9.74999999992918, !- X,Y,Z
   Vertex 1 {m}
  16.4952785002823, 65.2819899121439, 9.74999999989341, !- X,Y,Z
   Vertex 2 {m}
  16.4952785002736, 65.2819899121641, 6.4999999998934, !- X,Y,Z
   Vertex 3 {m}
  16.4952785002736, 60.2819899121641, 6.49999999992917; !- X,Y,Z
   Vertex 4 {m}

BuildingSurface:Detailed,
  Room_19_6ae0f9a9..Face4,                !- Name
  Floor,                                  !- Surface Type
```

```
  project_floor,                          !- Construction Name
  Room_19_6ae0f9a9,                       !- Zone Name
  Surface,                                !- Outside Boundary
   Condition
  Room_20_4d060559..Face5,                !- Outside Boundary
   Condition Object
  NoSun,                                  !- Sun Exposure
  NoWind,                                 !- Wind Exposure
  ,                                       !- View Factor to Ground
  ,                                       !- Number of Vertices
  19.8286118336069, 65.2819899121641, 6.49999999989867, !- X,Y,Z
   Vertex 1 {m}
  19.8286118336069, 60.2819899121641, 6.49999999993444, !- X,Y,Z
   Vertex 2 {m}
  16.4952785002736, 60.2819899121641, 6.49999999992917, !- X,Y,Z
   Vertex 3 {m}
  16.4952785002736, 65.2819899121641, 6.4999999998934; !- X,Y,Z
   Vertex 4 {m}

BuildingSurface:Detailed,
  Room_19_6ae0f9a9..Face5,                !- Name
  Roof,                                   !- Surface Type
  project_roof,                           !- Construction Name
  Room_19_6ae0f9a9,                       !- Zone Name
  Outdoors,                               !- Outside Boundary
   Condition
  ,                                       !- Outside Boundary
   Condition Object
  SunExposed,                             !- Sun Exposure
  WindExposed,                            !- Wind Exposure
  ,                                       !- View Factor to Ground
  ,                                       !- Number of Vertices
  19.8286118336156, 60.2819899121439, 9.74999999993446, !- X,Y,Z
   Vertex 1 {m}
  19.8286118336156, 65.2819899121439, 9.74999999989868, !- X,Y,Z
   Vertex 2 {m}
```

```
  16.4952785002823, 65.2819899121439, 9.74999999989341, !- X,Y,Z
   Vertex 3 {m}
  16.4952785002823, 60.2819899121439, 9.74999999992918; !- X,Y,Z
   Vertex 4 {m}

ZoneControl:Thermostat,
  Room_19_6ae0f9a9 Thermostat,            !- Name
  Room_19_6ae0f9a9,                       !- Zone or ZoneList Name
  Room_19_6ae0f9a9 Thermostat Schedule,   !- Control Type Schedule
   Name
  ThermostatSetpoint:DualSetpoint,        !- Control 1 Object Type
  Thermostat Setpoint Dual Setpoint 4,    !- Control 1 Name
  ,                                       !- Control 2 Object Type
  ,                                       !- Control 2 Name
  ,                                       !- Control 3 Object Type
  ,                                       !- Control 3 Name
  ,                                       !- Control 4 Object Type
  ,                                       !- Control 4 Name
  0;                                      !- Temperature Difference
   Between Cutout And Setpoint {deltaC}

Schedule:Compact,
  Room_19_6ae0f9a9 Thermostat Schedule,   !- Name
  Room_19_6ae0f9a9 Thermostat Schedule Type Limits, !- Schedule Type
    Limits Name
  Through: 12/31,                         !- Field 1
  For: AllDays,                           !- Field 2
  Until: 24:00,                           !- Field 3
  4;                                      !- Field 4

ScheduleTypeLimits,
  Room_19_6ae0f9a9 Thermostat Schedule Type Limits, !- Name
  0,                                      !- Lower Limit Value {
   BasedOnField A3}
  4,                                      !- Upper Limit Value {
   BasedOnField A3}
```

```
  DISCRETE;                               !- Numeric Type

ThermostatSetpoint:DualSetpoint,
  Thermostat Setpoint Dual Setpoint 4,    !- Name
  project_heat,                           !- Heating Setpoint
   Temperature Schedule Name
  Clg-SetP-Sch;                        !- Cooling Setpoint
   Temperature Schedule Name

ZoneHVAC:EquipmentConnections,
  Room_19_6ae0f9a9,                       !- Zone Name
  Room_19_6ae0f9a9 Equipment List,        !- Zone Conditioning
   Equipment List Name
  Room_19_6ae0f9a9 Inlet Node List,       !- Zone Air Inlet Node or
   NodeList Name
  Room_19_6ae0f9a9 Exhaust Node List,     !- Zone Air Exhaust Node
   or NodeList Name
  Room_19_6ae0f9a9 Zone Air Node,         !- Zone Air Node Name
  Room_19_6ae0f9a9 Return Node List;      !- Zone Return Air Node or
    NodeList Name

NodeList,
  Room_19_6ae0f9a9 Inlet Node List,       !- Name
  Room_19_6ae0f9a9 Air Terminal Outlet Air Node, !- Node Name 1
  Room_19_6ae0f9a9 VRF Terminal Unit Outlet Air Node; !- Node Name 2

NodeList,
  Room_19_6ae0f9a9 Exhaust Node List,     !- Name
  Room_19_6ae0f9a9 VRF Terminal Unit Inlet Air Node; !- Node Name 1

NodeList,
  Room_19_6ae0f9a9 Return Node List,      !- Name
  Room_19_6ae0f9a9 Return Air Node;       !- Node Name 1

AirTerminal:SingleDuct:ConstantVolume:NoReheat,
  Room_19_6ae0f9a9 Air Terminal,          !- Name
```

```
  Always On Discrete,                     !- Availability Schedule
   Name
  Room_19_6ae0f9a9 Air Terminal Inlet Air Node, !- Air Inlet Node
   Name
  Room_19_6ae0f9a9 Air Terminal Outlet Air Node, !- Air Outlet Node
   Name
  AutoSize;                               !- Maximum Air Flow Rate {
   m3/s}

ZoneHVAC:AirDistributionUnit,
  ADU Room_19_6ae0f9a9 Air Terminal,      !- Name
  Room_19_6ae0f9a9 Air Terminal Outlet Air Node, !- Air Distribution
    Unit Outlet Node Name
  AirTerminal:SingleDuct:ConstantVolume:NoReheat, !- Air Terminal
   Object Type
  Room_19_6ae0f9a9 Air Terminal;          !- Air Terminal Name

ZoneHVAC:TerminalUnit:VariableRefrigerantFlow,
  Room_19_6ae0f9a9 VRF Terminal Unit,     !- Zone Terminal Unit Name
  Always On Discrete,                     !- Terminal Unit
   Availability Schedule
  Room_19_6ae0f9a9 VRF Terminal Unit Inlet Air Node, !- Terminal
   Unit Air Inlet Node Name
  Room_19_6ae0f9a9 VRF Terminal Unit Outlet Air Node, !- Terminal
   Unit Air Outlet Node Name
  Autosize,                               !- Cooling Supply Air Flow
    Rate {m3/s}
  Autosize,                               !- No Cooling Supply Air
   Flow Rate {m3/s}
  Autosize,                               !- Heating Supply Air Flow
    Rate {m3/s}
  Autosize,                               !- No Heating Supply Air
   Flow Rate {m3/s}
  Autosize,                               !- Cooling Outdoor Air
   Flow Rate {m3/s}
```

```
Autosize,                                 !- Heating Outdoor Air
 Flow Rate {m3/s}
Autosize,                                 !- No Load Outdoor Air
 Flow Rate {m3/s}
Always Off Discrete,                      !- Supply Air Fan
 Operating Mode Schedule Name
DrawThrough,                              !- Supply Air Fan
 Placement
Fan:OnOff,                                !- Supply Air Fan Object
 Type
Room_19_6ae0f9a9 VRF Unit Cycling Fan,    !- Supply Air Fan Object
 Name
OutdoorAir:Mixer,                         !- Outside Air Mixer
 Object Type
Room_19_6ae0f9a9 VRF Terminal Unit OA Mixer, !- Outside Air Mixer
 Object Name
Coil:Cooling:DX:VariableRefrigerantFlow, !- Cooling Coil Object
 Type
Zone HVAC Terminal Unit Variable Refrigerant Flow 1 Cooling Coil
 3, !- Cooling Coil Object Name
Coil:Heating:DX:VariableRefrigerantFlow, !- Heating Coil Object
 Type
Zone HVAC Terminal Unit Variable Refrigerant Flow 1 Heating Coil
 3, !- Heating Coil Object Name
30,                                       !- Zone Terminal Unit On
 Parasitic Electric Energy Use {W}
20,                                       !- Zone Terminal Unit Off
 Parasitic Electric Energy Use {W}
1,                                        !- Rated Heating Capacity
 Sizing Ratio {W/W}
,                                         !- Availability Manager
 List Name
,                                         !- Design Specification
 ZoneHVAC Sizing Object Name
,                                         !- Supplemental Heating
 Coil Object Type
```

```
  ,                                       !- Supplemental Heating
   Coil Name
  Autosize,                               !- Maximum Supply Air
   Temperature from Supplemental Heater {C}
  21;                                     !- Maximum Outdoor Dry-
   Bulb Temperature for Supplemental Heater Operation {C}

OutdoorAir:Mixer,
  Room_19_6ae0f9a9 VRF Terminal Unit OA Mixer, !- Name
  Room_19_6ae0f9a9 VRF Terminal Unit Mixer Outlet Node, !- Mixed Air
    Node Name
  Room_19_6ae0f9a9 VRF Terminal Unit Outdoor Air Node, !- Outdoor
   Air Stream Node Name
  Room_19_6ae0f9a9 VRF Terminal Unit Relief Node Name, !- Relief Air
    Stream Node Name
  Room_19_6ae0f9a9 VRF Terminal Unit Inlet Air Node; !- Return Air
   Stream Node Name

OutdoorAir:NodeList,
  Room_19_6ae0f9a9 VRF Terminal Unit Outdoor Air Node; !- Node or
   NodeList Name 1

Coil:Cooling:DX:VariableRefrigerantFlow,
  Zone HVAC Terminal Unit Variable Refrigerant Flow 1 Cooling Coil
   3, !- Name
  Always On Discrete,                     !- Availability Schedule
   Name
  Autosize,                               !- Gross Rated Total
   Cooling Capacity {W}
  Autosize,                               !- Gross Rated Sensible
   Heat Ratio
  Autosize,                               !- Rated Air Flow Rate {m3
   /s}
  VRFTUCoolCapFT 3,                       !- Cooling Capacity Ratio
   Modifier Function of Temperature Curve Name
```

```
  VRFACCoolCapFFF 3,                      !- Cooling Capacity
   Modifier Curve Function of Flow Fraction Name
  Room_19_6ae0f9a9 VRF Terminal Unit Mixer Outlet Node, !- Coil Air
   Inlet Node
  Room_19_6ae0f9a9 VRF Terminal Unit Cooling Coil Outlet Node; !-
   Coil Air Outlet Node

Curve:Biquadratic,
  VRFTUCoolCapFT 3,                       !- Name
  0.0585884077803259,                     !- Coefficient1 Constant
  0.0587396532718384,                     !- Coefficient2 x
  -0.000210274979759697,                  !- Coefficient3 x**2
  0.0109370473889647,                     !- Coefficient4 y
  -0.0001219549,                          !- Coefficient5 y**2
  -0.0005246615,                          !- Coefficient6 x*y
  15,                                     !- Minimum Value of x {
   BasedOnField A2}
  23.89,                                  !- Maximum Value of x {
   BasedOnField A2}
  20,                                     !- Minimum Value of y {
   BasedOnField A3}
  43.33,                                  !- Maximum Value of y {
   BasedOnField A3}
  0.8083,                                 !- Minimum Curve Output {
   BasedOnField A4}
  1.2583;                                 !- Maximum Curve Output {
   BasedOnField A4}

Curve:Quadratic,
  VRFACCoolCapFFF 3,                      !- Name
  0.8,                                    !- Coefficient1 Constant
  0.2,                                    !- Coefficient2 x
  0,                                      !- Coefficient3 x**2
  0.5,                                    !- Minimum Value of x {
   BasedOnField A2}
```

```
  1.5;                                    !- Maximum Value of x {
   BasedOnField A2}

Coil:Heating:DX:VariableRefrigerantFlow,
  Zone HVAC Terminal Unit Variable Refrigerant Flow 1 Heating Coil
   3, !- Name
  Always On Discrete,                     !- Availability Schedule
  Autosize,                               !- Gross Rated Heating
   Capacity {W}
  Autosize,                               !- Rated Air Flow Rate {m3
   /s}
  Room_19_6ae0f9a9 VRF Terminal Unit Cooling Coil Outlet Node, !-
   Coil Air Inlet Node
  Room_19_6ae0f9a9 VRF Terminal Unit Heating Coil Outlet Node, !-
   Coil Air Outlet Node
  Coil Heating DX Variable Refrigerant Flow 1 VRFTUHeatCAPFT 3, !-
   Heating Capacity Ratio Modifier Function of Temperature Curve
   Name
  Coil Heating DX Variable Refrigerant Flow 1 VRFACCoolCapFFF 3; !-
   Heating Capacity Modifier Function of Flow Fraction Curve Name

Curve:Biquadratic,
  Coil Heating DX Variable Refrigerant Flow 1 VRFTUHeatCAPFT 3, !-
   Name
  0.375443994956127,                      !- Coefficient1 Constant
  0.0668190645147821,                     !- Coefficient2 x
  -0.00194171026482001,                   !- Coefficient3 x**2
  0.0442618420640187,                     !- Coefficient4 y
  -0.0004009578,                          !- Coefficient5 y**2
  -0.0014819801,                          !- Coefficient6 x*y
  21.11,                                  !- Minimum Value of x {
   BasedOnField A2}
  27.22,                                  !- Maximum Value of x {
   BasedOnField A2}
  -15,                                    !- Minimum Value of y {
   BasedOnField A3}
```

```
  18.33,                                  !- Maximum Value of y {
   BasedOnField A3}
  0.6074,                                 !- Minimum Curve Output {
   BasedOnField A4}
  1;                                      !- Maximum Curve Output {
   BasedOnField A4}

Curve:Quadratic,
  Coil Heating DX Variable Refrigerant Flow 1 VRFACCoolCapFFF 3, !-
   Name
  0.8,                                    !- Coefficient1 Constant
  0.2,                                    !- Coefficient2 x
  0,                                      !- Coefficient3 x**2
  0.5,                                    !- Minimum Value of x {
   BasedOnField A2}
  1.5;                                    !- Maximum Value of x {
   BasedOnField A2}

Fan:OnOff,
  Room_19_6ae0f9a9 VRF Unit Cycling Fan,  !- Name
  Always On Discrete,                     !- Availability Schedule
   Name
  0.6,                                    !- Fan Total Efficiency
  300,                                    !- Pressure Rise {Pa}
  Autosize,                               !- Maximum Flow Rate {m3/s
   }
  0.8,                                    !- Motor Efficiency
  1,                                      !- Motor In Airstream
   Fraction
  Room_19_6ae0f9a9 VRF Terminal Unit Heating Coil Outlet Node, !-
   Air Inlet Node Name
  Room_19_6ae0f9a9 VRF Terminal Unit Outlet Air Node, !- Air Outlet
   Node Name
  Fan On Off Power Curve 3,               !- Fan Power Ratio
   Function of Speed Ratio Curve Name
```

```
  Fan On Off Efficiency Curve 3,          !- Fan Efficiency Ratio
   Function of Speed Ratio Curve Name
  General;                                !- End-Use Subcategory

Curve:Exponent,
  Fan On Off Power Curve 3,               !- Name
  1,                                      !- Coefficient1 Constant
  0,                                      !- Coefficient2 Constant
  0,                                      !- Coefficient3 Constant
  0,                                      !- Minimum Value of x {
   BasedOnField A2}
  1;                                      !- Maximum Value of x {
   BasedOnField A2}

Curve:Cubic,
  Fan On Off Efficiency Curve 3,          !- Name
  1,                                      !- Coefficient1 Constant
  0,                                      !- Coefficient2 x
  0,                                      !- Coefficient3 x**2
  0,                                      !- Coefficient4 x**3
  0,                                      !- Minimum Value of x {
   BasedOnField A2}
  1;                                      !- Maximum Value of x {
   BasedOnField A2}

ZoneHVAC:EquipmentList,
  Room_19_6ae0f9a9 Equipment List,        !- Name
  SequentialLoad,                         !- Load Distribution
   Scheme
  ZoneHVAC:AirDistributionUnit,           !- Zone Equipment Object
   Type 1
  ADU Room_19_6ae0f9a9 Air Terminal,      !- Zone Equipment Name 1
  1,                                      !- Zone Equipment Cooling
   Sequence 1
  1,                                      !- Zone Equipment Heating
   or No-Load Sequence 1
```

```
  Schedule Constant 7,                    !- Zone Equipment
   Sequential Cooling Fraction Schedule Name 1
  Schedule Constant 8,                    !- Zone Equipment
   Sequential Heating Fraction Schedule Name 1
  ZoneHVAC:TerminalUnit:VariableRefrigerantFlow, !- Zone Equipment
   Object Type 2
  Room_19_6ae0f9a9 VRF Terminal Unit,     !- Zone Equipment Name 2
  2,                                      !- Zone Equipment Cooling
   Sequence 2
  2,                                      !- Zone Equipment Heating
   or No-Load Sequence 2
  ,                                       !- Zone Equipment
   Sequential Cooling Fraction Schedule Name 2
  ;                                       !- Zone Equipment
   Sequential Heating Fraction Schedule Name 2

Sizing:Zone,
  Room_19_6ae0f9a9,                       !- Zone or ZoneList Name
  SupplyAirTemperature,                   !- Zone Cooling Design
   Supply Air Temperature Input Method
  12.7777777777778,                       !- Zone Cooling Design
   Supply Air Temperature {C}
  11.11,                                  !- Zone Cooling Design
   Supply Air Temperature Difference {deltaC}
  SupplyAirTemperature,                   !- Zone Heating Design
   Supply Air Temperature Input Method
  40.0000000000001,                       !- Zone Heating Design
   Supply Air Temperature {C}
  11.11,                                  !- Zone Heating Design
   Supply Air Temperature Difference {deltaC}
  0.0085,                                 !- Zone Cooling Design
   Supply Air Humidity Ratio {kgWater/kgDryAir}
  0.008,                                  !- Zone Heating Design
   Supply Air Humidity Ratio {kgWater/kgDryAir}
  ventilation,                            !- Design Specification
   Outdoor Air Object Name
```

```
  ,                                       !- Zone Heating Sizing
   Factor
  ,                                       !- Zone Cooling Sizing
   Factor
  DesignDay,                              !- Cooling Design Air Flow
    Method
  0,                                      !- Cooling Design Air Flow
    Rate {m3/s}
  0.000762,                               !- Cooling Minimum Air
   Flow per Zone Floor Area {m3/s-m2}
  0,                                      !- Cooling Minimum Air
   Flow {m3/s}
  0,                                      !- Cooling Minimum Air
   Flow Fraction
  DesignDay,                              !- Heating Design Air Flow
    Method
  0,                                      !- Heating Design Air Flow
    Rate {m3/s}
  0.002032,                               !- Heating Maximum Air
   Flow per Zone Floor Area {m3/s-m2}
  0.1415762,                              !- Heating Maximum Air
   Flow {m3/s}
  0.3,                                    !- Heating Maximum Air
   Flow Fraction
  ,                                       !- Design Specification
   Zone Air Distribution Object Name
  Yes,                                    !- Account for Dedicated
   Outdoor Air System
  NeutralSupplyAir,                       !- Dedicated Outdoor Air
   System Control Strategy
  15.5555555555556,                       !- Dedicated Outdoor Air
   Low Setpoint Temperature for Design {C}
  21.1111111111111;                       !- Dedicated Outdoor Air
   High Setpoint Temperature for Design {C}

Zone,
```

```
  Room_20_4d060559,                       !- Name
  0,                                      !- Direction of Relative
   North {deg}
  0,                                      !- X Origin {m}
  0,                                      !- Y Origin {m}
  0,                                      !- Z Origin {m}
  ,                                       !- Type
  1,                                      !- Multiplier
  ,                                       !- Ceiling Height {m}
  ,                                       !- Volume {m3}
  ,                                       !- Floor Area {m2}
  ,                                       !- Zone Inside Convection
   Algorithm
  ,                                       !- Zone Outside Convection
    Algorithm
  Yes;                                    !- Part of Total Floor
   Area

BuildingSurface:Detailed,
  Room_20_4d060559..Face0,                !- Name
  Wall,                                   !- Surface Type
  project_wall_int,                       !- Construction Name
  Room_20_4d060559,                       !- Zone Name
  Surface,                                !- Outside Boundary
   Condition
  Room_17_fb615533..Face2,                !- Outside Boundary
   Condition Object
  NoSun,                                  !- Sun Exposure
  NoWind,                                 !- Wind Exposure
  ,                                       !- View Factor to Ground
  ,                                       !- Number of Vertices
  19.8286118336069, 60.2819899121641, 6.49999999993444, !- X,Y,Z
   Vertex 1 {m}
  16.4952785002736, 60.2819899121641, 6.49999999992917, !- X,Y,Z
   Vertex 2 {m}
```

```
  16.495278500265, 60.2819899121844, 3.24999999992918, !- X,Y,Z
   Vertex 3 {m}
  19.8286118335983, 60.2819899121844, 3.24999999993445; !- X,Y,Z
   Vertex 4 {m}

BuildingSurface:Detailed,
  Room_20_4d060559..Face1,                !- Name
  Wall,                                   !- Surface Type
  project_wall_int,                       !- Construction Name
  Room_20_4d060559,                       !- Zone Name
  Surface,                                !- Outside Boundary
   Condition
  Room_26_f4ea3797..Face2,                !- Outside Boundary
   Condition Object
  NoSun,                                  !- Sun Exposure
  NoWind,                                 !- Wind Exposure
  ,                                       !- View Factor to Ground
  ,                                       !- Number of Vertices
  19.8286118336069, 60.2819899121641, 6.49999999993444, !- X,Y,Z
   Vertex 1 {m}
  19.8286118335983, 60.2819899121844, 3.24999999993445, !- X,Y,Z
   Vertex 2 {m}
  19.8286118335983, 65.2819899121844, 3.24999999989868, !- X,Y,Z
   Vertex 3 {m}
  19.8286118336069, 65.2819899121641, 6.49999999989867; !- X,Y,Z
   Vertex 4 {m}

BuildingSurface:Detailed,
  Room_20_4d060559..Face2,                !- Name
  Wall,                                   !- Surface Type
  project_wall_int,                       !- Construction Name
  Room_20_4d060559,                       !- Zone Name
  Surface,                                !- Outside Boundary
   Condition
  Room_29_2a634042..Face1,                !- Outside Boundary
   Condition Object
```

```
  NoSun,                                  !- Sun Exposure
  NoWind,                                 !- Wind Exposure
  ,                                       !- View Factor to Ground
  ,                                       !- Number of Vertices
  19.8286118336069, 65.2819899121641, 6.49999999989867, !- X,Y,Z
   Vertex 1 {m}
  19.8286118335983, 65.2819899121844, 3.24999999989868, !- X,Y,Z
   Vertex 2 {m}
  16.495278500265, 65.2819899121844, 3.2499999998934, !- X,Y,Z
   Vertex 3 {m}
  16.4952785002736, 65.2819899121641, 6.4999999998934; !- X,Y,Z
   Vertex 4 {m}

BuildingSurface:Detailed,
  Room_20_4d060559..Face3,                !- Name
  Wall,                                   !- Surface Type
  project_wall_int,                       !- Construction Name
  Room_20_4d060559,                       !- Zone Name
  Surface,                                !- Outside Boundary
   Condition
  Room_23_e751e71f..Face1,                !- Outside Boundary
   Condition Object
  NoSun,                                  !- Sun Exposure
  NoWind,                                 !- Wind Exposure
  ,                                       !- View Factor to Ground
  ,                                       !- Number of Vertices
  16.4952785002736, 60.2819899121641, 6.49999999992917, !- X,Y,Z
   Vertex 1 {m}
  16.4952785002736, 65.2819899121641, 6.4999999998934, !- X,Y,Z
   Vertex 2 {m}
  16.495278500265, 65.2819899121844, 3.2499999998934, !- X,Y,Z
   Vertex 3 {m}
  16.495278500265, 60.2819899121844, 3.24999999992918; !- X,Y,Z
   Vertex 4 {m}

BuildingSurface:Detailed,
```

```
  Room_20_4d060559..Face4,                !- Name
  Floor,                                  !- Surface Type
  project_floor,                          !- Construction Name
  Room_20_4d060559,                       !- Zone Name
  Surface,                                !- Outside Boundary
   Condition
  Room_21_4c523269..Face5,                !- Outside Boundary
   Condition Object
  NoSun,                                  !- Sun Exposure
  NoWind,                                 !- Wind Exposure
  ,                                       !- View Factor to Ground
  ,                                       !- Number of Vertices
  19.8286118335983, 65.2819899121844, 3.24999999989868, !- X,Y,Z
   Vertex 1 {m}
  19.8286118335983, 60.2819899121844, 3.24999999993445, !- X,Y,Z
   Vertex 2 {m}
  16.495278500265, 60.2819899121844, 3.24999999992918, !- X,Y,Z
   Vertex 3 {m}
  16.495278500265, 65.2819899121844, 3.2499999998934; !- X,Y,Z
   Vertex 4 {m}

BuildingSurface:Detailed,
  Room_20_4d060559..Face5,                !- Name
  Ceiling,                                !- Surface Type
  project_ceiling_int,                    !- Construction Name
  Room_20_4d060559,                       !- Zone Name
  Surface,                                !- Outside Boundary
   Condition
  Room_19_6ae0f9a9..Face4,                !- Outside Boundary
   Condition Object
  NoSun,                                  !- Sun Exposure
  NoWind,                                 !- Wind Exposure
  ,                                       !- View Factor to Ground
  ,                                       !- Number of Vertices
  19.8286118336069, 60.2819899121641, 6.49999999993444, !- X,Y,Z
   Vertex 1 {m}
```

```
  19.8286118336069, 65.2819899121641, 6.49999999989867, !- X,Y,Z
   Vertex 2 {m}
  16.4952785002736, 65.2819899121641, 6.4999999998934, !- X,Y,Z
   Vertex 3 {m}
  16.4952785002736, 60.2819899121641, 6.49999999992917; !- X,Y,Z
   Vertex 4 {m}

ZoneControl:Thermostat,
  Room_20_4d060559 Thermostat,            !- Name
  Room_20_4d060559,                       !- Zone or ZoneList Name
  Room_20_4d060559 Thermostat Schedule,   !- Control Type Schedule
   Name
  ThermostatSetpoint:DualSetpoint,        !- Control 1 Object Type
  Thermostat Setpoint Dual Setpoint 5,    !- Control 1 Name
  ,                                       !- Control 2 Object Type
  ,                                       !- Control 2 Name
  ,                                       !- Control 3 Object Type
  ,                                       !- Control 3 Name
  ,                                       !- Control 4 Object Type
  ,                                       !- Control 4 Name
  0;                                      !- Temperature Difference
   Between Cutout And Setpoint {deltaC}

Schedule:Compact,
  Room_20_4d060559 Thermostat Schedule,   !- Name
  Room_20_4d060559 Thermostat Schedule Type Limits, !- Schedule Type
    Limits Name
  Through: 12/31,                         !- Field 1
  For: AllDays,                           !- Field 2
  Until: 24:00,                           !- Field 3
  4;                                      !- Field 4

ScheduleTypeLimits,
  Room_20_4d060559 Thermostat Schedule Type Limits, !- Name
  0,                                      !- Lower Limit Value {
   BasedOnField A3}
```

```
  4,                                      !- Upper Limit Value {
   BasedOnField A3}
  DISCRETE;                               !- Numeric Type

ThermostatSetpoint:DualSetpoint,
  Thermostat Setpoint Dual Setpoint 5,    !- Name
  project_heat,                           !- Heating Setpoint
   Temperature Schedule Name
  Clg-SetP-Sch;                        !- Cooling Setpoint
   Temperature Schedule Name

ZoneHVAC:EquipmentConnections,
  Room_20_4d060559,                       !- Zone Name
  Room_20_4d060559 Equipment List,        !- Zone Conditioning
   Equipment List Name
  Room_20_4d060559 Inlet Node List,       !- Zone Air Inlet Node or
   NodeList Name
  Room_20_4d060559 Exhaust Node List,     !- Zone Air Exhaust Node
   or NodeList Name
  Room_20_4d060559 Zone Air Node,         !- Zone Air Node Name
  Room_20_4d060559 Return Node List;      !- Zone Return Air Node or
    NodeList Name

NodeList,
  Room_20_4d060559 Inlet Node List,       !- Name
  Room_20_4d060559 Air Terminal Outlet Air Node, !- Node Name 1
  Room_20_4d060559 VRF Terminal Unit Outlet Air Node; !- Node Name 2

NodeList,
  Room_20_4d060559 Exhaust Node List,     !- Name
  Room_20_4d060559 VRF Terminal Unit Inlet Air Node; !- Node Name 1

NodeList,
  Room_20_4d060559 Return Node List,      !- Name
  Room_20_4d060559 Return Air Node;       !- Node Name 1
```

```
AirTerminal:SingleDuct:ConstantVolume:NoReheat,
  Room_20_4d060559 Air Terminal,          !- Name
  Always On Discrete,                     !- Availability Schedule
   Name
  Room_20_4d060559 Air Terminal Inlet Air Node, !- Air Inlet Node
   Name
  Room_20_4d060559 Air Terminal Outlet Air Node, !- Air Outlet Node
   Name
  AutoSize;                               !- Maximum Air Flow Rate {
   m3/s}

ZoneHVAC:AirDistributionUnit,
  ADU Room_20_4d060559 Air Terminal,      !- Name
  Room_20_4d060559 Air Terminal Outlet Air Node, !- Air Distribution
    Unit Outlet Node Name
  AirTerminal:SingleDuct:ConstantVolume:NoReheat, !- Air Terminal
   Object Type
  Room_20_4d060559 Air Terminal;          !- Air Terminal Name

ZoneHVAC:TerminalUnit:VariableRefrigerantFlow,
  Room_20_4d060559 VRF Terminal Unit,     !- Zone Terminal Unit Name
  Always On Discrete,                     !- Terminal Unit
   Availability Schedule
  Room_20_4d060559 VRF Terminal Unit Inlet Air Node, !- Terminal
   Unit Air Inlet Node Name
  Room_20_4d060559 VRF Terminal Unit Outlet Air Node, !- Terminal
   Unit Air Outlet Node Name
  Autosize,                               !- Cooling Supply Air Flow
    Rate {m3/s}
  Autosize,                               !- No Cooling Supply Air
   Flow Rate {m3/s}
  Autosize,                               !- Heating Supply Air Flow
    Rate {m3/s}
  Autosize,                               !- No Heating Supply Air
   Flow Rate {m3/s}
```

```
Autosize,                                 !- Cooling Outdoor Air
 Flow Rate {m3/s}
Autosize,                                 !- Heating Outdoor Air
 Flow Rate {m3/s}
Autosize,                                 !- No Load Outdoor Air
 Flow Rate {m3/s}
Always Off Discrete,                      !- Supply Air Fan
 Operating Mode Schedule Name
DrawThrough,                              !- Supply Air Fan
 Placement
Fan:OnOff,                                !- Supply Air Fan Object
 Type
Room_20_4d060559 VRF Unit Cycling Fan,    !- Supply Air Fan Object
 Name
OutdoorAir:Mixer,                         !- Outside Air Mixer
 Object Type
Room_20_4d060559 VRF Terminal Unit OA Mixer, !- Outside Air Mixer
 Object Name
Coil:Cooling:DX:VariableRefrigerantFlow, !- Cooling Coil Object
 Type
Zone HVAC Terminal Unit Variable Refrigerant Flow 1 Cooling Coil
 4, !- Cooling Coil Object Name
Coil:Heating:DX:VariableRefrigerantFlow, !- Heating Coil Object
 Type
Zone HVAC Terminal Unit Variable Refrigerant Flow 1 Heating Coil
 4, !- Heating Coil Object Name
30,                                       !- Zone Terminal Unit On
 Parasitic Electric Energy Use {W}
20,                                       !- Zone Terminal Unit Off
 Parasitic Electric Energy Use {W}
1,                                        !- Rated Heating Capacity
 Sizing Ratio {W/W}
,                                         !- Availability Manager
 List Name
,                                         !- Design Specification
 ZoneHVAC Sizing Object Name
```

```
  ,                                       !- Supplemental Heating
   Coil Object Type
  ,                                       !- Supplemental Heating
   Coil Name
  Autosize,                               !- Maximum Supply Air
   Temperature from Supplemental Heater {C}
  21;                                     !- Maximum Outdoor Dry-
   Bulb Temperature for Supplemental Heater Operation {C}

OutdoorAir:Mixer,
  Room_20_4d060559 VRF Terminal Unit OA Mixer, !- Name
  Room_20_4d060559 VRF Terminal Unit Mixer Outlet Node, !- Mixed Air
    Node Name
  Room_20_4d060559 VRF Terminal Unit Outdoor Air Node, !- Outdoor
   Air Stream Node Name
  Room_20_4d060559 VRF Terminal Unit Relief Node Name, !- Relief Air
    Stream Node Name
  Room_20_4d060559 VRF Terminal Unit Inlet Air Node; !- Return Air
   Stream Node Name

OutdoorAir:NodeList,
  Room_20_4d060559 VRF Terminal Unit Outdoor Air Node; !- Node or
   NodeList Name 1

Coil:Cooling:DX:VariableRefrigerantFlow,
  Zone HVAC Terminal Unit Variable Refrigerant Flow 1 Cooling Coil
   4, !- Name
  Always On Discrete,                     !- Availability Schedule
   Name
  Autosize,                               !- Gross Rated Total
   Cooling Capacity {W}
  Autosize,                               !- Gross Rated Sensible
   Heat Ratio
  Autosize,                               !- Rated Air Flow Rate {m3
   /s}
```

```
  VRFTUCoolCapFT 4,                       !- Cooling Capacity Ratio
   Modifier Function of Temperature Curve Name
  VRFACCoolCapFFF 4,                      !- Cooling Capacity
   Modifier Curve Function of Flow Fraction Name
  Room_20_4d060559 VRF Terminal Unit Mixer Outlet Node, !- Coil Air
   Inlet Node
  Room_20_4d060559 VRF Terminal Unit Cooling Coil Outlet Node; !-
   Coil Air Outlet Node

Curve:Biquadratic,
  VRFTUCoolCapFT 4,                       !- Name
  0.0585884077803259,                     !- Coefficient1 Constant
  0.0587396532718384,                     !- Coefficient2 x
  -0.000210274979759697,                  !- Coefficient3 x**2
  0.0109370473889647,                     !- Coefficient4 y
  -0.0001219549,                          !- Coefficient5 y**2
  -0.0005246615,                          !- Coefficient6 x*y
  15,                                     !- Minimum Value of x {
   BasedOnField A2}
  23.89,                                  !- Maximum Value of x {
   BasedOnField A2}
  20,                                     !- Minimum Value of y {
   BasedOnField A3}
  43.33,                                  !- Maximum Value of y {
   BasedOnField A3}
  0.8083,                                 !- Minimum Curve Output {
   BasedOnField A4}
  1.2583;                                 !- Maximum Curve Output {
   BasedOnField A4}

Curve:Quadratic,
  VRFACCoolCapFFF 4,                      !- Name
  0.8,                                    !- Coefficient1 Constant
  0.2,                                    !- Coefficient2 x
  0,                                      !- Coefficient3 x**2
```

```
  0.5,                                    !- Minimum Value of x {
   BasedOnField A2}
  1.5;                                    !- Maximum Value of x {
   BasedOnField A2}

Coil:Heating:DX:VariableRefrigerantFlow,
  Zone HVAC Terminal Unit Variable Refrigerant Flow 1 Heating Coil
   4, !- Name
  Always On Discrete,                     !- Availability Schedule
  Autosize,                               !- Gross Rated Heating
   Capacity {W}
  Autosize,                               !- Rated Air Flow Rate {m3
   /s}
  Room_20_4d060559 VRF Terminal Unit Cooling Coil Outlet Node, !-
   Coil Air Inlet Node
  Room_20_4d060559 VRF Terminal Unit Heating Coil Outlet Node, !-
   Coil Air Outlet Node
  Coil Heating DX Variable Refrigerant Flow 1 VRFTUHeatCAPFT 4, !-
   Heating Capacity Ratio Modifier Function of Temperature Curve
   Name
  Coil Heating DX Variable Refrigerant Flow 1 VRFACCoolCapFFF 4; !-
   Heating Capacity Modifier Function of Flow Fraction Curve Name

Curve:Biquadratic,
  Coil Heating DX Variable Refrigerant Flow 1 VRFTUHeatCAPFT 4, !-
   Name
  0.375443994956127,                      !- Coefficient1 Constant
  0.0668190645147821,                     !- Coefficient2 x
  -0.00194171026482001,                   !- Coefficient3 x**2
  0.0442618420640187,                     !- Coefficient4 y
  -0.0004009578,                          !- Coefficient5 y**2
  -0.0014819801,                          !- Coefficient6 x*y
  21.11,                                  !- Minimum Value of x {
   BasedOnField A2}
  27.22,                                  !- Maximum Value of x {
   BasedOnField A2}
```

```
  -15,                                    !- Minimum Value of y {
   BasedOnField A3}
  18.33,                                  !- Maximum Value of y {
   BasedOnField A3}
  0.6074,                                 !- Minimum Curve Output {
   BasedOnField A4}
  1;                                      !- Maximum Curve Output {
   BasedOnField A4}

Curve:Quadratic,
  Coil Heating DX Variable Refrigerant Flow 1 VRFACCoolCapFFF 4, !-
   Name
  0.8,                                    !- Coefficient1 Constant
  0.2,                                    !- Coefficient2 x
  0,                                      !- Coefficient3 x**2
  0.5,                                    !- Minimum Value of x {
   BasedOnField A2}
  1.5;                                    !- Maximum Value of x {
   BasedOnField A2}

Fan:OnOff,
  Room_20_4d060559 VRF Unit Cycling Fan,  !- Name
  Always On Discrete,                     !- Availability Schedule
   Name
  0.6,                                    !- Fan Total Efficiency
  300,                                    !- Pressure Rise {Pa}
  Autosize,                               !- Maximum Flow Rate {m3/s
   }
  0.8,                                    !- Motor Efficiency
  1,                                      !- Motor In Airstream
   Fraction
  Room_20_4d060559 VRF Terminal Unit Heating Coil Outlet Node, !-
   Air Inlet Node Name
  Room_20_4d060559 VRF Terminal Unit Outlet Air Node, !- Air Outlet
   Node Name
```

```
  Fan On Off Power Curve 4,               !- Fan Power Ratio
   Function of Speed Ratio Curve Name
  Fan On Off Efficiency Curve 4,          !- Fan Efficiency Ratio
   Function of Speed Ratio Curve Name
  General;                                !- End-Use Subcategory

Curve:Exponent,
  Fan On Off Power Curve 4,               !- Name
  1,                                      !- Coefficient1 Constant
  0,                                      !- Coefficient2 Constant
  0,                                      !- Coefficient3 Constant
  0,                                      !- Minimum Value of x {
   BasedOnField A2}
  1;                                      !- Maximum Value of x {
   BasedOnField A2}

Curve:Cubic,
  Fan On Off Efficiency Curve 4,          !- Name
  1,                                      !- Coefficient1 Constant
  0,                                      !- Coefficient2 x
  0,                                      !- Coefficient3 x**2
  0,                                      !- Coefficient4 x**3
  0,                                      !- Minimum Value of x {
   BasedOnField A2}
  1;                                      !- Maximum Value of x {
   BasedOnField A2}

ZoneHVAC:EquipmentList,
  Room_20_4d060559 Equipment List,        !- Name
  SequentialLoad,                         !- Load Distribution
   Scheme
  ZoneHVAC:AirDistributionUnit,           !- Zone Equipment Object
   Type 1
  ADU Room_20_4d060559 Air Terminal,      !- Zone Equipment Name 1
  1,                                      !- Zone Equipment Cooling
   Sequence 1
```

```
  1,                                      !- Zone Equipment Heating
   or No-Load Sequence 1
  Schedule Constant 9,                    !- Zone Equipment
   Sequential Cooling Fraction Schedule Name 1
  Schedule Constant 10,                   !- Zone Equipment
   Sequential Heating Fraction Schedule Name 1
  ZoneHVAC:TerminalUnit:VariableRefrigerantFlow, !- Zone Equipment
   Object Type 2
  Room_20_4d060559 VRF Terminal Unit,     !- Zone Equipment Name 2
  2,                                      !- Zone Equipment Cooling
   Sequence 2
  2,                                      !- Zone Equipment Heating
   or No-Load Sequence 2
  ,                                       !- Zone Equipment
   Sequential Cooling Fraction Schedule Name 2
  ;                                       !- Zone Equipment
   Sequential Heating Fraction Schedule Name 2

Sizing:Zone,
  Room_20_4d060559,                       !- Zone or ZoneList Name
  SupplyAirTemperature,                   !- Zone Cooling Design
   Supply Air Temperature Input Method
  12.7777777777778,                       !- Zone Cooling Design
   Supply Air Temperature {C}
  11.11,                                  !- Zone Cooling Design
   Supply Air Temperature Difference {deltaC}
  SupplyAirTemperature,                   !- Zone Heating Design
   Supply Air Temperature Input Method
  40.0000000000001,                       !- Zone Heating Design
   Supply Air Temperature {C}
  11.11,                                  !- Zone Heating Design
   Supply Air Temperature Difference {deltaC}
  0.0085,                                 !- Zone Cooling Design
   Supply Air Humidity Ratio {kgWater/kgDryAir}
  0.008,                                  !- Zone Heating Design
   Supply Air Humidity Ratio {kgWater/kgDryAir}
```

```
ventilation,                            !- Design Specification
 Outdoor Air Object Name
,                                       !- Zone Heating Sizing
 Factor
,                                       !- Zone Cooling Sizing
 Factor
DesignDay,                              !- Cooling Design Air Flow
  Method
0,                                      !- Cooling Design Air Flow
  Rate {m3/s}
0.000762,                               !- Cooling Minimum Air
 Flow per Zone Floor Area {m3/s-m2}
0,                                      !- Cooling Minimum Air
 Flow {m3/s}
0,                                      !- Cooling Minimum Air
 Flow Fraction
DesignDay,                              !- Heating Design Air Flow
  Method
0,                                      !- Heating Design Air Flow
  Rate {m3/s}
0.002032,                               !- Heating Maximum Air
 Flow per Zone Floor Area {m3/s-m2}
0.1415762,                              !- Heating Maximum Air
 Flow {m3/s}
0.3,                                    !- Heating Maximum Air
 Flow Fraction
,                                       !- Design Specification
 Zone Air Distribution Object Name
Yes,                                    !- Account for Dedicated
 Outdoor Air System
NeutralSupplyAir,                       !- Dedicated Outdoor Air
 System Control Strategy
15.5555555555556,                       !- Dedicated Outdoor Air
 Low Setpoint Temperature for Design {C}
21.1111111111111;                       !- Dedicated Outdoor Air
 High Setpoint Temperature for Design {C}
```

```
Zone,
  Room_21_4c523269,                       !- Name
  0,                                      !- Direction of Relative
   North {deg}
  0,                                      !- X Origin {m}
  0,                                      !- Y Origin {m}
  0,                                      !- Z Origin {m}
  ,                                       !- Type
  1,                                      !- Multiplier
  ,                                       !- Ceiling Height {m}
  ,                                       !- Volume {m3}
  ,                                       !- Floor Area {m2}
  ,                                       !- Zone Inside Convection
   Algorithm
  ,                                       !- Zone Outside Convection
    Algorithm
  Yes;                                    !- Part of Total Floor
   Area

BuildingSurface:Detailed,
  Room_21_4c523269..Face0,                !- Name
  Wall,                                   !- Surface Type
  project_wall_int,                       !- Construction Name
  Room_21_4c523269,                       !- Zone Name
  Surface,                                !- Outside Boundary
   Condition
  Room_16_3d8c5364..Face2,                !- Outside Boundary
   Condition Object
  NoSun,                                  !- Sun Exposure
  NoWind,                                 !- Wind Exposure
  ,                                       !- View Factor to Ground
  ,                                       !- Number of Vertices
  19.8286118335983, 60.2819899121844, 3.24999999993445, !- X,Y,Z
   Vertex 1 {m}
```

```
  16.495278500265, 60.2819899121844, 3.24999999992918, !- X,Y,Z
   Vertex 2 {m}
  16.4952785002563, 60.2819899122047, -7.08246976248188e-11, !- X,Y,
   Z Vertex 3 {m}
  19.8286118335897, 60.2819899122047, -6.55526866515655e-11; !- X,Y,
   Z Vertex 4 {m}

BuildingSurface:Detailed,
  Room_21_4c523269..Face1,                !- Name
  Wall,                                   !- Surface Type
  project_wall_int,                       !- Construction Name
  Room_21_4c523269,                       !- Zone Name
  Surface,                                !- Outside Boundary
   Condition
  Room_27_0080b418..Face2,                !- Outside Boundary
   Condition Object
  NoSun,                                  !- Sun Exposure
  NoWind,                                 !- Wind Exposure
  ,                                       !- View Factor to Ground
  ,                                       !- Number of Vertices
  19.8286118335983, 60.2819899121844, 3.24999999993445, !- X,Y,Z
   Vertex 1 {m}
  19.8286118335897, 60.2819899122047, -6.55526866515655e-11, !- X,Y,
   Z Vertex 2 {m}
  19.8286118335897, 65.2819899122047, -1.0132554747248e-10, !- X,Y,Z
    Vertex 3 {m}
  19.8286118335983, 65.2819899121844, 3.24999999989868; !- X,Y,Z
   Vertex 4 {m}

BuildingSurface:Detailed,
  Room_21_4c523269..Face2,                !- Name
  Wall,                                   !- Surface Type
  project_wall_int,                       !- Construction Name
  Room_21_4c523269,                       !- Zone Name
  Surface,                                !- Outside Boundary
   Condition
```

```
  Room_30_98f1d6c8..Face1,                !- Outside Boundary
   Condition Object
  NoSun,                                  !- Sun Exposure
  NoWind,                                 !- Wind Exposure
  ,                                       !- View Factor to Ground
  ,                                       !- Number of Vertices
  19.8286118335983, 65.2819899121844, 3.24999999989868, !- X,Y,Z
   Vertex 1 {m}
  19.8286118335897, 65.2819899122047, -1.0132554747248e-10, !- X,Y,Z
    Vertex 2 {m}
  16.4952785002563, 65.2819899122047, -1.06597558445733e-10, !- X,Y,
   Z Vertex 3 {m}
  16.495278500265, 65.2819899121844, 3.2499999998934; !- X,Y,Z
   Vertex 4 {m}

BuildingSurface:Detailed,
  Room_21_4c523269..Face3,                !- Name
  Wall,                                   !- Surface Type
  project_wall_int,                       !- Construction Name
  Room_21_4c523269,                       !- Zone Name
  Surface,                                !- Outside Boundary
   Condition
  Room_24_159d21b7..Face1,                !- Outside Boundary
   Condition Object
  NoSun,                                  !- Sun Exposure
  NoWind,                                 !- Wind Exposure
  ,                                       !- View Factor to Ground
  ,                                       !- Number of Vertices
  16.495278500265, 60.2819899121844, 3.24999999992918, !- X,Y,Z
   Vertex 1 {m}
  16.495278500265, 65.2819899121844, 3.2499999998934, !- X,Y,Z
   Vertex 2 {m}
  16.4952785002563, 65.2819899122047, -1.06597558445733e-10, !- X,Y,
   Z Vertex 3 {m}
  16.4952785002563, 60.2819899122047, -7.08246976248188e-11; !- X,Y,
   Z Vertex 4 {m}
```

```
BuildingSurface:Detailed,
  Room_21_4c523269..Face4,                !- Name
  Floor,                                  !- Surface Type
  project_slab,                           !- Construction Name
  Room_21_4c523269,                       !- Zone Name
  Ground,                                 !- Outside Boundary
   Condition
  ,                                       !- Outside Boundary
   Condition Object
  NoSun,                                  !- Sun Exposure
  NoWind,                                 !- Wind Exposure
  ,                                       !- View Factor to Ground
  ,                                       !- Number of Vertices
  19.8286118335897, 65.2819899122047, -1.0132554747248e-10, !- X,Y,Z
    Vertex 1 {m}
  19.8286118335897, 60.2819899122047, -6.55526866515655e-11, !- X,Y,
   Z Vertex 2 {m}
  16.4952785002563, 60.2819899122047, -7.08246976248188e-11, !- X,Y,
   Z Vertex 3 {m}
  16.4952785002563, 65.2819899122047, -1.06597558445733e-10; !- X,Y,
   Z Vertex 4 {m}

BuildingSurface:Detailed,
  Room_21_4c523269..Face5,                !- Name
  Ceiling,                                !- Surface Type
  project_ceiling_int,                    !- Construction Name
  Room_21_4c523269,                       !- Zone Name
  Surface,                                !- Outside Boundary
   Condition
  Room_20_4d060559..Face4,                !- Outside Boundary
   Condition Object
  NoSun,                                  !- Sun Exposure
  NoWind,                                 !- Wind Exposure
  ,                                       !- View Factor to Ground
  ,                                       !- Number of Vertices
```

```
  19.8286118335983, 60.2819899121844, 3.24999999993445, !- X,Y,Z
   Vertex 1 {m}
  19.8286118335983, 65.2819899121844, 3.24999999989868, !- X,Y,Z
   Vertex 2 {m}
  16.495278500265, 65.2819899121844, 3.2499999998934, !- X,Y,Z
   Vertex 3 {m}
  16.495278500265, 60.2819899121844, 3.24999999992918; !- X,Y,Z
   Vertex 4 {m}

ZoneControl:Thermostat,
  Room_21_4c523269 Thermostat,            !- Name
  Room_21_4c523269,                       !- Zone or ZoneList Name
  Room_21_4c523269 Thermostat Schedule,   !- Control Type Schedule
   Name
  ThermostatSetpoint:DualSetpoint,        !- Control 1 Object Type
  Thermostat Setpoint Dual Setpoint 6,    !- Control 1 Name
  ,                                       !- Control 2 Object Type
  ,                                       !- Control 2 Name
  ,                                       !- Control 3 Object Type
  ,                                       !- Control 3 Name
  ,                                       !- Control 4 Object Type
  ,                                       !- Control 4 Name
  0;                                      !- Temperature Difference
   Between Cutout And Setpoint {deltaC}

Schedule:Compact,
  Room_21_4c523269 Thermostat Schedule,   !- Name
  Room_21_4c523269 Thermostat Schedule Type Limits, !- Schedule Type
    Limits Name
  Through: 12/31,                         !- Field 1
  For: AllDays,                           !- Field 2
  Until: 24:00,                           !- Field 3
  4;                                      !- Field 4

ScheduleTypeLimits,
  Room_21_4c523269 Thermostat Schedule Type Limits, !- Name
```

```
  0,                                      !- Lower Limit Value {
   BasedOnField A3}
  4,                                      !- Upper Limit Value {
   BasedOnField A3}
  DISCRETE;                               !- Numeric Type

ThermostatSetpoint:DualSetpoint,
  Thermostat Setpoint Dual Setpoint 6,    !- Name
  project_heat,                           !- Heating Setpoint
   Temperature Schedule Name
  Clg-SetP-Sch;                        !- Cooling Setpoint
   Temperature Schedule Name

ZoneHVAC:EquipmentConnections,
  Room_21_4c523269,                       !- Zone Name
  Room_21_4c523269 Equipment List,        !- Zone Conditioning
   Equipment List Name
  Room_21_4c523269 Inlet Node List,       !- Zone Air Inlet Node or
   NodeList Name
  Room_21_4c523269 Exhaust Node List,     !- Zone Air Exhaust Node
   or NodeList Name
  Room_21_4c523269 Zone Air Node,         !- Zone Air Node Name
  Room_21_4c523269 Return Node List;      !- Zone Return Air Node or
    NodeList Name

NodeList,
  Room_21_4c523269 Inlet Node List,       !- Name
  Room_21_4c523269 Air Terminal Outlet Air Node, !- Node Name 1
  Room_21_4c523269 VRF Terminal Unit Outlet Air Node; !- Node Name 2

NodeList,
  Room_21_4c523269 Exhaust Node List,     !- Name
  Room_21_4c523269 VRF Terminal Unit Inlet Air Node; !- Node Name 1

NodeList,
  Room_21_4c523269 Return Node List,      !- Name
```

```
  Room_21_4c523269 Return Air Node;       !- Node Name 1

AirTerminal:SingleDuct:ConstantVolume:NoReheat,
  Room_21_4c523269 Air Terminal,          !- Name
  Always On Discrete,                     !- Availability Schedule
   Name
  Room_21_4c523269 Air Terminal Inlet Air Node, !- Air Inlet Node
   Name
  Room_21_4c523269 Air Terminal Outlet Air Node, !- Air Outlet Node
   Name
  AutoSize;                               !- Maximum Air Flow Rate {
   m3/s}

ZoneHVAC:AirDistributionUnit,
  ADU Room_21_4c523269 Air Terminal,      !- Name
  Room_21_4c523269 Air Terminal Outlet Air Node, !- Air Distribution
    Unit Outlet Node Name
  AirTerminal:SingleDuct:ConstantVolume:NoReheat, !- Air Terminal
   Object Type
  Room_21_4c523269 Air Terminal;          !- Air Terminal Name

ZoneHVAC:TerminalUnit:VariableRefrigerantFlow,
  Room_21_4c523269 VRF Terminal Unit,     !- Zone Terminal Unit Name
  Always On Discrete,                     !- Terminal Unit
   Availability Schedule
  Room_21_4c523269 VRF Terminal Unit Inlet Air Node, !- Terminal
   Unit Air Inlet Node Name
  Room_21_4c523269 VRF Terminal Unit Outlet Air Node, !- Terminal
   Unit Air Outlet Node Name
  Autosize,                               !- Cooling Supply Air Flow
    Rate {m3/s}
  Autosize,                               !- No Cooling Supply Air
   Flow Rate {m3/s}
  Autosize,                               !- Heating Supply Air Flow
    Rate {m3/s}
```

```
Autosize,                                 !- No Heating Supply Air
 Flow Rate {m3/s}
Autosize,                                 !- Cooling Outdoor Air
 Flow Rate {m3/s}
Autosize,                                 !- Heating Outdoor Air
 Flow Rate {m3/s}
Autosize,                                 !- No Load Outdoor Air
 Flow Rate {m3/s}
Always Off Discrete,                      !- Supply Air Fan
 Operating Mode Schedule Name
DrawThrough,                              !- Supply Air Fan
 Placement
Fan:OnOff,                                !- Supply Air Fan Object
 Type
Room_21_4c523269 VRF Unit Cycling Fan,    !- Supply Air Fan Object
 Name
OutdoorAir:Mixer,                         !- Outside Air Mixer
 Object Type
Room_21_4c523269 VRF Terminal Unit OA Mixer, !- Outside Air Mixer
 Object Name
Coil:Cooling:DX:VariableRefrigerantFlow, !- Cooling Coil Object
 Type
Zone HVAC Terminal Unit Variable Refrigerant Flow 1 Cooling Coil
 5, !- Cooling Coil Object Name
Coil:Heating:DX:VariableRefrigerantFlow, !- Heating Coil Object
 Type
Zone HVAC Terminal Unit Variable Refrigerant Flow 1 Heating Coil
 5, !- Heating Coil Object Name
30,                                       !- Zone Terminal Unit On
 Parasitic Electric Energy Use {W}
20,                                       !- Zone Terminal Unit Off
 Parasitic Electric Energy Use {W}
1,                                        !- Rated Heating Capacity
 Sizing Ratio {W/W}
,                                         !- Availability Manager
 List Name
```

```
  ,                                       !- Design Specification
   ZoneHVAC Sizing Object Name
  ,                                       !- Supplemental Heating
   Coil Object Type
  ,                                       !- Supplemental Heating
   Coil Name
  Autosize,                               !- Maximum Supply Air
   Temperature from Supplemental Heater {C}
  21;                                     !- Maximum Outdoor Dry-
   Bulb Temperature for Supplemental Heater Operation {C}

OutdoorAir:Mixer,
  Room_21_4c523269 VRF Terminal Unit OA Mixer, !- Name
  Room_21_4c523269 VRF Terminal Unit Mixer Outlet Node, !- Mixed Air
    Node Name
  Room_21_4c523269 VRF Terminal Unit Outdoor Air Node, !- Outdoor
   Air Stream Node Name
  Room_21_4c523269 VRF Terminal Unit Relief Node Name, !- Relief Air
    Stream Node Name
  Room_21_4c523269 VRF Terminal Unit Inlet Air Node; !- Return Air
   Stream Node Name

OutdoorAir:NodeList,
  Room_21_4c523269 VRF Terminal Unit Outdoor Air Node; !- Node or
   NodeList Name 1

Coil:Cooling:DX:VariableRefrigerantFlow,
  Zone HVAC Terminal Unit Variable Refrigerant Flow 1 Cooling Coil
   5, !- Name
  Always On Discrete,                     !- Availability Schedule
   Name
  Autosize,                               !- Gross Rated Total
   Cooling Capacity {W}
  Autosize,                               !- Gross Rated Sensible
   Heat Ratio
```

```
  Autosize,                               !- Rated Air Flow Rate {m3
   /s}
  VRFTUCoolCapFT 5,                       !- Cooling Capacity Ratio
   Modifier Function of Temperature Curve Name
  VRFACCoolCapFFF 5,                      !- Cooling Capacity
   Modifier Curve Function of Flow Fraction Name
  Room_21_4c523269 VRF Terminal Unit Mixer Outlet Node, !- Coil Air
   Inlet Node
  Room_21_4c523269 VRF Terminal Unit Cooling Coil Outlet Node; !-
   Coil Air Outlet Node

Curve:Biquadratic,
  VRFTUCoolCapFT 5,                       !- Name
  0.0585884077803259,                     !- Coefficient1 Constant
  0.0587396532718384,                     !- Coefficient2 x
  -0.000210274979759697,                  !- Coefficient3 x**2
  0.0109370473889647,                     !- Coefficient4 y
  -0.0001219549,                          !- Coefficient5 y**2
  -0.0005246615,                          !- Coefficient6 x*y
  15,                                     !- Minimum Value of x {
   BasedOnField A2}
  23.89,                                  !- Maximum Value of x {
   BasedOnField A2}
  20,                                     !- Minimum Value of y {
   BasedOnField A3}
  43.33,                                  !- Maximum Value of y {
   BasedOnField A3}
  0.8083,                                 !- Minimum Curve Output {
   BasedOnField A4}
  1.2583;                                 !- Maximum Curve Output {
   BasedOnField A4}

Curve:Quadratic,
  VRFACCoolCapFFF 5,                      !- Name
  0.8,                                    !- Coefficient1 Constant
  0.2,                                    !- Coefficient2 x
```

```
  0,                                      !- Coefficient3 x**2
  0.5,                                    !- Minimum Value of x {
   BasedOnField A2}
  1.5;                                    !- Maximum Value of x {
   BasedOnField A2}

Coil:Heating:DX:VariableRefrigerantFlow,
  Zone HVAC Terminal Unit Variable Refrigerant Flow 1 Heating Coil
   5, !- Name
  Always On Discrete,                     !- Availability Schedule
  Autosize,                               !- Gross Rated Heating
   Capacity {W}
  Autosize,                               !- Rated Air Flow Rate {m3
   /s}
  Room_21_4c523269 VRF Terminal Unit Cooling Coil Outlet Node, !-
   Coil Air Inlet Node
  Room_21_4c523269 VRF Terminal Unit Heating Coil Outlet Node, !-
   Coil Air Outlet Node
  Coil Heating DX Variable Refrigerant Flow 1 VRFTUHeatCAPFT 5, !-
   Heating Capacity Ratio Modifier Function of Temperature Curve
   Name
  Coil Heating DX Variable Refrigerant Flow 1 VRFACCoolCapFFF 5; !-
   Heating Capacity Modifier Function of Flow Fraction Curve Name

Curve:Biquadratic,
  Coil Heating DX Variable Refrigerant Flow 1 VRFTUHeatCAPFT 5, !-
   Name
  0.375443994956127,                      !- Coefficient1 Constant
  0.0668190645147821,                     !- Coefficient2 x
  -0.00194171026482001,                   !- Coefficient3 x**2
  0.0442618420640187,                     !- Coefficient4 y
  -0.0004009578,                          !- Coefficient5 y**2
  -0.0014819801,                          !- Coefficient6 x*y
  21.11,                                  !- Minimum Value of x {
   BasedOnField A2}
```

```
  27.22,                                  !- Maximum Value of x {
   BasedOnField A2}
  -15,                                    !- Minimum Value of y {
   BasedOnField A3}
  18.33,                                  !- Maximum Value of y {
   BasedOnField A3}
  0.6074,                                 !- Minimum Curve Output {
   BasedOnField A4}
  1;                                      !- Maximum Curve Output {
   BasedOnField A4}

Curve:Quadratic,
  Coil Heating DX Variable Refrigerant Flow 1 VRFACCoolCapFFF 5, !-
   Name
  0.8,                                    !- Coefficient1 Constant
  0.2,                                    !- Coefficient2 x
  0,                                      !- Coefficient3 x**2
  0.5,                                    !- Minimum Value of x {
   BasedOnField A2}
  1.5;                                    !- Maximum Value of x {
   BasedOnField A2}

Fan:OnOff,
  Room_21_4c523269 VRF Unit Cycling Fan,  !- Name
  Always On Discrete,                     !- Availability Schedule
   Name
  0.6,                                    !- Fan Total Efficiency
  300,                                    !- Pressure Rise {Pa}
  Autosize,                               !- Maximum Flow Rate {m3/s
   }
  0.8,                                    !- Motor Efficiency
  1,                                      !- Motor In Airstream
   Fraction
  Room_21_4c523269 VRF Terminal Unit Heating Coil Outlet Node, !-
   Air Inlet Node Name
```

```
  Room_21_4c523269 VRF Terminal Unit Outlet Air Node, !- Air Outlet
   Node Name
  Fan On Off Power Curve 5,                !- Fan Power Ratio
   Function of Speed Ratio Curve Name
  Fan On Off Efficiency Curve 5,           !- Fan Efficiency Ratio
   Function of Speed Ratio Curve Name
  General;                                 !- End-Use Subcategory

Curve:Exponent,
  Fan On Off Power Curve 5,                !- Name
  1,                                       !- Coefficient1 Constant
  0,                                       !- Coefficient2 Constant
  0,                                       !- Coefficient3 Constant
  0,                                       !- Minimum Value of x {
   BasedOnField A2}
  1;                                       !- Maximum Value of x {
   BasedOnField A2}

Curve:Cubic,
  Fan On Off Efficiency Curve 5,           !- Name
  1,                                       !- Coefficient1 Constant
  0,                                       !- Coefficient2 x
  0,                                       !- Coefficient3 x**2
  0,                                       !- Coefficient4 x**3
  0,                                       !- Minimum Value of x {
   BasedOnField A2}
  1;                                       !- Maximum Value of x {
   BasedOnField A2}

ZoneHVAC:EquipmentList,
  Room_21_4c523269 Equipment List,         !- Name
  SequentialLoad,                          !- Load Distribution
   Scheme
  ZoneHVAC:AirDistributionUnit,            !- Zone Equipment Object
   Type 1
  ADU Room_21_4c523269 Air Terminal,       !- Zone Equipment Name 1
```

```
  1,                                        !- Zone Equipment Cooling
   Sequence 1
  1,                                        !- Zone Equipment Heating
   or No-Load Sequence 1
  Schedule Constant 11,                     !- Zone Equipment
   Sequential Cooling Fraction Schedule Name 1
  Schedule Constant 12,                     !- Zone Equipment
   Sequential Heating Fraction Schedule Name 1
  ZoneHVAC:TerminalUnit:VariableRefrigerantFlow, !- Zone Equipment
   Object Type 2
  Room_21_4c523269 VRF Terminal Unit,       !- Zone Equipment Name 2
  2,                                        !- Zone Equipment Cooling
   Sequence 2
  2,                                        !- Zone Equipment Heating
   or No-Load Sequence 2
  ,                                         !- Zone Equipment
   Sequential Cooling Fraction Schedule Name 2
  ;                                         !- Zone Equipment
   Sequential Heating Fraction Schedule Name 2

Sizing:Zone,
  Room_21_4c523269,                         !- Zone or ZoneList Name
  SupplyAirTemperature,                     !- Zone Cooling Design
   Supply Air Temperature Input Method
  12.7777777777778,                         !- Zone Cooling Design
   Supply Air Temperature {C}
  11.11,                                    !- Zone Cooling Design
   Supply Air Temperature Difference {deltaC}
  SupplyAirTemperature,                     !- Zone Heating Design
   Supply Air Temperature Input Method
  40.0000000000001,                         !- Zone Heating Design
   Supply Air Temperature {C}
  11.11,                                    !- Zone Heating Design
   Supply Air Temperature Difference {deltaC}
  0.0085,                                   !- Zone Cooling Design
   Supply Air Humidity Ratio {kgWater/kgDryAir}
```

```
0.008,                                  !- Zone Heating Design
 Supply Air Humidity Ratio {kgWater/kgDryAir}
ventilation,                            !- Design Specification
 Outdoor Air Object Name
,                                       !- Zone Heating Sizing
 Factor
,                                       !- Zone Cooling Sizing
 Factor
DesignDay,                              !- Cooling Design Air Flow
  Method
0,                                      !- Cooling Design Air Flow
  Rate {m3/s}
0.000762,                               !- Cooling Minimum Air
 Flow per Zone Floor Area {m3/s-m2}
0,                                      !- Cooling Minimum Air
 Flow {m3/s}
0,                                      !- Cooling Minimum Air
 Flow Fraction
DesignDay,                              !- Heating Design Air Flow
  Method
0,                                      !- Heating Design Air Flow
  Rate {m3/s}
0.002032,                               !- Heating Maximum Air
 Flow per Zone Floor Area {m3/s-m2}
0.1415762,                              !- Heating Maximum Air
 Flow {m3/s}
0.3,                                    !- Heating Maximum Air
 Flow Fraction
,                                       !- Design Specification
 Zone Air Distribution Object Name
Yes,                                    !- Account for Dedicated
 Outdoor Air System
NeutralSupplyAir,                       !- Dedicated Outdoor Air
 System Control Strategy
15.5555555555556,                       !- Dedicated Outdoor Air
 Low Setpoint Temperature for Design {C}
```

```
  21.1111111111111;                       !- Dedicated Outdoor Air
   High Setpoint Temperature for Design {C}

Zone,
  Room_22_f3ee5a53,                       !- Name
  0,                                      !- Direction of Relative
   North {deg}
  0,                                      !- X Origin {m}
  0,                                      !- Y Origin {m}
  0,                                      !- Z Origin {m}
  ,                                       !- Type
  1,                                      !- Multiplier
  ,                                       !- Ceiling Height {m}
  ,                                       !- Volume {m3}
  ,                                       !- Floor Area {m2}
  ,                                       !- Zone Inside Convection
   Algorithm
  ,                                       !- Zone Outside Convection
    Algorithm
  Yes;                                    !- Part of Total Floor
   Area

BuildingSurface:Detailed,
  Room_22_f3ee5a53..Face0,                !- Name
  Wall,                                   !- Surface Type
  project_wall_int,                       !- Construction Name
  Room_22_f3ee5a53,                       !- Zone Name
  Surface,                                !- Outside Boundary
   Condition
  Room_18_6cc35095..Face3,                !- Outside Boundary
   Condition Object
  NoSun,                                  !- Sun Exposure
  NoWind,                                 !- Wind Exposure
  ,                                       !- View Factor to Ground
  ,                                       !- Number of Vertices
```

```
  13.1619451669489, 55.2819899121439, 9.74999999995968, !- X,Y,Z
   Vertex 1 {m}
  13.1619451669403, 55.2819899121641, 6.49999999995968, !- X,Y,Z
   Vertex 2 {m}
  16.4952785002736, 60.2819899121641, 6.49999999992917, !- X,Y,Z
   Vertex 3 {m}
  16.4952785002823, 60.2819899121439, 9.74999999992918; !- X,Y,Z
   Vertex 4 {m}

BuildingSurface:Detailed,
  Room_22_f3ee5a53..Face1,                !- Name
  Wall,                                   !- Surface Type
  project_wall_int,                       !- Construction Name
  Room_22_f3ee5a53,                       !- Zone Name
  Surface,                                !- Outside Boundary
   Condition
  Room_19_6ae0f9a9..Face3,                !- Outside Boundary
   Condition Object
  NoSun,                                  !- Sun Exposure
  NoWind,                                 !- Wind Exposure
  ,                                       !- View Factor to Ground
  ,                                       !- Number of Vertices
  16.4952785002823, 60.2819899121439, 9.74999999992918, !- X,Y,Z
   Vertex 1 {m}
  16.4952785002736, 60.2819899121641, 6.49999999992917, !- X,Y,Z
   Vertex 2 {m}
  16.4952785002736, 65.2819899121641, 6.4999999998934, !- X,Y,Z
   Vertex 3 {m}
  16.4952785002823, 65.2819899121439, 9.74999999989341; !- X,Y,Z
   Vertex 4 {m}

BuildingSurface:Detailed,
  Room_22_f3ee5a53..Face2,                !- Name
  Wall,                                   !- Surface Type
  project_wall_int,                       !- Construction Name
  Room_22_f3ee5a53,                       !- Zone Name
```

```
  Surface,                                !- Outside Boundary
   Condition
  Room_28_d6ed2799..Face0,                !- Outside Boundary
   Condition Object
  NoSun,                                  !- Sun Exposure
  NoWind,                                 !- Wind Exposure
  ,                                       !- View Factor to Ground
  ,                                       !- Number of Vertices
  16.4952785002823, 65.2819899121439, 9.74999999989341, !- X,Y,Z
   Vertex 1 {m}
  16.4952785002736, 65.2819899121641, 6.4999999998934, !- X,Y,Z
   Vertex 2 {m}
  13.1619451669403, 70.2819899121641, 6.49999999985236, !- X,Y,Z
   Vertex 3 {m}
  13.1619451669489, 70.2819899121439, 9.74999999985237; !- X,Y,Z
   Vertex 4 {m}

BuildingSurface:Detailed,
  Room_22_f3ee5a53..Face3,                !- Name
  Wall,                                   !- Surface Type
  project_wall,                           !- Construction Name
  Room_22_f3ee5a53,                       !- Zone Name
  Outdoors,                               !- Outside Boundary
   Condition
  ,                                       !- Outside Boundary
   Condition Object
  SunExposed,                             !- Sun Exposure
  WindExposed,                            !- Wind Exposure
  ,                                       !- View Factor to Ground
  ,                                       !- Number of Vertices
  13.1619451669489, 55.2819899121439, 9.74999999995968, !- X,Y,Z
   Vertex 1 {m}
  13.1619451669489, 70.2819899121439, 9.74999999985237, !- X,Y,Z
   Vertex 2 {m}
  13.1619451669403, 70.2819899121641, 6.49999999985236, !- X,Y,Z
   Vertex 3 {m}
```

```
  13.1619451669403, 55.2819899121641, 6.49999999995968; !- X,Y,Z
   Vertex 4 {m}

FenestrationSurface:Detailed,
  Room_22_f3ee5a53..Face3_Glz0,           !- Name
  Window,                                 !- Surface Type
  project_window,                         !- Construction Name
  Room_22_f3ee5a53..Face3,                !- Building Surface Name
  ,                                       !- Outside Boundary
   Condition Object
  ,                                       !- View Factor to Ground
  ,                                       !- Frame and Divider Name
  ,                                       !- Multiplier
  ,                                       !- Number of Vertices
  13.1619451669477, 68.4163649121461, 9.29999999986571, !- X,Y,Z
   Vertex 1 {m}
  13.1619451669477, 69.147614912144, 9.29999999986048, !- X,Y,Z
   Vertex 2 {m}
  13.1619451669424, 69.1476149121297, 7.29999999986048, !- X,Y,Z
   Vertex 3 {m}
  13.1619451669424, 68.4163649121318, 7.29999999986571; !- X,Y,Z
   Vertex 4 {m}

FenestrationSurface:Detailed,
  Room_22_f3ee5a53..Face3_Glz1,           !- Name
  Window,                                 !- Surface Type
  project_window,                         !- Construction Name
  Room_22_f3ee5a53..Face3,                !- Building Surface Name
  ,                                       !- Outside Boundary
   Condition Object
  ,                                       !- View Factor to Ground
  ,                                       !- Frame and Divider Name
  ,                                       !- Multiplier
  ,                                       !- Number of Vertices
  13.1619451669477, 65.4163649121548, 9.29999999988717, !- X,Y,Z
   Vertex 1 {m}
```

```
  13.1619451669477, 66.1476149121527, 9.29999999988194, !- X,Y,Z
   Vertex 2 {m}
  13.1619451669424, 66.1476149121384, 7.29999999988194, !- X,Y,Z
   Vertex 3 {m}
  13.1619451669424, 65.4163649121405, 7.29999999988717; !- X,Y,Z
   Vertex 4 {m}

FenestrationSurface:Detailed,
  Room_22_f3ee5a53..Face3_Glz2,           !- Name
  Window,                                 !- Surface Type
  project_window,                         !- Construction Name
  Room_22_f3ee5a53..Face3,                !- Building Surface Name
  ,                                       !- Outside Boundary
   Condition Object
  ,                                       !- View Factor to Ground
  ,                                       !- Frame and Divider Name
  ,                                       !- Multiplier
  ,                                       !- Number of Vertices
  13.1619451669477, 62.4163649121635, 9.29999999990864, !- X,Y,Z
   Vertex 1 {m}
  13.1619451669477, 63.1476149121614, 9.2999999999034, !- X,Y,Z
   Vertex 2 {m}
  13.1619451669424, 63.1476149121471, 7.2999999999034, !- X,Y,Z
   Vertex 3 {m}
  13.1619451669424, 62.4163649121492, 7.29999999990864; !- X,Y,Z
   Vertex 4 {m}

FenestrationSurface:Detailed,
  Room_22_f3ee5a53..Face3_Glz3,           !- Name
  Window,                                 !- Surface Type
  project_window,                         !- Construction Name
  Room_22_f3ee5a53..Face3,                !- Building Surface Name
  ,                                       !- Outside Boundary
   Condition Object
  ,                                       !- View Factor to Ground
  ,                                       !- Frame and Divider Name
```

```
  ,                                         !- Multiplier
  ,                                         !- Number of Vertices
  13.1619451669477, 59.4163649121722, 9.2999999999301, !- X,Y,Z
   Vertex 1 {m}
  13.1619451669477, 60.1476149121701, 9.29999999992487, !- X,Y,Z
   Vertex 2 {m}
  13.1619451669424, 60.1476149121558, 7.29999999992487, !- X,Y,Z
   Vertex 3 {m}
  13.1619451669424, 59.4163649121579, 7.2999999999301; !- X,Y,Z
   Vertex 4 {m}

FenestrationSurface:Detailed,
  Room_22_f3ee5a53..Face3_Glz4,             !- Name
  Window,                                   !- Surface Type
  project_window,                           !- Construction Name
  Room_22_f3ee5a53..Face3,                  !- Building Surface Name
  ,                                         !- Outside Boundary
   Condition Object
  ,                                         !- View Factor to Ground
  ,                                         !- Frame and Divider Name
  ,                                         !- Multiplier
  ,                                         !- Number of Vertices
  13.1619451669477, 56.4163649121809, 9.29999999995156, !- X,Y,Z
   Vertex 1 {m}
  13.1619451669477, 57.1476149121788, 9.29999999994633, !- X,Y,Z
   Vertex 2 {m}
  13.1619451669424, 57.1476149121645, 7.29999999994633, !- X,Y,Z
   Vertex 3 {m}
  13.1619451669424, 56.4163649121666, 7.29999999995156; !- X,Y,Z
   Vertex 4 {m}

BuildingSurface:Detailed,
  Room_22_f3ee5a53..Face4,                  !- Name
  Floor,                                    !- Surface Type
  project_floor,                            !- Construction Name
  Room_22_f3ee5a53,                         !- Zone Name
```

```
  Surface,                                !- Outside Boundary
   Condition
  Room_23_e751e71f..Face5,                !- Outside Boundary
   Condition Object
  NoSun,                                  !- Sun Exposure
  NoWind,                                 !- Wind Exposure
  ,                                       !- View Factor to Ground
  ,                                       !- Number of Vertices
  13.1619451669403, 70.2819899121641, 6.49999999985236, !- X,Y,Z
   Vertex 1 {m}
  16.4952785002736, 65.2819899121641, 6.4999999998934, !- X,Y,Z
   Vertex 2 {m}
  16.4952785002736, 60.2819899121641, 6.49999999992917, !- X,Y,Z
   Vertex 3 {m}
  13.1619451669403, 55.2819899121641, 6.49999999995968; !- X,Y,Z
   Vertex 4 {m}

BuildingSurface:Detailed,
  Room_22_f3ee5a53..Face5,                !- Name
  Roof,                                   !- Surface Type
  project_roof,                           !- Construction Name
  Room_22_f3ee5a53,                       !- Zone Name
  Outdoors,                               !- Outside Boundary
   Condition
  ,                                       !- Outside Boundary
   Condition Object
  SunExposed,                             !- Sun Exposure
  WindExposed,                            !- Wind Exposure
  ,                                       !- View Factor to Ground
  ,                                       !- Number of Vertices
  13.1619451669489, 55.2819899121439, 9.74999999995968, !- X,Y,Z
   Vertex 1 {m}
  16.4952785002823, 60.2819899121439, 9.74999999992918, !- X,Y,Z
   Vertex 2 {m}
  16.4952785002823, 65.2819899121439, 9.74999999989341, !- X,Y,Z
   Vertex 3 {m}
```

```
  13.1619451669489, 70.2819899121439, 9.74999999985237; !- X,Y,Z
   Vertex 4 {m}

ZoneControl:Thermostat,
  Room_22_f3ee5a53 Thermostat,            !- Name
  Room_22_f3ee5a53,                       !- Zone or ZoneList Name
  Room_22_f3ee5a53 Thermostat Schedule,   !- Control Type Schedule
   Name
  ThermostatSetpoint:DualSetpoint,        !- Control 1 Object Type
  Thermostat Setpoint Dual Setpoint 7,    !- Control 1 Name
  ,                                       !- Control 2 Object Type
  ,                                       !- Control 2 Name
  ,                                       !- Control 3 Object Type
  ,                                       !- Control 3 Name
  ,                                       !- Control 4 Object Type
  ,                                       !- Control 4 Name
  0;                                      !- Temperature Difference
   Between Cutout And Setpoint {deltaC}

Schedule:Compact,
  Room_22_f3ee5a53 Thermostat Schedule,   !- Name
  Room_22_f3ee5a53 Thermostat Schedule Type Limits, !- Schedule Type
    Limits Name
  Through: 12/31,                         !- Field 1
  For: AllDays,                           !- Field 2
  Until: 24:00,                           !- Field 3
  4;                                      !- Field 4

ScheduleTypeLimits,
  Room_22_f3ee5a53 Thermostat Schedule Type Limits, !- Name
  0,                                      !- Lower Limit Value {
   BasedOnField A3}
  4,                                      !- Upper Limit Value {
   BasedOnField A3}
  DISCRETE;                               !- Numeric Type
```

```
ThermostatSetpoint:DualSetpoint,
  Thermostat Setpoint Dual Setpoint 7,    !- Name
  project_heat,                           !- Heating Setpoint
   Temperature Schedule Name
  Clg-SetP-Sch;                        !- Cooling Setpoint
   Temperature Schedule Name

ZoneHVAC:EquipmentConnections,
  Room_22_f3ee5a53,                       !- Zone Name
  Room_22_f3ee5a53 Equipment List,        !- Zone Conditioning
   Equipment List Name
  Room_22_f3ee5a53 Inlet Node List,       !- Zone Air Inlet Node or
   NodeList Name
  Room_22_f3ee5a53 Exhaust Node List,     !- Zone Air Exhaust Node
   or NodeList Name
  Room_22_f3ee5a53 Zone Air Node,         !- Zone Air Node Name
  Room_22_f3ee5a53 Return Node List;      !- Zone Return Air Node or
    NodeList Name

NodeList,
  Room_22_f3ee5a53 Inlet Node List,       !- Name
  Room_22_f3ee5a53 Air Terminal Outlet Air Node, !- Node Name 1
  Room_22_f3ee5a53 VRF Terminal Unit Outlet Air Node; !- Node Name 2

NodeList,
  Room_22_f3ee5a53 Exhaust Node List,     !- Name
  Room_22_f3ee5a53 VRF Terminal Unit Inlet Air Node; !- Node Name 1

NodeList,
  Room_22_f3ee5a53 Return Node List,      !- Name
  Room_22_f3ee5a53 Return Air Node;       !- Node Name 1

AirTerminal:SingleDuct:ConstantVolume:NoReheat,
  Room_22_f3ee5a53 Air Terminal,          !- Name
  Always On Discrete,                     !- Availability Schedule
   Name
```

```
  Room_22_f3ee5a53 Air Terminal Inlet Air Node, !- Air Inlet Node
   Name
  Room_22_f3ee5a53 Air Terminal Outlet Air Node, !- Air Outlet Node
   Name
  AutoSize;                               !- Maximum Air Flow Rate {
   m3/s}

ZoneHVAC:AirDistributionUnit,
  ADU Room_22_f3ee5a53 Air Terminal,      !- Name
  Room_22_f3ee5a53 Air Terminal Outlet Air Node, !- Air Distribution
    Unit Outlet Node Name
  AirTerminal:SingleDuct:ConstantVolume:NoReheat, !- Air Terminal
   Object Type
  Room_22_f3ee5a53 Air Terminal;          !- Air Terminal Name

ZoneHVAC:TerminalUnit:VariableRefrigerantFlow,
  Room_22_f3ee5a53 VRF Terminal Unit,     !- Zone Terminal Unit Name
  Always On Discrete,                     !- Terminal Unit
   Availability Schedule
  Room_22_f3ee5a53 VRF Terminal Unit Inlet Air Node, !- Terminal
   Unit Air Inlet Node Name
  Room_22_f3ee5a53 VRF Terminal Unit Outlet Air Node, !- Terminal
   Unit Air Outlet Node Name
  Autosize,                               !- Cooling Supply Air Flow
    Rate {m3/s}
  Autosize,                               !- No Cooling Supply Air
   Flow Rate {m3/s}
  Autosize,                               !- Heating Supply Air Flow
    Rate {m3/s}
  Autosize,                               !- No Heating Supply Air
   Flow Rate {m3/s}
  Autosize,                               !- Cooling Outdoor Air
   Flow Rate {m3/s}
  Autosize,                               !- Heating Outdoor Air
   Flow Rate {m3/s}
```

```
Autosize,                                 !- No Load Outdoor Air
 Flow Rate {m3/s}
Always Off Discrete,                      !- Supply Air Fan
 Operating Mode Schedule Name
DrawThrough,                              !- Supply Air Fan
 Placement
Fan:OnOff,                                !- Supply Air Fan Object
 Type
Room_22_f3ee5a53 VRF Unit Cycling Fan,    !- Supply Air Fan Object
 Name
OutdoorAir:Mixer,                         !- Outside Air Mixer
 Object Type
Room_22_f3ee5a53 VRF Terminal Unit OA Mixer, !- Outside Air Mixer
 Object Name
Coil:Cooling:DX:VariableRefrigerantFlow, !- Cooling Coil Object
 Type
Zone HVAC Terminal Unit Variable Refrigerant Flow 1 Cooling Coil
 6, !- Cooling Coil Object Name
Coil:Heating:DX:VariableRefrigerantFlow, !- Heating Coil Object
 Type
Zone HVAC Terminal Unit Variable Refrigerant Flow 1 Heating Coil
 6, !- Heating Coil Object Name
30,                                       !- Zone Terminal Unit On
 Parasitic Electric Energy Use {W}
20,                                       !- Zone Terminal Unit Off
 Parasitic Electric Energy Use {W}
1,                                        !- Rated Heating Capacity
 Sizing Ratio {W/W}
,                                         !- Availability Manager
 List Name
,                                         !- Design Specification
 ZoneHVAC Sizing Object Name
,                                         !- Supplemental Heating
 Coil Object Type
,                                         !- Supplemental Heating
 Coil Name
```

```
  Autosize,                               !- Maximum Supply Air
   Temperature from Supplemental Heater {C}
  21;                                     !- Maximum Outdoor Dry-
   Bulb Temperature for Supplemental Heater Operation {C}

OutdoorAir:Mixer,
  Room_22_f3ee5a53 VRF Terminal Unit OA Mixer, !- Name
  Room_22_f3ee5a53 VRF Terminal Unit Mixer Outlet Node, !- Mixed Air
    Node Name
  Room_22_f3ee5a53 VRF Terminal Unit Outdoor Air Node, !- Outdoor
   Air Stream Node Name
  Room_22_f3ee5a53 VRF Terminal Unit Relief Node Name, !- Relief Air
    Stream Node Name
  Room_22_f3ee5a53 VRF Terminal Unit Inlet Air Node; !- Return Air
   Stream Node Name

OutdoorAir:NodeList,
  Room_22_f3ee5a53 VRF Terminal Unit Outdoor Air Node; !- Node or
   NodeList Name 1

Coil:Cooling:DX:VariableRefrigerantFlow,
  Zone HVAC Terminal Unit Variable Refrigerant Flow 1 Cooling Coil
   6, !- Name
  Always On Discrete,                     !- Availability Schedule
   Name
  Autosize,                               !- Gross Rated Total
   Cooling Capacity {W}
  Autosize,                               !- Gross Rated Sensible
   Heat Ratio
  Autosize,                               !- Rated Air Flow Rate {m3
   /s}
  VRFTUCoolCapFT 6,                       !- Cooling Capacity Ratio
   Modifier Function of Temperature Curve Name
  VRFACCoolCapFFF 6,                      !- Cooling Capacity
   Modifier Curve Function of Flow Fraction Name
```

```
  Room_22_f3ee5a53 VRF Terminal Unit Mixer Outlet Node, !- Coil Air
   Inlet Node
  Room_22_f3ee5a53 VRF Terminal Unit Cooling Coil Outlet Node; !-
   Coil Air Outlet Node

Curve:Biquadratic,
  VRFTUCoolCapFT 6,                       !- Name
  0.0585884077803259,                     !- Coefficient1 Constant
  0.0587396532718384,                     !- Coefficient2 x
  -0.000210274979759697,                  !- Coefficient3 x**2
  0.0109370473889647,                     !- Coefficient4 y
  -0.0001219549,                          !- Coefficient5 y**2
  -0.0005246615,                          !- Coefficient6 x*y
  15,                                     !- Minimum Value of x {
   BasedOnField A2}
  23.89,                                  !- Maximum Value of x {
   BasedOnField A2}
  20,                                     !- Minimum Value of y {
   BasedOnField A3}
  43.33,                                  !- Maximum Value of y {
   BasedOnField A3}
  0.8083,                                 !- Minimum Curve Output {
   BasedOnField A4}
  1.2583;                                 !- Maximum Curve Output {
   BasedOnField A4}

Curve:Quadratic,
  VRFACCoolCapFFF 6,                      !- Name
  0.8,                                    !- Coefficient1 Constant
  0.2,                                    !- Coefficient2 x
  0,                                      !- Coefficient3 x**2
  0.5,                                    !- Minimum Value of x {
   BasedOnField A2}
  1.5;                                    !- Maximum Value of x {
   BasedOnField A2}
```

```
Coil:Heating:DX:VariableRefrigerantFlow,
  Zone HVAC Terminal Unit Variable Refrigerant Flow 1 Heating Coil
   6, !- Name
  Always On Discrete,                     !- Availability Schedule
  Autosize,                               !- Gross Rated Heating
   Capacity {W}
  Autosize,                               !- Rated Air Flow Rate {m3
   /s}
  Room_22_f3ee5a53 VRF Terminal Unit Cooling Coil Outlet Node, !-
   Coil Air Inlet Node
  Room_22_f3ee5a53 VRF Terminal Unit Heating Coil Outlet Node, !-
   Coil Air Outlet Node
  Coil Heating DX Variable Refrigerant Flow 1 VRFTUHeatCAPFT 6, !-
   Heating Capacity Ratio Modifier Function of Temperature Curve
   Name
  Coil Heating DX Variable Refrigerant Flow 1 VRFACCoolCapFFF 6; !-
   Heating Capacity Modifier Function of Flow Fraction Curve Name

Curve:Biquadratic,
  Coil Heating DX Variable Refrigerant Flow 1 VRFTUHeatCAPFT 6, !-
   Name
  0.375443994956127,                      !- Coefficient1 Constant
  0.0668190645147821,                     !- Coefficient2 x
  -0.00194171026482001,                   !- Coefficient3 x**2
  0.0442618420640187,                     !- Coefficient4 y
  -0.0004009578,                          !- Coefficient5 y**2
  -0.0014819801,                          !- Coefficient6 x*y
  21.11,                                  !- Minimum Value of x {
   BasedOnField A2}
  27.22,                                  !- Maximum Value of x {
   BasedOnField A2}
  -15,                                    !- Minimum Value of y {
   BasedOnField A3}
  18.33,                                  !- Maximum Value of y {
   BasedOnField A3}
```

```
  0.6074,                                 !- Minimum Curve Output {
   BasedOnField A4}
  1;                                      !- Maximum Curve Output {
   BasedOnField A4}

Curve:Quadratic,
  Coil Heating DX Variable Refrigerant Flow 1 VRFACCoolCapFFF 6, !-
   Name
  0.8,                                    !- Coefficient1 Constant
  0.2,                                    !- Coefficient2 x
  0,                                      !- Coefficient3 x**2
  0.5,                                    !- Minimum Value of x {
   BasedOnField A2}
  1.5;                                    !- Maximum Value of x {
   BasedOnField A2}

Fan:OnOff,
  Room_22_f3ee5a53 VRF Unit Cycling Fan,  !- Name
  Always On Discrete,                     !- Availability Schedule
   Name
  0.6,                                    !- Fan Total Efficiency
  300,                                    !- Pressure Rise {Pa}
  Autosize,                               !- Maximum Flow Rate {m3/s
   }
  0.8,                                    !- Motor Efficiency
  1,                                      !- Motor In Airstream
   Fraction
  Room_22_f3ee5a53 VRF Terminal Unit Heating Coil Outlet Node, !-
   Air Inlet Node Name
  Room_22_f3ee5a53 VRF Terminal Unit Outlet Air Node, !- Air Outlet
   Node Name
  Fan On Off Power Curve 6,               !- Fan Power Ratio
   Function of Speed Ratio Curve Name
  Fan On Off Efficiency Curve 6,          !- Fan Efficiency Ratio
   Function of Speed Ratio Curve Name
  General;                                !- End-Use Subcategory
```

```
Curve:Exponent,
  Fan On Off Power Curve 6,               !- Name
  1,                                      !- Coefficient1 Constant
  0,                                      !- Coefficient2 Constant
  0,                                      !- Coefficient3 Constant
  0,                                      !- Minimum Value of x {
   BasedOnField A2}
  1;                                      !- Maximum Value of x {
   BasedOnField A2}

Curve:Cubic,
  Fan On Off Efficiency Curve 6,          !- Name
  1,                                      !- Coefficient1 Constant
  0,                                      !- Coefficient2 x
  0,                                      !- Coefficient3 x**2
  0,                                      !- Coefficient4 x**3
  0,                                      !- Minimum Value of x {
   BasedOnField A2}
  1;                                      !- Maximum Value of x {
   BasedOnField A2}

ZoneHVAC:EquipmentList,
  Room_22_f3ee5a53 Equipment List,        !- Name
  SequentialLoad,                         !- Load Distribution
   Scheme
  ZoneHVAC:AirDistributionUnit,           !- Zone Equipment Object
   Type 1
  ADU Room_22_f3ee5a53 Air Terminal,      !- Zone Equipment Name 1
  1,                                      !- Zone Equipment Cooling
   Sequence 1
  1,                                      !- Zone Equipment Heating
   or No-Load Sequence 1
  Schedule Constant 13,                   !- Zone Equipment
   Sequential Cooling Fraction Schedule Name 1
```

```
  Schedule Constant 14,                   !- Zone Equipment
   Sequential Heating Fraction Schedule Name 1
  ZoneHVAC:TerminalUnit:VariableRefrigerantFlow, !- Zone Equipment
   Object Type 2
  Room_22_f3ee5a53 VRF Terminal Unit,     !- Zone Equipment Name 2
  2,                                      !- Zone Equipment Cooling
   Sequence 2
  2,                                      !- Zone Equipment Heating
   or No-Load Sequence 2
  ,                                       !- Zone Equipment
   Sequential Cooling Fraction Schedule Name 2
  ;                                       !- Zone Equipment
   Sequential Heating Fraction Schedule Name 2

Sizing:Zone,
  Room_22_f3ee5a53,                       !- Zone or ZoneList Name
  SupplyAirTemperature,                   !- Zone Cooling Design
   Supply Air Temperature Input Method
  12.7777777777778,                       !- Zone Cooling Design
   Supply Air Temperature {C}
  11.11,                                  !- Zone Cooling Design
   Supply Air Temperature Difference {deltaC}
  SupplyAirTemperature,                   !- Zone Heating Design
   Supply Air Temperature Input Method
  40.0000000000001,                       !- Zone Heating Design
   Supply Air Temperature {C}
  11.11,                                  !- Zone Heating Design
   Supply Air Temperature Difference {deltaC}
  0.0085,                                 !- Zone Cooling Design
   Supply Air Humidity Ratio {kgWater/kgDryAir}
  0.008,                                  !- Zone Heating Design
   Supply Air Humidity Ratio {kgWater/kgDryAir}
  ventilation,                            !- Design Specification
   Outdoor Air Object Name
  ,                                       !- Zone Heating Sizing
   Factor
```

```
  ,                                       !- Zone Cooling Sizing
   Factor
  DesignDay,                              !- Cooling Design Air Flow
    Method
  0,                                      !- Cooling Design Air Flow
    Rate {m3/s}
  0.000762,                               !- Cooling Minimum Air
   Flow per Zone Floor Area {m3/s-m2}
  0,                                      !- Cooling Minimum Air
   Flow {m3/s}
  0,                                      !- Cooling Minimum Air
   Flow Fraction
  DesignDay,                              !- Heating Design Air Flow
    Method
  0,                                      !- Heating Design Air Flow
    Rate {m3/s}
  0.002032,                               !- Heating Maximum Air
   Flow per Zone Floor Area {m3/s-m2}
  0.1415762,                              !- Heating Maximum Air
   Flow {m3/s}
  0.3,                                    !- Heating Maximum Air
   Flow Fraction
  ,                                       !- Design Specification
   Zone Air Distribution Object Name
  Yes,                                    !- Account for Dedicated
   Outdoor Air System
  NeutralSupplyAir,                       !- Dedicated Outdoor Air
   System Control Strategy
  15.5555555555556,                       !- Dedicated Outdoor Air
   Low Setpoint Temperature for Design {C}
  21.1111111111111;                       !- Dedicated Outdoor Air
   High Setpoint Temperature for Design {C}

Zone,
  Room_23_e751e71f,                       !- Name
```

```
  0,                                      !- Direction of Relative
   North {deg}
  0,                                      !- X Origin {m}
  0,                                      !- Y Origin {m}
  0,                                      !- Z Origin {m}
  ,                                       !- Type
  1,                                      !- Multiplier
  ,                                       !- Ceiling Height {m}
  ,                                       !- Volume {m3}
  ,                                       !- Floor Area {m2}
  ,                                       !- Zone Inside Convection
   Algorithm
  ,                                       !- Zone Outside Convection
    Algorithm
  Yes;                                    !- Part of Total Floor
   Area

BuildingSurface:Detailed,
  Room_23_e751e71f..Face0,                !- Name
  Wall,                                   !- Surface Type
  project_wall_int,                       !- Construction Name
  Room_23_e751e71f,                       !- Zone Name
  Surface,                                !- Outside Boundary
   Condition
  Room_17_fb615533..Face3,                !- Outside Boundary
   Condition Object
  NoSun,                                  !- Sun Exposure
  NoWind,                                 !- Wind Exposure
  ,                                       !- View Factor to Ground
  ,                                       !- Number of Vertices
  13.1619451669403, 55.2819899121641, 6.49999999995968, !- X,Y,Z
   Vertex 1 {m}
  13.1619451669316, 55.2819899121844, 3.24999999995968, !- X,Y,Z
   Vertex 2 {m}
  16.495278500265, 60.2819899121844, 3.24999999992918, !- X,Y,Z
   Vertex 3 {m}
```

```
  16.4952785002736, 60.2819899121641, 6.49999999992917; !- X,Y,Z
   Vertex 4 {m}

BuildingSurface:Detailed,
  Room_23_e751e71f..Face1,                !- Name
  Wall,                                   !- Surface Type
  project_wall_int,                       !- Construction Name
  Room_23_e751e71f,                       !- Zone Name
  Surface,                                !- Outside Boundary
   Condition
  Room_20_4d060559..Face3,                !- Outside Boundary
   Condition Object
  NoSun,                                  !- Sun Exposure
  NoWind,                                 !- Wind Exposure
  ,                                       !- View Factor to Ground
  ,                                       !- Number of Vertices
  16.4952785002736, 60.2819899121641, 6.49999999992917, !- X,Y,Z
   Vertex 1 {m}
  16.495278500265, 60.2819899121844, 3.24999999992918, !- X,Y,Z
   Vertex 2 {m}
  16.495278500265, 65.2819899121844, 3.2499999998934, !- X,Y,Z
   Vertex 3 {m}
  16.4952785002736, 65.2819899121641, 6.4999999998934; !- X,Y,Z
   Vertex 4 {m}

BuildingSurface:Detailed,
  Room_23_e751e71f..Face2,                !- Name
  Wall,                                   !- Surface Type
  project_wall_int,                       !- Construction Name
  Room_23_e751e71f,                       !- Zone Name
  Surface,                                !- Outside Boundary
   Condition
  Room_29_2a634042..Face0,                !- Outside Boundary
   Condition Object
  NoSun,                                  !- Sun Exposure
  NoWind,                                 !- Wind Exposure
```

```
  ,                                         !- View Factor to Ground
  ,                                         !- Number of Vertices
  16.4952785002736, 65.2819899121641, 6.4999999998934, !- X,Y,Z
   Vertex 1 {m}
  16.495278500265, 65.2819899121844, 3.2499999998934, !- X,Y,Z
   Vertex 2 {m}
  13.1619451669316, 70.2819899121844, 3.24999999985236, !- X,Y,Z
   Vertex 3 {m}
  13.1619451669403, 70.2819899121641, 6.49999999985236; !- X,Y,Z
   Vertex 4 {m}

BuildingSurface:Detailed,
  Room_23_e751e71f..Face3,                  !- Name
  Wall,                                     !- Surface Type
  project_wall,                             !- Construction Name
  Room_23_e751e71f,                         !- Zone Name
  Outdoors,                                 !- Outside Boundary
   Condition
  ,                                         !- Outside Boundary
   Condition Object
  SunExposed,                               !- Sun Exposure
  WindExposed,                              !- Wind Exposure
  ,                                         !- View Factor to Ground
  ,                                         !- Number of Vertices
  13.1619451669403, 55.2819899121641, 6.49999999995968, !- X,Y,Z
   Vertex 1 {m}
  13.1619451669403, 70.2819899121641, 6.49999999985236, !- X,Y,Z
   Vertex 2 {m}
  13.1619451669316, 70.2819899121844, 3.24999999985236, !- X,Y,Z
   Vertex 3 {m}
  13.1619451669316, 55.2819899121844, 3.24999999995968; !- X,Y,Z
   Vertex 4 {m}

FenestrationSurface:Detailed,
  Room_23_e751e71f..Face3_Glz0,             !- Name
  Window,                                   !- Surface Type
```

```
  project_window,                         !- Construction Name
  Room_23_e751e71f..Face3,                !- Building Surface Name
  ,                                       !- Outside Boundary
   Condition Object
  ,                                       !- View Factor to Ground
  ,                                       !- Frame and Divider Name
  ,                                       !- Multiplier
  ,                                       !- Number of Vertices
  13.1619451669391, 68.4163649121664, 6.04999999986571, !- X,Y,Z
   Vertex 1 {m}
  13.1619451669391, 69.1476149121642, 6.04999999986048, !- X,Y,Z
   Vertex 2 {m}
  13.1619451669338, 69.1476149121499, 4.04999999986048, !- X,Y,Z
   Vertex 3 {m}
  13.1619451669338, 68.416364912152, 4.04999999986571; !- X,Y,Z
   Vertex 4 {m}

FenestrationSurface:Detailed,
  Room_23_e751e71f..Face3_Glz1,           !- Name
  Window,                                 !- Surface Type
  project_window,                         !- Construction Name
  Room_23_e751e71f..Face3,                !- Building Surface Name
  ,                                       !- Outside Boundary
   Condition Object
  ,                                       !- View Factor to Ground
  ,                                       !- Frame and Divider Name
  ,                                       !- Multiplier
  ,                                       !- Number of Vertices
  13.1619451669391, 65.4163649121751, 6.04999999988717, !- X,Y,Z
   Vertex 1 {m}
  13.1619451669391, 66.147614912173, 6.04999999988194, !- X,Y,Z
   Vertex 2 {m}
  13.1619451669338, 66.1476149121586, 4.04999999988194, !- X,Y,Z
   Vertex 3 {m}
  13.1619451669338, 65.4163649121608, 4.04999999988717; !- X,Y,Z
   Vertex 4 {m}
```

```
FenestrationSurface:Detailed,
  Room_23_e751e71f..Face3_Glz2,           !- Name
  Window,                                 !- Surface Type
  project_window,                         !- Construction Name
  Room_23_e751e71f..Face3,                !- Building Surface Name
  ,                                       !- Outside Boundary
   Condition Object
  ,                                       !- View Factor to Ground
  ,                                       !- Frame and Divider Name
  ,                                       !- Multiplier
  ,                                       !- Number of Vertices
  13.1619451669391, 62.4163649121838, 6.04999999990863, !- X,Y,Z
   Vertex 1 {m}
  13.1619451669391, 63.1476149121817, 6.0499999999034, !- X,Y,Z
   Vertex 2 {m}
  13.1619451669338, 63.1476149121673, 4.0499999999034, !- X,Y,Z
   Vertex 3 {m}
  13.1619451669338, 62.4163649121695, 4.04999999990863; !- X,Y,Z
   Vertex 4 {m}

FenestrationSurface:Detailed,
  Room_23_e751e71f..Face3_Glz3,           !- Name
  Window,                                 !- Surface Type
  project_window,                         !- Construction Name
  Room_23_e751e71f..Face3,                !- Building Surface Name
  ,                                       !- Outside Boundary
   Condition Object
  ,                                       !- View Factor to Ground
  ,                                       !- Frame and Divider Name
  ,                                       !- Multiplier
  ,                                       !- Number of Vertices
  13.1619451669391, 59.4163649121925, 6.0499999999301, !- X,Y,Z
   Vertex 1 {m}
  13.1619451669391, 60.1476149121903, 6.04999999992487, !- X,Y,Z
   Vertex 2 {m}
```

```
  13.1619451669338, 60.147614912176, 4.04999999992487, !- X,Y,Z
   Vertex 3 {m}
  13.1619451669338, 59.4163649121782, 4.0499999999301; !- X,Y,Z
   Vertex 4 {m}

FenestrationSurface:Detailed,
  Room_23_e751e71f..Face3_Glz4,           !- Name
  Window,                                 !- Surface Type
  project_window,                         !- Construction Name
  Room_23_e751e71f..Face3,                !- Building Surface Name
  ,                                       !- Outside Boundary
   Condition Object
  ,                                       !- View Factor to Ground
  ,                                       !- Frame and Divider Name
  ,                                       !- Multiplier
  ,                                       !- Number of Vertices
  13.1619451669391, 56.4163649122012, 6.04999999995156, !- X,Y,Z
   Vertex 1 {m}
  13.1619451669391, 57.1476149121991, 6.04999999994633, !- X,Y,Z
   Vertex 2 {m}
  13.1619451669338, 57.1476149121847, 4.04999999994633, !- X,Y,Z
   Vertex 3 {m}
  13.1619451669338, 56.4163649121869, 4.04999999995156; !- X,Y,Z
   Vertex 4 {m}

BuildingSurface:Detailed,
  Room_23_e751e71f..Face4,                !- Name
  Floor,                                  !- Surface Type
  project_floor,                          !- Construction Name
  Room_23_e751e71f,                       !- Zone Name
  Surface,                                !- Outside Boundary
   Condition
  Room_24_159d21b7..Face5,                !- Outside Boundary
   Condition Object
  NoSun,                                  !- Sun Exposure
  NoWind,                                 !- Wind Exposure
```

```
  ,                                       !- View Factor to Ground
  ,                                       !- Number of Vertices
  13.1619451669316, 70.2819899121844, 3.24999999985236, !- X,Y,Z
   Vertex 1 {m}
  16.495278500265, 65.2819899121844, 3.2499999998934, !- X,Y,Z
   Vertex 2 {m}
  16.495278500265, 60.2819899121844, 3.24999999992918, !- X,Y,Z
   Vertex 3 {m}
  13.1619451669316, 55.2819899121844, 3.24999999995968; !- X,Y,Z
   Vertex 4 {m}

BuildingSurface:Detailed,
  Room_23_e751e71f..Face5,                !- Name
  Ceiling,                                !- Surface Type
  project_ceiling_int,                    !- Construction Name
  Room_23_e751e71f,                       !- Zone Name
  Surface,                                !- Outside Boundary
   Condition
  Room_22_f3ee5a53..Face4,                !- Outside Boundary
   Condition Object
  NoSun,                                  !- Sun Exposure
  NoWind,                                 !- Wind Exposure
  ,                                       !- View Factor to Ground
  ,                                       !- Number of Vertices
  13.1619451669403, 55.2819899121641, 6.49999999995968, !- X,Y,Z
   Vertex 1 {m}
  16.4952785002736, 60.2819899121641, 6.49999999992917, !- X,Y,Z
   Vertex 2 {m}
  16.4952785002736, 65.2819899121641, 6.4999999998934, !- X,Y,Z
   Vertex 3 {m}
  13.1619451669403, 70.2819899121641, 6.49999999985236; !- X,Y,Z
   Vertex 4 {m}

ZoneControl:Thermostat,
  Room_23_e751e71f Thermostat,            !- Name
  Room_23_e751e71f,                       !- Zone or ZoneList Name
```

```
  Room_23_e751e71f Thermostat Schedule,   !- Control Type Schedule
   Name
  ThermostatSetpoint:DualSetpoint,        !- Control 1 Object Type
  Thermostat Setpoint Dual Setpoint 8,    !- Control 1 Name
  ,                                       !- Control 2 Object Type
  ,                                       !- Control 2 Name
  ,                                       !- Control 3 Object Type
  ,                                       !- Control 3 Name
  ,                                       !- Control 4 Object Type
  ,                                       !- Control 4 Name
  0;                                      !- Temperature Difference
   Between Cutout And Setpoint {deltaC}

Schedule:Compact,
  Room_23_e751e71f Thermostat Schedule,   !- Name
  Room_23_e751e71f Thermostat Schedule Type Limits, !- Schedule Type
    Limits Name
  Through: 12/31,                         !- Field 1
  For: AllDays,                           !- Field 2
  Until: 24:00,                           !- Field 3
  4;                                      !- Field 4

ScheduleTypeLimits,
  Room_23_e751e71f Thermostat Schedule Type Limits, !- Name
  0,                                      !- Lower Limit Value {
   BasedOnField A3}
  4,                                      !- Upper Limit Value {
   BasedOnField A3}
  DISCRETE;                               !- Numeric Type

ThermostatSetpoint:DualSetpoint,
  Thermostat Setpoint Dual Setpoint 8,    !- Name
  project_heat,                           !- Heating Setpoint
   Temperature Schedule Name
  Clg-SetP-Sch;                        !- Cooling Setpoint
   Temperature Schedule Name
```

```
ZoneHVAC:EquipmentConnections,
  Room_23_e751e71f,                       !- Zone Name
  Room_23_e751e71f Equipment List,        !- Zone Conditioning
   Equipment List Name
  Room_23_e751e71f Inlet Node List,       !- Zone Air Inlet Node or
   NodeList Name
  Room_23_e751e71f Exhaust Node List,     !- Zone Air Exhaust Node
   or NodeList Name
  Room_23_e751e71f Zone Air Node,         !- Zone Air Node Name
  Room_23_e751e71f Return Node List;      !- Zone Return Air Node or
    NodeList Name

NodeList,
  Room_23_e751e71f Inlet Node List,       !- Name
  Room_23_e751e71f Air Terminal Outlet Air Node, !- Node Name 1
  Room_23_e751e71f VRF Terminal Unit Outlet Air Node; !- Node Name 2

NodeList,
  Room_23_e751e71f Exhaust Node List,     !- Name
  Room_23_e751e71f VRF Terminal Unit Inlet Air Node; !- Node Name 1

NodeList,
  Room_23_e751e71f Return Node List,      !- Name
  Room_23_e751e71f Return Air Node;       !- Node Name 1

AirTerminal:SingleDuct:ConstantVolume:NoReheat,
  Room_23_e751e71f Air Terminal,          !- Name
  Always On Discrete,                     !- Availability Schedule
   Name
  Room_23_e751e71f Air Terminal Inlet Air Node, !- Air Inlet Node
   Name
  Room_23_e751e71f Air Terminal Outlet Air Node, !- Air Outlet Node
   Name
  AutoSize;                               !- Maximum Air Flow Rate {
   m3/s}
```

```
ZoneHVAC:AirDistributionUnit,
  ADU Room_23_e751e71f Air Terminal,      !- Name
  Room_23_e751e71f Air Terminal Outlet Air Node, !- Air Distribution
    Unit Outlet Node Name
  AirTerminal:SingleDuct:ConstantVolume:NoReheat, !- Air Terminal
   Object Type
  Room_23_e751e71f Air Terminal;          !- Air Terminal Name

ZoneHVAC:TerminalUnit:VariableRefrigerantFlow,
  Room_23_e751e71f VRF Terminal Unit,     !- Zone Terminal Unit Name
  Always On Discrete,                     !- Terminal Unit
   Availability Schedule
  Room_23_e751e71f VRF Terminal Unit Inlet Air Node, !- Terminal
   Unit Air Inlet Node Name
  Room_23_e751e71f VRF Terminal Unit Outlet Air Node, !- Terminal
   Unit Air Outlet Node Name
  Autosize,                               !- Cooling Supply Air Flow
    Rate {m3/s}
  Autosize,                               !- No Cooling Supply Air
   Flow Rate {m3/s}
  Autosize,                               !- Heating Supply Air Flow
    Rate {m3/s}
  Autosize,                               !- No Heating Supply Air
   Flow Rate {m3/s}
  Autosize,                               !- Cooling Outdoor Air
   Flow Rate {m3/s}
  Autosize,                               !- Heating Outdoor Air
   Flow Rate {m3/s}
  Autosize,                               !- No Load Outdoor Air
   Flow Rate {m3/s}
  Always Off Discrete,                    !- Supply Air Fan
   Operating Mode Schedule Name
  DrawThrough,                            !- Supply Air Fan
   Placement
```

```
  Fan:OnOff,                                !- Supply Air Fan Object
   Type
  Room_23_e751e71f VRF Unit Cycling Fan,  !- Supply Air Fan Object
   Name
  OutdoorAir:Mixer,                         !- Outside Air Mixer
   Object Type
  Room_23_e751e71f VRF Terminal Unit OA Mixer, !- Outside Air Mixer
   Object Name
  Coil:Cooling:DX:VariableRefrigerantFlow, !- Cooling Coil Object
   Type
  Zone HVAC Terminal Unit Variable Refrigerant Flow 1 Cooling Coil
   7, !- Cooling Coil Object Name
  Coil:Heating:DX:VariableRefrigerantFlow, !- Heating Coil Object
   Type
  Zone HVAC Terminal Unit Variable Refrigerant Flow 1 Heating Coil
   7, !- Heating Coil Object Name
  30,                                       !- Zone Terminal Unit On
   Parasitic Electric Energy Use {W}
  20,                                       !- Zone Terminal Unit Off
   Parasitic Electric Energy Use {W}
  1,                                        !- Rated Heating Capacity
   Sizing Ratio {W/W}
  ,                                         !- Availability Manager
   List Name
  ,                                         !- Design Specification
   ZoneHVAC Sizing Object Name
  ,                                         !- Supplemental Heating
   Coil Object Type
  ,                                         !- Supplemental Heating
   Coil Name
  Autosize,                                 !- Maximum Supply Air
   Temperature from Supplemental Heater {C}
  21;                                       !- Maximum Outdoor Dry-
   Bulb Temperature for Supplemental Heater Operation {C}

OutdoorAir:Mixer,
```

```
  Room_23_e751e71f VRF Terminal Unit OA Mixer, !- Name
  Room_23_e751e71f VRF Terminal Unit Mixer Outlet Node, !- Mixed Air
    Node Name
  Room_23_e751e71f VRF Terminal Unit Outdoor Air Node, !- Outdoor
   Air Stream Node Name
  Room_23_e751e71f VRF Terminal Unit Relief Node Name, !- Relief Air
    Stream Node Name
  Room_23_e751e71f VRF Terminal Unit Inlet Air Node; !- Return Air
   Stream Node Name

OutdoorAir:NodeList,
  Room_23_e751e71f VRF Terminal Unit Outdoor Air Node; !- Node or
   NodeList Name 1

Coil:Cooling:DX:VariableRefrigerantFlow,
  Zone HVAC Terminal Unit Variable Refrigerant Flow 1 Cooling Coil
   7, !- Name
  Always On Discrete,                     !- Availability Schedule
   Name
  Autosize,                               !- Gross Rated Total
   Cooling Capacity {W}
  Autosize,                               !- Gross Rated Sensible
   Heat Ratio
  Autosize,                               !- Rated Air Flow Rate {m3
   /s}
  VRFTUCoolCapFT 7,                       !- Cooling Capacity Ratio
   Modifier Function of Temperature Curve Name
  VRFACCoolCapFFF 7,                      !- Cooling Capacity
   Modifier Curve Function of Flow Fraction Name
  Room_23_e751e71f VRF Terminal Unit Mixer Outlet Node, !- Coil Air
   Inlet Node
  Room_23_e751e71f VRF Terminal Unit Cooling Coil Outlet Node; !-
   Coil Air Outlet Node

Curve:Biquadratic,
  VRFTUCoolCapFT 7,                       !- Name
```

```
  0.0585884077803259,                     !- Coefficient1 Constant
  0.0587396532718384,                     !- Coefficient2 x
  -0.000210274979759697,                  !- Coefficient3 x**2
  0.0109370473889647,                     !- Coefficient4 y
  -0.0001219549,                          !- Coefficient5 y**2
  -0.0005246615,                          !- Coefficient6 x*y
  15,                                     !- Minimum Value of x {
   BasedOnField A2}
  23.89,                                  !- Maximum Value of x {
   BasedOnField A2}
  20,                                     !- Minimum Value of y {
   BasedOnField A3}
  43.33,                                  !- Maximum Value of y {
   BasedOnField A3}
  0.8083,                                 !- Minimum Curve Output {
   BasedOnField A4}
  1.2583;                                 !- Maximum Curve Output {
   BasedOnField A4}

Curve:Quadratic,
  VRFACCoolCapFFF 7,                      !- Name
  0.8,                                    !- Coefficient1 Constant
  0.2,                                    !- Coefficient2 x
  0,                                      !- Coefficient3 x**2
  0.5,                                    !- Minimum Value of x {
   BasedOnField A2}
  1.5;                                    !- Maximum Value of x {
   BasedOnField A2}

Coil:Heating:DX:VariableRefrigerantFlow,
  Zone HVAC Terminal Unit Variable Refrigerant Flow 1 Heating Coil
   7, !- Name
  Always On Discrete,                     !- Availability Schedule
  Autosize,                               !- Gross Rated Heating
   Capacity {W}
```

```
  Autosize,                               !- Rated Air Flow Rate {m3
   /s}
  Room_23_e751e71f VRF Terminal Unit Cooling Coil Outlet Node, !-
   Coil Air Inlet Node
  Room_23_e751e71f VRF Terminal Unit Heating Coil Outlet Node, !-
   Coil Air Outlet Node
  Coil Heating DX Variable Refrigerant Flow 1 VRFTUHeatCAPFT 7, !-
   Heating Capacity Ratio Modifier Function of Temperature Curve
   Name
  Coil Heating DX Variable Refrigerant Flow 1 VRFACCoolCapFFF 7; !-
   Heating Capacity Modifier Function of Flow Fraction Curve Name

Curve:Biquadratic,
  Coil Heating DX Variable Refrigerant Flow 1 VRFTUHeatCAPFT 7, !-
   Name
  0.375443994956127,                      !- Coefficient1 Constant
  0.0668190645147821,                     !- Coefficient2 x
  -0.00194171026482001,                   !- Coefficient3 x**2
  0.0442618420640187,                     !- Coefficient4 y
  -0.0004009578,                          !- Coefficient5 y**2
  -0.0014819801,                          !- Coefficient6 x*y
  21.11,                                  !- Minimum Value of x {
   BasedOnField A2}
  27.22,                                  !- Maximum Value of x {
   BasedOnField A2}
  -15,                                    !- Minimum Value of y {
   BasedOnField A3}
  18.33,                                  !- Maximum Value of y {
   BasedOnField A3}
  0.6074,                                 !- Minimum Curve Output {
   BasedOnField A4}
  1;                                      !- Maximum Curve Output {
   BasedOnField A4}

Curve:Quadratic,
```

```
  Coil Heating DX Variable Refrigerant Flow 1 VRFACCoolCapFFF 7, !-
   Name
  0.8,                                     !- Coefficient1 Constant
  0.2,                                     !- Coefficient2 x
  0,                                       !- Coefficient3 x**2
  0.5,                                     !- Minimum Value of x {
   BasedOnField A2}
  1.5;                                     !- Maximum Value of x {
   BasedOnField A2}

Fan:OnOff,
  Room_23_e751e71f VRF Unit Cycling Fan,  !- Name
  Always On Discrete,                      !- Availability Schedule
   Name
  0.6,                                     !- Fan Total Efficiency
  300,                                     !- Pressure Rise {Pa}
  Autosize,                                !- Maximum Flow Rate {m3/s
   }
  0.8,                                     !- Motor Efficiency
  1,                                       !- Motor In Airstream
   Fraction
  Room_23_e751e71f VRF Terminal Unit Heating Coil Outlet Node, !-
   Air Inlet Node Name
  Room_23_e751e71f VRF Terminal Unit Outlet Air Node, !- Air Outlet
   Node Name
  Fan On Off Power Curve 7,                !- Fan Power Ratio
   Function of Speed Ratio Curve Name
  Fan On Off Efficiency Curve 7,           !- Fan Efficiency Ratio
   Function of Speed Ratio Curve Name
  General;                                 !- End-Use Subcategory

Curve:Exponent,
  Fan On Off Power Curve 7,                !- Name
  1,                                       !- Coefficient1 Constant
  0,                                       !- Coefficient2 Constant
  0,                                       !- Coefficient3 Constant
```

```
  0,                                      !- Minimum Value of x {
   BasedOnField A2}
  1;                                      !- Maximum Value of x {
   BasedOnField A2}

Curve:Cubic,
  Fan On Off Efficiency Curve 7,          !- Name
  1,                                      !- Coefficient1 Constant
  0,                                      !- Coefficient2 x
  0,                                      !- Coefficient3 x**2
  0,                                      !- Coefficient4 x**3
  0,                                      !- Minimum Value of x {
   BasedOnField A2}
  1;                                      !- Maximum Value of x {
   BasedOnField A2}

ZoneHVAC:EquipmentList,
  Room_23_e751e71f Equipment List,        !- Name
  SequentialLoad,                         !- Load Distribution
   Scheme
  ZoneHVAC:AirDistributionUnit,           !- Zone Equipment Object
   Type 1
  ADU Room_23_e751e71f Air Terminal,      !- Zone Equipment Name 1
  1,                                      !- Zone Equipment Cooling
   Sequence 1
  1,                                      !- Zone Equipment Heating
   or No-Load Sequence 1
  Schedule Constant 15,                   !- Zone Equipment
   Sequential Cooling Fraction Schedule Name 1
  Schedule Constant 16,                   !- Zone Equipment
   Sequential Heating Fraction Schedule Name 1
  ZoneHVAC:TerminalUnit:VariableRefrigerantFlow, !- Zone Equipment
   Object Type 2
  Room_23_e751e71f VRF Terminal Unit,     !- Zone Equipment Name 2
  2,                                      !- Zone Equipment Cooling
   Sequence 2
```

```
  2,                                      !- Zone Equipment Heating
    or No-Load Sequence 2
  ,                                       !- Zone Equipment
    Sequential Cooling Fraction Schedule Name 2
  ;                                       !- Zone Equipment
    Sequential Heating Fraction Schedule Name 2

Sizing:Zone,
  Room_23_e751e71f,                       !- Zone or ZoneList Name
  SupplyAirTemperature,                   !- Zone Cooling Design
    Supply Air Temperature Input Method
  12.7777777777778,                       !- Zone Cooling Design
    Supply Air Temperature {C}
  11.11,                                  !- Zone Cooling Design
    Supply Air Temperature Difference {deltaC}
  SupplyAirTemperature,                   !- Zone Heating Design
    Supply Air Temperature Input Method
  40.0000000000001,                       !- Zone Heating Design
    Supply Air Temperature {C}
  11.11,                                  !- Zone Heating Design
    Supply Air Temperature Difference {deltaC}
  0.0085,                                 !- Zone Cooling Design
    Supply Air Humidity Ratio {kgWater/kgDryAir}
  0.008,                                  !- Zone Heating Design
    Supply Air Humidity Ratio {kgWater/kgDryAir}
  ventilation,                            !- Design Specification
    Outdoor Air Object Name
  ,                                       !- Zone Heating Sizing
    Factor
  ,                                       !- Zone Cooling Sizing
    Factor
  DesignDay,                              !- Cooling Design Air Flow
     Method
  0,                                      !- Cooling Design Air Flow
     Rate {m3/s}
```

```
  0.000762,                               !- Cooling Minimum Air
   Flow per Zone Floor Area {m3/s-m2}
  0,                                      !- Cooling Minimum Air
   Flow {m3/s}
  0,                                      !- Cooling Minimum Air
   Flow Fraction
  DesignDay,                              !- Heating Design Air Flow
    Method
  0,                                      !- Heating Design Air Flow
    Rate {m3/s}
  0.002032,                               !- Heating Maximum Air
   Flow per Zone Floor Area {m3/s-m2}
  0.1415762,                              !- Heating Maximum Air
   Flow {m3/s}
  0.3,                                    !- Heating Maximum Air
   Flow Fraction
  ,                                       !- Design Specification
   Zone Air Distribution Object Name
  Yes,                                    !- Account for Dedicated
   Outdoor Air System
  NeutralSupplyAir,                       !- Dedicated Outdoor Air
   System Control Strategy
  15.5555555555556,                       !- Dedicated Outdoor Air
   Low Setpoint Temperature for Design {C}
  21.1111111111111;                       !- Dedicated Outdoor Air
   High Setpoint Temperature for Design {C}

Zone,
  Room_24_159d21b7,                       !- Name
  0,                                      !- Direction of Relative
   North {deg}
  0,                                      !- X Origin {m}
  0,                                      !- Y Origin {m}
  0,                                      !- Z Origin {m}
  ,                                       !- Type
  1,                                      !- Multiplier
```

```
  ,                                       !- Ceiling Height {m}
  ,                                       !- Volume {m3}
  ,                                       !- Floor Area {m2}
  ,                                       !- Zone Inside Convection
   Algorithm
  ,                                       !- Zone Outside Convection
    Algorithm
  Yes;                                    !- Part of Total Floor
   Area

BuildingSurface:Detailed,
  Room_24_159d21b7..Face0,                !- Name
  Wall,                                   !- Surface Type
  project_wall_int,                       !- Construction Name
  Room_24_159d21b7,                       !- Zone Name
  Surface,                                !- Outside Boundary
   Condition
  Room_16_3d8c5364..Face3,                !- Outside Boundary
   Condition Object
  NoSun,                                  !- Sun Exposure
  NoWind,                                 !- Wind Exposure
  ,                                       !- View Factor to Ground
  ,                                       !- Number of Vertices
  13.1619451669316, 55.2819899121844, 3.24999999995968, !- X,Y,Z
   Vertex 1 {m}
  13.161945166923, 55.2819899122047, -4.03238477771582e-11, !- X,Y,Z
    Vertex 2 {m}
  16.4952785002563, 60.2819899122047, -7.08246976248188e-11, !- X,Y,
   Z Vertex 3 {m}
  16.495278500265, 60.2819899121844, 3.24999999992918; !- X,Y,Z
   Vertex 4 {m}

BuildingSurface:Detailed,
  Room_24_159d21b7..Face1,                !- Name
  Wall,                                   !- Surface Type
  project_wall_int,                       !- Construction Name
```

```
  Room_24_159d21b7,                       !- Zone Name
  Surface,                                !- Outside Boundary
   Condition
  Room_21_4c523269..Face3,                !- Outside Boundary
   Condition Object
  NoSun,                                  !- Sun Exposure
  NoWind,                                 !- Wind Exposure
  ,                                       !- View Factor to Ground
  ,                                       !- Number of Vertices
  16.495278500265, 60.2819899121844, 3.24999999992918, !- X,Y,Z
   Vertex 1 {m}
  16.4952785002563, 60.2819899122047, -7.08246976248188e-11, !- X,Y,
   Z Vertex 2 {m}
  16.4952785002563, 65.2819899122047, -1.06597558445733e-10, !- X,Y,
   Z Vertex 3 {m}
  16.495278500265, 65.2819899121844, 3.2499999998934; !- X,Y,Z
   Vertex 4 {m}

BuildingSurface:Detailed,
  Room_24_159d21b7..Face2,                !- Name
  Wall,                                   !- Surface Type
  project_wall_int,                       !- Construction Name
  Room_24_159d21b7,                       !- Zone Name
  Surface,                                !- Outside Boundary
   Condition
  Room_30_98f1d6c8..Face0,                !- Outside Boundary
   Condition Object
  NoSun,                                  !- Sun Exposure
  NoWind,                                 !- Wind Exposure
  ,                                       !- View Factor to Ground
  ,                                       !- Number of Vertices
  16.495278500265, 65.2819899121844, 3.2499999998934, !- X,Y,Z
   Vertex 1 {m}
  16.4952785002563, 65.2819899122047, -1.06597558445733e-10, !- X,Y,
   Z Vertex 2 {m}
```

```
  13.161945166923, 70.2819899122047, -1.47642430239901e-10, !- X,Y,Z
    Vertex 3 {m}
  13.1619451669316, 70.2819899121844, 3.24999999985236; !- X,Y,Z
   Vertex 4 {m}

BuildingSurface:Detailed,
  Room_24_159d21b7..Face3,                !- Name
  Wall,                                   !- Surface Type
  project_wall,                           !- Construction Name
  Room_24_159d21b7,                       !- Zone Name
  Outdoors,                               !- Outside Boundary
   Condition
  ,                                       !- Outside Boundary
   Condition Object
  SunExposed,                             !- Sun Exposure
  WindExposed,                            !- Wind Exposure
  ,                                       !- View Factor to Ground
  ,                                       !- Number of Vertices
  13.1619451669316, 55.2819899121844, 3.24999999995968, !- X,Y,Z
   Vertex 1 {m}
  13.1619451669316, 70.2819899121844, 3.24999999985236, !- X,Y,Z
   Vertex 2 {m}
  13.161945166923, 70.2819899122047, -1.47642430239901e-10, !- X,Y,Z
    Vertex 3 {m}
  13.161945166923, 55.2819899122047, -4.03238477771582e-11; !- X,Y,Z
    Vertex 4 {m}

FenestrationSurface:Detailed,
  Room_24_159d21b7..Face3_Glz0,           !- Name
  Window,                                 !- Surface Type
  project_window,                         !- Construction Name
  Room_24_159d21b7..Face3,                !- Building Surface Name
  ,                                       !- Outside Boundary
   Condition Object
  ,                                       !- View Factor to Ground
  ,                                       !- Frame and Divider Name
```

```
  ,                                         !- Multiplier
  ,                                         !- Number of Vertices
  13.1619451669304, 68.4163649121866, 2.79999999986571, !- X,Y,Z
   Vertex 1 {m}
  13.1619451669304, 69.1476149121845, 2.79999999986047, !- X,Y,Z
   Vertex 2 {m}
  13.1619451669251, 69.1476149121702, 0.799999999860474, !- X,Y,Z
   Vertex 3 {m}
  13.1619451669251, 68.4163649121723, 0.799999999865705; !- X,Y,Z
   Vertex 4 {m}

FenestrationSurface:Detailed,
  Room_24_159d21b7..Face3_Glz1,             !- Name
  Window,                                   !- Surface Type
  project_window,                           !- Construction Name
  Room_24_159d21b7..Face3,                  !- Building Surface Name
  ,                                         !- Outside Boundary
   Condition Object
  ,                                         !- View Factor to Ground
  ,                                         !- Frame and Divider Name
  ,                                         !- Multiplier
  ,                                         !- Number of Vertices
  13.1619451669304, 65.4163649121953, 2.79999999988717, !- X,Y,Z
   Vertex 1 {m}
  13.1619451669304, 66.1476149121932, 2.79999999988194, !- X,Y,Z
   Vertex 2 {m}
  13.1619451669251, 66.1476149121789, 0.799999999881937, !- X,Y,Z
   Vertex 3 {m}
  13.1619451669251, 65.416364912181, 0.799999999887169; !- X,Y,Z
   Vertex 4 {m}

FenestrationSurface:Detailed,
  Room_24_159d21b7..Face3_Glz2,             !- Name
  Window,                                   !- Surface Type
  project_window,                           !- Construction Name
  Room_24_159d21b7..Face3,                  !- Building Surface Name
```

```
  ,                                       !- Outside Boundary
   Condition Object
  ,                                       !- View Factor to Ground
  ,                                       !- Frame and Divider Name
  ,                                       !- Multiplier
  ,                                       !- Number of Vertices
  13.1619451669304, 62.4163649122041, 2.79999999990863, !- X,Y,Z
   Vertex 1 {m}
  13.1619451669304, 63.1476149122019, 2.7999999999034, !- X,Y,Z
   Vertex 2 {m}
  13.1619451669251, 63.1476149121876, 0.799999999903401, !- X,Y,Z
   Vertex 3 {m}
  13.1619451669251, 62.4163649121897, 0.799999999908633; !- X,Y,Z
   Vertex 4 {m}

FenestrationSurface:Detailed,
  Room_24_159d21b7..Face3_Glz3,           !- Name
  Window,                                 !- Surface Type
  project_window,                         !- Construction Name
  Room_24_159d21b7..Face3,                !- Building Surface Name
  ,                                       !- Outside Boundary
   Condition Object
  ,                                       !- View Factor to Ground
  ,                                       !- Frame and Divider Name
  ,                                       !- Multiplier
  ,                                       !- Number of Vertices
  13.1619451669304, 59.4163649122128, 2.7999999999301, !- X,Y,Z
   Vertex 1 {m}
  13.1619451669304, 60.1476149122106, 2.79999999992486, !- X,Y,Z
   Vertex 2 {m}
  13.1619451669251, 60.1476149121963, 0.799999999924865, !- X,Y,Z
   Vertex 3 {m}
  13.1619451669251, 59.4163649121985, 0.799999999930097; !- X,Y,Z
   Vertex 4 {m}

FenestrationSurface:Detailed,
```

```
  Room_24_159d21b7..Face3_Glz4,           !- Name
  Window,                                 !- Surface Type
  project_window,                         !- Construction Name
  Room_24_159d21b7..Face3,                !- Building Surface Name
  ,                                       !- Outside Boundary
   Condition Object
  ,                                       !- View Factor to Ground
  ,                                       !- Frame and Divider Name
  ,                                       !- Multiplier
  ,                                       !- Number of Vertices
  13.1619451669304, 56.4163649122215, 2.79999999995156, !- X,Y,Z
   Vertex 1 {m}
  13.1619451669304, 57.1476149122194, 2.79999999994633, !- X,Y,Z
   Vertex 2 {m}
  13.1619451669251, 57.147614912205, 0.799999999946328, !- X,Y,Z
   Vertex 3 {m}
  13.1619451669251, 56.4163649122072, 0.79999999995156; !- X,Y,Z
   Vertex 4 {m}

BuildingSurface:Detailed,
  Room_24_159d21b7..Face4,                !- Name
  Floor,                                  !- Surface Type
  project_slab,                           !- Construction Name
  Room_24_159d21b7,                       !- Zone Name
  Ground,                                 !- Outside Boundary
   Condition
  ,                                       !- Outside Boundary
   Condition Object
  NoSun,                                  !- Sun Exposure
  NoWind,                                 !- Wind Exposure
  ,                                       !- View Factor to Ground
  ,                                       !- Number of Vertices
  13.161945166923, 70.2819899122047, -1.47642430239901e-10, !- X,Y,Z
    Vertex 1 {m}
  16.4952785002563, 65.2819899122047, -1.06597558445733e-10, !- X,Y,
   Z Vertex 2 {m}
```

```
  16.4952785002563, 60.2819899122047, -7.08246976248188e-11, !- X,Y,
   Z Vertex 3 {m}
  13.161945166923, 55.2819899122047, -4.03238477771582e-11; !- X,Y,Z
    Vertex 4 {m}

BuildingSurface:Detailed,
  Room_24_159d21b7..Face5,                !- Name
  Ceiling,                                !- Surface Type
  project_ceiling_int,                    !- Construction Name
  Room_24_159d21b7,                       !- Zone Name
  Surface,                                !- Outside Boundary
   Condition
  Room_23_e751e71f..Face4,                !- Outside Boundary
   Condition Object
  NoSun,                                  !- Sun Exposure
  NoWind,                                 !- Wind Exposure
  ,                                       !- View Factor to Ground
  ,                                       !- Number of Vertices
  13.1619451669316, 55.2819899121844, 3.24999999995968, !- X,Y,Z
   Vertex 1 {m}
  16.495278500265, 60.2819899121844, 3.24999999992918, !- X,Y,Z
   Vertex 2 {m}
  16.495278500265, 65.2819899121844, 3.2499999998934, !- X,Y,Z
   Vertex 3 {m}
  13.1619451669316, 70.2819899121844, 3.24999999985236; !- X,Y,Z
   Vertex 4 {m}

ZoneControl:Thermostat,
  Room_24_159d21b7 Thermostat,            !- Name
  Room_24_159d21b7,                       !- Zone or ZoneList Name
  Room_24_159d21b7 Thermostat Schedule,   !- Control Type Schedule
   Name
  ThermostatSetpoint:DualSetpoint,        !- Control 1 Object Type
  Thermostat Setpoint Dual Setpoint 9,    !- Control 1 Name
  ,                                       !- Control 2 Object Type
  ,                                       !- Control 2 Name
```

```
  ,                                       !- Control 3 Object Type
  ,                                       !- Control 3 Name
  ,                                       !- Control 4 Object Type
  ,                                       !- Control 4 Name
  0;                                      !- Temperature Difference
   Between Cutout And Setpoint {deltaC}

Schedule:Compact,
  Room_24_159d21b7 Thermostat Schedule,   !- Name
  Room_24_159d21b7 Thermostat Schedule Type Limits, !- Schedule Type
    Limits Name
  Through: 12/31,                         !- Field 1
  For: AllDays,                           !- Field 2
  Until: 24:00,                           !- Field 3
  4;                                      !- Field 4

ScheduleTypeLimits,
  Room_24_159d21b7 Thermostat Schedule Type Limits, !- Name
  0,                                      !- Lower Limit Value {
   BasedOnField A3}
  4,                                      !- Upper Limit Value {
   BasedOnField A3}
  DISCRETE;                               !- Numeric Type

ThermostatSetpoint:DualSetpoint,
  Thermostat Setpoint Dual Setpoint 9,    !- Name
  project_heat,                           !- Heating Setpoint
   Temperature Schedule Name
  Clg-SetP-Sch;                       !- Cooling Setpoint
   Temperature Schedule Name

ZoneHVAC:EquipmentConnections,
  Room_24_159d21b7,                       !- Zone Name
  Room_24_159d21b7 Equipment List,        !- Zone Conditioning
   Equipment List Name
```

```
  Room_24_159d21b7 Inlet Node List,       !- Zone Air Inlet Node or
   NodeList Name
  Room_24_159d21b7 Exhaust Node List,     !- Zone Air Exhaust Node
   or NodeList Name
  Room_24_159d21b7 Zone Air Node,         !- Zone Air Node Name
  Room_24_159d21b7 Return Node List;      !- Zone Return Air Node or
    NodeList Name

NodeList,
  Room_24_159d21b7 Inlet Node List,       !- Name
  Room_24_159d21b7 Air Terminal Outlet Air Node, !- Node Name 1
  Room_24_159d21b7 VRF Terminal Unit Outlet Air Node; !- Node Name 2

NodeList,
  Room_24_159d21b7 Exhaust Node List,     !- Name
  Room_24_159d21b7 VRF Terminal Unit Inlet Air Node; !- Node Name 1

NodeList,
  Room_24_159d21b7 Return Node List,      !- Name
  Room_24_159d21b7 Return Air Node;       !- Node Name 1

AirTerminal:SingleDuct:ConstantVolume:NoReheat,
  Room_24_159d21b7 Air Terminal,          !- Name
  Always On Discrete,                     !- Availability Schedule
   Name
  Room_24_159d21b7 Air Terminal Inlet Air Node, !- Air Inlet Node
   Name
  Room_24_159d21b7 Air Terminal Outlet Air Node, !- Air Outlet Node
   Name
  AutoSize;                               !- Maximum Air Flow Rate {
   m3/s}

ZoneHVAC:AirDistributionUnit,
  ADU Room_24_159d21b7 Air Terminal,      !- Name
  Room_24_159d21b7 Air Terminal Outlet Air Node, !- Air Distribution
    Unit Outlet Node Name
```

```
  AirTerminal:SingleDuct:ConstantVolume:NoReheat, !- Air Terminal
   Object Type
  Room_24_159d21b7 Air Terminal;          !- Air Terminal Name

ZoneHVAC:TerminalUnit:VariableRefrigerantFlow,
  Room_24_159d21b7 VRF Terminal Unit,     !- Zone Terminal Unit Name
  Always On Discrete,                     !- Terminal Unit
   Availability Schedule
  Room_24_159d21b7 VRF Terminal Unit Inlet Air Node, !- Terminal
   Unit Air Inlet Node Name
  Room_24_159d21b7 VRF Terminal Unit Outlet Air Node, !- Terminal
   Unit Air Outlet Node Name
  Autosize,                               !- Cooling Supply Air Flow
    Rate {m3/s}
  Autosize,                               !- No Cooling Supply Air
   Flow Rate {m3/s}
  Autosize,                               !- Heating Supply Air Flow
    Rate {m3/s}
  Autosize,                               !- No Heating Supply Air
   Flow Rate {m3/s}
  Autosize,                               !- Cooling Outdoor Air
   Flow Rate {m3/s}
  Autosize,                               !- Heating Outdoor Air
   Flow Rate {m3/s}
  Autosize,                               !- No Load Outdoor Air
   Flow Rate {m3/s}
  Always Off Discrete,                    !- Supply Air Fan
   Operating Mode Schedule Name
  DrawThrough,                            !- Supply Air Fan
   Placement
  Fan:OnOff,                              !- Supply Air Fan Object
   Type
  Room_24_159d21b7 VRF Unit Cycling Fan,  !- Supply Air Fan Object
   Name
  OutdoorAir:Mixer,                       !- Outside Air Mixer
   Object Type
```

```
  Room_24_159d21b7 VRF Terminal Unit OA Mixer, !- Outside Air Mixer
   Object Name
  Coil:Cooling:DX:VariableRefrigerantFlow, !- Cooling Coil Object
   Type
  Zone HVAC Terminal Unit Variable Refrigerant Flow 1 Cooling Coil
   8, !- Cooling Coil Object Name
  Coil:Heating:DX:VariableRefrigerantFlow, !- Heating Coil Object
   Type
  Zone HVAC Terminal Unit Variable Refrigerant Flow 1 Heating Coil
   8, !- Heating Coil Object Name
  30,                                     !- Zone Terminal Unit On
   Parasitic Electric Energy Use {W}
  20,                                     !- Zone Terminal Unit Off
   Parasitic Electric Energy Use {W}
  1,                                      !- Rated Heating Capacity
   Sizing Ratio {W/W}
  ,                                       !- Availability Manager
   List Name
  ,                                       !- Design Specification
   ZoneHVAC Sizing Object Name
  ,                                       !- Supplemental Heating
   Coil Object Type
  ,                                       !- Supplemental Heating
   Coil Name
  Autosize,                               !- Maximum Supply Air
   Temperature from Supplemental Heater {C}
  21;                                     !- Maximum Outdoor Dry-
   Bulb Temperature for Supplemental Heater Operation {C}

OutdoorAir:Mixer,
  Room_24_159d21b7 VRF Terminal Unit OA Mixer, !- Name
  Room_24_159d21b7 VRF Terminal Unit Mixer Outlet Node, !- Mixed Air
    Node Name
  Room_24_159d21b7 VRF Terminal Unit Outdoor Air Node, !- Outdoor
   Air Stream Node Name
```

```
  Room_24_159d21b7 VRF Terminal Unit Relief Node Name, !- Relief Air
    Stream Node Name
  Room_24_159d21b7 VRF Terminal Unit Inlet Air Node; !- Return Air
   Stream Node Name

OutdoorAir:NodeList,
  Room_24_159d21b7 VRF Terminal Unit Outdoor Air Node; !- Node or
   NodeList Name 1

Coil:Cooling:DX:VariableRefrigerantFlow,
  Zone HVAC Terminal Unit Variable Refrigerant Flow 1 Cooling Coil
   8, !- Name
  Always On Discrete,                     !- Availability Schedule
   Name
  Autosize,                               !- Gross Rated Total
   Cooling Capacity {W}
  Autosize,                               !- Gross Rated Sensible
   Heat Ratio
  Autosize,                               !- Rated Air Flow Rate {m3
   /s}
  VRFTUCoolCapFT 8,                       !- Cooling Capacity Ratio
   Modifier Function of Temperature Curve Name
  VRFACCoolCapFFF 8,                      !- Cooling Capacity
   Modifier Curve Function of Flow Fraction Name
  Room_24_159d21b7 VRF Terminal Unit Mixer Outlet Node, !- Coil Air
   Inlet Node
  Room_24_159d21b7 VRF Terminal Unit Cooling Coil Outlet Node; !-
   Coil Air Outlet Node

Curve:Biquadratic,
  VRFTUCoolCapFT 8,                       !- Name
  0.0585884077803259,                     !- Coefficient1 Constant
  0.0587396532718384,                     !- Coefficient2 x
  -0.000210274979759697,                  !- Coefficient3 x**2
  0.0109370473889647,                     !- Coefficient4 y
  -0.0001219549,                          !- Coefficient5 y**2
```

```
  -0.0005246615,                          !- Coefficient6 x*y
  15,                                     !- Minimum Value of x {
   BasedOnField A2}
  23.89,                                  !- Maximum Value of x {
   BasedOnField A2}
  20,                                     !- Minimum Value of y {
   BasedOnField A3}
  43.33,                                  !- Maximum Value of y {
   BasedOnField A3}
  0.8083,                                 !- Minimum Curve Output {
   BasedOnField A4}
  1.2583;                                 !- Maximum Curve Output {
   BasedOnField A4}

Curve:Quadratic,
  VRFACCoolCapFFF 8,                      !- Name
  0.8,                                    !- Coefficient1 Constant
  0.2,                                    !- Coefficient2 x
  0,                                      !- Coefficient3 x**2
  0.5,                                    !- Minimum Value of x {
   BasedOnField A2}
  1.5;                                    !- Maximum Value of x {
   BasedOnField A2}

Coil:Heating:DX:VariableRefrigerantFlow,
  Zone HVAC Terminal Unit Variable Refrigerant Flow 1 Heating Coil
   8, !- Name
  Always On Discrete,                     !- Availability Schedule
  Autosize,                               !- Gross Rated Heating
   Capacity {W}
  Autosize,                               !- Rated Air Flow Rate {m3
   /s}
  Room_24_159d21b7 VRF Terminal Unit Cooling Coil Outlet Node, !-
   Coil Air Inlet Node
  Room_24_159d21b7 VRF Terminal Unit Heating Coil Outlet Node, !-
   Coil Air Outlet Node
```

```
  Coil Heating DX Variable Refrigerant Flow 1 VRFTUHeatCAPFT 8, !-
   Heating Capacity Ratio Modifier Function of Temperature Curve
   Name
  Coil Heating DX Variable Refrigerant Flow 1 VRFACCoolCapFFF 8; !-
   Heating Capacity Modifier Function of Flow Fraction Curve Name

Curve:Biquadratic,
  Coil Heating DX Variable Refrigerant Flow 1 VRFTUHeatCAPFT 8, !-
   Name
  0.375443994956127,                      !- Coefficient1 Constant
  0.0668190645147821,                     !- Coefficient2 x
  -0.00194171026482001,                   !- Coefficient3 x**2
  0.0442618420640187,                     !- Coefficient4 y
  -0.0004009578,                          !- Coefficient5 y**2
  -0.0014819801,                          !- Coefficient6 x*y
  21.11,                                  !- Minimum Value of x {
   BasedOnField A2}
  27.22,                                  !- Maximum Value of x {
   BasedOnField A2}
  -15,                                    !- Minimum Value of y {
   BasedOnField A3}
  18.33,                                  !- Maximum Value of y {
   BasedOnField A3}
  0.6074,                                 !- Minimum Curve Output {
   BasedOnField A4}
  1;                                      !- Maximum Curve Output {
   BasedOnField A4}

Curve:Quadratic,
  Coil Heating DX Variable Refrigerant Flow 1 VRFACCoolCapFFF 8, !-
   Name
  0.8,                                    !- Coefficient1 Constant
  0.2,                                    !- Coefficient2 x
  0,                                      !- Coefficient3 x**2
  0.5,                                    !- Minimum Value of x {
   BasedOnField A2}
```

```
  1.5;                                    !- Maximum Value of x {
   BasedOnField A2}

Fan:OnOff,
  Room_24_159d21b7 VRF Unit Cycling Fan,  !- Name
  Always On Discrete,                     !- Availability Schedule
   Name
  0.6,                                    !- Fan Total Efficiency
  300,                                    !- Pressure Rise {Pa}
  Autosize,                               !- Maximum Flow Rate {m3/s
   }
  0.8,                                    !- Motor Efficiency
  1,                                      !- Motor In Airstream
   Fraction
  Room_24_159d21b7 VRF Terminal Unit Heating Coil Outlet Node, !-
   Air Inlet Node Name
  Room_24_159d21b7 VRF Terminal Unit Outlet Air Node, !- Air Outlet
   Node Name
  Fan On Off Power Curve 8,               !- Fan Power Ratio
   Function of Speed Ratio Curve Name
  Fan On Off Efficiency Curve 8,          !- Fan Efficiency Ratio
   Function of Speed Ratio Curve Name
  General;                                !- End-Use Subcategory

Curve:Exponent,
  Fan On Off Power Curve 8,               !- Name
  1,                                      !- Coefficient1 Constant
  0,                                      !- Coefficient2 Constant
  0,                                      !- Coefficient3 Constant
  0,                                      !- Minimum Value of x {
   BasedOnField A2}
  1;                                      !- Maximum Value of x {
   BasedOnField A2}

Curve:Cubic,
  Fan On Off Efficiency Curve 8,          !- Name
```

```
  1,                                        !- Coefficient1 Constant
  0,                                        !- Coefficient2 x
  0,                                        !- Coefficient3 x**2
  0,                                        !- Coefficient4 x**3
  0,                                        !- Minimum Value of x {
   BasedOnField A2}
  1;                                        !- Maximum Value of x {
   BasedOnField A2}

ZoneHVAC:EquipmentList,
  Room_24_159d21b7 Equipment List,          !- Name
  SequentialLoad,                           !- Load Distribution
   Scheme
  ZoneHVAC:AirDistributionUnit,             !- Zone Equipment Object
   Type 1
  ADU Room_24_159d21b7 Air Terminal,        !- Zone Equipment Name 1
  1,                                        !- Zone Equipment Cooling
   Sequence 1
  1,                                        !- Zone Equipment Heating
   or No-Load Sequence 1
  Schedule Constant 17,                     !- Zone Equipment
   Sequential Cooling Fraction Schedule Name 1
  Schedule Constant 18,                     !- Zone Equipment
   Sequential Heating Fraction Schedule Name 1
  ZoneHVAC:TerminalUnit:VariableRefrigerantFlow, !- Zone Equipment
   Object Type 2
  Room_24_159d21b7 VRF Terminal Unit,       !- Zone Equipment Name 2
  2,                                        !- Zone Equipment Cooling
   Sequence 2
  2,                                        !- Zone Equipment Heating
   or No-Load Sequence 2
  ,                                         !- Zone Equipment
   Sequential Cooling Fraction Schedule Name 2
  ;                                         !- Zone Equipment
   Sequential Heating Fraction Schedule Name 2
```

```
Sizing:Zone,
  Room_24_159d21b7,                       !- Zone or ZoneList Name
  SupplyAirTemperature,                   !- Zone Cooling Design
   Supply Air Temperature Input Method
  12.7777777777778,                       !- Zone Cooling Design
   Supply Air Temperature {C}
  11.11,                                  !- Zone Cooling Design
   Supply Air Temperature Difference {deltaC}
  SupplyAirTemperature,                   !- Zone Heating Design
   Supply Air Temperature Input Method
  40.0000000000001,                       !- Zone Heating Design
   Supply Air Temperature {C}
  11.11,                                  !- Zone Heating Design
   Supply Air Temperature Difference {deltaC}
  0.0085,                                 !- Zone Cooling Design
   Supply Air Humidity Ratio {kgWater/kgDryAir}
  0.008,                                  !- Zone Heating Design
   Supply Air Humidity Ratio {kgWater/kgDryAir}
  ventilation,                            !- Design Specification
   Outdoor Air Object Name
  ,                                       !- Zone Heating Sizing
   Factor
  ,                                       !- Zone Cooling Sizing
   Factor
  DesignDay,                              !- Cooling Design Air Flow
    Method
  0,                                      !- Cooling Design Air Flow
    Rate {m3/s}
  0.000762,                               !- Cooling Minimum Air
   Flow per Zone Floor Area {m3/s-m2}
  0,                                      !- Cooling Minimum Air
   Flow {m3/s}
  0,                                      !- Cooling Minimum Air
   Flow Fraction
  DesignDay,                              !- Heating Design Air Flow
    Method
```

```
  0,                                      !- Heating Design Air Flow
    Rate {m3/s}
  0.002032,                               !- Heating Maximum Air
   Flow per Zone Floor Area {m3/s-m2}
  0.1415762,                              !- Heating Maximum Air
   Flow {m3/s}
  0.3,                                    !- Heating Maximum Air
   Flow Fraction
  ,                                       !- Design Specification
   Zone Air Distribution Object Name
  Yes,                                    !- Account for Dedicated
   Outdoor Air System
  NeutralSupplyAir,                       !- Dedicated Outdoor Air
   System Control Strategy
  15.5555555555556,                       !- Dedicated Outdoor Air
   Low Setpoint Temperature for Design {C}
  21.1111111111111;                       !- Dedicated Outdoor Air
   High Setpoint Temperature for Design {C}

Zone,
  Room_25_d27e0933,                       !- Name
  0,                                      !- Direction of Relative
   North {deg}
  0,                                      !- X Origin {m}
  0,                                      !- Y Origin {m}
  0,                                      !- Z Origin {m}
  ,                                       !- Type
  1,                                      !- Multiplier
  ,                                       !- Ceiling Height {m}
  ,                                       !- Volume {m3}
  ,                                       !- Floor Area {m2}
  ,                                       !- Zone Inside Convection
   Algorithm
  ,                                       !- Zone Outside Convection
    Algorithm
```

```
  Yes;                                    !- Part of Total Floor
   Area

BuildingSurface:Detailed,
  Room_25_d27e0933..Face0,                !- Name
  Wall,                                   !- Surface Type
  project_wall,                           !- Construction Name
  Room_25_d27e0933,                       !- Zone Name
  Outdoors,                               !- Outside Boundary
   Condition
  ,                                       !- Outside Boundary
   Condition Object
  SunExposed,                             !- Sun Exposure
  WindExposed,                            !- Wind Exposure
  ,                                       !- View Factor to Ground
  ,                                       !- Number of Vertices
  23.1619451669489, 55.2819899121439, 9.7499999999755, !- X,Y,Z
   Vertex 1 {m}
  23.1619451669403, 55.2819899121641, 6.49999999997549, !- X,Y,Z
   Vertex 2 {m}
  23.1619451669403, 70.2819899121641, 6.49999999986818, !- X,Y,Z
   Vertex 3 {m}
  23.1619451669489, 70.2819899121439, 9.74999999986818; !- X,Y,Z
   Vertex 4 {m}

FenestrationSurface:Detailed,
  Room_25_d27e0933..Face0_Glz0,           !- Name
  Window,                                 !- Surface Type
  project_window,                         !- Construction Name
  Room_25_d27e0933..Face0,                !- Building Surface Name
  ,                                       !- Outside Boundary
   Condition Object
  ,                                       !- View Factor to Ground
  ,                                       !- Frame and Divider Name
  ,                                       !- Multiplier
  ,                                       !- Number of Vertices
```

```
  23.1619451669477, 56.4163649121809, 9.29999999996738, !- X,Y,Z
   Vertex 1 {m}
  23.1619451669424, 56.4163649121666, 7.29999999996738, !- X,Y,Z
   Vertex 2 {m}
  23.1619451669424, 57.1476149121645, 7.29999999996215, !- X,Y,Z
   Vertex 3 {m}
  23.1619451669477, 57.1476149121788, 9.29999999996215; !- X,Y,Z
   Vertex 4 {m}

FenestrationSurface:Detailed,
  Room_25_d27e0933..Face0_Glz1,           !- Name
  Window,                                 !- Surface Type
  project_window,                         !- Construction Name
  Room_25_d27e0933..Face0,                !- Building Surface Name
  ,                                       !- Outside Boundary
   Condition Object
  ,                                       !- View Factor to Ground
  ,                                       !- Frame and Divider Name
  ,                                       !- Multiplier
  ,                                       !- Number of Vertices
  23.1619451669477, 59.4163649121722, 9.29999999994591, !- X,Y,Z
   Vertex 1 {m}
  23.1619451669424, 59.4163649121579, 7.29999999994591, !- X,Y,Z
   Vertex 2 {m}
  23.1619451669424, 60.1476149121558, 7.29999999994068, !- X,Y,Z
   Vertex 3 {m}
  23.1619451669477, 60.1476149121701, 9.29999999994068; !- X,Y,Z
   Vertex 4 {m}

FenestrationSurface:Detailed,
  Room_25_d27e0933..Face0_Glz2,           !- Name
  Window,                                 !- Surface Type
  project_window,                         !- Construction Name
  Room_25_d27e0933..Face0,                !- Building Surface Name
  ,                                       !- Outside Boundary
   Condition Object
```

```
  ,                                       !- View Factor to Ground
  ,                                       !- Frame and Divider Name
  ,                                       !- Multiplier
  ,                                       !- Number of Vertices
  23.1619451669477, 62.4163649121635, 9.29999999992445, !- X,Y,Z
   Vertex 1 {m}
  23.1619451669424, 62.4163649121492, 7.29999999992445, !- X,Y,Z
   Vertex 2 {m}
  23.1619451669424, 63.1476149121471, 7.29999999991922, !- X,Y,Z
   Vertex 3 {m}
  23.1619451669477, 63.1476149121614, 9.29999999991922; !- X,Y,Z
   Vertex 4 {m}

FenestrationSurface:Detailed,
  Room_25_d27e0933..Face0_Glz3,           !- Name
  Window,                                 !- Surface Type
  project_window,                         !- Construction Name
  Room_25_d27e0933..Face0,                !- Building Surface Name
  ,                                       !- Outside Boundary
   Condition Object
  ,                                       !- View Factor to Ground
  ,                                       !- Frame and Divider Name
  ,                                       !- Multiplier
  ,                                       !- Number of Vertices
  23.1619451669477, 65.4163649121548, 9.29999999990299, !- X,Y,Z
   Vertex 1 {m}
  23.1619451669424, 65.4163649121405, 7.29999999990299, !- X,Y,Z
   Vertex 2 {m}
  23.1619451669424, 66.1476149121384, 7.29999999989776, !- X,Y,Z
   Vertex 3 {m}
  23.1619451669477, 66.1476149121527, 9.29999999989776; !- X,Y,Z
   Vertex 4 {m}

FenestrationSurface:Detailed,
  Room_25_d27e0933..Face0_Glz4,           !- Name
  Window,                                 !- Surface Type
```

```
  project_window,                          !- Construction Name
  Room_25_d27e0933..Face0,                 !- Building Surface Name
  ,                                        !- Outside Boundary
   Condition Object
  ,                                        !- View Factor to Ground
  ,                                        !- Frame and Divider Name
  ,                                        !- Multiplier
  ,                                        !- Number of Vertices
  23.1619451669477, 68.4163649121461, 9.29999999988152, !- X,Y,Z
   Vertex 1 {m}
  23.1619451669424, 68.4163649121318, 7.29999999988152, !- X,Y,Z
   Vertex 2 {m}
  23.1619451669424, 69.1476149121296, 7.29999999987629, !- X,Y,Z
   Vertex 3 {m}
  23.1619451669477, 69.147614912144, 9.29999999987629; !- X,Y,Z
   Vertex 4 {m}

BuildingSurface:Detailed,
  Room_25_d27e0933..Face1,                 !- Name
  Wall,                                    !- Surface Type
  project_wall_int,                        !- Construction Name
  Room_25_d27e0933,                        !- Zone Name
  Surface,                                 !- Outside Boundary
   Condition
  Room_28_d6ed2799..Face2,                 !- Outside Boundary
   Condition Object
  NoSun,                                   !- Sun Exposure
  NoWind,                                  !- Wind Exposure
  ,                                        !- View Factor to Ground
  ,                                        !- Number of Vertices
  19.8286118336156, 65.2819899121439, 9.74999999989868, !- X,Y,Z
   Vertex 1 {m}
  23.1619451669489, 70.2819899121439, 9.74999999986818, !- X,Y,Z
   Vertex 2 {m}
  23.1619451669403, 70.2819899121641, 6.49999999986818, !- X,Y,Z
   Vertex 3 {m}
```

```
  19.8286118336069, 65.2819899121641, 6.49999999989867; !- X,Y,Z
   Vertex 4 {m}

BuildingSurface:Detailed,
  Room_25_d27e0933..Face2,                !- Name
  Wall,                                   !- Surface Type
  project_wall_int,                       !- Construction Name
  Room_25_d27e0933,                       !- Zone Name
  Surface,                                !- Outside Boundary
   Condition
  Room_19_6ae0f9a9..Face1,                !- Outside Boundary
   Condition Object
  NoSun,                                  !- Sun Exposure
  NoWind,                                 !- Wind Exposure
  ,                                       !- View Factor to Ground
  ,                                       !- Number of Vertices
  19.8286118336156, 60.2819899121439, 9.74999999993446, !- X,Y,Z
   Vertex 1 {m}
  19.8286118336156, 65.2819899121439, 9.74999999989868, !- X,Y,Z
   Vertex 2 {m}
  19.8286118336069, 65.2819899121641, 6.49999999989867, !- X,Y,Z
   Vertex 3 {m}
  19.8286118336069, 60.2819899121641, 6.49999999993444; !- X,Y,Z
   Vertex 4 {m}

BuildingSurface:Detailed,
  Room_25_d27e0933..Face3,                !- Name
  Wall,                                   !- Surface Type
  project_wall_int,                       !- Construction Name
  Room_25_d27e0933,                       !- Zone Name
  Surface,                                !- Outside Boundary
   Condition
  Room_18_6cc35095..Face1,                !- Outside Boundary
   Condition Object
  NoSun,                                  !- Sun Exposure
  NoWind,                                 !- Wind Exposure
```

```
  ,                                         !- View Factor to Ground
  ,                                         !- Number of Vertices
  23.1619451669489, 55.2819899121439, 9.7499999999755, !- X,Y,Z
   Vertex 1 {m}
  19.8286118336156, 60.2819899121439, 9.74999999993446, !- X,Y,Z
   Vertex 2 {m}
  19.8286118336069, 60.2819899121641, 6.49999999993444, !- X,Y,Z
   Vertex 3 {m}
  23.1619451669403, 55.2819899121641, 6.49999999997549; !- X,Y,Z
   Vertex 4 {m}

BuildingSurface:Detailed,
  Room_25_d27e0933..Face4,                  !- Name
  Floor,                                    !- Surface Type
  project_floor,                            !- Construction Name
  Room_25_d27e0933,                         !- Zone Name
  Surface,                                  !- Outside Boundary
   Condition
  Room_26_f4ea3797..Face5,                  !- Outside Boundary
   Condition Object
  NoSun,                                    !- Sun Exposure
  NoWind,                                   !- Wind Exposure
  ,                                         !- View Factor to Ground
  ,                                         !- Number of Vertices
  23.1619451669403, 70.2819899121641, 6.49999999986818, !- X,Y,Z
   Vertex 1 {m}
  23.1619451669403, 55.2819899121641, 6.49999999997549, !- X,Y,Z
   Vertex 2 {m}
  19.8286118336069, 60.2819899121641, 6.49999999993444, !- X,Y,Z
   Vertex 3 {m}
  19.8286118336069, 65.2819899121641, 6.49999999989867; !- X,Y,Z
   Vertex 4 {m}

BuildingSurface:Detailed,
  Room_25_d27e0933..Face5,                  !- Name
  Roof,                                     !- Surface Type
```

```
  project_roof,                           !- Construction Name
  Room_25_d27e0933,                       !- Zone Name
  Outdoors,                               !- Outside Boundary
   Condition
  ,                                       !- Outside Boundary
   Condition Object
  SunExposed,                             !- Sun Exposure
  WindExposed,                            !- Wind Exposure
  ,                                       !- View Factor to Ground
  ,                                       !- Number of Vertices
  23.1619451669489, 55.2819899121439, 9.7499999999755, !- X,Y,Z
   Vertex 1 {m}
  23.1619451669489, 70.2819899121439, 9.74999999986818, !- X,Y,Z
   Vertex 2 {m}
  19.8286118336156, 65.2819899121439, 9.74999999989868, !- X,Y,Z
   Vertex 3 {m}
  19.8286118336156, 60.2819899121439, 9.74999999993446; !- X,Y,Z
   Vertex 4 {m}

ZoneControl:Thermostat,
  Room_25_d27e0933 Thermostat,            !- Name
  Room_25_d27e0933,                       !- Zone or ZoneList Name
  Room_25_d27e0933 Thermostat Schedule,   !- Control Type Schedule
   Name
  ThermostatSetpoint:DualSetpoint,        !- Control 1 Object Type
  Thermostat Setpoint Dual Setpoint 10,   !- Control 1 Name
  ,                                       !- Control 2 Object Type
  ,                                       !- Control 2 Name
  ,                                       !- Control 3 Object Type
  ,                                       !- Control 3 Name
  ,                                       !- Control 4 Object Type
  ,                                       !- Control 4 Name
  0;                                      !- Temperature Difference
   Between Cutout And Setpoint {deltaC}

Schedule:Compact,
```

```
  Room_25_d27e0933 Thermostat Schedule,   !- Name
  Room_25_d27e0933 Thermostat Schedule Type Limits, !- Schedule Type
    Limits Name
  Through: 12/31,                         !- Field 1
  For: AllDays,                           !- Field 2
  Until: 24:00,                           !- Field 3
  4;                                      !- Field 4

ScheduleTypeLimits,
  Room_25_d27e0933 Thermostat Schedule Type Limits, !- Name
  0,                                      !- Lower Limit Value {
   BasedOnField A3}
  4,                                      !- Upper Limit Value {
   BasedOnField A3}
  DISCRETE;                               !- Numeric Type

ThermostatSetpoint:DualSetpoint,
  Thermostat Setpoint Dual Setpoint 10,   !- Name
  project_heat,                           !- Heating Setpoint
   Temperature Schedule Name
  Clg-SetP-Sch;                        !- Cooling Setpoint
   Temperature Schedule Name

ZoneHVAC:EquipmentConnections,
  Room_25_d27e0933,                       !- Zone Name
  Room_25_d27e0933 Equipment List,        !- Zone Conditioning
   Equipment List Name
  Room_25_d27e0933 Inlet Node List,       !- Zone Air Inlet Node or
   NodeList Name
  Room_25_d27e0933 Exhaust Node List,     !- Zone Air Exhaust Node
   or NodeList Name
  Room_25_d27e0933 Zone Air Node,         !- Zone Air Node Name
  Room_25_d27e0933 Return Node List;      !- Zone Return Air Node or
    NodeList Name

NodeList,
```

```
  Room_25_d27e0933 Inlet Node List,       !- Name
  Room_25_d27e0933 Air Terminal Outlet Air Node, !- Node Name 1
  Room_25_d27e0933 VRF Terminal Unit Outlet Air Node; !- Node Name 2

NodeList,
  Room_25_d27e0933 Exhaust Node List,     !- Name
  Room_25_d27e0933 VRF Terminal Unit Inlet Air Node; !- Node Name 1

NodeList,
  Room_25_d27e0933 Return Node List,      !- Name
  Room_25_d27e0933 Return Air Node;       !- Node Name 1

AirTerminal:SingleDuct:ConstantVolume:NoReheat,
  Room_25_d27e0933 Air Terminal,          !- Name
  Always On Discrete,                     !- Availability Schedule
   Name
  Room_25_d27e0933 Air Terminal Inlet Air Node, !- Air Inlet Node
   Name
  Room_25_d27e0933 Air Terminal Outlet Air Node, !- Air Outlet Node
   Name
  AutoSize;                               !- Maximum Air Flow Rate {
   m3/s}

ZoneHVAC:AirDistributionUnit,
  ADU Room_25_d27e0933 Air Terminal,      !- Name
  Room_25_d27e0933 Air Terminal Outlet Air Node, !- Air Distribution
    Unit Outlet Node Name
  AirTerminal:SingleDuct:ConstantVolume:NoReheat, !- Air Terminal
   Object Type
  Room_25_d27e0933 Air Terminal;          !- Air Terminal Name

ZoneHVAC:TerminalUnit:VariableRefrigerantFlow,
  Room_25_d27e0933 VRF Terminal Unit,     !- Zone Terminal Unit Name
  Always On Discrete,                     !- Terminal Unit
   Availability Schedule
```

```
Room_25_d27e0933 VRF Terminal Unit Inlet Air Node, !- Terminal
 Unit Air Inlet Node Name
Room_25_d27e0933 VRF Terminal Unit Outlet Air Node, !- Terminal
 Unit Air Outlet Node Name
Autosize,                               !- Cooling Supply Air Flow
  Rate {m3/s}
Autosize,                               !- No Cooling Supply Air
 Flow Rate {m3/s}
Autosize,                               !- Heating Supply Air Flow
  Rate {m3/s}
Autosize,                               !- No Heating Supply Air
 Flow Rate {m3/s}
Autosize,                               !- Cooling Outdoor Air
 Flow Rate {m3/s}
Autosize,                               !- Heating Outdoor Air
 Flow Rate {m3/s}
Autosize,                               !- No Load Outdoor Air
 Flow Rate {m3/s}
Always Off Discrete,                    !- Supply Air Fan
 Operating Mode Schedule Name
DrawThrough,                            !- Supply Air Fan
 Placement
Fan:OnOff,                              !- Supply Air Fan Object
 Type
Room_25_d27e0933 VRF Unit Cycling Fan,  !- Supply Air Fan Object
 Name
OutdoorAir:Mixer,                       !- Outside Air Mixer
 Object Type
Room_25_d27e0933 VRF Terminal Unit OA Mixer, !- Outside Air Mixer
 Object Name
Coil:Cooling:DX:VariableRefrigerantFlow, !- Cooling Coil Object
 Type
Zone HVAC Terminal Unit Variable Refrigerant Flow 1 Cooling Coil
 9, !- Cooling Coil Object Name
Coil:Heating:DX:VariableRefrigerantFlow, !- Heating Coil Object
 Type
```

```
  Zone HVAC Terminal Unit Variable Refrigerant Flow 1 Heating Coil
   9, !- Heating Coil Object Name
  30,                                     !- Zone Terminal Unit On
   Parasitic Electric Energy Use {W}
  20,                                     !- Zone Terminal Unit Off
   Parasitic Electric Energy Use {W}
  1,                                      !- Rated Heating Capacity
   Sizing Ratio {W/W}
  ,                                       !- Availability Manager
   List Name
  ,                                       !- Design Specification
   ZoneHVAC Sizing Object Name
  ,                                       !- Supplemental Heating
   Coil Object Type
  ,                                       !- Supplemental Heating
   Coil Name
  Autosize,                               !- Maximum Supply Air
   Temperature from Supplemental Heater {C}
  21;                                     !- Maximum Outdoor Dry-
   Bulb Temperature for Supplemental Heater Operation {C}

OutdoorAir:Mixer,
  Room_25_d27e0933 VRF Terminal Unit OA Mixer, !- Name
  Room_25_d27e0933 VRF Terminal Unit Mixer Outlet Node, !- Mixed Air
    Node Name
  Room_25_d27e0933 VRF Terminal Unit Outdoor Air Node, !- Outdoor
   Air Stream Node Name
  Room_25_d27e0933 VRF Terminal Unit Relief Node Name, !- Relief Air
    Stream Node Name
  Room_25_d27e0933 VRF Terminal Unit Inlet Air Node; !- Return Air
   Stream Node Name

OutdoorAir:NodeList,
  Room_25_d27e0933 VRF Terminal Unit Outdoor Air Node; !- Node or
   NodeList Name 1
```

```
Coil:Cooling:DX:VariableRefrigerantFlow,
  Zone HVAC Terminal Unit Variable Refrigerant Flow 1 Cooling Coil
   9, !- Name
  Always On Discrete,                     !- Availability Schedule
   Name
  Autosize,                               !- Gross Rated Total
   Cooling Capacity {W}
  Autosize,                               !- Gross Rated Sensible
   Heat Ratio
  Autosize,                               !- Rated Air Flow Rate {m3
   /s}
  VRFTUCoolCapFT 9,                       !- Cooling Capacity Ratio
   Modifier Function of Temperature Curve Name
  VRFACCoolCapFFF 9,                      !- Cooling Capacity
   Modifier Curve Function of Flow Fraction Name
  Room_25_d27e0933 VRF Terminal Unit Mixer Outlet Node, !- Coil Air
   Inlet Node
  Room_25_d27e0933 VRF Terminal Unit Cooling Coil Outlet Node; !-
   Coil Air Outlet Node

Curve:Biquadratic,
  VRFTUCoolCapFT 9,                       !- Name
  0.0585884077803259,                     !- Coefficient1 Constant
  0.0587396532718384,                     !- Coefficient2 x
  -0.000210274979759697,                  !- Coefficient3 x**2
  0.0109370473889647,                     !- Coefficient4 y
  -0.0001219549,                          !- Coefficient5 y**2
  -0.0005246615,                          !- Coefficient6 x*y
  15,                                     !- Minimum Value of x {
   BasedOnField A2}
  23.89,                                  !- Maximum Value of x {
   BasedOnField A2}
  20,                                     !- Minimum Value of y {
   BasedOnField A3}
  43.33,                                  !- Maximum Value of y {
   BasedOnField A3}
```

```
  0.8083,                                 !- Minimum Curve Output {
   BasedOnField A4}
  1.2583;                                 !- Maximum Curve Output {
   BasedOnField A4}

Curve:Quadratic,
  VRFACCoolCapFFF 9,                      !- Name
  0.8,                                    !- Coefficient1 Constant
  0.2,                                    !- Coefficient2 x
  0,                                      !- Coefficient3 x**2
  0.5,                                    !- Minimum Value of x {
   BasedOnField A2}
  1.5;                                    !- Maximum Value of x {
   BasedOnField A2}

Coil:Heating:DX:VariableRefrigerantFlow,
  Zone HVAC Terminal Unit Variable Refrigerant Flow 1 Heating Coil
   9, !- Name
  Always On Discrete,                     !- Availability Schedule
  Autosize,                               !- Gross Rated Heating
   Capacity {W}
  Autosize,                               !- Rated Air Flow Rate {m3
   /s}
  Room_25_d27e0933 VRF Terminal Unit Cooling Coil Outlet Node, !-
   Coil Air Inlet Node
  Room_25_d27e0933 VRF Terminal Unit Heating Coil Outlet Node, !-
   Coil Air Outlet Node
  Coil Heating DX Variable Refrigerant Flow 1 VRFTUHeatCAPFT 9, !-
   Heating Capacity Ratio Modifier Function of Temperature Curve
   Name
  Coil Heating DX Variable Refrigerant Flow 1 VRFACCoolCapFFF 9; !-
   Heating Capacity Modifier Function of Flow Fraction Curve Name

Curve:Biquadratic,
  Coil Heating DX Variable Refrigerant Flow 1 VRFTUHeatCAPFT 9, !-
   Name
```

```
  0.375443994956127,                      !- Coefficient1 Constant
  0.0668190645147821,                     !- Coefficient2 x
  -0.00194171026482001,                   !- Coefficient3 x**2
  0.0442618420640187,                     !- Coefficient4 y
  -0.0004009578,                          !- Coefficient5 y**2
  -0.0014819801,                          !- Coefficient6 x*y
  21.11,                                  !- Minimum Value of x {
   BasedOnField A2}
  27.22,                                  !- Maximum Value of x {
   BasedOnField A2}
  -15,                                    !- Minimum Value of y {
   BasedOnField A3}
  18.33,                                  !- Maximum Value of y {
   BasedOnField A3}
  0.6074,                                 !- Minimum Curve Output {
   BasedOnField A4}
  1;                                      !- Maximum Curve Output {
   BasedOnField A4}

Curve:Quadratic,
  Coil Heating DX Variable Refrigerant Flow 1 VRFACCoolCapFFF 9, !-
   Name
  0.8,                                    !- Coefficient1 Constant
  0.2,                                    !- Coefficient2 x
  0,                                      !- Coefficient3 x**2
  0.5,                                    !- Minimum Value of x {
   BasedOnField A2}
  1.5;                                    !- Maximum Value of x {
   BasedOnField A2}

Fan:OnOff,
  Room_25_d27e0933 VRF Unit Cycling Fan,  !- Name
  Always On Discrete,                     !- Availability Schedule
   Name
  0.6,                                    !- Fan Total Efficiency
  300,                                    !- Pressure Rise {Pa}
```

```
  Autosize,                               !- Maximum Flow Rate {m3/s
   }
  0.8,                                    !- Motor Efficiency
  1,                                      !- Motor In Airstream
   Fraction
  Room_25_d27e0933 VRF Terminal Unit Heating Coil Outlet Node, !-
   Air Inlet Node Name
  Room_25_d27e0933 VRF Terminal Unit Outlet Air Node, !- Air Outlet
   Node Name
  Fan On Off Power Curve 9,               !- Fan Power Ratio
   Function of Speed Ratio Curve Name
  Fan On Off Efficiency Curve 9,          !- Fan Efficiency Ratio
   Function of Speed Ratio Curve Name
  General;                                !- End-Use Subcategory

Curve:Exponent,
  Fan On Off Power Curve 9,               !- Name
  1,                                      !- Coefficient1 Constant
  0,                                      !- Coefficient2 Constant
  0,                                      !- Coefficient3 Constant
  0,                                      !- Minimum Value of x {
   BasedOnField A2}
  1;                                      !- Maximum Value of x {
   BasedOnField A2}

Curve:Cubic,
  Fan On Off Efficiency Curve 9,          !- Name
  1,                                      !- Coefficient1 Constant
  0,                                      !- Coefficient2 x
  0,                                      !- Coefficient3 x**2
  0,                                      !- Coefficient4 x**3
  0,                                      !- Minimum Value of x {
   BasedOnField A2}
  1;                                      !- Maximum Value of x {
   BasedOnField A2}
```

```
ZoneHVAC:EquipmentList,
  Room_25_d27e0933 Equipment List,        !- Name
  SequentialLoad,                         !- Load Distribution
   Scheme
  ZoneHVAC:AirDistributionUnit,           !- Zone Equipment Object
   Type 1
  ADU Room_25_d27e0933 Air Terminal,      !- Zone Equipment Name 1
  1,                                      !- Zone Equipment Cooling
   Sequence 1
  1,                                      !- Zone Equipment Heating
   or No-Load Sequence 1
  Schedule Constant 19,                   !- Zone Equipment
   Sequential Cooling Fraction Schedule Name 1
  Schedule Constant 20,                   !- Zone Equipment
   Sequential Heating Fraction Schedule Name 1
  ZoneHVAC:TerminalUnit:VariableRefrigerantFlow, !- Zone Equipment
   Object Type 2
  Room_25_d27e0933 VRF Terminal Unit,     !- Zone Equipment Name 2
  2,                                      !- Zone Equipment Cooling
   Sequence 2
  2,                                      !- Zone Equipment Heating
   or No-Load Sequence 2
  ,                                       !- Zone Equipment
   Sequential Cooling Fraction Schedule Name 2
  ;                                       !- Zone Equipment
   Sequential Heating Fraction Schedule Name 2

Sizing:Zone,
  Room_25_d27e0933,                       !- Zone or ZoneList Name
  SupplyAirTemperature,                   !- Zone Cooling Design
   Supply Air Temperature Input Method
  12.7777777777778,                       !- Zone Cooling Design
   Supply Air Temperature {C}
  11.11,                                  !- Zone Cooling Design
   Supply Air Temperature Difference {deltaC}
```

```
SupplyAirTemperature,                   !- Zone Heating Design
 Supply Air Temperature Input Method
40.0000000000001,                       !- Zone Heating Design
 Supply Air Temperature {C}
11.11,                                  !- Zone Heating Design
 Supply Air Temperature Difference {deltaC}
0.0085,                                 !- Zone Cooling Design
 Supply Air Humidity Ratio {kgWater/kgDryAir}
0.008,                                  !- Zone Heating Design
 Supply Air Humidity Ratio {kgWater/kgDryAir}
ventilation,                            !- Design Specification
 Outdoor Air Object Name
,                                       !- Zone Heating Sizing
 Factor
,                                       !- Zone Cooling Sizing
 Factor
DesignDay,                              !- Cooling Design Air Flow
  Method
0,                                      !- Cooling Design Air Flow
  Rate {m3/s}
0.000762,                               !- Cooling Minimum Air
 Flow per Zone Floor Area {m3/s-m2}
0,                                      !- Cooling Minimum Air
 Flow {m3/s}
0,                                      !- Cooling Minimum Air
 Flow Fraction
DesignDay,                              !- Heating Design Air Flow
  Method
0,                                      !- Heating Design Air Flow
  Rate {m3/s}
0.002032,                               !- Heating Maximum Air
 Flow per Zone Floor Area {m3/s-m2}
0.1415762,                              !- Heating Maximum Air
 Flow {m3/s}
0.3,                                    !- Heating Maximum Air
 Flow Fraction
```

```
  ,                                       !- Design Specification
   Zone Air Distribution Object Name
  Yes,                                    !- Account for Dedicated
   Outdoor Air System
  NeutralSupplyAir,                       !- Dedicated Outdoor Air
   System Control Strategy
  15.5555555555556,                       !- Dedicated Outdoor Air
   Low Setpoint Temperature for Design {C}
  21.111111111111;                        !- Dedicated Outdoor Air
   High Setpoint Temperature for Design {C}

Zone,
  Room_26_f4ea3797,                       !- Name
  0,                                      !- Direction of Relative
   North {deg}
  0,                                      !- X Origin {m}
  0,                                      !- Y Origin {m}
  0,                                      !- Z Origin {m}
  ,                                       !- Type
  1,                                      !- Multiplier
  ,                                       !- Ceiling Height {m}
  ,                                       !- Volume {m3}
  ,                                       !- Floor Area {m2}
  ,                                       !- Zone Inside Convection
   Algorithm
  ,                                       !- Zone Outside Convection
    Algorithm
  Yes;                                    !- Part of Total Floor
   Area

BuildingSurface:Detailed,
  Room_26_f4ea3797..Face0,                !- Name
  Wall,                                   !- Surface Type
  project_wall,                           !- Construction Name
  Room_26_f4ea3797,                       !- Zone Name
```

```
  Outdoors,                               !- Outside Boundary
   Condition
  ,                                       !- Outside Boundary
   Condition Object
  SunExposed,                             !- Sun Exposure
  WindExposed,                            !- Wind Exposure
  ,                                       !- View Factor to Ground
  ,                                       !- Number of Vertices
  23.1619451669403, 55.2819899121641, 6.49999999997549, !- X,Y,Z
   Vertex 1 {m}
  23.1619451669316, 55.2819899121844, 3.24999999997549, !- X,Y,Z
   Vertex 2 {m}
  23.1619451669316, 70.2819899121844, 3.24999999986817, !- X,Y,Z
   Vertex 3 {m}
  23.1619451669403, 70.2819899121641, 6.49999999986818; !- X,Y,Z
   Vertex 4 {m}

FenestrationSurface:Detailed,
  Room_26_f4ea3797..Face0_Glz0,           !- Name
  Window,                                 !- Surface Type
  project_window,                         !- Construction Name
  Room_26_f4ea3797..Face0,                !- Building Surface Name
  ,                                       !- Outside Boundary
   Condition Object
  ,                                       !- View Factor to Ground
  ,                                       !- Frame and Divider Name
  ,                                       !- Multiplier
  ,                                       !- Number of Vertices
  23.1619451669391, 56.4163649122012, 6.04999999996738, !- X,Y,Z
   Vertex 1 {m}
  23.1619451669338, 56.4163649121869, 4.04999999996738, !- X,Y,Z
   Vertex 2 {m}
  23.1619451669338, 57.1476149121848, 4.04999999996214, !- X,Y,Z
   Vertex 3 {m}
  23.1619451669391, 57.1476149121991, 6.04999999996214; !- X,Y,Z
   Vertex 4 {m}
```

```
FenestrationSurface:Detailed,
  Room_26_f4ea3797..Face0_Glz1,           !- Name
  Window,                                 !- Surface Type
  project_window,                         !- Construction Name
  Room_26_f4ea3797..Face0,                !- Building Surface Name
  ,                                       !- Outside Boundary
   Condition Object
  ,                                       !- View Factor to Ground
  ,                                       !- Frame and Divider Name
  ,                                       !- Multiplier
  ,                                       !- Number of Vertices
  23.1619451669391, 59.4163649121925, 6.04999999994591, !- X,Y,Z
   Vertex 1 {m}
  23.1619451669338, 59.4163649121782, 4.04999999994591, !- X,Y,Z
   Vertex 2 {m}
  23.1619451669338, 60.147614912176, 4.04999999994068, !- X,Y,Z
   Vertex 3 {m}
  23.1619451669391, 60.1476149121904, 6.04999999994068; !- X,Y,Z
   Vertex 4 {m}

FenestrationSurface:Detailed,
  Room_26_f4ea3797..Face0_Glz2,           !- Name
  Window,                                 !- Surface Type
  project_window,                         !- Construction Name
  Room_26_f4ea3797..Face0,                !- Building Surface Name
  ,                                       !- Outside Boundary
   Condition Object
  ,                                       !- View Factor to Ground
  ,                                       !- Frame and Divider Name
  ,                                       !- Multiplier
  ,                                       !- Number of Vertices
  23.1619451669391, 62.4163649121838, 6.04999999992445, !- X,Y,Z
   Vertex 1 {m}
  23.1619451669338, 62.4163649121695, 4.04999999992445, !- X,Y,Z
   Vertex 2 {m}
```

```
  23.1619451669338, 63.1476149121673, 4.04999999991922, !- X,Y,Z
   Vertex 3 {m}
  23.1619451669391, 63.1476149121817, 6.04999999991922; !- X,Y,Z
   Vertex 4 {m}

FenestrationSurface:Detailed,
  Room_26_f4ea3797..Face0_Glz3,           !- Name
  Window,                                 !- Surface Type
  project_window,                         !- Construction Name
  Room_26_f4ea3797..Face0,                !- Building Surface Name
  ,                                       !- Outside Boundary
   Condition Object
  ,                                       !- View Factor to Ground
  ,                                       !- Frame and Divider Name
  ,                                       !- Multiplier
  ,                                       !- Number of Vertices
  23.1619451669391, 65.4163649121751, 6.04999999990298, !- X,Y,Z
   Vertex 1 {m}
  23.1619451669338, 65.4163649121608, 4.04999999990298, !- X,Y,Z
   Vertex 2 {m}
  23.1619451669338, 66.1476149121586, 4.04999999989775, !- X,Y,Z
   Vertex 3 {m}
  23.1619451669391, 66.1476149121729, 6.04999999989775; !- X,Y,Z
   Vertex 4 {m}

FenestrationSurface:Detailed,
  Room_26_f4ea3797..Face0_Glz4,           !- Name
  Window,                                 !- Surface Type
  project_window,                         !- Construction Name
  Room_26_f4ea3797..Face0,                !- Building Surface Name
  ,                                       !- Outside Boundary
   Condition Object
  ,                                       !- View Factor to Ground
  ,                                       !- Frame and Divider Name
  ,                                       !- Multiplier
  ,                                       !- Number of Vertices
```

```
  23.1619451669391, 68.4163649121663, 6.04999999988152, !- X,Y,Z
   Vertex 1 {m}
  23.1619451669338, 68.416364912152, 4.04999999988152, !- X,Y,Z
   Vertex 2 {m}
  23.1619451669338, 69.1476149121499, 4.04999999987629, !- X,Y,Z
   Vertex 3 {m}
  23.1619451669391, 69.1476149121642, 6.04999999987629; !- X,Y,Z
   Vertex 4 {m}

BuildingSurface:Detailed,
  Room_26_f4ea3797..Face1,                !- Name
  Wall,                                   !- Surface Type
  project_wall_int,                       !- Construction Name
  Room_26_f4ea3797,                       !- Zone Name
  Surface,                                !- Outside Boundary
   Condition
  Room_29_2a634042..Face2,                !- Outside Boundary
   Condition Object
  NoSun,                                  !- Sun Exposure
  NoWind,                                 !- Wind Exposure
  ,                                       !- View Factor to Ground
  ,                                       !- Number of Vertices
  19.8286118336069, 65.2819899121641, 6.49999999989867, !- X,Y,Z
   Vertex 1 {m}
  23.1619451669403, 70.2819899121641, 6.49999999986818, !- X,Y,Z
   Vertex 2 {m}
  23.1619451669316, 70.2819899121844, 3.24999999986817, !- X,Y,Z
   Vertex 3 {m}
  19.8286118335983, 65.2819899121844, 3.24999999989868; !- X,Y,Z
   Vertex 4 {m}

BuildingSurface:Detailed,
  Room_26_f4ea3797..Face2,                !- Name
  Wall,                                   !- Surface Type
  project_wall_int,                       !- Construction Name
  Room_26_f4ea3797,                       !- Zone Name
```

```
  Surface,                                !- Outside Boundary
   Condition
  Room_20_4d060559..Face1,                !- Outside Boundary
   Condition Object
  NoSun,                                  !- Sun Exposure
  NoWind,                                 !- Wind Exposure
  ,                                       !- View Factor to Ground
  ,                                       !- Number of Vertices
  19.8286118336069, 60.2819899121641, 6.49999999993444, !- X,Y,Z
   Vertex 1 {m}
  19.8286118336069, 65.2819899121641, 6.49999999989867, !- X,Y,Z
   Vertex 2 {m}
  19.8286118335983, 65.2819899121844, 3.24999999989868, !- X,Y,Z
   Vertex 3 {m}
  19.8286118335983, 60.2819899121844, 3.24999999993445; !- X,Y,Z
   Vertex 4 {m}

BuildingSurface:Detailed,
  Room_26_f4ea3797..Face3,                !- Name
  Wall,                                   !- Surface Type
  project_wall_int,                       !- Construction Name
  Room_26_f4ea3797,                       !- Zone Name
  Surface,                                !- Outside Boundary
   Condition
  Room_17_fb615533..Face1,                !- Outside Boundary
   Condition Object
  NoSun,                                  !- Sun Exposure
  NoWind,                                 !- Wind Exposure
  ,                                       !- View Factor to Ground
  ,                                       !- Number of Vertices
  23.1619451669403, 55.2819899121641, 6.49999999997549, !- X,Y,Z
   Vertex 1 {m}
  19.8286118336069, 60.2819899121641, 6.49999999993444, !- X,Y,Z
   Vertex 2 {m}
  19.8286118335983, 60.2819899121844, 3.24999999993445, !- X,Y,Z
   Vertex 3 {m}
```

```
  23.1619451669316, 55.2819899121844, 3.24999999997549; !- X,Y,Z
   Vertex 4 {m}

BuildingSurface:Detailed,
  Room_26_f4ea3797..Face4,                !- Name
  Floor,                                  !- Surface Type
  project_floor,                          !- Construction Name
  Room_26_f4ea3797,                       !- Zone Name
  Surface,                                !- Outside Boundary
   Condition
  Room_27_0080b418..Face5,                !- Outside Boundary
   Condition Object
  NoSun,                                  !- Sun Exposure
  NoWind,                                 !- Wind Exposure
  ,                                       !- View Factor to Ground
  ,                                       !- Number of Vertices
  23.1619451669316, 70.2819899121844, 3.24999999986817, !- X,Y,Z
   Vertex 1 {m}
  23.1619451669316, 55.2819899121844, 3.24999999997549, !- X,Y,Z
   Vertex 2 {m}
  19.8286118335983, 60.2819899121844, 3.24999999993445, !- X,Y,Z
   Vertex 3 {m}
  19.8286118335983, 65.2819899121844, 3.24999999989868; !- X,Y,Z
   Vertex 4 {m}

BuildingSurface:Detailed,
  Room_26_f4ea3797..Face5,                !- Name
  Ceiling,                                !- Surface Type
  project_ceiling_int,                    !- Construction Name
  Room_26_f4ea3797,                       !- Zone Name
  Surface,                                !- Outside Boundary
   Condition
  Room_25_d27e0933..Face4,                !- Outside Boundary
   Condition Object
  NoSun,                                  !- Sun Exposure
  NoWind,                                 !- Wind Exposure
```

```
  ,                                       !- View Factor to Ground
  ,                                       !- Number of Vertices
  23.1619451669403, 55.2819899121641, 6.49999999997549, !- X,Y,Z
   Vertex 1 {m}
  23.1619451669403, 70.2819899121641, 6.49999999986818, !- X,Y,Z
   Vertex 2 {m}
  19.8286118336069, 65.2819899121641, 6.49999999989867, !- X,Y,Z
   Vertex 3 {m}
  19.8286118336069, 60.2819899121641, 6.49999999993444; !- X,Y,Z
   Vertex 4 {m}

ZoneControl:Thermostat,
  Room_26_f4ea3797 Thermostat,            !- Name
  Room_26_f4ea3797,                       !- Zone or ZoneList Name
  Room_26_f4ea3797 Thermostat Schedule,   !- Control Type Schedule
   Name
  ThermostatSetpoint:DualSetpoint,        !- Control 1 Object Type
  Thermostat Setpoint Dual Setpoint 11,   !- Control 1 Name
  ,                                       !- Control 2 Object Type
  ,                                       !- Control 2 Name
  ,                                       !- Control 3 Object Type
  ,                                       !- Control 3 Name
  ,                                       !- Control 4 Object Type
  ,                                       !- Control 4 Name
  0;                                      !- Temperature Difference
   Between Cutout And Setpoint {deltaC}

Schedule:Compact,
  Room_26_f4ea3797 Thermostat Schedule,   !- Name
  Room_26_f4ea3797 Thermostat Schedule Type Limits, !- Schedule Type
    Limits Name
  Through: 12/31,                         !- Field 1
  For: AllDays,                           !- Field 2
  Until: 24:00,                           !- Field 3
  4;                                      !- Field 4
```

```
ScheduleTypeLimits,
  Room_26_f4ea3797 Thermostat Schedule Type Limits, !- Name
  0,                                       !- Lower Limit Value {
   BasedOnField A3}
  4,                                       !- Upper Limit Value {
   BasedOnField A3}
  DISCRETE;                                !- Numeric Type

ThermostatSetpoint:DualSetpoint,
  Thermostat Setpoint Dual Setpoint 11,    !- Name
  project_heat,                            !- Heating Setpoint
   Temperature Schedule Name
  Clg-SetP-Sch;                         !- Cooling Setpoint
   Temperature Schedule Name

ZoneHVAC:EquipmentConnections,
  Room_26_f4ea3797,                        !- Zone Name
  Room_26_f4ea3797 Equipment List,         !- Zone Conditioning
   Equipment List Name
  Room_26_f4ea3797 Inlet Node List,        !- Zone Air Inlet Node or
   NodeList Name
  Room_26_f4ea3797 Exhaust Node List,      !- Zone Air Exhaust Node
   or NodeList Name
  Room_26_f4ea3797 Zone Air Node,          !- Zone Air Node Name
  Room_26_f4ea3797 Return Node List;       !- Zone Return Air Node or
    NodeList Name

NodeList,
  Room_26_f4ea3797 Inlet Node List,        !- Name
  Room_26_f4ea3797 Air Terminal Outlet Air Node, !- Node Name 1
  Room_26_f4ea3797 VRF Terminal Unit Outlet Air Node; !- Node Name 2

NodeList,
  Room_26_f4ea3797 Exhaust Node List,      !- Name
  Room_26_f4ea3797 VRF Terminal Unit Inlet Air Node; !- Node Name 1
```

```
NodeList,
  Room_26_f4ea3797 Return Node List,      !- Name
  Room_26_f4ea3797 Return Air Node;       !- Node Name 1

AirTerminal:SingleDuct:ConstantVolume:NoReheat,
  Room_26_f4ea3797 Air Terminal,          !- Name
  Always On Discrete,                     !- Availability Schedule
   Name
  Room_26_f4ea3797 Air Terminal Inlet Air Node, !- Air Inlet Node
   Name
  Room_26_f4ea3797 Air Terminal Outlet Air Node, !- Air Outlet Node
   Name
  AutoSize;                               !- Maximum Air Flow Rate {
   m3/s}

ZoneHVAC:AirDistributionUnit,
  ADU Room_26_f4ea3797 Air Terminal,      !- Name
  Room_26_f4ea3797 Air Terminal Outlet Air Node, !- Air Distribution
    Unit Outlet Node Name
  AirTerminal:SingleDuct:ConstantVolume:NoReheat, !- Air Terminal
   Object Type
  Room_26_f4ea3797 Air Terminal;          !- Air Terminal Name

ZoneHVAC:TerminalUnit:VariableRefrigerantFlow,
  Room_26_f4ea3797 VRF Terminal Unit,     !- Zone Terminal Unit Name
  Always On Discrete,                     !- Terminal Unit
   Availability Schedule
  Room_26_f4ea3797 VRF Terminal Unit Inlet Air Node, !- Terminal
   Unit Air Inlet Node Name
  Room_26_f4ea3797 VRF Terminal Unit Outlet Air Node, !- Terminal
   Unit Air Outlet Node Name
  Autosize,                               !- Cooling Supply Air Flow
    Rate {m3/s}
  Autosize,                               !- No Cooling Supply Air
   Flow Rate {m3/s}
```

```
Autosize,                                 !- Heating Supply Air Flow
  Rate {m3/s}
Autosize,                                 !- No Heating Supply Air
 Flow Rate {m3/s}
Autosize,                                 !- Cooling Outdoor Air
 Flow Rate {m3/s}
Autosize,                                 !- Heating Outdoor Air
 Flow Rate {m3/s}
Autosize,                                 !- No Load Outdoor Air
 Flow Rate {m3/s}
Always Off Discrete,                      !- Supply Air Fan
 Operating Mode Schedule Name
DrawThrough,                              !- Supply Air Fan
 Placement
Fan:OnOff,                                !- Supply Air Fan Object
 Type
Room_26_f4ea3797 VRF Unit Cycling Fan,    !- Supply Air Fan Object
 Name
OutdoorAir:Mixer,                         !- Outside Air Mixer
 Object Type
Room_26_f4ea3797 VRF Terminal Unit OA Mixer, !- Outside Air Mixer
 Object Name
Coil:Cooling:DX:VariableRefrigerantFlow, !- Cooling Coil Object
 Type
Zone HVAC Terminal Unit Variable Refrigerant Flow 1 Cooling Coil
 10, !- Cooling Coil Object Name
Coil:Heating:DX:VariableRefrigerantFlow, !- Heating Coil Object
 Type
Zone HVAC Terminal Unit Variable Refrigerant Flow 1 Heating Coil
 10, !- Heating Coil Object Name
30,                                       !- Zone Terminal Unit On
 Parasitic Electric Energy Use {W}
20,                                       !- Zone Terminal Unit Off
 Parasitic Electric Energy Use {W}
1,                                        !- Rated Heating Capacity
 Sizing Ratio {W/W}
```

```
  ,                                       !- Availability Manager
   List Name
  ,                                       !- Design Specification
   ZoneHVAC Sizing Object Name
  ,                                       !- Supplemental Heating
   Coil Object Type
  ,                                       !- Supplemental Heating
   Coil Name
  Autosize,                               !- Maximum Supply Air
   Temperature from Supplemental Heater {C}
  21;                                     !- Maximum Outdoor Dry-
   Bulb Temperature for Supplemental Heater Operation {C}

OutdoorAir:Mixer,
  Room_26_f4ea3797 VRF Terminal Unit OA Mixer, !- Name
  Room_26_f4ea3797 VRF Terminal Unit Mixer Outlet Node, !- Mixed Air
    Node Name
  Room_26_f4ea3797 VRF Terminal Unit Outdoor Air Node, !- Outdoor
   Air Stream Node Name
  Room_26_f4ea3797 VRF Terminal Unit Relief Node Name, !- Relief Air
    Stream Node Name
  Room_26_f4ea3797 VRF Terminal Unit Inlet Air Node; !- Return Air
   Stream Node Name

OutdoorAir:NodeList,
  Room_26_f4ea3797 VRF Terminal Unit Outdoor Air Node; !- Node or
   NodeList Name 1

Coil:Cooling:DX:VariableRefrigerantFlow,
  Zone HVAC Terminal Unit Variable Refrigerant Flow 1 Cooling Coil
   10, !- Name
  Always On Discrete,                     !- Availability Schedule
   Name
  Autosize,                               !- Gross Rated Total
   Cooling Capacity {W}
```

```
  Autosize,                               !- Gross Rated Sensible
   Heat Ratio
  Autosize,                               !- Rated Air Flow Rate {m3
   /s}
  VRFTUCoolCapFT 10,                      !- Cooling Capacity Ratio
   Modifier Function of Temperature Curve Name
  VRFACCoolCapFFF 10,                     !- Cooling Capacity
   Modifier Curve Function of Flow Fraction Name
  Room_26_f4ea3797 VRF Terminal Unit Mixer Outlet Node, !- Coil Air
   Inlet Node
  Room_26_f4ea3797 VRF Terminal Unit Cooling Coil Outlet Node; !-
   Coil Air Outlet Node

Curve:Biquadratic,
  VRFTUCoolCapFT 10,                      !- Name
  0.0585884077803259,                     !- Coefficient1 Constant
  0.0587396532718384,                     !- Coefficient2 x
  -0.000210274979759697,                  !- Coefficient3 x**2
  0.0109370473889647,                     !- Coefficient4 y
  -0.0001219549,                          !- Coefficient5 y**2
  -0.0005246615,                          !- Coefficient6 x*y
  15,                                     !- Minimum Value of x {
   BasedOnField A2}
  23.89,                                  !- Maximum Value of x {
   BasedOnField A2}
  20,                                     !- Minimum Value of y {
   BasedOnField A3}
  43.33,                                  !- Maximum Value of y {
   BasedOnField A3}
  0.8083,                                 !- Minimum Curve Output {
   BasedOnField A4}
  1.2583;                                 !- Maximum Curve Output {
   BasedOnField A4}

Curve:Quadratic,
  VRFACCoolCapFFF 10,                     !- Name
```

```
  0.8,                                    !- Coefficient1 Constant
  0.2,                                    !- Coefficient2 x
  0,                                      !- Coefficient3 x**2
  0.5,                                    !- Minimum Value of x {
   BasedOnField A2}
  1.5;                                    !- Maximum Value of x {
   BasedOnField A2}

Coil:Heating:DX:VariableRefrigerantFlow,
  Zone HVAC Terminal Unit Variable Refrigerant Flow 1 Heating Coil
   10, !- Name
  Always On Discrete,                     !- Availability Schedule
  Autosize,                               !- Gross Rated Heating
   Capacity {W}
  Autosize,                               !- Rated Air Flow Rate {m3
   /s}
  Room_26_f4ea3797 VRF Terminal Unit Cooling Coil Outlet Node, !-
   Coil Air Inlet Node
  Room_26_f4ea3797 VRF Terminal Unit Heating Coil Outlet Node, !-
   Coil Air Outlet Node
  Coil Heating DX Variable Refrigerant Flow 1 VRFTUHeatCAPFT 10, !-
   Heating Capacity Ratio Modifier Function of Temperature Curve
   Name
  Coil Heating DX Variable Refrigerant Flow 1 VRFACCoolCapFFF 10; !-
    Heating Capacity Modifier Function of Flow Fraction Curve Name

Curve:Biquadratic,
  Coil Heating DX Variable Refrigerant Flow 1 VRFTUHeatCAPFT 10, !-
   Name
  0.375443994956127,                      !- Coefficient1 Constant
  0.0668190645147821,                     !- Coefficient2 x
  -0.00194171026482001,                   !- Coefficient3 x**2
  0.0442618420640187,                     !- Coefficient4 y
  -0.0004009578,                          !- Coefficient5 y**2
  -0.0014819801,                          !- Coefficient6 x*y
```

```
  21.11,                                  !- Minimum Value of x {
   BasedOnField A2}
  27.22,                                  !- Maximum Value of x {
   BasedOnField A2}
  -15,                                    !- Minimum Value of y {
   BasedOnField A3}
  18.33,                                  !- Maximum Value of y {
   BasedOnField A3}
  0.6074,                                 !- Minimum Curve Output {
   BasedOnField A4}
  1;                                      !- Maximum Curve Output {
   BasedOnField A4}

Curve:Quadratic,
  Coil Heating DX Variable Refrigerant Flow 1 VRFACCoolCapFFF 10, !-
    Name
  0.8,                                    !- Coefficient1 Constant
  0.2,                                    !- Coefficient2 x
  0,                                      !- Coefficient3 x**2
  0.5,                                    !- Minimum Value of x {
   BasedOnField A2}
  1.5;                                    !- Maximum Value of x {
   BasedOnField A2}

Fan:OnOff,
  Room_26_f4ea3797 VRF Unit Cycling Fan,  !- Name
  Always On Discrete,                     !- Availability Schedule
   Name
  0.6,                                    !- Fan Total Efficiency
  300,                                    !- Pressure Rise {Pa}
  Autosize,                               !- Maximum Flow Rate {m3/s
   }
  0.8,                                    !- Motor Efficiency
  1,                                      !- Motor In Airstream
   Fraction
```

```
  Room_26_f4ea3797 VRF Terminal Unit Heating Coil Outlet Node, !-
   Air Inlet Node Name
  Room_26_f4ea3797 VRF Terminal Unit Outlet Air Node, !- Air Outlet
   Node Name
  Fan On Off Power Curve 10,              !- Fan Power Ratio
   Function of Speed Ratio Curve Name
  Fan On Off Efficiency Curve 10,         !- Fan Efficiency Ratio
   Function of Speed Ratio Curve Name
  General;                                !- End-Use Subcategory

Curve:Exponent,
  Fan On Off Power Curve 10,              !- Name
  1,                                      !- Coefficient1 Constant
  0,                                      !- Coefficient2 Constant
  0,                                      !- Coefficient3 Constant
  0,                                      !- Minimum Value of x {
   BasedOnField A2}
  1;                                      !- Maximum Value of x {
   BasedOnField A2}

Curve:Cubic,
  Fan On Off Efficiency Curve 10,         !- Name
  1,                                      !- Coefficient1 Constant
  0,                                      !- Coefficient2 x
  0,                                      !- Coefficient3 x**2
  0,                                      !- Coefficient4 x**3
  0,                                      !- Minimum Value of x {
   BasedOnField A2}
  1;                                      !- Maximum Value of x {
   BasedOnField A2}

ZoneHVAC:EquipmentList,
  Room_26_f4ea3797 Equipment List,        !- Name
  SequentialLoad,                         !- Load Distribution
   Scheme
```

```
  ZoneHVAC:AirDistributionUnit,           !- Zone Equipment Object
   Type 1
  ADU Room_26_f4ea3797 Air Terminal,      !- Zone Equipment Name 1
  1,                                      !- Zone Equipment Cooling
   Sequence 1
  1,                                      !- Zone Equipment Heating
   or No-Load Sequence 1
  Schedule Constant 21,                   !- Zone Equipment
   Sequential Cooling Fraction Schedule Name 1
  Schedule Constant 22,                   !- Zone Equipment
   Sequential Heating Fraction Schedule Name 1
  ZoneHVAC:TerminalUnit:VariableRefrigerantFlow, !- Zone Equipment
   Object Type 2
  Room_26_f4ea3797 VRF Terminal Unit,     !- Zone Equipment Name 2
  2,                                      !- Zone Equipment Cooling
   Sequence 2
  2,                                      !- Zone Equipment Heating
   or No-Load Sequence 2
  ,                                       !- Zone Equipment
   Sequential Cooling Fraction Schedule Name 2
  ;                                       !- Zone Equipment
   Sequential Heating Fraction Schedule Name 2

Sizing:Zone,
  Room_26_f4ea3797,                       !- Zone or ZoneList Name
  SupplyAirTemperature,                   !- Zone Cooling Design
   Supply Air Temperature Input Method
  12.7777777777778,                       !- Zone Cooling Design
   Supply Air Temperature {C}
  11.11,                                  !- Zone Cooling Design
   Supply Air Temperature Difference {deltaC}
  SupplyAirTemperature,                   !- Zone Heating Design
   Supply Air Temperature Input Method
  40.0000000000001,                       !- Zone Heating Design
   Supply Air Temperature {C}
```

```
11.11,                                  !- Zone Heating Design
 Supply Air Temperature Difference {deltaC}
0.0085,                                 !- Zone Cooling Design
 Supply Air Humidity Ratio {kgWater/kgDryAir}
0.008,                                  !- Zone Heating Design
 Supply Air Humidity Ratio {kgWater/kgDryAir}
ventilation,                            !- Design Specification
 Outdoor Air Object Name
,                                       !- Zone Heating Sizing
 Factor
,                                       !- Zone Cooling Sizing
 Factor
DesignDay,                              !- Cooling Design Air Flow
  Method
0,                                      !- Cooling Design Air Flow
  Rate {m3/s}
0.000762,                               !- Cooling Minimum Air
 Flow per Zone Floor Area {m3/s-m2}
0,                                      !- Cooling Minimum Air
 Flow {m3/s}
0,                                      !- Cooling Minimum Air
 Flow Fraction
DesignDay,                              !- Heating Design Air Flow
  Method
0,                                      !- Heating Design Air Flow
  Rate {m3/s}
0.002032,                               !- Heating Maximum Air
 Flow per Zone Floor Area {m3/s-m2}
0.1415762,                              !- Heating Maximum Air
 Flow {m3/s}
0.3,                                    !- Heating Maximum Air
 Flow Fraction
,                                       !- Design Specification
 Zone Air Distribution Object Name
Yes,                                    !- Account for Dedicated
 Outdoor Air System
```

```
  NeutralSupplyAir,                       !- Dedicated Outdoor Air
   System Control Strategy
  15.5555555555556,                       !- Dedicated Outdoor Air
   Low Setpoint Temperature for Design {C}
  21.1111111111111;                       !- Dedicated Outdoor Air
   High Setpoint Temperature for Design {C}

Zone,
  Room_27_0080b418,                       !- Name
  0,                                      !- Direction of Relative
   North {deg}
  0,                                      !- X Origin {m}
  0,                                      !- Y Origin {m}
  0,                                      !- Z Origin {m}
  ,                                       !- Type
  1,                                      !- Multiplier
  ,                                       !- Ceiling Height {m}
  ,                                       !- Volume {m3}
  ,                                       !- Floor Area {m2}
  ,                                       !- Zone Inside Convection
   Algorithm
  ,                                       !- Zone Outside Convection
    Algorithm
  Yes;                                    !- Part of Total Floor
   Area

BuildingSurface:Detailed,
  Room_27_0080b418..Face0,                !- Name
  Wall,                                   !- Surface Type
  project_wall,                           !- Construction Name
  Room_27_0080b418,                       !- Zone Name
  Outdoors,                               !- Outside Boundary
   Condition
  ,                                       !- Outside Boundary
   Condition Object
  SunExposed,                             !- Sun Exposure
```

```
  WindExposed,                            !- Wind Exposure
  ,                                       !- View Factor to Ground
  ,                                       !- Number of Vertices
  23.1619451669316, 55.2819899121844, 3.24999999997549, !- X,Y,Z
   Vertex 1 {m}
  23.161945166923, 55.2819899122047, -2.45078148573979e-11, !- X,Y,Z
    Vertex 2 {m}
  23.161945166923, 70.2819899122047, -1.3182639732014e-10, !- X,Y,Z
   Vertex 3 {m}
  23.1619451669316, 70.2819899121844, 3.24999999986817; !- X,Y,Z
   Vertex 4 {m}

FenestrationSurface:Detailed,
  Room_27_0080b418..Face0_Glz0,           !- Name
  Window,                                 !- Surface Type
  project_window,                         !- Construction Name
  Room_27_0080b418..Face0,                !- Building Surface Name
  ,                                       !- Outside Boundary
   Condition Object
  ,                                       !- View Factor to Ground
  ,                                       !- Frame and Divider Name
  ,                                       !- Multiplier
  ,                                       !- Number of Vertices
  23.1619451669304, 56.4163649122215, 2.79999999996738, !- X,Y,Z
   Vertex 1 {m}
  23.1619451669251, 56.4163649122072, 0.799999999967376, !- X,Y,Z
   Vertex 2 {m}
  23.1619451669251, 57.147614912205, 0.799999999962144, !- X,Y,Z
   Vertex 3 {m}
  23.1619451669304, 57.1476149122193, 2.79999999996214; !- X,Y,Z
   Vertex 4 {m}

FenestrationSurface:Detailed,
  Room_27_0080b418..Face0_Glz1,           !- Name
  Window,                                 !- Surface Type
  project_window,                         !- Construction Name
```

```
  Room_27_0080b418..Face0,                !- Building Surface Name
  ,                                       !- Outside Boundary
   Condition Object
  ,                                       !- View Factor to Ground
  ,                                       !- Frame and Divider Name
  ,                                       !- Multiplier
  ,                                       !- Number of Vertices
  23.1619451669304, 59.4163649122128, 2.79999999994591, !- X,Y,Z
   Vertex 1 {m}
  23.1619451669251, 59.4163649121985, 0.799999999945913, !- X,Y,Z
   Vertex 2 {m}
  23.1619451669251, 60.1476149121963, 0.799999999940681, !- X,Y,Z
   Vertex 3 {m}
  23.1619451669304, 60.1476149122106, 2.79999999994068; !- X,Y,Z
   Vertex 4 {m}

FenestrationSurface:Detailed,
  Room_27_0080b418..Face0_Glz2,           !- Name
  Window,                                 !- Surface Type
  project_window,                         !- Construction Name
  Room_27_0080b418..Face0,                !- Building Surface Name
  ,                                       !- Outside Boundary
   Condition Object
  ,                                       !- View Factor to Ground
  ,                                       !- Frame and Divider Name
  ,                                       !- Multiplier
  ,                                       !- Number of Vertices
  23.1619451669304, 62.4163649122041, 2.79999999992445, !- X,Y,Z
   Vertex 1 {m}
  23.1619451669251, 62.4163649121897, 0.799999999924449, !- X,Y,Z
   Vertex 2 {m}
  23.1619451669251, 63.1476149121876, 0.799999999919217, !- X,Y,Z
   Vertex 3 {m}
  23.1619451669304, 63.1476149122019, 2.79999999991922; !- X,Y,Z
   Vertex 4 {m}
```

```
FenestrationSurface:Detailed,
  Room_27_0080b418..Face0_Glz3,           !- Name
  Window,                                 !- Surface Type
  project_window,                         !- Construction Name
  Room_27_0080b418..Face0,                !- Building Surface Name
  ,                                       !- Outside Boundary
   Condition Object
  ,                                       !- View Factor to Ground
  ,                                       !- Frame and Divider Name
  ,                                       !- Multiplier
  ,                                       !- Number of Vertices
  23.1619451669304, 65.4163649121953, 2.79999999990298, !- X,Y,Z
   Vertex 1 {m}
  23.1619451669251, 65.416364912181, 0.799999999902985, !- X,Y,Z
   Vertex 2 {m}
  23.1619451669251, 66.1476149121789, 0.799999999897753, !- X,Y,Z
   Vertex 3 {m}
  23.1619451669304, 66.1476149121932, 2.79999999989775; !- X,Y,Z
   Vertex 4 {m}

FenestrationSurface:Detailed,
  Room_27_0080b418..Face0_Glz4,           !- Name
  Window,                                 !- Surface Type
  project_window,                         !- Construction Name
  Room_27_0080b418..Face0,                !- Building Surface Name
  ,                                       !- Outside Boundary
   Condition Object
  ,                                       !- View Factor to Ground
  ,                                       !- Frame and Divider Name
  ,                                       !- Multiplier
  ,                                       !- Number of Vertices
  23.1619451669304, 68.4163649121866, 2.79999999988152, !- X,Y,Z
   Vertex 1 {m}
  23.1619451669251, 68.4163649121723, 0.799999999881521, !- X,Y,Z
   Vertex 2 {m}
```

```
  23.1619451669251, 69.1476149121702, 0.79999999987629, !- X,Y,Z
   Vertex 3 {m}
  23.1619451669304, 69.1476149121845, 2.79999999987629; !- X,Y,Z
   Vertex 4 {m}

BuildingSurface:Detailed,
  Room_27_0080b418..Face1,                !- Name
  Wall,                                   !- Surface Type
  project_wall_int,                       !- Construction Name
  Room_27_0080b418,                       !- Zone Name
  Surface,                                !- Outside Boundary
   Condition
  Room_30_98f1d6c8..Face2,                !- Outside Boundary
   Condition Object
  NoSun,                                  !- Sun Exposure
  NoWind,                                 !- Wind Exposure
  ,                                       !- View Factor to Ground
  ,                                       !- Number of Vertices
  19.8286118335983, 65.2819899121844, 3.24999999989868, !- X,Y,Z
   Vertex 1 {m}
  23.1619451669316, 70.2819899121844, 3.24999999986817, !- X,Y,Z
   Vertex 2 {m}
  23.161945166923, 70.2819899122047, -1.3182639732014e-10, !- X,Y,Z
   Vertex 3 {m}
  19.8286118335897, 65.2819899122047, -1.0132554747248e-10; !- X,Y,Z
    Vertex 4 {m}

BuildingSurface:Detailed,
  Room_27_0080b418..Face2,                !- Name
  Wall,                                   !- Surface Type
  project_wall_int,                       !- Construction Name
  Room_27_0080b418,                       !- Zone Name
  Surface,                                !- Outside Boundary
   Condition
  Room_21_4c523269..Face1,                !- Outside Boundary
   Condition Object
```

```
  NoSun,                                  !- Sun Exposure
  NoWind,                                 !- Wind Exposure
  ,                                       !- View Factor to Ground
  ,                                       !- Number of Vertices
  19.8286118335983, 60.2819899121844, 3.24999999993445, !- X,Y,Z
   Vertex 1 {m}
  19.8286118335983, 65.2819899121844, 3.24999999989868, !- X,Y,Z
   Vertex 2 {m}
  19.8286118335897, 65.2819899122047, -1.0132554747248e-10, !- X,Y,Z
    Vertex 3 {m}
  19.8286118335897, 60.2819899122047, -6.55526866515655e-11; !- X,Y,
   Z Vertex 4 {m}

BuildingSurface:Detailed,
  Room_27_0080b418..Face3,                !- Name
  Wall,                                   !- Surface Type
  project_wall_int,                       !- Construction Name
  Room_27_0080b418,                       !- Zone Name
  Surface,                                !- Outside Boundary
   Condition
  Room_16_3d8c5364..Face1,                !- Outside Boundary
   Condition Object
  NoSun,                                  !- Sun Exposure
  NoWind,                                 !- Wind Exposure
  ,                                       !- View Factor to Ground
  ,                                       !- Number of Vertices
  23.1619451669316, 55.2819899121844, 3.24999999997549, !- X,Y,Z
   Vertex 1 {m}
  19.8286118335983, 60.2819899121844, 3.24999999993445, !- X,Y,Z
   Vertex 2 {m}
  19.8286118335897, 60.2819899122047, -6.55526866515655e-11, !- X,Y,
   Z Vertex 3 {m}
  23.161945166923, 55.2819899122047, -2.45078148573979e-11; !- X,Y,Z
    Vertex 4 {m}

BuildingSurface:Detailed,
```

```
  Room_27_0080b418..Face4,                !- Name
  Floor,                                  !- Surface Type
  project_slab,                           !- Construction Name
  Room_27_0080b418,                       !- Zone Name
  Ground,                                 !- Outside Boundary
   Condition
  ,                                       !- Outside Boundary
   Condition Object
  NoSun,                                  !- Sun Exposure
  NoWind,                                 !- Wind Exposure
  ,                                       !- View Factor to Ground
  ,                                       !- Number of Vertices
  23.161945166923, 70.2819899122047, -1.3182639732014e-10, !- X,Y,Z
   Vertex 1 {m}
  23.161945166923, 55.2819899122047, -2.45078148573979e-11, !- X,Y,Z
    Vertex 2 {m}
  19.8286118335897, 60.2819899122047, -6.55526866515655e-11, !- X,Y,
   Z Vertex 3 {m}
  19.8286118335897, 65.2819899122047, -1.0132554747248e-10; !- X,Y,Z
    Vertex 4 {m}

BuildingSurface:Detailed,
  Room_27_0080b418..Face5,                !- Name
  Ceiling,                                !- Surface Type
  project_ceiling_int,                    !- Construction Name
  Room_27_0080b418,                       !- Zone Name
  Surface,                                !- Outside Boundary
   Condition
  Room_26_f4ea3797..Face4,                !- Outside Boundary
   Condition Object
  NoSun,                                  !- Sun Exposure
  NoWind,                                 !- Wind Exposure
  ,                                       !- View Factor to Ground
  ,                                       !- Number of Vertices
  23.1619451669316, 55.2819899121844, 3.24999999997549, !- X,Y,Z
   Vertex 1 {m}
```

```
  23.1619451669316, 70.2819899121844, 3.24999999986817, !- X,Y,Z
   Vertex 2 {m}
  19.8286118335983, 65.2819899121844, 3.24999999989868, !- X,Y,Z
   Vertex 3 {m}
  19.8286118335983, 60.2819899121844, 3.24999999993445; !- X,Y,Z
   Vertex 4 {m}

ZoneControl:Thermostat,
  Room_27_0080b418 Thermostat,            !- Name
  Room_27_0080b418,                       !- Zone or ZoneList Name
  Room_27_0080b418 Thermostat Schedule,   !- Control Type Schedule
   Name
  ThermostatSetpoint:DualSetpoint,        !- Control 1 Object Type
  Thermostat Setpoint Dual Setpoint 12,   !- Control 1 Name
  ,                                       !- Control 2 Object Type
  ,                                       !- Control 2 Name
  ,                                       !- Control 3 Object Type
  ,                                       !- Control 3 Name
  ,                                       !- Control 4 Object Type
  ,                                       !- Control 4 Name
  0;                                      !- Temperature Difference
   Between Cutout And Setpoint {deltaC}

Schedule:Compact,
  Room_27_0080b418 Thermostat Schedule,   !- Name
  Room_27_0080b418 Thermostat Schedule Type Limits, !- Schedule Type
    Limits Name
  Through: 12/31,                         !- Field 1
  For: AllDays,                           !- Field 2
  Until: 24:00,                           !- Field 3
  4;                                      !- Field 4

ScheduleTypeLimits,
  Room_27_0080b418 Thermostat Schedule Type Limits, !- Name
  0,                                      !- Lower Limit Value {
   BasedOnField A3}
```

```
  4,                                      !- Upper Limit Value {
   BasedOnField A3}
  DISCRETE;                               !- Numeric Type

ThermostatSetpoint:DualSetpoint,
  Thermostat Setpoint Dual Setpoint 12,   !- Name
  project_heat,                           !- Heating Setpoint
   Temperature Schedule Name
  Clg-SetP-Sch;                        !- Cooling Setpoint
   Temperature Schedule Name

ZoneHVAC:EquipmentConnections,
  Room_27_0080b418,                       !- Zone Name
  Room_27_0080b418 Equipment List,        !- Zone Conditioning
   Equipment List Name
  Room_27_0080b418 Inlet Node List,       !- Zone Air Inlet Node or
   NodeList Name
  Room_27_0080b418 Exhaust Node List,     !- Zone Air Exhaust Node
   or NodeList Name
  Room_27_0080b418 Zone Air Node,         !- Zone Air Node Name
  Room_27_0080b418 Return Node List;      !- Zone Return Air Node or
    NodeList Name

NodeList,
  Room_27_0080b418 Inlet Node List,       !- Name
  Room_27_0080b418 Air Terminal Outlet Air Node, !- Node Name 1
  Room_27_0080b418 VRF Terminal Unit Outlet Air Node; !- Node Name 2

NodeList,
  Room_27_0080b418 Exhaust Node List,     !- Name
  Room_27_0080b418 VRF Terminal Unit Inlet Air Node; !- Node Name 1

NodeList,
  Room_27_0080b418 Return Node List,      !- Name
  Room_27_0080b418 Return Air Node;       !- Node Name 1
```

```
AirTerminal:SingleDuct:ConstantVolume:NoReheat,
  Room_27_0080b418 Air Terminal,          !- Name
  Always On Discrete,                     !- Availability Schedule
   Name
  Room_27_0080b418 Air Terminal Inlet Air Node, !- Air Inlet Node
   Name
  Room_27_0080b418 Air Terminal Outlet Air Node, !- Air Outlet Node
   Name
  AutoSize;                               !- Maximum Air Flow Rate {
   m3/s}

ZoneHVAC:AirDistributionUnit,
  ADU Room_27_0080b418 Air Terminal,      !- Name
  Room_27_0080b418 Air Terminal Outlet Air Node, !- Air Distribution
    Unit Outlet Node Name
  AirTerminal:SingleDuct:ConstantVolume:NoReheat, !- Air Terminal
   Object Type
  Room_27_0080b418 Air Terminal;          !- Air Terminal Name

ZoneHVAC:TerminalUnit:VariableRefrigerantFlow,
  Room_27_0080b418 VRF Terminal Unit,     !- Zone Terminal Unit Name
  Always On Discrete,                     !- Terminal Unit
   Availability Schedule
  Room_27_0080b418 VRF Terminal Unit Inlet Air Node, !- Terminal
   Unit Air Inlet Node Name
  Room_27_0080b418 VRF Terminal Unit Outlet Air Node, !- Terminal
   Unit Air Outlet Node Name
  Autosize,                               !- Cooling Supply Air Flow
    Rate {m3/s}
  Autosize,                               !- No Cooling Supply Air
   Flow Rate {m3/s}
  Autosize,                               !- Heating Supply Air Flow
    Rate {m3/s}
  Autosize,                               !- No Heating Supply Air
   Flow Rate {m3/s}
```

```
Autosize,                                 !- Cooling Outdoor Air
 Flow Rate {m3/s}
Autosize,                                 !- Heating Outdoor Air
 Flow Rate {m3/s}
Autosize,                                 !- No Load Outdoor Air
 Flow Rate {m3/s}
Always Off Discrete,                      !- Supply Air Fan
 Operating Mode Schedule Name
DrawThrough,                              !- Supply Air Fan
 Placement
Fan:OnOff,                                !- Supply Air Fan Object
 Type
Room_27_0080b418 VRF Unit Cycling Fan,    !- Supply Air Fan Object
 Name
OutdoorAir:Mixer,                         !- Outside Air Mixer
 Object Type
Room_27_0080b418 VRF Terminal Unit OA Mixer, !- Outside Air Mixer
 Object Name
Coil:Cooling:DX:VariableRefrigerantFlow, !- Cooling Coil Object
 Type
Zone HVAC Terminal Unit Variable Refrigerant Flow 1 Cooling Coil
 11, !- Cooling Coil Object Name
Coil:Heating:DX:VariableRefrigerantFlow, !- Heating Coil Object
 Type
Zone HVAC Terminal Unit Variable Refrigerant Flow 1 Heating Coil
 11, !- Heating Coil Object Name
30,                                       !- Zone Terminal Unit On
 Parasitic Electric Energy Use {W}
20,                                       !- Zone Terminal Unit Off
 Parasitic Electric Energy Use {W}
1,                                        !- Rated Heating Capacity
 Sizing Ratio {W/W}
,                                         !- Availability Manager
 List Name
,                                         !- Design Specification
 ZoneHVAC Sizing Object Name
```

```
  ,                                       !- Supplemental Heating
   Coil Object Type
  ,                                       !- Supplemental Heating
   Coil Name
  Autosize,                               !- Maximum Supply Air
   Temperature from Supplemental Heater {C}
  21;                                     !- Maximum Outdoor Dry-
   Bulb Temperature for Supplemental Heater Operation {C}

OutdoorAir:Mixer,
  Room_27_0080b418 VRF Terminal Unit OA Mixer, !- Name
  Room_27_0080b418 VRF Terminal Unit Mixer Outlet Node, !- Mixed Air
    Node Name
  Room_27_0080b418 VRF Terminal Unit Outdoor Air Node, !- Outdoor
   Air Stream Node Name
  Room_27_0080b418 VRF Terminal Unit Relief Node Name, !- Relief Air
    Stream Node Name
  Room_27_0080b418 VRF Terminal Unit Inlet Air Node; !- Return Air
   Stream Node Name

OutdoorAir:NodeList,
  Room_27_0080b418 VRF Terminal Unit Outdoor Air Node; !- Node or
   NodeList Name 1

Coil:Cooling:DX:VariableRefrigerantFlow,
  Zone HVAC Terminal Unit Variable Refrigerant Flow 1 Cooling Coil
   11, !- Name
  Always On Discrete,                     !- Availability Schedule
   Name
  Autosize,                               !- Gross Rated Total
   Cooling Capacity {W}
  Autosize,                               !- Gross Rated Sensible
   Heat Ratio
  Autosize,                               !- Rated Air Flow Rate {m3
   /s}
```

```
  VRFTUCoolCapFT 11,                      !- Cooling Capacity Ratio
   Modifier Function of Temperature Curve Name
  VRFACCoolCapFFF 11,                     !- Cooling Capacity
   Modifier Curve Function of Flow Fraction Name
  Room_27_0080b418 VRF Terminal Unit Mixer Outlet Node, !- Coil Air
   Inlet Node
  Room_27_0080b418 VRF Terminal Unit Cooling Coil Outlet Node; !-
   Coil Air Outlet Node

Curve:Biquadratic,
  VRFTUCoolCapFT 11,                      !- Name
  0.0585884077803259,                     !- Coefficient1 Constant
  0.0587396532718384,                     !- Coefficient2 x
  -0.000210274979759697,                  !- Coefficient3 x**2
  0.0109370473889647,                     !- Coefficient4 y
  -0.0001219549,                          !- Coefficient5 y**2
  -0.0005246615,                          !- Coefficient6 x*y
  15,                                     !- Minimum Value of x {
   BasedOnField A2}
  23.89,                                  !- Maximum Value of x {
   BasedOnField A2}
  20,                                     !- Minimum Value of y {
   BasedOnField A3}
  43.33,                                  !- Maximum Value of y {
   BasedOnField A3}
  0.8083,                                 !- Minimum Curve Output {
   BasedOnField A4}
  1.2583;                                 !- Maximum Curve Output {
   BasedOnField A4}

Curve:Quadratic,
  VRFACCoolCapFFF 11,                     !- Name
  0.8,                                    !- Coefficient1 Constant
  0.2,                                    !- Coefficient2 x
  0,                                      !- Coefficient3 x**2
```

```
  0.5,                                    !- Minimum Value of x {
   BasedOnField A2}
  1.5;                                    !- Maximum Value of x {
   BasedOnField A2}

Coil:Heating:DX:VariableRefrigerantFlow,
  Zone HVAC Terminal Unit Variable Refrigerant Flow 1 Heating Coil
   11, !- Name
  Always On Discrete,                     !- Availability Schedule
  Autosize,                               !- Gross Rated Heating
   Capacity {W}
  Autosize,                               !- Rated Air Flow Rate {m3
   /s}
  Room_27_0080b418 VRF Terminal Unit Cooling Coil Outlet Node, !-
   Coil Air Inlet Node
  Room_27_0080b418 VRF Terminal Unit Heating Coil Outlet Node, !-
   Coil Air Outlet Node
  Coil Heating DX Variable Refrigerant Flow 1 VRFTUHeatCAPFT 11, !-
   Heating Capacity Ratio Modifier Function of Temperature Curve
   Name
  Coil Heating DX Variable Refrigerant Flow 1 VRFACCoolCapFFF 11; !-
    Heating Capacity Modifier Function of Flow Fraction Curve Name

Curve:Biquadratic,
  Coil Heating DX Variable Refrigerant Flow 1 VRFTUHeatCAPFT 11, !-
   Name
  0.375443994956127,                      !- Coefficient1 Constant
  0.0668190645147821,                     !- Coefficient2 x
  -0.00194171026482001,                   !- Coefficient3 x**2
  0.0442618420640187,                     !- Coefficient4 y
  -0.0004009578,                          !- Coefficient5 y**2
  -0.0014819801,                          !- Coefficient6 x*y
  21.11,                                  !- Minimum Value of x {
   BasedOnField A2}
  27.22,                                  !- Maximum Value of x {
   BasedOnField A2}
```

```
  -15,                                    !- Minimum Value of y {
   BasedOnField A3}
  18.33,                                  !- Maximum Value of y {
   BasedOnField A3}
  0.6074,                                 !- Minimum Curve Output {
   BasedOnField A4}
  1;                                      !- Maximum Curve Output {
   BasedOnField A4}

Curve:Quadratic,
  Coil Heating DX Variable Refrigerant Flow 1 VRFACCoolCapFFF 11, !-
    Name
  0.8,                                    !- Coefficient1 Constant
  0.2,                                    !- Coefficient2 x
  0,                                      !- Coefficient3 x**2
  0.5,                                    !- Minimum Value of x {
   BasedOnField A2}
  1.5;                                    !- Maximum Value of x {
   BasedOnField A2}

Fan:OnOff,
  Room_27_0080b418 VRF Unit Cycling Fan,  !- Name
  Always On Discrete,                     !- Availability Schedule
   Name
  0.6,                                    !- Fan Total Efficiency
  300,                                    !- Pressure Rise {Pa}
  Autosize,                               !- Maximum Flow Rate {m3/s
   }
  0.8,                                    !- Motor Efficiency
  1,                                      !- Motor In Airstream
   Fraction
  Room_27_0080b418 VRF Terminal Unit Heating Coil Outlet Node, !-
   Air Inlet Node Name
  Room_27_0080b418 VRF Terminal Unit Outlet Air Node, !- Air Outlet
   Node Name
```

```
  Fan On Off Power Curve 11,              !- Fan Power Ratio
   Function of Speed Ratio Curve Name
  Fan On Off Efficiency Curve 11,         !- Fan Efficiency Ratio
   Function of Speed Ratio Curve Name
  General;                                !- End-Use Subcategory

Curve:Exponent,
  Fan On Off Power Curve 11,              !- Name
  1,                                      !- Coefficient1 Constant
  0,                                      !- Coefficient2 Constant
  0,                                      !- Coefficient3 Constant
  0,                                      !- Minimum Value of x {
   BasedOnField A2}
  1;                                      !- Maximum Value of x {
   BasedOnField A2}

Curve:Cubic,
  Fan On Off Efficiency Curve 11,         !- Name
  1,                                      !- Coefficient1 Constant
  0,                                      !- Coefficient2 x
  0,                                      !- Coefficient3 x**2
  0,                                      !- Coefficient4 x**3
  0,                                      !- Minimum Value of x {
   BasedOnField A2}
  1;                                      !- Maximum Value of x {
   BasedOnField A2}

ZoneHVAC:EquipmentList,
  Room_27_0080b418 Equipment List,        !- Name
  SequentialLoad,                         !- Load Distribution
   Scheme
  ZoneHVAC:AirDistributionUnit,           !- Zone Equipment Object
   Type 1
  ADU Room_27_0080b418 Air Terminal,      !- Zone Equipment Name 1
  1,                                      !- Zone Equipment Cooling
   Sequence 1
```

```
  1,                                      !- Zone Equipment Heating
   or No-Load Sequence 1
  Schedule Constant 23,                   !- Zone Equipment
   Sequential Cooling Fraction Schedule Name 1
  Schedule Constant 24,                   !- Zone Equipment
   Sequential Heating Fraction Schedule Name 1
  ZoneHVAC:TerminalUnit:VariableRefrigerantFlow, !- Zone Equipment
   Object Type 2
  Room_27_0080b418 VRF Terminal Unit,     !- Zone Equipment Name 2
  2,                                      !- Zone Equipment Cooling
   Sequence 2
  2,                                      !- Zone Equipment Heating
   or No-Load Sequence 2
  ,                                       !- Zone Equipment
   Sequential Cooling Fraction Schedule Name 2
  ;                                       !- Zone Equipment
   Sequential Heating Fraction Schedule Name 2

Sizing:Zone,
  Room_27_0080b418,                       !- Zone or ZoneList Name
  SupplyAirTemperature,                   !- Zone Cooling Design
   Supply Air Temperature Input Method
  12.7777777777778,                       !- Zone Cooling Design
   Supply Air Temperature {C}
  11.11,                                  !- Zone Cooling Design
   Supply Air Temperature Difference {deltaC}
  SupplyAirTemperature,                   !- Zone Heating Design
   Supply Air Temperature Input Method
  40.0000000000001,                       !- Zone Heating Design
   Supply Air Temperature {C}
  11.11,                                  !- Zone Heating Design
   Supply Air Temperature Difference {deltaC}
  0.0085,                                 !- Zone Cooling Design
   Supply Air Humidity Ratio {kgWater/kgDryAir}
  0.008,                                  !- Zone Heating Design
   Supply Air Humidity Ratio {kgWater/kgDryAir}
```

```
ventilation,                            !- Design Specification
 Outdoor Air Object Name
,                                       !- Zone Heating Sizing
 Factor
,                                       !- Zone Cooling Sizing
 Factor
DesignDay,                              !- Cooling Design Air Flow
  Method
0,                                      !- Cooling Design Air Flow
  Rate {m3/s}
0.000762,                               !- Cooling Minimum Air
 Flow per Zone Floor Area {m3/s-m2}
0,                                      !- Cooling Minimum Air
 Flow {m3/s}
0,                                      !- Cooling Minimum Air
 Flow Fraction
DesignDay,                              !- Heating Design Air Flow
  Method
0,                                      !- Heating Design Air Flow
  Rate {m3/s}
0.002032,                               !- Heating Maximum Air
 Flow per Zone Floor Area {m3/s-m2}
0.1415762,                              !- Heating Maximum Air
 Flow {m3/s}
0.3,                                    !- Heating Maximum Air
 Flow Fraction
,                                       !- Design Specification
 Zone Air Distribution Object Name
Yes,                                    !- Account for Dedicated
 Outdoor Air System
NeutralSupplyAir,                       !- Dedicated Outdoor Air
 System Control Strategy
15.5555555555556,                       !- Dedicated Outdoor Air
 Low Setpoint Temperature for Design {C}
21.1111111111111;                       !- Dedicated Outdoor Air
 High Setpoint Temperature for Design {C}
```

```
Zone,
  Room_28_d6ed2799,                       !- Name
  0,                                      !- Direction of Relative
   North {deg}
  0,                                      !- X Origin {m}
  0,                                      !- Y Origin {m}
  0,                                      !- Z Origin {m}
  ,                                       !- Type
  1,                                      !- Multiplier
  ,                                       !- Ceiling Height {m}
  ,                                       !- Volume {m3}
  ,                                       !- Floor Area {m2}
  ,                                       !- Zone Inside Convection
   Algorithm
  ,                                       !- Zone Outside Convection
    Algorithm
  Yes;                                    !- Part of Total Floor
   Area

BuildingSurface:Detailed,
  Room_28_d6ed2799..Face0,                !- Name
  Wall,                                   !- Surface Type
  project_wall_int,                       !- Construction Name
  Room_28_d6ed2799,                       !- Zone Name
  Surface,                                !- Outside Boundary
   Condition
  Room_22_f3ee5a53..Face2,                !- Outside Boundary
   Condition Object
  NoSun,                                  !- Sun Exposure
  NoWind,                                 !- Wind Exposure
  ,                                       !- View Factor to Ground
  ,                                       !- Number of Vertices
  16.4952785002823, 65.2819899121439, 9.74999999989341, !- X,Y,Z
   Vertex 1 {m}
```

```
  13.1619451669489, 70.2819899121439, 9.74999999985237, !- X,Y,Z
   Vertex 2 {m}
  13.1619451669403, 70.2819899121641, 6.49999999985236, !- X,Y,Z
   Vertex 3 {m}
  16.4952785002736, 65.2819899121641, 6.4999999998934; !- X,Y,Z
   Vertex 4 {m}

BuildingSurface:Detailed,
  Room_28_d6ed2799..Face1,                !- Name
  Wall,                                   !- Surface Type
  project_wall_int,                       !- Construction Name
  Room_28_d6ed2799,                       !- Zone Name
  Surface,                                !- Outside Boundary
   Condition
  Room_19_6ae0f9a9..Face2,                !- Outside Boundary
   Condition Object
  NoSun,                                  !- Sun Exposure
  NoWind,                                 !- Wind Exposure
  ,                                       !- View Factor to Ground
  ,                                       !- Number of Vertices
  19.8286118336156, 65.2819899121439, 9.74999999989868, !- X,Y,Z
   Vertex 1 {m}
  16.4952785002823, 65.2819899121439, 9.74999999989341, !- X,Y,Z
   Vertex 2 {m}
  16.4952785002736, 65.2819899121641, 6.4999999998934, !- X,Y,Z
   Vertex 3 {m}
  19.8286118336069, 65.2819899121641, 6.49999999989867; !- X,Y,Z
   Vertex 4 {m}

BuildingSurface:Detailed,
  Room_28_d6ed2799..Face2,                !- Name
  Wall,                                   !- Surface Type
  project_wall_int,                       !- Construction Name
  Room_28_d6ed2799,                       !- Zone Name
  Surface,                                !- Outside Boundary
   Condition
```

```
  Room_25_d27e0933..Face1,                !- Outside Boundary
   Condition Object
  NoSun,                                  !- Sun Exposure
  NoWind,                                 !- Wind Exposure
  ,                                       !- View Factor to Ground
  ,                                       !- Number of Vertices
  19.8286118336156, 65.2819899121439, 9.74999999989868, !- X,Y,Z
   Vertex 1 {m}
  19.8286118336069, 65.2819899121641, 6.49999999989867, !- X,Y,Z
   Vertex 2 {m}
  23.1619451669403, 70.2819899121641, 6.49999999986818, !- X,Y,Z
   Vertex 3 {m}
  23.1619451669489, 70.2819899121439, 9.74999999986818; !- X,Y,Z
   Vertex 4 {m}

BuildingSurface:Detailed,
  Room_28_d6ed2799..Face3,                !- Name
  Wall,                                   !- Surface Type
  project_wall,                           !- Construction Name
  Room_28_d6ed2799,                       !- Zone Name
  Outdoors,                               !- Outside Boundary
   Condition
  ,                                       !- Outside Boundary
   Condition Object
  SunExposed,                             !- Sun Exposure
  WindExposed,                            !- Wind Exposure
  ,                                       !- View Factor to Ground
  ,                                       !- Number of Vertices
  23.1619451669489, 70.2819899121439, 9.74999999986818, !- X,Y,Z
   Vertex 1 {m}
  23.1619451669403, 70.2819899121641, 6.49999999986818, !- X,Y,Z
   Vertex 2 {m}
  13.1619451669403, 70.2819899121641, 6.49999999985236, !- X,Y,Z
   Vertex 3 {m}
  13.1619451669489, 70.2819899121439, 9.74999999985237; !- X,Y,Z
   Vertex 4 {m}
```

```
FenestrationSurface:Detailed,
  Room_28_d6ed2799..Face3_Glz0,           !- Name
  Window,                                 !- Surface Type
  project_window,                         !- Construction Name
  Room_28_d6ed2799..Face3,                !- Building Surface Name
  ,                                       !- Outside Boundary
   Condition Object
  ,                                       !- View Factor to Ground
  ,                                       !- Frame and Divider Name
  ,                                       !- Multiplier
  ,                                       !- Number of Vertices
  21.9015285002709, 70.2819899121467, 9.29999999986618, !- X,Y,Z
   Vertex 1 {m}
  21.9015285002741, 70.2819899121592, 7.29999999986618, !- X,Y,Z
   Vertex 2 {m}
  21.0890285002752, 70.2819899121592, 7.2999999998649, !- X,Y,Z
   Vertex 3 {m}
  21.089028500272, 70.2819899121467, 9.2999999998649; !- X,Y,Z
   Vertex 4 {m}

FenestrationSurface:Detailed,
  Room_28_d6ed2799..Face3_Glz1,           !- Name
  Window,                                 !- Surface Type
  project_window,                         !- Construction Name
  Room_28_d6ed2799..Face3,                !- Building Surface Name
  ,                                       !- Outside Boundary
   Condition Object
  ,                                       !- View Factor to Ground
  ,                                       !- Frame and Divider Name
  ,                                       !- Multiplier
  ,                                       !- Number of Vertices
  18.5681951669422, 70.2819899121467, 9.29999999986091, !- X,Y,Z
   Vertex 1 {m}
  18.5681951669453, 70.2819899121592, 7.29999999986091, !- X,Y,Z
   Vertex 2 {m}
```

```
  17.7556951669465, 70.2819899121592, 7.29999999985962, !- X,Y,Z
   Vertex 3 {m}
  17.7556951669433, 70.2819899121467, 9.29999999985963; !- X,Y,Z
   Vertex 4 {m}

FenestrationSurface:Detailed,
  Room_28_d6ed2799..Face3_Glz2,           !- Name
  Window,                                 !- Surface Type
  project_window,                         !- Construction Name
  Room_28_d6ed2799..Face3,                !- Building Surface Name
  ,                                       !- Outside Boundary
   Condition Object
  ,                                       !- View Factor to Ground
  ,                                       !- Frame and Divider Name
  ,                                       !- Multiplier
  ,                                       !- Number of Vertices
  15.2348618336134, 70.2819899121467, 9.29999999985564, !- X,Y,Z
   Vertex 1 {m}
  15.2348618336166, 70.2819899121592, 7.29999999985564, !- X,Y,Z
   Vertex 2 {m}
  14.4223618336177, 70.2819899121592, 7.29999999985435, !- X,Y,Z
   Vertex 3 {m}
  14.4223618336146, 70.2819899121467, 9.29999999985435; !- X,Y,Z
   Vertex 4 {m}

BuildingSurface:Detailed,
  Room_28_d6ed2799..Face4,                !- Name
  Floor,                                  !- Surface Type
  project_floor,                          !- Construction Name
  Room_28_d6ed2799,                       !- Zone Name
  Surface,                                !- Outside Boundary
   Condition
  Room_29_2a634042..Face5,                !- Outside Boundary
   Condition Object
  NoSun,                                  !- Sun Exposure
  NoWind,                                 !- Wind Exposure
```

```
  ,                                       !- View Factor to Ground
  ,                                       !- Number of Vertices
  23.1619451669403, 70.2819899121641, 6.49999999986818, !- X,Y,Z
   Vertex 1 {m}
  19.8286118336069, 65.2819899121641, 6.49999999989867, !- X,Y,Z
   Vertex 2 {m}
  16.4952785002736, 65.2819899121641, 6.4999999998934, !- X,Y,Z
   Vertex 3 {m}
  13.1619451669403, 70.2819899121641, 6.49999999985236; !- X,Y,Z
   Vertex 4 {m}

BuildingSurface:Detailed,
  Room_28_d6ed2799..Face5,                !- Name
  Roof,                                   !- Surface Type
  project_roof,                           !- Construction Name
  Room_28_d6ed2799,                       !- Zone Name
  Outdoors,                               !- Outside Boundary
   Condition
  ,                                       !- Outside Boundary
   Condition Object
  SunExposed,                             !- Sun Exposure
  WindExposed,                            !- Wind Exposure
  ,                                       !- View Factor to Ground
  ,                                       !- Number of Vertices
  19.8286118336156, 65.2819899121439, 9.74999999989868, !- X,Y,Z
   Vertex 1 {m}
  23.1619451669489, 70.2819899121439, 9.74999999986818, !- X,Y,Z
   Vertex 2 {m}
  13.1619451669489, 70.2819899121439, 9.74999999985237, !- X,Y,Z
   Vertex 3 {m}
  16.4952785002823, 65.2819899121439, 9.74999999989341; !- X,Y,Z
   Vertex 4 {m}

ZoneControl:Thermostat,
  Room_28_d6ed2799 Thermostat,            !- Name
  Room_28_d6ed2799,                       !- Zone or ZoneList Name
```

```
  Room_28_d6ed2799 Thermostat Schedule,   !- Control Type Schedule
   Name
  ThermostatSetpoint:DualSetpoint,        !- Control 1 Object Type
  Thermostat Setpoint Dual Setpoint 13,   !- Control 1 Name
  ,                                       !- Control 2 Object Type
  ,                                       !- Control 2 Name
  ,                                       !- Control 3 Object Type
  ,                                       !- Control 3 Name
  ,                                       !- Control 4 Object Type
  ,                                       !- Control 4 Name
  0;                                      !- Temperature Difference
   Between Cutout And Setpoint {deltaC}

Schedule:Compact,
  Room_28_d6ed2799 Thermostat Schedule,   !- Name
  Room_28_d6ed2799 Thermostat Schedule Type Limits, !- Schedule Type
    Limits Name
  Through: 12/31,                         !- Field 1
  For: AllDays,                           !- Field 2
  Until: 24:00,                           !- Field 3
  4;                                      !- Field 4

ScheduleTypeLimits,
  Room_28_d6ed2799 Thermostat Schedule Type Limits, !- Name
  0,                                      !- Lower Limit Value {
   BasedOnField A3}
  4,                                      !- Upper Limit Value {
   BasedOnField A3}
  DISCRETE;                               !- Numeric Type

ThermostatSetpoint:DualSetpoint,
  Thermostat Setpoint Dual Setpoint 13,   !- Name
  project_heat,                           !- Heating Setpoint
   Temperature Schedule Name
  Clg-SetP-Sch;                        !- Cooling Setpoint
   Temperature Schedule Name
```

```
ZoneHVAC:EquipmentConnections,
  Room_28_d6ed2799,                        !- Zone Name
  Room_28_d6ed2799 Equipment List,         !- Zone Conditioning
   Equipment List Name
  Room_28_d6ed2799 Inlet Node List,        !- Zone Air Inlet Node or
   NodeList Name
  Room_28_d6ed2799 Exhaust Node List,      !- Zone Air Exhaust Node
   or NodeList Name
  Room_28_d6ed2799 Zone Air Node,          !- Zone Air Node Name
  Room_28_d6ed2799 Return Node List;       !- Zone Return Air Node or
    NodeList Name

NodeList,
  Room_28_d6ed2799 Inlet Node List,        !- Name
  Room_28_d6ed2799 Air Terminal Outlet Air Node, !- Node Name 1
  Room_28_d6ed2799 VRF Terminal Unit Outlet Air Node; !- Node Name 2

NodeList,
  Room_28_d6ed2799 Exhaust Node List,      !- Name
  Room_28_d6ed2799 VRF Terminal Unit Inlet Air Node; !- Node Name 1

NodeList,
  Room_28_d6ed2799 Return Node List,       !- Name
  Room_28_d6ed2799 Return Air Node;        !- Node Name 1

AirTerminal:SingleDuct:ConstantVolume:NoReheat,
  Room_28_d6ed2799 Air Terminal,           !- Name
  Always On Discrete,                      !- Availability Schedule
   Name
  Room_28_d6ed2799 Air Terminal Inlet Air Node, !- Air Inlet Node
   Name
  Room_28_d6ed2799 Air Terminal Outlet Air Node, !- Air Outlet Node
   Name
  AutoSize;                                !- Maximum Air Flow Rate {
   m3/s}
```

```
ZoneHVAC:AirDistributionUnit,
  ADU Room_28_d6ed2799 Air Terminal,      !- Name
  Room_28_d6ed2799 Air Terminal Outlet Air Node, !- Air Distribution
    Unit Outlet Node Name
  AirTerminal:SingleDuct:ConstantVolume:NoReheat, !- Air Terminal
   Object Type
  Room_28_d6ed2799 Air Terminal;          !- Air Terminal Name

ZoneHVAC:TerminalUnit:VariableRefrigerantFlow,
  Room_28_d6ed2799 VRF Terminal Unit,     !- Zone Terminal Unit Name
  Always On Discrete,                     !- Terminal Unit
   Availability Schedule
  Room_28_d6ed2799 VRF Terminal Unit Inlet Air Node, !- Terminal
   Unit Air Inlet Node Name
  Room_28_d6ed2799 VRF Terminal Unit Outlet Air Node, !- Terminal
   Unit Air Outlet Node Name
  Autosize,                               !- Cooling Supply Air Flow
    Rate {m3/s}
  Autosize,                               !- No Cooling Supply Air
   Flow Rate {m3/s}
  Autosize,                               !- Heating Supply Air Flow
    Rate {m3/s}
  Autosize,                               !- No Heating Supply Air
   Flow Rate {m3/s}
  Autosize,                               !- Cooling Outdoor Air
   Flow Rate {m3/s}
  Autosize,                               !- Heating Outdoor Air
   Flow Rate {m3/s}
  Autosize,                               !- No Load Outdoor Air
   Flow Rate {m3/s}
  Always Off Discrete,                    !- Supply Air Fan
   Operating Mode Schedule Name
  DrawThrough,                            !- Supply Air Fan
   Placement
```

```
  Fan:OnOff,                                !- Supply Air Fan Object
   Type
  Room_28_d6ed2799 VRF Unit Cycling Fan,  !- Supply Air Fan Object
   Name
  OutdoorAir:Mixer,                         !- Outside Air Mixer
   Object Type
  Room_28_d6ed2799 VRF Terminal Unit OA Mixer, !- Outside Air Mixer
   Object Name
  Coil:Cooling:DX:VariableRefrigerantFlow, !- Cooling Coil Object
   Type
  Zone HVAC Terminal Unit Variable Refrigerant Flow 1 Cooling Coil
   12, !- Cooling Coil Object Name
  Coil:Heating:DX:VariableRefrigerantFlow, !- Heating Coil Object
   Type
  Zone HVAC Terminal Unit Variable Refrigerant Flow 1 Heating Coil
   12, !- Heating Coil Object Name
  30,                                       !- Zone Terminal Unit On
   Parasitic Electric Energy Use {W}
  20,                                       !- Zone Terminal Unit Off
   Parasitic Electric Energy Use {W}
  1,                                        !- Rated Heating Capacity
   Sizing Ratio {W/W}
  ,                                         !- Availability Manager
   List Name
  ,                                         !- Design Specification
   ZoneHVAC Sizing Object Name
  ,                                         !- Supplemental Heating
   Coil Object Type
  ,                                         !- Supplemental Heating
   Coil Name
  Autosize,                                 !- Maximum Supply Air
   Temperature from Supplemental Heater {C}
  21;                                       !- Maximum Outdoor Dry-
   Bulb Temperature for Supplemental Heater Operation {C}

OutdoorAir:Mixer,
```

```
  Room_28_d6ed2799 VRF Terminal Unit OA Mixer, !- Name
  Room_28_d6ed2799 VRF Terminal Unit Mixer Outlet Node, !- Mixed Air
    Node Name
  Room_28_d6ed2799 VRF Terminal Unit Outdoor Air Node, !- Outdoor
   Air Stream Node Name
  Room_28_d6ed2799 VRF Terminal Unit Relief Node Name, !- Relief Air
    Stream Node Name
  Room_28_d6ed2799 VRF Terminal Unit Inlet Air Node; !- Return Air
   Stream Node Name

OutdoorAir:NodeList,
  Room_28_d6ed2799 VRF Terminal Unit Outdoor Air Node; !- Node or
   NodeList Name 1

Coil:Cooling:DX:VariableRefrigerantFlow,
  Zone HVAC Terminal Unit Variable Refrigerant Flow 1 Cooling Coil
   12, !- Name
  Always On Discrete,                     !- Availability Schedule
   Name
  Autosize,                               !- Gross Rated Total
   Cooling Capacity {W}
  Autosize,                               !- Gross Rated Sensible
   Heat Ratio
  Autosize,                               !- Rated Air Flow Rate {m3
   /s}
  VRFTUCoolCapFT 12,                      !- Cooling Capacity Ratio
   Modifier Function of Temperature Curve Name
  VRFACCoolCapFFF 12,                     !- Cooling Capacity
   Modifier Curve Function of Flow Fraction Name
  Room_28_d6ed2799 VRF Terminal Unit Mixer Outlet Node, !- Coil Air
   Inlet Node
  Room_28_d6ed2799 VRF Terminal Unit Cooling Coil Outlet Node; !-
   Coil Air Outlet Node

Curve:Biquadratic,
  VRFTUCoolCapFT 12,                      !- Name
```

```
  0.0585884077803259,                     !- Coefficient1 Constant
  0.0587396532718384,                     !- Coefficient2 x
  -0.000210274979759697,                  !- Coefficient3 x**2
  0.0109370473889647,                     !- Coefficient4 y
  -0.0001219549,                          !- Coefficient5 y**2
  -0.0005246615,                          !- Coefficient6 x*y
  15,                                     !- Minimum Value of x {
   BasedOnField A2}
  23.89,                                  !- Maximum Value of x {
   BasedOnField A2}
  20,                                     !- Minimum Value of y {
   BasedOnField A3}
  43.33,                                  !- Maximum Value of y {
   BasedOnField A3}
  0.8083,                                 !- Minimum Curve Output {
   BasedOnField A4}
  1.2583;                                 !- Maximum Curve Output {
   BasedOnField A4}

Curve:Quadratic,
  VRFACCoolCapFFF 12,                     !- Name
  0.8,                                    !- Coefficient1 Constant
  0.2,                                    !- Coefficient2 x
  0,                                      !- Coefficient3 x**2
  0.5,                                    !- Minimum Value of x {
   BasedOnField A2}
  1.5;                                    !- Maximum Value of x {
   BasedOnField A2}

Coil:Heating:DX:VariableRefrigerantFlow,
  Zone HVAC Terminal Unit Variable Refrigerant Flow 1 Heating Coil
   12, !- Name
  Always On Discrete,                     !- Availability Schedule
  Autosize,                               !- Gross Rated Heating
   Capacity {W}
```

```
  Autosize,                               !- Rated Air Flow Rate {m3
   /s}
  Room_28_d6ed2799 VRF Terminal Unit Cooling Coil Outlet Node, !-
   Coil Air Inlet Node
  Room_28_d6ed2799 VRF Terminal Unit Heating Coil Outlet Node, !-
   Coil Air Outlet Node
  Coil Heating DX Variable Refrigerant Flow 1 VRFTUHeatCAPFT 12, !-
   Heating Capacity Ratio Modifier Function of Temperature Curve
   Name
  Coil Heating DX Variable Refrigerant Flow 1 VRFACCoolCapFFF 12; !-
    Heating Capacity Modifier Function of Flow Fraction Curve Name

Curve:Biquadratic,
  Coil Heating DX Variable Refrigerant Flow 1 VRFTUHeatCAPFT 12, !-
   Name
  0.375443994956127,                      !- Coefficient1 Constant
  0.0668190645147821,                     !- Coefficient2 x
  -0.00194171026482001,                   !- Coefficient3 x**2
  0.0442618420640187,                     !- Coefficient4 y
  -0.0004009578,                          !- Coefficient5 y**2
  -0.0014819801,                          !- Coefficient6 x*y
  21.11,                                  !- Minimum Value of x {
   BasedOnField A2}
  27.22,                                  !- Maximum Value of x {
   BasedOnField A2}
  -15,                                    !- Minimum Value of y {
   BasedOnField A3}
  18.33,                                  !- Maximum Value of y {
   BasedOnField A3}
  0.6074,                                 !- Minimum Curve Output {
   BasedOnField A4}
  1;                                      !- Maximum Curve Output {
   BasedOnField A4}

Curve:Quadratic,
```

```
  Coil Heating DX Variable Refrigerant Flow 1 VRFACCoolCapFFF 12, !-
    Name
  0.8,                                    !- Coefficient1 Constant
  0.2,                                    !- Coefficient2 x
  0,                                      !- Coefficient3 x**2
  0.5,                                    !- Minimum Value of x {
   BasedOnField A2}
  1.5;                                    !- Maximum Value of x {
   BasedOnField A2}

Fan:OnOff,
  Room_28_d6ed2799 VRF Unit Cycling Fan,  !- Name
  Always On Discrete,                     !- Availability Schedule
   Name
  0.6,                                    !- Fan Total Efficiency
  300,                                    !- Pressure Rise {Pa}
  Autosize,                               !- Maximum Flow Rate {m3/s
   }
  0.8,                                    !- Motor Efficiency
  1,                                      !- Motor In Airstream
   Fraction
  Room_28_d6ed2799 VRF Terminal Unit Heating Coil Outlet Node, !-
   Air Inlet Node Name
  Room_28_d6ed2799 VRF Terminal Unit Outlet Air Node, !- Air Outlet
   Node Name
  Fan On Off Power Curve 12,              !- Fan Power Ratio
   Function of Speed Ratio Curve Name
  Fan On Off Efficiency Curve 12,         !- Fan Efficiency Ratio
   Function of Speed Ratio Curve Name
  General;                                !- End-Use Subcategory

Curve:Exponent,
  Fan On Off Power Curve 12,              !- Name
  1,                                      !- Coefficient1 Constant
  0,                                      !- Coefficient2 Constant
  0,                                      !- Coefficient3 Constant
```

```
  0,                                      !- Minimum Value of x {
   BasedOnField A2}
  1;                                      !- Maximum Value of x {
   BasedOnField A2}

Curve:Cubic,
  Fan On Off Efficiency Curve 12,         !- Name
  1,                                      !- Coefficient1 Constant
  0,                                      !- Coefficient2 x
  0,                                      !- Coefficient3 x**2
  0,                                      !- Coefficient4 x**3
  0,                                      !- Minimum Value of x {
   BasedOnField A2}
  1;                                      !- Maximum Value of x {
   BasedOnField A2}

ZoneHVAC:EquipmentList,
  Room_28_d6ed2799 Equipment List,        !- Name
  SequentialLoad,                         !- Load Distribution
   Scheme
  ZoneHVAC:AirDistributionUnit,           !- Zone Equipment Object
   Type 1
  ADU Room_28_d6ed2799 Air Terminal,      !- Zone Equipment Name 1
  1,                                      !- Zone Equipment Cooling
   Sequence 1
  1,                                      !- Zone Equipment Heating
   or No-Load Sequence 1
  Schedule Constant 25,                   !- Zone Equipment
   Sequential Cooling Fraction Schedule Name 1
  Schedule Constant 26,                   !- Zone Equipment
   Sequential Heating Fraction Schedule Name 1
  ZoneHVAC:TerminalUnit:VariableRefrigerantFlow, !- Zone Equipment
   Object Type 2
  Room_28_d6ed2799 VRF Terminal Unit,     !- Zone Equipment Name 2
  2,                                      !- Zone Equipment Cooling
   Sequence 2
```

```
  2,                                      !- Zone Equipment Heating
    or No-Load Sequence 2
  ,                                       !- Zone Equipment
    Sequential Cooling Fraction Schedule Name 2
  ;                                       !- Zone Equipment
    Sequential Heating Fraction Schedule Name 2

Sizing:Zone,
  Room_28_d6ed2799,                       !- Zone or ZoneList Name
  SupplyAirTemperature,                   !- Zone Cooling Design
    Supply Air Temperature Input Method
  12.7777777777778,                       !- Zone Cooling Design
    Supply Air Temperature {C}
  11.11,                                  !- Zone Cooling Design
    Supply Air Temperature Difference {deltaC}
  SupplyAirTemperature,                   !- Zone Heating Design
    Supply Air Temperature Input Method
  40.0000000000001,                       !- Zone Heating Design
    Supply Air Temperature {C}
  11.11,                                  !- Zone Heating Design
    Supply Air Temperature Difference {deltaC}
  0.0085,                                 !- Zone Cooling Design
    Supply Air Humidity Ratio {kgWater/kgDryAir}
  0.008,                                  !- Zone Heating Design
    Supply Air Humidity Ratio {kgWater/kgDryAir}
  ventilation,                            !- Design Specification
    Outdoor Air Object Name
  ,                                       !- Zone Heating Sizing
    Factor
  ,                                       !- Zone Cooling Sizing
    Factor
  DesignDay,                              !- Cooling Design Air Flow
     Method
  0,                                      !- Cooling Design Air Flow
     Rate {m3/s}
```

```
  0.000762,                               !- Cooling Minimum Air
   Flow per Zone Floor Area {m3/s-m2}
  0,                                      !- Cooling Minimum Air
   Flow {m3/s}
  0,                                      !- Cooling Minimum Air
   Flow Fraction
  DesignDay,                              !- Heating Design Air Flow
    Method
  0,                                      !- Heating Design Air Flow
    Rate {m3/s}
  0.002032,                               !- Heating Maximum Air
   Flow per Zone Floor Area {m3/s-m2}
  0.1415762,                              !- Heating Maximum Air
   Flow {m3/s}
  0.3,                                    !- Heating Maximum Air
   Flow Fraction
  ,                                       !- Design Specification
   Zone Air Distribution Object Name
  Yes,                                    !- Account for Dedicated
   Outdoor Air System
  NeutralSupplyAir,                       !- Dedicated Outdoor Air
   System Control Strategy
  15.5555555555556,                       !- Dedicated Outdoor Air
   Low Setpoint Temperature for Design {C}
  21.1111111111111;                       !- Dedicated Outdoor Air
   High Setpoint Temperature for Design {C}

Zone,
  Room_29_2a634042,                       !- Name
  0,                                      !- Direction of Relative
   North {deg}
  0,                                      !- X Origin {m}
  0,                                      !- Y Origin {m}
  0,                                      !- Z Origin {m}
  ,                                       !- Type
  1,                                      !- Multiplier
```

```
  ,                                       !- Ceiling Height {m}
  ,                                       !- Volume {m3}
  ,                                       !- Floor Area {m2}
  ,                                       !- Zone Inside Convection
   Algorithm
  ,                                       !- Zone Outside Convection
    Algorithm
  Yes;                                    !- Part of Total Floor
   Area

BuildingSurface:Detailed,
  Room_29_2a634042..Face0,                !- Name
  Wall,                                   !- Surface Type
  project_wall_int,                       !- Construction Name
  Room_29_2a634042,                       !- Zone Name
  Surface,                                !- Outside Boundary
   Condition
  Room_23_e751e71f..Face2,                !- Outside Boundary
   Condition Object
  NoSun,                                  !- Sun Exposure
  NoWind,                                 !- Wind Exposure
  ,                                       !- View Factor to Ground
  ,                                       !- Number of Vertices
  16.4952785002736, 65.2819899121641, 6.4999999998934, !- X,Y,Z
   Vertex 1 {m}
  13.1619451669403, 70.2819899121641, 6.49999999985236, !- X,Y,Z
   Vertex 2 {m}
  13.1619451669316, 70.2819899121844, 3.24999999985236, !- X,Y,Z
   Vertex 3 {m}
  16.495278500265, 65.2819899121844, 3.2499999998934; !- X,Y,Z
   Vertex 4 {m}

BuildingSurface:Detailed,
  Room_29_2a634042..Face1,                !- Name
  Wall,                                   !- Surface Type
  project_wall_int,                       !- Construction Name
```

```
  Room_29_2a634042,                       !- Zone Name
  Surface,                                !- Outside Boundary
   Condition
  Room_20_4d060559..Face2,                !- Outside Boundary
   Condition Object
  NoSun,                                  !- Sun Exposure
  NoWind,                                 !- Wind Exposure
  ,                                       !- View Factor to Ground
  ,                                       !- Number of Vertices
  19.8286118336069, 65.2819899121641, 6.49999999989867, !- X,Y,Z
   Vertex 1 {m}
  16.4952785002736, 65.2819899121641, 6.4999999998934, !- X,Y,Z
   Vertex 2 {m}
  16.495278500265, 65.2819899121844, 3.2499999998934, !- X,Y,Z
   Vertex 3 {m}
  19.8286118335983, 65.2819899121844, 3.24999999989868; !- X,Y,Z
   Vertex 4 {m}

BuildingSurface:Detailed,
  Room_29_2a634042..Face2,                !- Name
  Wall,                                   !- Surface Type
  project_wall_int,                       !- Construction Name
  Room_29_2a634042,                       !- Zone Name
  Surface,                                !- Outside Boundary
   Condition
  Room_26_f4ea3797..Face1,                !- Outside Boundary
   Condition Object
  NoSun,                                  !- Sun Exposure
  NoWind,                                 !- Wind Exposure
  ,                                       !- View Factor to Ground
  ,                                       !- Number of Vertices
  19.8286118336069, 65.2819899121641, 6.49999999989867, !- X,Y,Z
   Vertex 1 {m}
  19.8286118335983, 65.2819899121844, 3.24999999989868, !- X,Y,Z
   Vertex 2 {m}
```

```
  23.1619451669316, 70.2819899121844, 3.24999999986817, !- X,Y,Z
   Vertex 3 {m}
  23.1619451669403, 70.2819899121641, 6.49999999986818; !- X,Y,Z
   Vertex 4 {m}

BuildingSurface:Detailed,
  Room_29_2a634042..Face3,                !- Name
  Wall,                                   !- Surface Type
  project_wall,                           !- Construction Name
  Room_29_2a634042,                       !- Zone Name
  Outdoors,                               !- Outside Boundary
   Condition
  ,                                       !- Outside Boundary
   Condition Object
  SunExposed,                             !- Sun Exposure
  WindExposed,                            !- Wind Exposure
  ,                                       !- View Factor to Ground
  ,                                       !- Number of Vertices
  23.1619451669403, 70.2819899121641, 6.49999999986818, !- X,Y,Z
   Vertex 1 {m}
  23.1619451669316, 70.2819899121844, 3.24999999986817, !- X,Y,Z
   Vertex 2 {m}
  13.1619451669316, 70.2819899121844, 3.24999999985236, !- X,Y,Z
   Vertex 3 {m}
  13.1619451669403, 70.2819899121641, 6.49999999985236; !- X,Y,Z
   Vertex 4 {m}

FenestrationSurface:Detailed,
  Room_29_2a634042..Face3_Glz0,           !- Name
  Window,                                 !- Surface Type
  project_window,                         !- Construction Name
  Room_29_2a634042..Face3,                !- Building Surface Name
  ,                                       !- Outside Boundary
   Condition Object
  ,                                       !- View Factor to Ground
  ,                                       !- Frame and Divider Name
```

```
  ,                                         !- Multiplier
  ,                                         !- Number of Vertices
  21.9015285002623, 70.2819899121669, 6.04999999986618, !- X,Y,Z
   Vertex 1 {m}
  21.9015285002654, 70.2819899121794, 4.04999999986618, !- X,Y,Z
   Vertex 2 {m}
  21.0890285002666, 70.2819899121794, 4.04999999986489, !- X,Y,Z
   Vertex 3 {m}
  21.0890285002634, 70.2819899121669, 6.04999999986489; !- X,Y,Z
   Vertex 4 {m}

FenestrationSurface:Detailed,
  Room_29_2a634042..Face3_Glz1,           !- Name
  Window,                                 !- Surface Type
  project_window,                         !- Construction Name
  Room_29_2a634042..Face3,                !- Building Surface Name
  ,                                       !- Outside Boundary
   Condition Object
  ,                                       !- View Factor to Ground
  ,                                       !- Frame and Divider Name
  ,                                       !- Multiplier
  ,                                       !- Number of Vertices
  18.5681951669335, 70.2819899121669, 6.04999999986091, !- X,Y,Z
   Vertex 1 {m}
  18.5681951669367, 70.2819899121794, 4.04999999986091, !- X,Y,Z
   Vertex 2 {m}
  17.7556951669378, 70.2819899121794, 4.04999999985962, !- X,Y,Z
   Vertex 3 {m}
  17.7556951669347, 70.2819899121669, 6.04999999985962; !- X,Y,Z
   Vertex 4 {m}

FenestrationSurface:Detailed,
  Room_29_2a634042..Face3_Glz2,           !- Name
  Window,                                 !- Surface Type
  project_window,                         !- Construction Name
  Room_29_2a634042..Face3,                !- Building Surface Name
```

```
  ,                                       !- Outside Boundary
   Condition Object
  ,                                       !- View Factor to Ground
  ,                                       !- Frame and Divider Name
  ,                                       !- Multiplier
  ,                                       !- Number of Vertices
  15.2348618336048, 70.2819899121669, 6.04999999985564, !- X,Y,Z
   Vertex 1 {m}
  15.234861833608, 70.2819899121794, 4.04999999985564, !- X,Y,Z
   Vertex 2 {m}
  14.4223618336091, 70.2819899121794, 4.04999999985435, !- X,Y,Z
   Vertex 3 {m}
  14.4223618336059, 70.2819899121669, 6.04999999985435; !- X,Y,Z
   Vertex 4 {m}

BuildingSurface:Detailed,
  Room_29_2a634042..Face4,                !- Name
  Floor,                                  !- Surface Type
  project_floor,                          !- Construction Name
  Room_29_2a634042,                       !- Zone Name
  Surface,                                !- Outside Boundary
   Condition
  Room_30_98f1d6c8..Face5,                !- Outside Boundary
   Condition Object
  NoSun,                                  !- Sun Exposure
  NoWind,                                 !- Wind Exposure
  ,                                       !- View Factor to Ground
  ,                                       !- Number of Vertices
  23.1619451669316, 70.2819899121844, 3.24999999986817, !- X,Y,Z
   Vertex 1 {m}
  19.8286118335983, 65.2819899121844, 3.24999999989868, !- X,Y,Z
   Vertex 2 {m}
  16.495278500265, 65.2819899121844, 3.2499999998934, !- X,Y,Z
   Vertex 3 {m}
  13.1619451669316, 70.2819899121844, 3.24999999985236; !- X,Y,Z
   Vertex 4 {m}
```

```
BuildingSurface:Detailed,
  Room_29_2a634042..Face5,                !- Name
  Ceiling,                                !- Surface Type
  project_ceiling_int,                    !- Construction Name
  Room_29_2a634042,                       !- Zone Name
  Surface,                                !- Outside Boundary
   Condition
  Room_28_d6ed2799..Face4,                !- Outside Boundary
   Condition Object
  NoSun,                                  !- Sun Exposure
  NoWind,                                 !- Wind Exposure
  ,                                       !- View Factor to Ground
  ,                                       !- Number of Vertices
  19.8286118336069, 65.2819899121641, 6.49999999989867, !- X,Y,Z
   Vertex 1 {m}
  23.1619451669403, 70.2819899121641, 6.49999999986818, !- X,Y,Z
   Vertex 2 {m}
  13.1619451669403, 70.2819899121641, 6.49999999985236, !- X,Y,Z
   Vertex 3 {m}
  16.4952785002736, 65.2819899121641, 6.4999999998934; !- X,Y,Z
   Vertex 4 {m}

ZoneControl:Thermostat,
  Room_29_2a634042 Thermostat,            !- Name
  Room_29_2a634042,                       !- Zone or ZoneList Name
  Room_29_2a634042 Thermostat Schedule,   !- Control Type Schedule
   Name
  ThermostatSetpoint:DualSetpoint,        !- Control 1 Object Type
  Thermostat Setpoint Dual Setpoint 14,   !- Control 1 Name
  ,                                       !- Control 2 Object Type
  ,                                       !- Control 2 Name
  ,                                       !- Control 3 Object Type
  ,                                       !- Control 3 Name
  ,                                       !- Control 4 Object Type
  ,                                       !- Control 4 Name
```

```
  0;                                      !- Temperature Difference
   Between Cutout And Setpoint {deltaC}

Schedule:Compact,
  Room_29_2a634042 Thermostat Schedule,   !- Name
  Room_29_2a634042 Thermostat Schedule Type Limits, !- Schedule Type
    Limits Name
  Through: 12/31,                         !- Field 1
  For: AllDays,                           !- Field 2
  Until: 24:00,                           !- Field 3
  4;                                      !- Field 4

ScheduleTypeLimits,
  Room_29_2a634042 Thermostat Schedule Type Limits, !- Name
  0,                                      !- Lower Limit Value {
   BasedOnField A3}
  4,                                      !- Upper Limit Value {
   BasedOnField A3}
  DISCRETE;                               !- Numeric Type

ThermostatSetpoint:DualSetpoint,
  Thermostat Setpoint Dual Setpoint 14,   !- Name
  project_heat,                           !- Heating Setpoint
   Temperature Schedule Name
  Clg-SetP-Sch;                        !- Cooling Setpoint
   Temperature Schedule Name

ZoneHVAC:EquipmentConnections,
  Room_29_2a634042,                       !- Zone Name
  Room_29_2a634042 Equipment List,        !- Zone Conditioning
   Equipment List Name
  Room_29_2a634042 Inlet Node List,       !- Zone Air Inlet Node or
   NodeList Name
  Room_29_2a634042 Exhaust Node List,     !- Zone Air Exhaust Node
   or NodeList Name
  Room_29_2a634042 Zone Air Node,         !- Zone Air Node Name
```

```
  Room_29_2a634042 Return Node List;      !- Zone Return Air Node or
    NodeList Name

NodeList,
  Room_29_2a634042 Inlet Node List,       !- Name
  Room_29_2a634042 Air Terminal Outlet Air Node, !- Node Name 1
  Room_29_2a634042 VRF Terminal Unit Outlet Air Node; !- Node Name 2

NodeList,
  Room_29_2a634042 Exhaust Node List,     !- Name
  Room_29_2a634042 VRF Terminal Unit Inlet Air Node; !- Node Name 1

NodeList,
  Room_29_2a634042 Return Node List,      !- Name
  Room_29_2a634042 Return Air Node;       !- Node Name 1

AirTerminal:SingleDuct:ConstantVolume:NoReheat,
  Room_29_2a634042 Air Terminal,          !- Name
  Always On Discrete,                     !- Availability Schedule
   Name
  Room_29_2a634042 Air Terminal Inlet Air Node, !- Air Inlet Node
   Name
  Room_29_2a634042 Air Terminal Outlet Air Node, !- Air Outlet Node
   Name
  AutoSize;                               !- Maximum Air Flow Rate {
   m3/s}

ZoneHVAC:AirDistributionUnit,
  ADU Room_29_2a634042 Air Terminal,      !- Name
  Room_29_2a634042 Air Terminal Outlet Air Node, !- Air Distribution
    Unit Outlet Node Name
  AirTerminal:SingleDuct:ConstantVolume:NoReheat, !- Air Terminal
   Object Type
  Room_29_2a634042 Air Terminal;          !- Air Terminal Name

ZoneHVAC:TerminalUnit:VariableRefrigerantFlow,
```

```
Room_29_2a634042 VRF Terminal Unit,     !- Zone Terminal Unit Name
Always On Discrete,                     !- Terminal Unit
 Availability Schedule
Room_29_2a634042 VRF Terminal Unit Inlet Air Node, !- Terminal
 Unit Air Inlet Node Name
Room_29_2a634042 VRF Terminal Unit Outlet Air Node, !- Terminal
 Unit Air Outlet Node Name
Autosize,                               !- Cooling Supply Air Flow
  Rate {m3/s}
Autosize,                               !- No Cooling Supply Air
 Flow Rate {m3/s}
Autosize,                               !- Heating Supply Air Flow
  Rate {m3/s}
Autosize,                               !- No Heating Supply Air
 Flow Rate {m3/s}
Autosize,                               !- Cooling Outdoor Air
 Flow Rate {m3/s}
Autosize,                               !- Heating Outdoor Air
 Flow Rate {m3/s}
Autosize,                               !- No Load Outdoor Air
 Flow Rate {m3/s}
Always Off Discrete,                    !- Supply Air Fan
 Operating Mode Schedule Name
DrawThrough,                            !- Supply Air Fan
 Placement
Fan:OnOff,                              !- Supply Air Fan Object
 Type
Room_29_2a634042 VRF Unit Cycling Fan,  !- Supply Air Fan Object
 Name
OutdoorAir:Mixer,                       !- Outside Air Mixer
 Object Type
Room_29_2a634042 VRF Terminal Unit OA Mixer, !- Outside Air Mixer
 Object Name
Coil:Cooling:DX:VariableRefrigerantFlow, !- Cooling Coil Object
 Type
```

```
  Zone HVAC Terminal Unit Variable Refrigerant Flow 1 Cooling Coil
   13, !- Cooling Coil Object Name
  Coil:Heating:DX:VariableRefrigerantFlow, !- Heating Coil Object
   Type
  Zone HVAC Terminal Unit Variable Refrigerant Flow 1 Heating Coil
   13, !- Heating Coil Object Name
  30,                                      !- Zone Terminal Unit On
   Parasitic Electric Energy Use {W}
  20,                                      !- Zone Terminal Unit Off
   Parasitic Electric Energy Use {W}
  1,                                       !- Rated Heating Capacity
   Sizing Ratio {W/W}
  ,                                        !- Availability Manager
   List Name
  ,                                        !- Design Specification
   ZoneHVAC Sizing Object Name
  ,                                        !- Supplemental Heating
   Coil Object Type
  ,                                        !- Supplemental Heating
   Coil Name
  Autosize,                                !- Maximum Supply Air
   Temperature from Supplemental Heater {C}
  21;                                      !- Maximum Outdoor Dry-
   Bulb Temperature for Supplemental Heater Operation {C}

OutdoorAir:Mixer,
  Room_29_2a634042 VRF Terminal Unit OA Mixer, !- Name
  Room_29_2a634042 VRF Terminal Unit Mixer Outlet Node, !- Mixed Air
    Node Name
  Room_29_2a634042 VRF Terminal Unit Outdoor Air Node, !- Outdoor
   Air Stream Node Name
  Room_29_2a634042 VRF Terminal Unit Relief Node Name, !- Relief Air
    Stream Node Name
  Room_29_2a634042 VRF Terminal Unit Inlet Air Node; !- Return Air
   Stream Node Name
```

```
OutdoorAir:NodeList,
  Room_29_2a634042 VRF Terminal Unit Outdoor Air Node; !- Node or
   NodeList Name 1

Coil:Cooling:DX:VariableRefrigerantFlow,
  Zone HVAC Terminal Unit Variable Refrigerant Flow 1 Cooling Coil
   13, !- Name
  Always On Discrete,                     !- Availability Schedule
   Name
  Autosize,                               !- Gross Rated Total
   Cooling Capacity {W}
  Autosize,                               !- Gross Rated Sensible
   Heat Ratio
  Autosize,                               !- Rated Air Flow Rate {m3
   /s}
  VRFTUCoolCapFT 13,                      !- Cooling Capacity Ratio
   Modifier Function of Temperature Curve Name
  VRFACCoolCapFFF 13,                     !- Cooling Capacity
   Modifier Curve Function of Flow Fraction Name
  Room_29_2a634042 VRF Terminal Unit Mixer Outlet Node, !- Coil Air
   Inlet Node
  Room_29_2a634042 VRF Terminal Unit Cooling Coil Outlet Node; !-
   Coil Air Outlet Node

Curve:Biquadratic,
  VRFTUCoolCapFT 13,                      !- Name
  0.0585884077803259,                     !- Coefficient1 Constant
  0.0587396532718384,                     !- Coefficient2 x
  -0.000210274979759697,                  !- Coefficient3 x**2
  0.0109370473889647,                     !- Coefficient4 y
  -0.0001219549,                          !- Coefficient5 y**2
  -0.0005246615,                          !- Coefficient6 x*y
  15,                                     !- Minimum Value of x {
   BasedOnField A2}
  23.89,                                  !- Maximum Value of x {
   BasedOnField A2}
```

```
  20,                                     !- Minimum Value of y {
   BasedOnField A3}
  43.33,                                  !- Maximum Value of y {
   BasedOnField A3}
  0.8083,                                 !- Minimum Curve Output {
   BasedOnField A4}
  1.2583;                                 !- Maximum Curve Output {
   BasedOnField A4}

Curve:Quadratic,
  VRFACCoolCapFFF 13,                     !- Name
  0.8,                                    !- Coefficient1 Constant
  0.2,                                    !- Coefficient2 x
  0,                                      !- Coefficient3 x**2
  0.5,                                    !- Minimum Value of x {
   BasedOnField A2}
  1.5;                                    !- Maximum Value of x {
   BasedOnField A2}

Coil:Heating:DX:VariableRefrigerantFlow,
  Zone HVAC Terminal Unit Variable Refrigerant Flow 1 Heating Coil
   13, !- Name
  Always On Discrete,                     !- Availability Schedule
  Autosize,                               !- Gross Rated Heating
   Capacity {W}
  Autosize,                               !- Rated Air Flow Rate {m3
   /s}
  Room_29_2a634042 VRF Terminal Unit Cooling Coil Outlet Node, !-
   Coil Air Inlet Node
  Room_29_2a634042 VRF Terminal Unit Heating Coil Outlet Node, !-
   Coil Air Outlet Node
  Coil Heating DX Variable Refrigerant Flow 1 VRFTUHeatCAPFT 13, !-
   Heating Capacity Ratio Modifier Function of Temperature Curve
   Name
  Coil Heating DX Variable Refrigerant Flow 1 VRFACCoolCapFFF 13; !-
    Heating Capacity Modifier Function of Flow Fraction Curve Name
```

```
Curve:Biquadratic,
  Coil Heating DX Variable Refrigerant Flow 1 VRFTUHeatCAPFT 13, !-
   Name
  0.375443994956127,                      !- Coefficient1 Constant
  0.0668190645147821,                     !- Coefficient2 x
  -0.00194171026482001,                   !- Coefficient3 x**2
  0.0442618420640187,                     !- Coefficient4 y
  -0.0004009578,                          !- Coefficient5 y**2
  -0.0014819801,                          !- Coefficient6 x*y
  21.11,                                  !- Minimum Value of x {
   BasedOnField A2}
  27.22,                                  !- Maximum Value of x {
   BasedOnField A2}
  -15,                                    !- Minimum Value of y {
   BasedOnField A3}
  18.33,                                  !- Maximum Value of y {
   BasedOnField A3}
  0.6074,                                 !- Minimum Curve Output {
   BasedOnField A4}
  1;                                      !- Maximum Curve Output {
   BasedOnField A4}

Curve:Quadratic,
  Coil Heating DX Variable Refrigerant Flow 1 VRFACCoolCapFFF 13, !-
    Name
  0.8,                                    !- Coefficient1 Constant
  0.2,                                    !- Coefficient2 x
  0,                                      !- Coefficient3 x**2
  0.5,                                    !- Minimum Value of x {
   BasedOnField A2}
  1.5;                                    !- Maximum Value of x {
   BasedOnField A2}

Fan:OnOff,
  Room_29_2a634042 VRF Unit Cycling Fan,  !- Name
```

```
  Always On Discrete,                     !- Availability Schedule
   Name
  0.6,                                    !- Fan Total Efficiency
  300,                                    !- Pressure Rise {Pa}
  Autosize,                               !- Maximum Flow Rate {m3/s
   }
  0.8,                                    !- Motor Efficiency
  1,                                      !- Motor In Airstream
   Fraction
  Room_29_2a634042 VRF Terminal Unit Heating Coil Outlet Node, !-
   Air Inlet Node Name
  Room_29_2a634042 VRF Terminal Unit Outlet Air Node, !- Air Outlet
   Node Name
  Fan On Off Power Curve 13,              !- Fan Power Ratio
   Function of Speed Ratio Curve Name
  Fan On Off Efficiency Curve 13,         !- Fan Efficiency Ratio
   Function of Speed Ratio Curve Name
  General;                                !- End-Use Subcategory

Curve:Exponent,
  Fan On Off Power Curve 13,              !- Name
  1,                                      !- Coefficient1 Constant
  0,                                      !- Coefficient2 Constant
  0,                                      !- Coefficient3 Constant
  0,                                      !- Minimum Value of x {
   BasedOnField A2}
  1;                                      !- Maximum Value of x {
   BasedOnField A2}

Curve:Cubic,
  Fan On Off Efficiency Curve 13,         !- Name
  1,                                      !- Coefficient1 Constant
  0,                                      !- Coefficient2 x
  0,                                      !- Coefficient3 x**2
  0,                                      !- Coefficient4 x**3
```

```
  0,                                      !- Minimum Value of x {
   BasedOnField A2}
  1;                                      !- Maximum Value of x {
   BasedOnField A2}

ZoneHVAC:EquipmentList,
  Room_29_2a634042 Equipment List,        !- Name
  SequentialLoad,                         !- Load Distribution
   Scheme
  ZoneHVAC:AirDistributionUnit,           !- Zone Equipment Object
   Type 1
  ADU Room_29_2a634042 Air Terminal,      !- Zone Equipment Name 1
  1,                                      !- Zone Equipment Cooling
   Sequence 1
  1,                                      !- Zone Equipment Heating
   or No-Load Sequence 1
  Schedule Constant 27,                   !- Zone Equipment
   Sequential Cooling Fraction Schedule Name 1
  Schedule Constant 28,                   !- Zone Equipment
   Sequential Heating Fraction Schedule Name 1
  ZoneHVAC:TerminalUnit:VariableRefrigerantFlow, !- Zone Equipment
   Object Type 2
  Room_29_2a634042 VRF Terminal Unit,     !- Zone Equipment Name 2
  2,                                      !- Zone Equipment Cooling
   Sequence 2
  2,                                      !- Zone Equipment Heating
   or No-Load Sequence 2
  ,                                       !- Zone Equipment
   Sequential Cooling Fraction Schedule Name 2
  ;                                       !- Zone Equipment
   Sequential Heating Fraction Schedule Name 2

Sizing:Zone,
  Room_29_2a634042,                       !- Zone or ZoneList Name
  SupplyAirTemperature,                   !- Zone Cooling Design
   Supply Air Temperature Input Method
```

```
12.7777777777778,                       !- Zone Cooling Design
 Supply Air Temperature {C}
11.11,                                  !- Zone Cooling Design
 Supply Air Temperature Difference {deltaC}
SupplyAirTemperature,                   !- Zone Heating Design
 Supply Air Temperature Input Method
40.0000000000001,                       !- Zone Heating Design
 Supply Air Temperature {C}
11.11,                                  !- Zone Heating Design
 Supply Air Temperature Difference {deltaC}
0.0085,                                 !- Zone Cooling Design
 Supply Air Humidity Ratio {kgWater/kgDryAir}
0.008,                                  !- Zone Heating Design
 Supply Air Humidity Ratio {kgWater/kgDryAir}
ventilation,                            !- Design Specification
 Outdoor Air Object Name
,                                       !- Zone Heating Sizing
 Factor
,                                       !- Zone Cooling Sizing
 Factor
DesignDay,                              !- Cooling Design Air Flow
  Method
0,                                      !- Cooling Design Air Flow
  Rate {m3/s}
0.000762,                               !- Cooling Minimum Air
 Flow per Zone Floor Area {m3/s-m2}
0,                                      !- Cooling Minimum Air
 Flow {m3/s}
0,                                      !- Cooling Minimum Air
 Flow Fraction
DesignDay,                              !- Heating Design Air Flow
  Method
0,                                      !- Heating Design Air Flow
  Rate {m3/s}
0.002032,                               !- Heating Maximum Air
 Flow per Zone Floor Area {m3/s-m2}
```

```
  0.1415762,                              !- Heating Maximum Air
   Flow {m3/s}
  0.3,                                    !- Heating Maximum Air
   Flow Fraction
  ,                                       !- Design Specification
   Zone Air Distribution Object Name
  Yes,                                    !- Account for Dedicated
   Outdoor Air System
  NeutralSupplyAir,                       !- Dedicated Outdoor Air
   System Control Strategy
  15.5555555555556,                       !- Dedicated Outdoor Air
   Low Setpoint Temperature for Design {C}
  21.1111111111111;                       !- Dedicated Outdoor Air
   High Setpoint Temperature for Design {C}

Zone,
  Room_30_98f1d6c8,                       !- Name
  0,                                      !- Direction of Relative
   North {deg}
  0,                                      !- X Origin {m}
  0,                                      !- Y Origin {m}
  0,                                      !- Z Origin {m}
  ,                                       !- Type
  1,                                      !- Multiplier
  ,                                       !- Ceiling Height {m}
  ,                                       !- Volume {m3}
  ,                                       !- Floor Area {m2}
  ,                                       !- Zone Inside Convection
   Algorithm
  ,                                       !- Zone Outside Convection
    Algorithm
  Yes;                                    !- Part of Total Floor
   Area

BuildingSurface:Detailed,
  Room_30_98f1d6c8..Face0,                !- Name
```

```
  Wall,                                   !- Surface Type
  project_wall_int,                       !- Construction Name
  Room_30_98f1d6c8,                       !- Zone Name
  Surface,                                !- Outside Boundary
   Condition
  Room_24_159d21b7..Face2,                !- Outside Boundary
   Condition Object
  NoSun,                                  !- Sun Exposure
  NoWind,                                 !- Wind Exposure
  ,                                       !- View Factor to Ground
  ,                                       !- Number of Vertices
  16.495278500265, 65.2819899121844, 3.2499999998934, !- X,Y,Z
   Vertex 1 {m}
  13.1619451669316, 70.2819899121844, 3.24999999985236, !- X,Y,Z
   Vertex 2 {m}
  13.161945166923, 70.2819899122047, -1.47642430239901e-10, !- X,Y,Z
    Vertex 3 {m}
  16.4952785002563, 65.2819899122047, -1.06597558445733e-10; !- X,Y,
   Z Vertex 4 {m}

BuildingSurface:Detailed,
  Room_30_98f1d6c8..Face1,                !- Name
  Wall,                                   !- Surface Type
  project_wall_int,                       !- Construction Name
  Room_30_98f1d6c8,                       !- Zone Name
  Surface,                                !- Outside Boundary
   Condition
  Room_21_4c523269..Face2,                !- Outside Boundary
   Condition Object
  NoSun,                                  !- Sun Exposure
  NoWind,                                 !- Wind Exposure
  ,                                       !- View Factor to Ground
  ,                                       !- Number of Vertices
  19.8286118335983, 65.2819899121844, 3.24999999989868, !- X,Y,Z
   Vertex 1 {m}
```

```
  16.495278500265, 65.2819899121844, 3.2499999998934, !- X,Y,Z
   Vertex 2 {m}
  16.4952785002563, 65.2819899122047, -1.06597558445733e-10, !- X,Y,
   Z Vertex 3 {m}
  19.8286118335897, 65.2819899122047, -1.0132554747248e-10; !- X,Y,Z
    Vertex 4 {m}

BuildingSurface:Detailed,
  Room_30_98f1d6c8..Face2,                !- Name
  Wall,                                   !- Surface Type
  project_wall_int,                       !- Construction Name
  Room_30_98f1d6c8,                       !- Zone Name
  Surface,                                !- Outside Boundary
   Condition
  Room_27_0080b418..Face1,                !- Outside Boundary
   Condition Object
  NoSun,                                  !- Sun Exposure
  NoWind,                                 !- Wind Exposure
  ,                                       !- View Factor to Ground
  ,                                       !- Number of Vertices
  19.8286118335983, 65.2819899121844, 3.24999999989868, !- X,Y,Z
   Vertex 1 {m}
  19.8286118335897, 65.2819899122047, -1.0132554747248e-10, !- X,Y,Z
    Vertex 2 {m}
  23.161945166923, 70.2819899122047, -1.3182639732014e-10, !- X,Y,Z
   Vertex 3 {m}
  23.1619451669316, 70.2819899121844, 3.24999999986817; !- X,Y,Z
   Vertex 4 {m}

BuildingSurface:Detailed,
  Room_30_98f1d6c8..Face3,                !- Name
  Wall,                                   !- Surface Type
  project_wall,                           !- Construction Name
  Room_30_98f1d6c8,                       !- Zone Name
  Outdoors,                               !- Outside Boundary
   Condition
```

```
  ,                                       !- Outside Boundary
   Condition Object
  SunExposed,                             !- Sun Exposure
  WindExposed,                            !- Wind Exposure
  ,                                       !- View Factor to Ground
  ,                                       !- Number of Vertices
  23.1619451669316, 70.2819899121844, 3.24999999986817, !- X,Y,Z
   Vertex 1 {m}
  23.161945166923, 70.2819899122047, -1.3182639732014e-10, !- X,Y,Z
   Vertex 2 {m}
  13.161945166923, 70.2819899122047, -1.47642430239901e-10, !- X,Y,Z
    Vertex 3 {m}
  13.1619451669316, 70.2819899121844, 3.24999999985236; !- X,Y,Z
   Vertex 4 {m}

FenestrationSurface:Detailed,
  Room_30_98f1d6c8..Face3_Glz0,           !- Name
  Window,                                 !- Surface Type
  project_window,                         !- Construction Name
  Room_30_98f1d6c8..Face3,                !- Building Surface Name
  ,                                       !- Outside Boundary
   Condition Object
  ,                                       !- View Factor to Ground
  ,                                       !- Frame and Divider Name
  ,                                       !- Multiplier
  ,                                       !- Number of Vertices
  21.9015285002536, 70.2819899121873, 2.79999999986618, !- X,Y,Z
   Vertex 1 {m}
  21.9015285002568, 70.2819899121997, 0.79999999986618, !- X,Y,Z
   Vertex 2 {m}
  21.0890285002579, 70.2819899121997, 0.799999999864895, !- X,Y,Z
   Vertex 3 {m}
  21.0890285002548, 70.2819899121873, 2.7999999998649; !- X,Y,Z
   Vertex 4 {m}

FenestrationSurface:Detailed,
```

```
  Room_30_98f1d6c8..Face3_Glz1,           !- Name
  Window,                                 !- Surface Type
  project_window,                         !- Construction Name
  Room_30_98f1d6c8..Face3,                !- Building Surface Name
  ,                                       !- Outside Boundary
   Condition Object
  ,                                       !- View Factor to Ground
  ,                                       !- Frame and Divider Name
  ,                                       !- Multiplier
  ,                                       !- Number of Vertices
  18.5681951669249, 70.2819899121873, 2.79999999986091, !- X,Y,Z
   Vertex 1 {m}
  18.5681951669281, 70.2819899121997, 0.799999999860908, !- X,Y,Z
   Vertex 2 {m}
  17.7556951669292, 70.2819899121997, 0.799999999859623, !- X,Y,Z
   Vertex 3 {m}
  17.755695166926, 70.2819899121873, 2.79999999985962; !- X,Y,Z
   Vertex 4 {m}

FenestrationSurface:Detailed,
  Room_30_98f1d6c8..Face3_Glz2,           !- Name
  Window,                                 !- Surface Type
  project_window,                         !- Construction Name
  Room_30_98f1d6c8..Face3,                !- Building Surface Name
  ,                                       !- Outside Boundary
   Condition Object
  ,                                       !- View Factor to Ground
  ,                                       !- Frame and Divider Name
  ,                                       !- Multiplier
  ,                                       !- Number of Vertices
  15.2348618335962, 70.2819899121873, 2.79999999985564, !- X,Y,Z
   Vertex 1 {m}
  15.2348618335993, 70.2819899121997, 0.799999999855636, !- X,Y,Z
   Vertex 2 {m}
  14.4223618336004, 70.2819899121997, 0.799999999854351, !- X,Y,Z
   Vertex 3 {m}
```

```
  14.4223618335973, 70.2819899121873, 2.79999999985435; !- X,Y,Z
   Vertex 4 {m}

BuildingSurface:Detailed,
  Room_30_98f1d6c8..Face4,                !- Name
  Floor,                                  !- Surface Type
  project_slab,                           !- Construction Name
  Room_30_98f1d6c8,                       !- Zone Name
  Ground,                                 !- Outside Boundary
   Condition
  ,                                       !- Outside Boundary
   Condition Object
  NoSun,                                  !- Sun Exposure
  NoWind,                                 !- Wind Exposure
  ,                                       !- View Factor to Ground
  ,                                       !- Number of Vertices
  23.161945166923, 70.2819899122047, -1.3182639732014e-10, !- X,Y,Z
   Vertex 1 {m}
  19.8286118335897, 65.2819899122047, -1.0132554747248e-10, !- X,Y,Z
    Vertex 2 {m}
  16.4952785002563, 65.2819899122047, -1.06597558445733e-10, !- X,Y,
   Z Vertex 3 {m}
  13.161945166923, 70.2819899122047, -1.47642430239901e-10; !- X,Y,Z
    Vertex 4 {m}

BuildingSurface:Detailed,
  Room_30_98f1d6c8..Face5,                !- Name
  Ceiling,                                !- Surface Type
  project_ceiling_int,                    !- Construction Name
  Room_30_98f1d6c8,                       !- Zone Name
  Surface,                                !- Outside Boundary
   Condition
  Room_29_2a634042..Face4,                !- Outside Boundary
   Condition Object
  NoSun,                                  !- Sun Exposure
  NoWind,                                 !- Wind Exposure
```

```
  ,                                       !- View Factor to Ground
  ,                                       !- Number of Vertices
  19.8286118335983, 65.2819899121844, 3.24999999989868, !- X,Y,Z
   Vertex 1 {m}
  23.1619451669316, 70.2819899121844, 3.24999999986817, !- X,Y,Z
   Vertex 2 {m}
  13.1619451669316, 70.2819899121844, 3.24999999985236, !- X,Y,Z
   Vertex 3 {m}
  16.495278500265, 65.2819899121844, 3.2499999998934; !- X,Y,Z
   Vertex 4 {m}

ZoneControl:Thermostat,
  Room_30_98f1d6c8 Thermostat,            !- Name
  Room_30_98f1d6c8,                       !- Zone or ZoneList Name
  Room_30_98f1d6c8 Thermostat Schedule,   !- Control Type Schedule
   Name
  ThermostatSetpoint:DualSetpoint,        !- Control 1 Object Type
  Thermostat Setpoint Dual Setpoint 15,   !- Control 1 Name
  ,                                       !- Control 2 Object Type
  ,                                       !- Control 2 Name
  ,                                       !- Control 3 Object Type
  ,                                       !- Control 3 Name
  ,                                       !- Control 4 Object Type
  ,                                       !- Control 4 Name
  0;                                      !- Temperature Difference
   Between Cutout And Setpoint {deltaC}

Schedule:Compact,
  Room_30_98f1d6c8 Thermostat Schedule,   !- Name
  Room_30_98f1d6c8 Thermostat Schedule Type Limits, !- Schedule Type
    Limits Name
  Through: 12/31,                         !- Field 1
  For: AllDays,                           !- Field 2
  Until: 24:00,                           !- Field 3
  4;                                      !- Field 4
```

```
ScheduleTypeLimits,
  Room_30_98f1d6c8 Thermostat Schedule Type Limits, !- Name
  0,                                       !- Lower Limit Value {
   BasedOnField A3}
  4,                                       !- Upper Limit Value {
   BasedOnField A3}
  DISCRETE;                                !- Numeric Type

ThermostatSetpoint:DualSetpoint,
  Thermostat Setpoint Dual Setpoint 15,    !- Name
  project_heat,                            !- Heating Setpoint
   Temperature Schedule Name
  Clg-SetP-Sch;                         !- Cooling Setpoint
   Temperature Schedule Name

ZoneHVAC:EquipmentConnections,
  Room_30_98f1d6c8,                        !- Zone Name
  Room_30_98f1d6c8 Equipment List,         !- Zone Conditioning
   Equipment List Name
  Room_30_98f1d6c8 Inlet Node List,        !- Zone Air Inlet Node or
   NodeList Name
  Room_30_98f1d6c8 Exhaust Node List,      !- Zone Air Exhaust Node
   or NodeList Name
  Room_30_98f1d6c8 Zone Air Node,          !- Zone Air Node Name
  Room_30_98f1d6c8 Return Node List;       !- Zone Return Air Node or
    NodeList Name

NodeList,
  Room_30_98f1d6c8 Inlet Node List,        !- Name
  Room_30_98f1d6c8 Air Terminal Outlet Air Node, !- Node Name 1
  Room_30_98f1d6c8 VRF Terminal Unit Outlet Air Node; !- Node Name 2

NodeList,
  Room_30_98f1d6c8 Exhaust Node List,      !- Name
  Room_30_98f1d6c8 VRF Terminal Unit Inlet Air Node; !- Node Name 1
```

```
NodeList,
  Room_30_98f1d6c8 Return Node List,      !- Name
  Room_30_98f1d6c8 Return Air Node;       !- Node Name 1

AirTerminal:SingleDuct:ConstantVolume:NoReheat,
  Room_30_98f1d6c8 Air Terminal,          !- Name
  Always On Discrete,                     !- Availability Schedule
   Name
  Room_30_98f1d6c8 Air Terminal Inlet Air Node, !- Air Inlet Node
   Name
  Room_30_98f1d6c8 Air Terminal Outlet Air Node, !- Air Outlet Node
   Name
  AutoSize;                               !- Maximum Air Flow Rate {
   m3/s}

ZoneHVAC:AirDistributionUnit,
  ADU Room_30_98f1d6c8 Air Terminal,      !- Name
  Room_30_98f1d6c8 Air Terminal Outlet Air Node, !- Air Distribution
    Unit Outlet Node Name
  AirTerminal:SingleDuct:ConstantVolume:NoReheat, !- Air Terminal
   Object Type
  Room_30_98f1d6c8 Air Terminal;          !- Air Terminal Name

ZoneHVAC:TerminalUnit:VariableRefrigerantFlow,
  Room_30_98f1d6c8 VRF Terminal Unit,     !- Zone Terminal Unit Name
  Always On Discrete,                     !- Terminal Unit
   Availability Schedule
  Room_30_98f1d6c8 VRF Terminal Unit Inlet Air Node, !- Terminal
   Unit Air Inlet Node Name
  Room_30_98f1d6c8 VRF Terminal Unit Outlet Air Node, !- Terminal
   Unit Air Outlet Node Name
  Autosize,                               !- Cooling Supply Air Flow
    Rate {m3/s}
  Autosize,                               !- No Cooling Supply Air
   Flow Rate {m3/s}
```

```
Autosize,                                 !- Heating Supply Air Flow
  Rate {m3/s}
Autosize,                                 !- No Heating Supply Air
 Flow Rate {m3/s}
Autosize,                                 !- Cooling Outdoor Air
 Flow Rate {m3/s}
Autosize,                                 !- Heating Outdoor Air
 Flow Rate {m3/s}
Autosize,                                 !- No Load Outdoor Air
 Flow Rate {m3/s}
Always Off Discrete,                      !- Supply Air Fan
 Operating Mode Schedule Name
DrawThrough,                              !- Supply Air Fan
 Placement
Fan:OnOff,                                !- Supply Air Fan Object
 Type
Room_30_98f1d6c8 VRF Unit Cycling Fan,    !- Supply Air Fan Object
 Name
OutdoorAir:Mixer,                         !- Outside Air Mixer
 Object Type
Room_30_98f1d6c8 VRF Terminal Unit OA Mixer, !- Outside Air Mixer
 Object Name
Coil:Cooling:DX:VariableRefrigerantFlow, !- Cooling Coil Object
 Type
Zone HVAC Terminal Unit Variable Refrigerant Flow 1 Cooling Coil
 14, !- Cooling Coil Object Name
Coil:Heating:DX:VariableRefrigerantFlow, !- Heating Coil Object
 Type
Zone HVAC Terminal Unit Variable Refrigerant Flow 1 Heating Coil
 14, !- Heating Coil Object Name
30,                                       !- Zone Terminal Unit On
 Parasitic Electric Energy Use {W}
20,                                       !- Zone Terminal Unit Off
 Parasitic Electric Energy Use {W}
1,                                        !- Rated Heating Capacity
 Sizing Ratio {W/W}
```

```
  ,                                       !- Availability Manager
   List Name
  ,                                       !- Design Specification
   ZoneHVAC Sizing Object Name
  ,                                       !- Supplemental Heating
   Coil Object Type
  ,                                       !- Supplemental Heating
   Coil Name
  Autosize,                               !- Maximum Supply Air
   Temperature from Supplemental Heater {C}
  21;                                     !- Maximum Outdoor Dry-
   Bulb Temperature for Supplemental Heater Operation {C}

OutdoorAir:Mixer,
  Room_30_98f1d6c8 VRF Terminal Unit OA Mixer, !- Name
  Room_30_98f1d6c8 VRF Terminal Unit Mixer Outlet Node, !- Mixed Air
    Node Name
  Room_30_98f1d6c8 VRF Terminal Unit Outdoor Air Node, !- Outdoor
   Air Stream Node Name
  Room_30_98f1d6c8 VRF Terminal Unit Relief Node Name, !- Relief Air
    Stream Node Name
  Room_30_98f1d6c8 VRF Terminal Unit Inlet Air Node; !- Return Air
   Stream Node Name

OutdoorAir:NodeList,
  Room_30_98f1d6c8 VRF Terminal Unit Outdoor Air Node; !- Node or
   NodeList Name 1

Coil:Cooling:DX:VariableRefrigerantFlow,
  Zone HVAC Terminal Unit Variable Refrigerant Flow 1 Cooling Coil
   14, !- Name
  Always On Discrete,                     !- Availability Schedule
   Name
  Autosize,                               !- Gross Rated Total
   Cooling Capacity {W}
```

```
  Autosize,                               !- Gross Rated Sensible
   Heat Ratio
  Autosize,                               !- Rated Air Flow Rate {m3
   /s}
  VRFTUCoolCapFT 14,                      !- Cooling Capacity Ratio
   Modifier Function of Temperature Curve Name
  VRFACCoolCapFFF 14,                     !- Cooling Capacity
   Modifier Curve Function of Flow Fraction Name
  Room_30_98f1d6c8 VRF Terminal Unit Mixer Outlet Node, !- Coil Air
   Inlet Node
  Room_30_98f1d6c8 VRF Terminal Unit Cooling Coil Outlet Node; !-
   Coil Air Outlet Node

Curve:Biquadratic,
  VRFTUCoolCapFT 14,                      !- Name
  0.0585884077803259,                     !- Coefficient1 Constant
  0.0587396532718384,                     !- Coefficient2 x
  -0.000210274979759697,                  !- Coefficient3 x**2
  0.0109370473889647,                     !- Coefficient4 y
  -0.0001219549,                          !- Coefficient5 y**2
  -0.0005246615,                          !- Coefficient6 x*y
  15,                                     !- Minimum Value of x {
   BasedOnField A2}
  23.89,                                  !- Maximum Value of x {
   BasedOnField A2}
  20,                                     !- Minimum Value of y {
   BasedOnField A3}
  43.33,                                  !- Maximum Value of y {
   BasedOnField A3}
  0.8083,                                 !- Minimum Curve Output {
   BasedOnField A4}
  1.2583;                                 !- Maximum Curve Output {
   BasedOnField A4}

Curve:Quadratic,
  VRFACCoolCapFFF 14,                     !- Name
```

```
  0.8,                                    !- Coefficient1 Constant
  0.2,                                    !- Coefficient2 x
  0,                                      !- Coefficient3 x**2
  0.5,                                    !- Minimum Value of x {
   BasedOnField A2}
  1.5;                                    !- Maximum Value of x {
   BasedOnField A2}

Coil:Heating:DX:VariableRefrigerantFlow,
  Zone HVAC Terminal Unit Variable Refrigerant Flow 1 Heating Coil
   14, !- Name
  Always On Discrete,                     !- Availability Schedule
  Autosize,                               !- Gross Rated Heating
   Capacity {W}
  Autosize,                               !- Rated Air Flow Rate {m3
   /s}
  Room_30_98f1d6c8 VRF Terminal Unit Cooling Coil Outlet Node, !-
   Coil Air Inlet Node
  Room_30_98f1d6c8 VRF Terminal Unit Heating Coil Outlet Node, !-
   Coil Air Outlet Node
  Coil Heating DX Variable Refrigerant Flow 1 VRFTUHeatCAPFT 14, !-
   Heating Capacity Ratio Modifier Function of Temperature Curve
   Name
  Coil Heating DX Variable Refrigerant Flow 1 VRFACCoolCapFFF 14; !-
    Heating Capacity Modifier Function of Flow Fraction Curve Name

Curve:Biquadratic,
  Coil Heating DX Variable Refrigerant Flow 1 VRFTUHeatCAPFT 14, !-
   Name
  0.375443994956127,                      !- Coefficient1 Constant
  0.0668190645147821,                     !- Coefficient2 x
  -0.00194171026482001,                   !- Coefficient3 x**2
  0.0442618420640187,                     !- Coefficient4 y
  -0.0004009578,                          !- Coefficient5 y**2
  -0.0014819801,                          !- Coefficient6 x*y
```

```
  21.11,                                  !- Minimum Value of x {
   BasedOnField A2}
  27.22,                                  !- Maximum Value of x {
   BasedOnField A2}
  -15,                                    !- Minimum Value of y {
   BasedOnField A3}
  18.33,                                  !- Maximum Value of y {
   BasedOnField A3}
  0.6074,                                 !- Minimum Curve Output {
   BasedOnField A4}
  1;                                      !- Maximum Curve Output {
   BasedOnField A4}

Curve:Quadratic,
  Coil Heating DX Variable Refrigerant Flow 1 VRFACCoolCapFFF 14, !-
    Name
  0.8,                                    !- Coefficient1 Constant
  0.2,                                    !- Coefficient2 x
  0,                                      !- Coefficient3 x**2
  0.5,                                    !- Minimum Value of x {
   BasedOnField A2}
  1.5;                                    !- Maximum Value of x {
   BasedOnField A2}

Fan:OnOff,
  Room_30_98f1d6c8 VRF Unit Cycling Fan,  !- Name
  Always On Discrete,                     !- Availability Schedule
   Name
  0.6,                                    !- Fan Total Efficiency
  300,                                    !- Pressure Rise {Pa}
  Autosize,                               !- Maximum Flow Rate {m3/s
   }
  0.8,                                    !- Motor Efficiency
  1,                                      !- Motor In Airstream
   Fraction
```

```
  Room_30_98f1d6c8 VRF Terminal Unit Heating Coil Outlet Node, !-
   Air Inlet Node Name
  Room_30_98f1d6c8 VRF Terminal Unit Outlet Air Node, !- Air Outlet
   Node Name
  Fan On Off Power Curve 14,              !- Fan Power Ratio
   Function of Speed Ratio Curve Name
  Fan On Off Efficiency Curve 14,         !- Fan Efficiency Ratio
   Function of Speed Ratio Curve Name
  General;                                !- End-Use Subcategory

Curve:Exponent,
  Fan On Off Power Curve 14,              !- Name
  1,                                      !- Coefficient1 Constant
  0,                                      !- Coefficient2 Constant
  0,                                      !- Coefficient3 Constant
  0,                                      !- Minimum Value of x {
   BasedOnField A2}
  1;                                      !- Maximum Value of x {
   BasedOnField A2}

Curve:Cubic,
  Fan On Off Efficiency Curve 14,         !- Name
  1,                                      !- Coefficient1 Constant
  0,                                      !- Coefficient2 x
  0,                                      !- Coefficient3 x**2
  0,                                      !- Coefficient4 x**3
  0,                                      !- Minimum Value of x {
   BasedOnField A2}
  1;                                      !- Maximum Value of x {
   BasedOnField A2}

ZoneHVAC:EquipmentList,
  Room_30_98f1d6c8 Equipment List,        !- Name
  SequentialLoad,                         !- Load Distribution
   Scheme
```

```
  ZoneHVAC:AirDistributionUnit,           !- Zone Equipment Object
   Type 1
  ADU Room_30_98f1d6c8 Air Terminal,      !- Zone Equipment Name 1
  1,                                      !- Zone Equipment Cooling
   Sequence 1
  1,                                      !- Zone Equipment Heating
   or No-Load Sequence 1
  Schedule Constant 29,                   !- Zone Equipment
   Sequential Cooling Fraction Schedule Name 1
  Schedule Constant 30,                   !- Zone Equipment
   Sequential Heating Fraction Schedule Name 1
  ZoneHVAC:TerminalUnit:VariableRefrigerantFlow, !- Zone Equipment
   Object Type 2
  Room_30_98f1d6c8 VRF Terminal Unit,     !- Zone Equipment Name 2
  2,                                      !- Zone Equipment Cooling
   Sequence 2
  2,                                      !- Zone Equipment Heating
   or No-Load Sequence 2
  ,                                       !- Zone Equipment
   Sequential Cooling Fraction Schedule Name 2
  ;                                       !- Zone Equipment
   Sequential Heating Fraction Schedule Name 2

Sizing:Zone,
  Room_30_98f1d6c8,                       !- Zone or ZoneList Name
  SupplyAirTemperature,                   !- Zone Cooling Design
   Supply Air Temperature Input Method
  12.7777777777778,                       !- Zone Cooling Design
   Supply Air Temperature {C}
  11.11,                                  !- Zone Cooling Design
   Supply Air Temperature Difference {deltaC}
  SupplyAirTemperature,                   !- Zone Heating Design
   Supply Air Temperature Input Method
  40.0000000000001,                       !- Zone Heating Design
   Supply Air Temperature {C}
```

```
11.11,                                  !- Zone Heating Design
 Supply Air Temperature Difference {deltaC}
0.0085,                                 !- Zone Cooling Design
 Supply Air Humidity Ratio {kgWater/kgDryAir}
0.008,                                  !- Zone Heating Design
 Supply Air Humidity Ratio {kgWater/kgDryAir}
ventilation,                            !- Design Specification
 Outdoor Air Object Name
,                                       !- Zone Heating Sizing
 Factor
,                                       !- Zone Cooling Sizing
 Factor
DesignDay,                              !- Cooling Design Air Flow
  Method
0,                                      !- Cooling Design Air Flow
  Rate {m3/s}
0.000762,                               !- Cooling Minimum Air
 Flow per Zone Floor Area {m3/s-m2}
0,                                      !- Cooling Minimum Air
 Flow {m3/s}
0,                                      !- Cooling Minimum Air
 Flow Fraction
DesignDay,                              !- Heating Design Air Flow
  Method
0,                                      !- Heating Design Air Flow
  Rate {m3/s}
0.002032,                               !- Heating Maximum Air
 Flow per Zone Floor Area {m3/s-m2}
0.1415762,                              !- Heating Maximum Air
 Flow {m3/s}
0.3,                                    !- Heating Maximum Air
 Flow Fraction
,                                       !- Design Specification
 Zone Air Distribution Object Name
Yes,                                    !- Account for Dedicated
 Outdoor Air System
```

```
  NeutralSupplyAir,                       !- Dedicated Outdoor Air
   System Control Strategy
  15.5555555555556,                       !- Dedicated Outdoor Air
   Low Setpoint Temperature for Design {C}
  21.1111111111111;                       !- Dedicated Outdoor Air
   High Setpoint Temperature for Design {C}

SimulationControl,
  Yes,                                    !- Do Zone Sizing
   Calculation
  Yes,                                    !- Do System Sizing
   Calculation
  Yes,                                    !- Do Plant Sizing
   Calculation
  No,                                     !- Run Simulation for
   Sizing Periods
  Yes,                                    !- Run Simulation for
   Weather File Run Periods
  No,                                     !- Do HVAC Sizing
   Simulation for Sizing Periods
  ;                                       !- Maximum Number of HVAC
   Sizing Simulation Passes

HeatBalanceAlgorithm,
  ConductionTransferFunction,             !- Algorithm
  200;                                    !- Surface Temperature
   Upper Limit {C}

RunPeriod,
  Run Period 1,                           !- Name
  7,                                      !- Begin Month
  25,                                     !- Begin Day of Month
  2006,                                   !- Begin Year
  8,                                      !- End Month
  28,                                     !- End Day of Month
  2006,                                   !- End Year
```

```
  Friday,                                 !- Day of Week for Start
   Day
  No,                                     !- Use Weather File
   Holidays and Special Days
  No,                                     !- Use Weather File
   Daylight Saving Period
  No,                                     !- Apply Weekend Holiday
   Rule
  Yes,                                    !- Use Weather File Rain
   Indicators
  Yes;                                    !- Use Weather File Snow
   Indicators

ShadowCalculation,
  PolygonClipping,                        !- Shading Calculation
   Method
  Periodic,                               !- Shading Calculation
   Update Frequency Method
  30,                                     !- Shading Calculation
   Update Frequency
  15000,                                  !- Maximum Figures in
   Shadow Overlap Calculations
  SutherlandHodgman,                      !- Polygon Clipping
   Algorithm
  512,                                    !- Pixel Counting
   Resolution
  SimpleSkyDiffuseModeling,               !- Sky Diffuse Modeling
   Algorithm
  No,                                     !- Output External Shading
    Calculation Results
  No,                                     !- Disable Self-Shading
   Within Shading Zone Groups
  No;                                     !- Disable Self-Shading
   From Shading Zone Groups to Other Zones

Sizing:Parameters,
```

```
  1.25,                                   !- Heating Sizing Factor
  1.15;                                   !- Cooling Sizing Factor

GlobalGeometryRules,
  UpperLeftCorner,                        !- Starting Vertex
   Position
  Counterclockwise,                       !- Vertex Entry Direction
  Relative,                               !- Coordinate System
  Relative,                               !- Daylighting Reference
   Point Coordinate System
  Relative;                               !- Rectangular Surface
   Coordinate System

Material,
  1/2 in. Gypsum Board,                   !- Name
  Smooth,                                 !- Roughness
  0.0127,                                 !- Thickness {m}
  0.159892999094055,                      !- Conductivity {W/m-K}
  800.001829191177,                       !- Density {kg/m3}
  1089.29718545594,                       !- Specific Heat {J/kg-K}
  0.9,                                    !- Thermal Absorptance
  0.7,                                    !- Solar Absorptance
  0.5;                                    !- Visible Absorptance

Material,
  1IN Stucco,                             !- Name
  Smooth,                                 !- Roughness
  0.0253,                                 !- Thickness {m}
  0.691337354832922,                      !- Conductivity {W/m-K}
  1858.00424829652,                       !- Density {kg/m3}
  836.460315804243,                       !- Specific Heat {J/kg-K}
  0.9,                                    !- Thermal Absorptance
  0.7,                                    !- Solar Absorptance
  0.92;                                   !- Visible Absorptance

Material,
```

```
  Generic 25mm Insulation,                !- Name
  MediumRough,                            !- Roughness
  0.05,                                   !- Thickness {m}
  0.03,                                   !- Conductivity {W/m-K}
  43,                                     !- Density {kg/m3}
  1210,                                   !- Specific Heat {J/kg-K}
  0.9,                                    !- Thermal Absorptance
  0.7,                                    !- Solar Absorptance
  0.7;                                    !- Visible Absorptance

Material,
  Generic 25mm Wood,                      !- Name
  MediumSmooth,                           !- Roughness
  0.0254,                                 !- Thickness {m}
  0.15,                                   !- Conductivity {W/m-K}
  608,                                    !- Density {kg/m3}
  1630,                                   !- Specific Heat {J/kg-K}
  0.9,                                    !- Thermal Absorptance
  0.5,                                    !- Solar Absorptance
  0.5;                                    !- Visible Absorptance

Material,
  Generic 50mm Insulation,                !- Name
  MediumRough,                            !- Roughness
  0.05,                                   !- Thickness {m}
  0.03,                                   !- Conductivity {W/m-K}
  43,                                     !- Density {kg/m3}
  1210,                                   !- Specific Heat {J/kg-K}
  0.9,                                    !- Thermal Absorptance
  0.7,                                    !- Solar Absorptance
  0.7;                                    !- Visible Absorptance

Material,
  Generic Acoustic Tile,                  !- Name
  MediumSmooth,                           !- Roughness
  0.02,                                   !- Thickness {m}
```

```
  0.06,                                   !- Conductivity {W/m-K}
  368,                                    !- Density {kg/m3}
  590,                                    !- Specific Heat {J/kg-K}
  0.9,                                    !- Thermal Absorptance
  0.2,                                    !- Solar Absorptance
  0.2;                                    !- Visible Absorptance

Material,
  Generic Brick,                          !- Name
  MediumRough,                            !- Roughness
  0.1,                                    !- Thickness {m}
  0.9,                                    !- Conductivity {W/m-K}
  1920,                                   !- Density {kg/m3}
  790,                                    !- Specific Heat {J/kg-K}
  0.9,                                    !- Thermal Absorptance
  0.65,                                   !- Solar Absorptance
  0.65;                                   !- Visible Absorptance

Material,
  Generic Ceiling Air Gap,                !- Name
  Smooth,                                 !- Roughness
  0.1,                                    !- Thickness {m}
  0.556,                                  !- Conductivity {W/m-K}
  1.28,                                   !- Density {kg/m3}
  1000,                                   !- Specific Heat {J/kg-K}
  0.9,                                    !- Thermal Absorptance
  0.7,                                    !- Solar Absorptance
  0.7;                                    !- Visible Absorptance

Material,
  Generic Gypsum Board,                   !- Name
  MediumSmooth,                           !- Roughness
  0.0127,                                 !- Thickness {m}
  0.16,                                   !- Conductivity {W/m-K}
  800,                                    !- Density {kg/m3}
  1090,                                   !- Specific Heat {J/kg-K}
```

```
  0.9,                                    !- Thermal Absorptance
  0.5,                                    !- Solar Absorptance
  0.5;                                    !- Visible Absorptance

Material,
  Generic HW Concrete,                    !- Name
  MediumRough,                            !- Roughness
  0.2,                                    !- Thickness {m}
  1.95,                                   !- Conductivity {W/m-K}
  2240,                                   !- Density {kg/m3}
  900,                                    !- Specific Heat {J/kg-K}
  0.9,                                    !- Thermal Absorptance
  0.8,                                    !- Solar Absorptance
  0.8;                                    !- Visible Absorptance

Material,
  Generic LW Concrete,                    !- Name
  MediumRough,                            !- Roughness
  0.1,                                    !- Thickness {m}
  0.53,                                   !- Conductivity {W/m-K}
  1280,                                   !- Density {kg/m3}
  840,                                    !- Specific Heat {J/kg-K}
  0.9,                                    !- Thermal Absorptance
  0.8,                                    !- Solar Absorptance
  0.8;                                    !- Visible Absorptance

Material,
  Generic Painted Metal,                  !- Name
  Smooth,                                 !- Roughness
  0.0015,                                 !- Thickness {m}
  45,                                     !- Conductivity {W/m-K}
  7690,                                   !- Density {kg/m3}
  410,                                    !- Specific Heat {J/kg-K}
  0.9,                                    !- Thermal Absorptance
  0.5,                                    !- Solar Absorptance
  0.5;                                    !- Visible Absorptance
```

```
Material,
  Generic Roof Membrane,                  !- Name
  MediumRough,                            !- Roughness
  0.01,                                   !- Thickness {m}
  0.16,                                   !- Conductivity {W/m-K}
  1120,                                   !- Density {kg/m3}
  1460,                                   !- Specific Heat {J/kg-K}
  0.9,                                    !- Thermal Absorptance
  0.65,                                   !- Solar Absorptance
  0.65;                                   !- Visible Absorptance

Material,
  Generic Wall Air Gap,                   !- Name
  Smooth,                                 !- Roughness
  0.1,                                    !- Thickness {m}
  0.667,                                  !- Conductivity {W/m-K}
  1.28,                                   !- Density {kg/m3}
  1000,                                   !- Specific Heat {J/kg-K}
  0.9,                                    !- Thermal Absorptance
  0.7,                                    !- Solar Absorptance
  0.7;                                    !- Visible Absorptance

Material,
  Material 1,                             !- Name
  Smooth,                                 !- Roughness
  0.1,                                    !- Thickness {m}
  0.1,                                    !- Conductivity {W/m-K}
  0.1,                                    !- Density {kg/m3}
  100,                                    !- Specific Heat {J/kg-K}
  0.9,                                    !- Thermal Absorptance
  0.65,                                   !- Solar Absorptance
  0.65;                                   !- Visible Absorptance

Material,
  Material 2,                             !- Name
```

```
  Smooth,                                 !- Roughness
  0.1,                                    !- Thickness {m}
  0.1,                                    !- Conductivity {W/m-K}
  0.1,                                    !- Density {kg/m3}
  100,                                    !- Specific Heat {J/kg-K}
  0.9,                                    !- Thermal Absorptance
  0.8,                                    !- Solar Absorptance
  0.8;                                    !- Visible Absorptance

Material,
  project_concrete_floor,                 !- Name
  MediumRough,                            !- Roughness
  0.203200406400813,                      !- Thickness {m}
  1.728,                                  !- Conductivity {W/m-K}
  2243,                                   !- Density {kg/m3}
  836.46,                                 !- Specific Heat {J/kg-K}
  0.9,                                    !- Thermal Absorptance
  0.65,                                   !- Solar Absorptance
  0.65;                                   !- Visible Absorptance

Material,
  project_concrete_int_wall,              !- Name
  MediumRough,                            !- Roughness
  0.15240030480061,                       !- Thickness {m}
  1,                                      !- Conductivity {W/m-K}
  2243,                                   !- Density {kg/m3}
  836.46,                                 !- Specific Heat {J/kg-K}
  0.9,                                    !- Thermal Absorptance
  0.65,                                   !- Solar Absorptance
  0.65;                                   !- Visible Absorptance

Material,
  project_concrete_roof,                  !- Name
  MediumRough,                            !- Roughness
  0.203200406400813,                      !- Thickness {m}
  1.728,                                  !- Conductivity {W/m-K}
```

```
  2243,                                   !- Density {kg/m3}
  836.46,                                 !- Specific Heat {J/kg-K}
  0.9,                                    !- Thermal Absorptance
  0.65,                                   !- Solar Absorptance
  0.65;                                   !- Visible Absorptance

Material,
  project_concrete_slab,                  !- Name
  MediumRough,                            !- Roughness
  0.101600203200406,                      !- Thickness {m}
  1.728,                                  !- Conductivity {W/m-K}
  2243,                                   !- Density {kg/m3}
  836.46,                                 !- Specific Heat {J/kg-K}
  0.9,                                    !- Thermal Absorptance
  0.65,                                   !- Solar Absorptance
  0.65;                                   !- Visible Absorptance

Material,
  project_concrete_wall,                  !- Name
  MediumRough,                            !- Roughness
  0.203200406400813,                      !- Thickness {m}
  1.728,                                  !- Conductivity {W/m-K}
  2243,                                   !- Density {kg/m3}
  836.46,                                 !- Specific Heat {J/kg-K}
  0.9,                                    !- Thermal Absorptance
  0.65,                                   !- Solar Absorptance
  0.65;                                   !- Visible Absorptance

Material:NoMass,
  project_roof_surface,                   !- Name
  MediumRough,                            !- Roughness
  0.2,                                    !- Thermal Resistance {m2-
   K/W}
  0.3,                                    !- Thermal Absorptance
  0.3,                                    !- Solar Absorptance
  0.3;                                    !- Visible Absorptance
```

```
Material:NoMass,
  Typical Insulation-R12,                 !- Name
  MediumSmooth,                           !- Roughness
  2.11332220571862,                       !- Thermal Resistance {m2-
   K/W}
  0.9,                                    !- Thermal Absorptance
  0.7,                                    !- Solar Absorptance
  0.7;                                    !- Visible Absorptance

Material:NoMass,
  Typical Insulation-R25,                 !- Name
  MediumSmooth,                           !- Roughness
  4.40275459524712,                       !- Thermal Resistance {m2-
   K/W}
  0.9,                                    !- Thermal Absorptance
  0.7,                                    !- Solar Absorptance
  0.7;                                    !- Visible Absorptance

WindowMaterial:Gas,
  Generic Window Air Gap,                 !- Name
  Air,                                    !- Gas Type
  0.0127;                                 !- Thickness {m}

WindowMaterial:Gas,
  Generic Window Argon Gap,               !- Name
  Argon,                                  !- Gas Type
  0.0127;                                 !- Thickness {m}

WindowMaterial:Glazing,
  Generic Clear Glass,                    !- Name
  SpectralAverage,                        !- Optical Data Type
  ,                                       !- Window Glass Spectral
   Data Set Name
  0.006,                                  !- Thickness {m}
```

```
  0.77,                                   !- Solar Transmittance at
   Normal Incidence
  0.07,                                   !- Front Side Solar
   Reflectance at Normal Incidence
  0.07,                                   !- Back Side Solar
   Reflectance at Normal Incidence
  0.88,                                   !- Visible Transmittance
   at Normal Incidence
  0.08,                                   !- Front Side Visible
   Reflectance at Normal Incidence
  0.08,                                   !- Back Side Visible
   Reflectance at Normal Incidence
  0,                                      !- Infrared Transmittance
   at Normal Incidence
  0.84,                                   !- Front Side Infrared
   Hemispherical Emissivity
  0.84,                                   !- Back Side Infrared
   Hemispherical Emissivity
  1,                                      !- Conductivity {W/m-K}
  1,                                      !- Dirt Correction Factor
   for Solar and Visible Transmittance
  No;                                     !- Solar Diffusing

WindowMaterial:Glazing,
  Generic Low-e Glass,                    !- Name
  SpectralAverage,                        !- Optical Data Type
  ,                                       !- Window Glass Spectral
   Data Set Name
  0.006,                                  !- Thickness {m}
  0.45,                                   !- Solar Transmittance at
   Normal Incidence
  0.36,                                   !- Front Side Solar
   Reflectance at Normal Incidence
  0.36,                                   !- Back Side Solar
   Reflectance at Normal Incidence
```

```
  0.71,                                   !- Visible Transmittance
   at Normal Incidence
  0.21,                                   !- Front Side Visible
   Reflectance at Normal Incidence
  0.21,                                   !- Back Side Visible
   Reflectance at Normal Incidence
  0,                                      !- Infrared Transmittance
   at Normal Incidence
  0.84,                                   !- Front Side Infrared
   Hemispherical Emissivity
  0.047,                                  !- Back Side Infrared
   Hemispherical Emissivity
  1,                                      !- Conductivity {W/m-K}
  1,                                      !- Dirt Correction Factor
   for Solar and Visible Transmittance
  No;                                     !- Solar Diffusing

WindowMaterial:SimpleGlazingSystem,
  project_glass,                          !- Name
  3.61,                                   !- U-Factor {W/m2-K}
  0.4,                                    !- Solar Heat Gain
   Coefficient
  0.6;                                    !- Visible Transmittance

Construction,
  Generic Context,                        !- Name
  Material 2;                             !- Layer 1

Construction,
  Generic Double Pane,                    !- Name
  Generic Low-e Glass,                    !- Layer 1
  Generic Window Air Gap,                 !- Layer 2
  Generic Clear Glass;                    !- Layer 3

Construction,
  Generic Exposed Floor,                  !- Name
```

```
  Generic Painted Metal,                  !- Layer 1
  Generic Ceiling Air Gap,                !- Layer 2
  Generic 50mm Insulation,                !- Layer 3
  Generic LW Concrete;                    !- Layer 4

Construction,
  Generic Exterior Door,                  !- Name
  Generic Painted Metal,                  !- Layer 1
  Generic 25mm Insulation,                !- Layer 2
  Generic Painted Metal;                  !- Layer 3

Construction,
  Generic Exterior Wall,                  !- Name
  Generic Brick,                          !- Layer 1
  Generic LW Concrete,                    !- Layer 2
  Generic 50mm Insulation,                !- Layer 3
  Generic Wall Air Gap,                   !- Layer 4
  Generic Gypsum Board;                   !- Layer 5

Construction,
  Generic Ground Slab,                    !- Name
  Generic 50mm Insulation,                !- Layer 1
  Generic HW Concrete;                    !- Layer 2

Construction,
  Generic Interior Ceiling,               !- Name
  Generic LW Concrete,                    !- Layer 1
  Generic Ceiling Air Gap,                !- Layer 2
  Generic Acoustic Tile;                  !- Layer 3

Construction,
  Generic Interior Door,                  !- Name
  Generic 25mm Wood;                      !- Layer 1

Construction,
  Generic Interior Floor,                 !- Name
```

```
  Generic Acoustic Tile,                  !- Layer 1
  Generic Ceiling Air Gap,                !- Layer 2
  Generic LW Concrete;                    !- Layer 3

Construction,
  Generic Interior Wall,                  !- Name
  Generic Gypsum Board,                   !- Layer 1
  Generic Wall Air Gap,                   !- Layer 2
  Generic Gypsum Board;                   !- Layer 3

Construction,
  Generic Roof,                           !- Name
  Generic Roof Membrane,                  !- Layer 1
  Generic 50mm Insulation,                !- Layer 2
  Generic LW Concrete,                    !- Layer 3
  Generic Ceiling Air Gap,                !- Layer 4
  Generic Acoustic Tile;                  !- Layer 5

Construction,
  Generic Shade,                          !- Name
  Material 1;                             !- Layer 1

Construction,
  Generic Single Pane,                    !- Name
  Generic Clear Glass;                    !- Layer 1

Construction,
  Generic Underground Roof,               !- Name
  Generic 50mm Insulation,                !- Layer 1
  Generic HW Concrete,                    !- Layer 2
  Generic Ceiling Air Gap,                !- Layer 3
  Generic Acoustic Tile;                  !- Layer 4

Construction,
  Generic Underground Wall,               !- Name
  Generic 50mm Insulation,                !- Layer 1
```

```
  Generic HW Concrete,                    !- Layer 2
  Generic Wall Air Gap,                   !- Layer 3
  Generic Gypsum Board;                   !- Layer 4

Construction,
  project_ceiling_int,                    !- Name
  1/2 in. Gypsum Board,                   !- Layer 1
  project_concrete_floor,                 !- Layer 2
  Generic 25mm Wood;                      !- Layer 3

Construction,
  project_floor,                          !- Name
  Generic 25mm Wood,                      !- Layer 1
  project_concrete_floor,                 !- Layer 2
  1/2 in. Gypsum Board;                   !- Layer 3

Construction,
  project_roof,                           !- Name
  project_roof_surface,                   !- Layer 1
  Typical Insulation-R25,                 !- Layer 2
  project_concrete_roof,                  !- Layer 3
  1/2 in. Gypsum Board;                   !- Layer 4

Construction,
  project_slab,                           !- Name
  Generic 50mm Insulation,                !- Layer 1
  project_concrete_slab,                  !- Layer 2
  Generic 25mm Wood;                      !- Layer 3

Construction,
  project_wall,                           !- Name
  1IN Stucco,                             !- Layer 1
  Typical Insulation-R12,                 !- Layer 2
  project_concrete_wall,                  !- Layer 3
  1/2 in. Gypsum Board;                   !- Layer 4
```

```
Construction,
  project_wall_int,                       !- Name
  1/2 in. Gypsum Board,                   !- Layer 1
  project_concrete_int_wall,              !- Layer 2
  1/2 in. Gypsum Board;                   !- Layer 3

Construction,
  project_window,                         !- Name
  project_glass;                          !- Layer 1

Construction:AirBoundary,
  Generic Air Boundary,                   !- Name
  None,                                   !- Air Exchange Method
  0,                                      !- Simple Mixing Air
   Changes per Hour {1/hr}
  ;                                       !- Simple Mixing Schedule
   Name

ScheduleTypeLimits,
  Activity Level,                         !- Name
  0,                                      !- Lower Limit Value {
   BasedOnField A3}
  ,                                       !- Upper Limit Value {
   BasedOnField A3}
  Continuous,                             !- Numeric Type
  activitylevel;                          !- Unit Type

ScheduleTypeLimits,
  Fractional,                             !- Name
  0,                                      !- Lower Limit Value {
   BasedOnField A3}
  1,                                      !- Upper Limit Value {
   BasedOnField A3}
  Continuous,                             !- Numeric Type
  dimensionless;                          !- Unit Type
```

```
ScheduleTypeLimits,
  OnOff,                                  !- Name
  0,                                      !- Lower Limit Value {
   BasedOnField A3}
  1,                                      !- Upper Limit Value {
   BasedOnField A3}
  Discrete,                               !- Numeric Type
  availability;                           !- Unit Type

ScheduleTypeLimits,
  OnOff 1,                                !- Name
  0,                                      !- Lower Limit Value {
   BasedOnField A3}
  1,                                      !- Upper Limit Value {
   BasedOnField A3}
  Discrete,                               !- Numeric Type
  availability;                           !- Unit Type

ScheduleTypeLimits,
  Temperature 1,                          !- Name
  ,                                       !- Lower Limit Value {
   BasedOnField A3}
  ,                                       !- Upper Limit Value {
   BasedOnField A3}
  Continuous,                             !- Numeric Type
  temperature;                            !- Unit Type

Schedule:Constant,
  Schedule Constant 1,                    !- Name
  Fractional,                             !- Schedule Type Limits
   Name
  0;                                      !- Hourly Value

Schedule:Constant,
  Schedule Constant 10,                   !- Name
```

```
  Fractional,                             !- Schedule Type Limits
   Name
  0;                                      !- Hourly Value

Schedule:Constant,
  Schedule Constant 11,                   !- Name
  Fractional,                             !- Schedule Type Limits
   Name
  0;                                      !- Hourly Value

Schedule:Constant,
  Schedule Constant 12,                   !- Name
  Fractional,                             !- Schedule Type Limits
   Name
  0;                                      !- Hourly Value

Schedule:Constant,
  Schedule Constant 13,                   !- Name
  Fractional,                             !- Schedule Type Limits
   Name
  0;                                      !- Hourly Value

Schedule:Constant,
  Schedule Constant 14,                   !- Name
  Fractional,                             !- Schedule Type Limits
   Name
  0;                                      !- Hourly Value

Schedule:Constant,
  Schedule Constant 15,                   !- Name
  Fractional,                             !- Schedule Type Limits
   Name
  0;                                      !- Hourly Value

Schedule:Constant,
  Schedule Constant 16,                   !- Name
```

```
  Fractional,                             !- Schedule Type Limits
   Name
  0;                                      !- Hourly Value

Schedule:Constant,
  Schedule Constant 17,                   !- Name
  Fractional,                             !- Schedule Type Limits
   Name
  0;                                      !- Hourly Value

Schedule:Constant,
  Schedule Constant 18,                   !- Name
  Fractional,                             !- Schedule Type Limits
   Name
  0;                                      !- Hourly Value

Schedule:Constant,
  Schedule Constant 19,                   !- Name
  Fractional,                             !- Schedule Type Limits
   Name
  0;                                      !- Hourly Value

Schedule:Constant,
  Schedule Constant 2,                    !- Name
  Fractional,                             !- Schedule Type Limits
   Name
  0;                                      !- Hourly Value

Schedule:Constant,
  Schedule Constant 20,                   !- Name
  Fractional,                             !- Schedule Type Limits
   Name
  0;                                      !- Hourly Value

Schedule:Constant,
  Schedule Constant 21,                   !- Name
```

```
  Fractional,                             !- Schedule Type Limits
   Name
  0;                                      !- Hourly Value

Schedule:Constant,
  Schedule Constant 22,                   !- Name
  Fractional,                             !- Schedule Type Limits
   Name
  0;                                      !- Hourly Value

Schedule:Constant,
  Schedule Constant 23,                   !- Name
  Fractional,                             !- Schedule Type Limits
   Name
  0;                                      !- Hourly Value

Schedule:Constant,
  Schedule Constant 24,                   !- Name
  Fractional,                             !- Schedule Type Limits
   Name
  0;                                      !- Hourly Value

Schedule:Constant,
  Schedule Constant 25,                   !- Name
  Fractional,                             !- Schedule Type Limits
   Name
  0;                                      !- Hourly Value

Schedule:Constant,
  Schedule Constant 26,                   !- Name
  Fractional,                             !- Schedule Type Limits
   Name
  0;                                      !- Hourly Value

Schedule:Constant,
  Schedule Constant 27,                   !- Name
```

```
  Fractional,                             !- Schedule Type Limits
   Name
  0;                                      !- Hourly Value

Schedule:Constant,
  Schedule Constant 28,                   !- Name
  Fractional,                             !- Schedule Type Limits
   Name
  0;                                      !- Hourly Value

Schedule:Constant,
  Schedule Constant 29,                   !- Name
  Fractional,                             !- Schedule Type Limits
   Name
  0;                                      !- Hourly Value

Schedule:Constant,
  Schedule Constant 3,                    !- Name
  Fractional,                             !- Schedule Type Limits
   Name
  0;                                      !- Hourly Value

Schedule:Constant,
  Schedule Constant 30,                   !- Name
  Fractional,                             !- Schedule Type Limits
   Name
  0;                                      !- Hourly Value

Schedule:Constant,
  Schedule Constant 4,                    !- Name
  Fractional,                             !- Schedule Type Limits
   Name
  0;                                      !- Hourly Value

Schedule:Constant,
  Schedule Constant 5,                    !- Name
```

```
  Fractional,                             !- Schedule Type Limits
   Name
  0;                                      !- Hourly Value

Schedule:Constant,
  Schedule Constant 6,                    !- Name
  Fractional,                             !- Schedule Type Limits
   Name
  0;                                      !- Hourly Value

Schedule:Constant,
  Schedule Constant 7,                    !- Name
  Fractional,                             !- Schedule Type Limits
   Name
  0;                                      !- Hourly Value

Schedule:Constant,
  Schedule Constant 8,                    !- Name
  Fractional,                             !- Schedule Type Limits
   Name
  0;                                      !- Hourly Value

Schedule:Constant,
  Schedule Constant 9,                    !- Name
  Fractional,                             !- Schedule Type Limits
   Name
  0;                                      !- Hourly Value

Schedule:Day:Interval,
  Always On_Day Schedule,                 !- Name
  Fractional,                             !- Schedule Type Limits
   Name
  No,                                     !- Interpolate to Timestep
  24:00,                                  !- Time 1 {hh:mm}
  1;                                      !- Value Until Time 1
```

```
Schedule:Day:Interval,
  MidriseApartment Building_People_Occ Schedule_Hol, !- Name
  Fractional,                              !- Schedule Type Limits
   Name
  No,                                      !- Interpolate to Timestep
  07:00,                                   !- Time 1 {hh:mm}
  0.958332824583389,                       !- Value Until Time 1
  08:00,                                   !- Time 2 {hh:mm}
  0.814582900895881,                       !- Value Until Time 2
  09:00,                                   !- Time 3 {hh:mm}
  0.373749801587522,                       !- Value Until Time 3
  16:00,                                   !- Time 4 {hh:mm}
  0.239583206145847,                       !- Value Until Time 4
  17:00,                                   !- Time 5 {hh:mm}
  0.287499847375017,                       !- Value Until Time 5
  18:00,                                   !- Time 6 {hh:mm}
  0.498333068783362,                       !- Value Until Time 6
  21:00,                                   !- Time 7 {hh:mm}
  0.833749557387549,                       !- Value Until Time 7
  24:00,                                   !- Time 8 {hh:mm}
  0.958332824583389;                       !- Value Until Time 8

Schedule:Day:Interval,
  MidriseApartment Building_People_Occ Schedule_Hol 1, !- Name
  Fractional,                              !- Schedule Type Limits
   Name
  No,                                      !- Interpolate to Timestep
  07:00,                                   !- Time 1 {hh:mm}
  0.958332824583389,                       !- Value Until Time 1
  08:00,                                   !- Time 2 {hh:mm}
  0.814582900895881,                       !- Value Until Time 2
  09:00,                                   !- Time 3 {hh:mm}
  0.373749801587522,                       !- Value Until Time 3
  16:00,                                   !- Time 4 {hh:mm}
  0.239583206145847,                       !- Value Until Time 4
  17:00,                                   !- Time 5 {hh:mm}
```

```
  0.287499847375017,                      !- Value Until Time 5
  18:00,                                  !- Time 6 {hh:mm}
  0.498333068783362,                      !- Value Until Time 6
  21:00,                                  !- Time 7 {hh:mm}
  0.833749557387549,                      !- Value Until Time 7
  24:00,                                  !- Time 8 {hh:mm}
  0.958332824583389;                      !- Value Until Time 8

Schedule:Day:Interval,
  MidriseApartment Building_People_Occ Schedule_Monday, !- Name
  Fractional,                             !- Schedule Type Limits
   Name
  No,                                     !- Interpolate to Timestep
  07:00,                                  !- Time 1 {hh:mm}
  0.958332824583389,                      !- Value Until Time 1
  08:00,                                  !- Time 2 {hh:mm}
  0.814582900895881,                      !- Value Until Time 2
  09:00,                                  !- Time 3 {hh:mm}
  0.415416977004133,                      !- Value Until Time 3
  12:00,                                  !- Time 4 {hh:mm}
  0.281250381562458,                      !- Value Until Time 4
  13:00,                                  !- Time 5 {hh:mm}
  0.260416793854153,                      !- Value Until Time 5
  16:00,                                  !- Time 6 {hh:mm}
  0.281250381562458,                      !- Value Until Time 6
  17:00,                                  !- Time 7 {hh:mm}
  0.329167022791627,                      !- Value Until Time 7
  18:00,                                  !- Time 8 {hh:mm}
  0.498333068783362,                      !- Value Until Time 8
  21:00,                                  !- Time 9 {hh:mm}
  0.833749557387549,                      !- Value Until Time 9
  24:00,                                  !- Time 10 {hh:mm}
  0.958332824583389;                      !- Value Until Time 10

Schedule:Day:Interval,
  MidriseApartment Building_People_Occ Schedule_SmrDsn, !- Name
```

```
  Fractional,                             !- Schedule Type Limits
   Name
  No,                                     !- Interpolate to Timestep
  07:00,                                  !- Time 1 {hh:mm}
  0.958332824583389,                      !- Value Until Time 1
  08:00,                                  !- Time 2 {hh:mm}
  0.814582900895881,                      !- Value Until Time 2
  09:00,                                  !- Time 3 {hh:mm}
  0.373749801587522,                      !- Value Until Time 3
  16:00,                                  !- Time 4 {hh:mm}
  0.239583206145847,                      !- Value Until Time 4
  17:00,                                  !- Time 5 {hh:mm}
  0.287499847375017,                      !- Value Until Time 5
  18:00,                                  !- Time 6 {hh:mm}
  0.498333068783362,                      !- Value Until Time 6
  21:00,                                  !- Time 7 {hh:mm}
  0.833749557387549,                      !- Value Until Time 7
  24:00,                                  !- Time 8 {hh:mm}
  0.958332824583389;                      !- Value Until Time 8

Schedule:Day:Interval,
  MidriseApartment Building_People_Occ Schedule_SmrDsn 1, !- Name
  Fractional,                             !- Schedule Type Limits
   Name
  No,                                     !- Interpolate to Timestep
  07:00,                                  !- Time 1 {hh:mm}
  0.958332824583389,                      !- Value Until Time 1
  08:00,                                  !- Time 2 {hh:mm}
  0.814582900895881,                      !- Value Until Time 2
  09:00,                                  !- Time 3 {hh:mm}
  0.373749801587522,                      !- Value Until Time 3
  16:00,                                  !- Time 4 {hh:mm}
  0.239583206145847,                      !- Value Until Time 4
  17:00,                                  !- Time 5 {hh:mm}
  0.287499847375017,                      !- Value Until Time 5
  18:00,                                  !- Time 6 {hh:mm}
```

```
  0.498333068783362,                      !- Value Until Time 6
  21:00,                                  !- Time 7 {hh:mm}
  0.833749557387549,                      !- Value Until Time 7
  24:00,                                  !- Time 8 {hh:mm}
  0.958332824583389;                      !- Value Until Time 8

Schedule:Day:Interval,
  MidriseApartment Building_People_Occ Schedule_Sunday, !- Name
  Fractional,                             !- Schedule Type Limits
   Name
  No,                                     !- Interpolate to Timestep
  07:00,                                  !- Time 1 {hh:mm}
  0.958332824583389,                      !- Value Until Time 1
  08:00,                                  !- Time 2 {hh:mm}
  0.814582900895881,                      !- Value Until Time 2
  09:00,                                  !- Time 3 {hh:mm}
  0.373749801587522,                      !- Value Until Time 3
  16:00,                                  !- Time 4 {hh:mm}
  0.239583206145847,                      !- Value Until Time 4
  17:00,                                  !- Time 5 {hh:mm}
  0.287499847375017,                      !- Value Until Time 5
  18:00,                                  !- Time 6 {hh:mm}
  0.498333068783362,                      !- Value Until Time 6
  21:00,                                  !- Time 7 {hh:mm}
  0.833749557387549,                      !- Value Until Time 7
  24:00,                                  !- Time 8 {hh:mm}
  0.958332824583389;                      !- Value Until Time 8

Schedule:Day:Interval,
  MidriseApartment Building_People_Occ Schedule_WntrDsn, !- Name
  Fractional,                             !- Schedule Type Limits
   Name
  No,                                     !- Interpolate to Timestep
  07:00,                                  !- Time 1 {hh:mm}
  0.958332824583389,                      !- Value Until Time 1
  08:00,                                  !- Time 2 {hh:mm}
```

```
  0.814582900895881,                      !- Value Until Time 2
  09:00,                                  !- Time 3 {hh:mm}
  0.373749801587522,                      !- Value Until Time 3
  16:00,                                  !- Time 4 {hh:mm}
  0.239583206145847,                      !- Value Until Time 4
  17:00,                                  !- Time 5 {hh:mm}
  0.287499847375017,                      !- Value Until Time 5
  18:00,                                  !- Time 6 {hh:mm}
  0.498333068783362,                      !- Value Until Time 6
  21:00,                                  !- Time 7 {hh:mm}
  0.833749557387549,                      !- Value Until Time 7
  24:00,                                  !- Time 8 {hh:mm}
  0.958332824583389;                      !- Value Until Time 8

Schedule:Day:Interval,
  MidriseApartment Building_People_Occ Schedule_WntrDsn 1, !- Name
  Fractional,                             !- Schedule Type Limits
   Name
  No,                                     !- Interpolate to Timestep
  07:00,                                  !- Time 1 {hh:mm}
  0.958332824583389,                      !- Value Until Time 1
  08:00,                                  !- Time 2 {hh:mm}
  0.814582900895881,                      !- Value Until Time 2
  09:00,                                  !- Time 3 {hh:mm}
  0.373749801587522,                      !- Value Until Time 3
  16:00,                                  !- Time 4 {hh:mm}
  0.239583206145847,                      !- Value Until Time 4
  17:00,                                  !- Time 5 {hh:mm}
  0.287499847375017,                      !- Value Until Time 5
  18:00,                                  !- Time 6 {hh:mm}
  0.498333068783362,                      !- Value Until Time 6
  21:00,                                  !- Time 7 {hh:mm}
  0.833749557387549,                      !- Value Until Time 7
  24:00,                                  !- Time 8 {hh:mm}
  0.958332824583389;                      !- Value Until Time 8
```

```
Schedule:Day:Interval,
  Schedule Day 1,                          !- Name
  Fractional,                              !- Schedule Type Limits
   Name
  No,                                      !- Interpolate to Timestep
  07:00,                                   !- Time 1 {hh:mm}
  0.958332824583389,                       !- Value Until Time 1
  08:00,                                   !- Time 2 {hh:mm}
  0.814582900895881,                       !- Value Until Time 2
  09:00,                                   !- Time 3 {hh:mm}
  0.415416977004133,                       !- Value Until Time 3
  12:00,                                   !- Time 4 {hh:mm}
  0.281250381562458,                       !- Value Until Time 4
  13:00,                                   !- Time 5 {hh:mm}
  0.260416793854153,                       !- Value Until Time 5
  16:00,                                   !- Time 6 {hh:mm}
  0.281250381562458,                       !- Value Until Time 6
  17:00,                                   !- Time 7 {hh:mm}
  0.329167022791627,                       !- Value Until Time 7
  18:00,                                   !- Time 8 {hh:mm}
  0.498333068783362,                       !- Value Until Time 8
  21:00,                                   !- Time 9 {hh:mm}
  0.833749557387549,                       !- Value Until Time 9
  24:00,                                   !- Time 10 {hh:mm}
  0.958332824583389;                       !- Value Until Time 10

Schedule:Day:Interval,
  Schedule Day 2,                          !- Name
  Temperature 1,                           !- Schedule Type Limits
   Name
  No,                                      !- Interpolate to Timestep
  24:00,                                   !- Time 1 {hh:mm}
  60;                                      !- Value Until Time 1

Schedule:Day:Interval,
  Schedule Day 3,                          !- Name
```

```
  ,                                       !- Schedule Type Limits
   Name
  No,                                     !- Interpolate to Timestep
  24:00,                                  !- Time 1 {hh:mm}
  0.2;                                    !- Value Until Time 1

Schedule:Day:Interval,
  Schedule Day 4,                         !- Name
  ,                                       !- Schedule Type Limits
   Name
  No,                                     !- Interpolate to Timestep
  24:00,                                  !- Time 1 {hh:mm}
  0.05;                                   !- Value Until Time 1

Schedule:Day:Interval,
  Schedule Day 5,                         !- Name
  Temperature 1,                          !- Schedule Type Limits
   Name
  No,                                     !- Interpolate to Timestep
  24:00,                                  !- Time 1 {hh:mm}
  60;                                     !- Value Until Time 1

Schedule:Day:Interval,
  Seated Adult Activity_Day Schedule,     !- Name
  Activity Level,                         !- Schedule Type Limits
   Name
  No,                                     !- Interpolate to Timestep
  24:00,                                  !- Time 1 {hh:mm}
  120;                                    !- Value Until Time 1

Schedule:Day:Interval,
  Standard_Cooling_Hol,                   !- Name
  Temperature,                            !- Schedule Type Limits
   Name
  No,                                     !- Interpolate to Timestep
  24:00,                                  !- Time 1 {hh:mm}
```

```
  23;                                     !- Value Until Time 1

Schedule:Day:Interval,
  Standard_Cooling_SmrDsn,                !- Name
  Temperature,                            !- Schedule Type Limits
   Name
  No,                                     !- Interpolate to Timestep
  24:00,                                  !- Time 1 {hh:mm}
  23;                                     !- Value Until Time 1

Schedule:Day:Interval,
  Standard_Cooling_WntrDsn,               !- Name
  Temperature,                            !- Schedule Type Limits
   Name
  No,                                     !- Interpolate to Timestep
  24:00,                                  !- Time 1 {hh:mm}
  23;                                     !- Value Until Time 1

Schedule:Day:Interval,
  Standard_Ventilation_Hol,               !- Name
  On-Off,                                 !- Schedule Type Limits
   Name
  No,                                     !- Interpolate to Timestep
  24:00,                                  !- Time 1 {hh:mm}
  1;                                      !- Value Until Time 1

Schedule:Day:Interval,
  Standard_Ventilation_SmrDsn,            !- Name
  On-Off,                                 !- Schedule Type Limits
   Name
  No,                                     !- Interpolate to Timestep
  24:00,                                  !- Time 1 {hh:mm}
  1;                                      !- Value Until Time 1

Schedule:Day:Interval,
  Standard_Ventilation_WntrDsn,           !- Name
```

```
  On-Off,                                 !- Schedule Type Limits
   Name
  No,                                     !- Interpolate to Timestep
  24:00,                                  !- Time 1 {hh:mm}
  1;                                      !- Value Until Time 1

Schedule:Week:Daily,
  0.05 Hot Water Latent Fraction Week Rule - Jan1-Dec31, !- Name
  Schedule Day 4,                         !- Sunday Schedule:Day
   Name
  Schedule Day 4,                         !- Monday Schedule:Day
   Name
  Schedule Day 4,                         !- Tuesday Schedule:Day
   Name
  Schedule Day 4,                         !- Wednesday Schedule:Day
   Name
  Schedule Day 4,                         !- Thursday Schedule:Day
   Name
  Schedule Day 4,                         !- Friday Schedule:Day
   Name
  Schedule Day 4,                         !- Saturday Schedule:Day
   Name
  Schedule Day 4,                         !- Holiday Schedule:Day
   Name
  Schedule Day 4,                         !- SummerDesignDay
   Schedule:Day Name
  Schedule Day 4,                         !- WinterDesignDay
   Schedule:Day Name
  Schedule Day 4,                         !- CustomDay1 Schedule:Day
    Name
  Schedule Day 4;                         !- CustomDay2 Schedule:Day
    Name

Schedule:Year,
  0.05 Hot Water Latent Fraction,         !- Name
```

```
  ,                                       !- Schedule Type Limits
   Name
  0.05 Hot Water Latent Fraction Week Rule - Jan1-Dec31, !- Schedule
   :Week Name 1
  1,                                      !- Start Month 1
  1,                                      !- Start Day 1
  12,                                     !- End Month 1
  31;                                     !- End Day 1

Schedule:Week:Daily,
  0.2 Hot Water Sensible Fraction Week Rule - Jan1-Dec31, !- Name
  Schedule Day 3,                         !- Sunday Schedule:Day
   Name
  Schedule Day 3,                         !- Monday Schedule:Day
   Name
  Schedule Day 3,                         !- Tuesday Schedule:Day
   Name
  Schedule Day 3,                         !- Wednesday Schedule:Day
   Name
  Schedule Day 3,                         !- Thursday Schedule:Day
   Name
  Schedule Day 3,                         !- Friday Schedule:Day
   Name
  Schedule Day 3,                         !- Saturday Schedule:Day
   Name
  Schedule Day 3,                         !- Holiday Schedule:Day
   Name
  Schedule Day 3,                         !- SummerDesignDay
   Schedule:Day Name
  Schedule Day 3,                         !- WinterDesignDay
   Schedule:Day Name
  Schedule Day 3,                         !- CustomDay1 Schedule:Day
    Name
  Schedule Day 3;                         !- CustomDay2 Schedule:Day
    Name
```

```
Schedule:Year,
  0.2 Hot Water Sensible Fraction,        !- Name
  ,                                       !- Schedule Type Limits
   Name
  0.2 Hot Water Sensible Fraction Week Rule - Jan1-Dec31, !-
   Schedule:Week Name 1
  1,                                      !- Start Month 1
  1,                                      !- Start Day 1
  12,                                     !- End Month 1
  31;                                     !- End Day 1

Schedule:Week:Daily,
  60.0C Hot Water Week Rule - Jan1-Dec31, !- Name
  Schedule Day 2,                         !- Sunday Schedule:Day
   Name
  Schedule Day 2,                         !- Monday Schedule:Day
   Name
  Schedule Day 2,                         !- Tuesday Schedule:Day
   Name
  Schedule Day 2,                         !- Wednesday Schedule:Day
   Name
  Schedule Day 2,                         !- Thursday Schedule:Day
   Name
  Schedule Day 2,                         !- Friday Schedule:Day
   Name
  Schedule Day 2,                         !- Saturday Schedule:Day
   Name
  Schedule Day 2,                         !- Holiday Schedule:Day
   Name
  Schedule Day 2,                         !- SummerDesignDay
   Schedule:Day Name
  Schedule Day 2,                         !- WinterDesignDay
   Schedule:Day Name
  Schedule Day 2,                         !- CustomDay1 Schedule:Day
    Name
```

```
  Schedule Day 2;                          !- CustomDay2 Schedule:Day
    Name

Schedule:Year,
  60.0C Hot Water,                         !- Name
  Temperature 1,                           !- Schedule Type Limits
   Name
  60.0C Hot Water Week Rule - Jan1-Dec31, !- Schedule:Week Name 1
  1,                                       !- Start Month 1
  1,                                       !- Start Day 1
  12,                                      !- End Month 1
  31;                                      !- End Day 1

Schedule:Week:Daily,
  60C Hot Water Week Rule - Jan1-Dec31,   !- Name
  Schedule Day 5,                          !- Sunday Schedule:Day
   Name
  Schedule Day 5,                          !- Monday Schedule:Day
   Name
  Schedule Day 5,                          !- Tuesday Schedule:Day
   Name
  Schedule Day 5,                          !- Wednesday Schedule:Day
   Name
  Schedule Day 5,                          !- Thursday Schedule:Day
   Name
  Schedule Day 5,                          !- Friday Schedule:Day
   Name
  Schedule Day 5,                          !- Saturday Schedule:Day
   Name
  Schedule Day 5,                          !- Holiday Schedule:Day
   Name
  Schedule Day 5,                          !- SummerDesignDay
   Schedule:Day Name
  Schedule Day 5,                          !- WinterDesignDay
   Schedule:Day Name
```

```
  Schedule Day 5,                          !- CustomDay1 Schedule:Day
    Name
  Schedule Day 5;                          !- CustomDay2 Schedule:Day
    Name

Schedule:Year,
  60C Hot Water,                           !- Name
  Temperature 1,                           !- Schedule Type Limits
   Name
  60C Hot Water Week Rule - Jan1-Dec31,    !- Schedule:Week Name 1
  1,                                       !- Start Month 1
  1,                                       !- Start Day 1
  12,                                      !- End Month 1
  31;                                      !- End Day 1

Schedule:Week:Daily,
  Always On Week Rule - Jan1-Dec31,        !- Name
  Always On_Day Schedule,                  !- Sunday Schedule:Day
   Name
  Always On_Day Schedule,                  !- Monday Schedule:Day
   Name
  Always On_Day Schedule,                  !- Tuesday Schedule:Day
   Name
  Always On_Day Schedule,                  !- Wednesday Schedule:Day
   Name
  Always On_Day Schedule,                  !- Thursday Schedule:Day
   Name
  Always On_Day Schedule,                  !- Friday Schedule:Day
   Name
  Always On_Day Schedule,                  !- Saturday Schedule:Day
   Name
  Always On_Day Schedule,                  !- Holiday Schedule:Day
   Name
  Always On_Day Schedule,                  !- SummerDesignDay
   Schedule:Day Name
```

```
  Always On_Day Schedule,                 !- WinterDesignDay
   Schedule:Day Name
  Always On_Day Schedule,                 !- CustomDay1 Schedule:Day
    Name
  Always On_Day Schedule;                 !- CustomDay2 Schedule:Day
    Name

Schedule:Year,
  Always On,                              !- Name
  Fractional,                             !- Schedule Type Limits
   Name
  Always On Week Rule - Jan1-Dec31,       !- Schedule:Week Name 1
  1,                                      !- Start Month 1
  1,                                      !- Start Day 1
  12,                                     !- End Month 1
  31;                                     !- End Day 1

Schedule:Week:Daily,
  MidriseApartment Building_People_Occ Schedule Week Rule - Jan1-
   Dec31, !- Name
  MidriseApartment Building_People_Occ Schedule_Sunday, !- Sunday
   Schedule:Day Name
  Schedule Day 1,                         !- Monday Schedule:Day
   Name
  Schedule Day 1,                         !- Tuesday Schedule:Day
   Name
  Schedule Day 1,                         !- Wednesday Schedule:Day
   Name
  Schedule Day 1,                         !- Thursday Schedule:Day
   Name
  Schedule Day 1,                         !- Friday Schedule:Day
   Name
  MidriseApartment Building_People_Occ Schedule_Sunday, !- Saturday
   Schedule:Day Name
  MidriseApartment Building_People_Occ Schedule_Hol 1, !- Holiday
   Schedule:Day Name
```

```
  MidriseApartment Building_People_Occ Schedule_SmrDsn 1, !-
   SummerDesignDay Schedule:Day Name
  MidriseApartment Building_People_Occ Schedule_WntrDsn 1, !-
   WinterDesignDay Schedule:Day Name
  MidriseApartment Building_People_Occ Schedule_Sunday, !-
   CustomDay1 Schedule:Day Name
  MidriseApartment Building_People_Occ Schedule_Sunday; !-
   CustomDay2 Schedule:Day Name

Schedule:Year,
  MidriseApartment Building_People_Occ Schedule, !- Name
  Fractional,                              !- Schedule Type Limits
   Name
  MidriseApartment Building_People_Occ Schedule Week Rule - Jan1-
   Dec31, !- Schedule:Week Name 1
  1,                                       !- Start Month 1
  1,                                       !- Start Day 1
  12,                                      !- End Month 1
  31;                                      !- End Day 1

Schedule:Week:Daily,
  Seated Adult Activity Week Rule - Jan1-Dec31, !- Name
  Seated Adult Activity_Day Schedule,      !- Sunday Schedule:Day
   Name
  Seated Adult Activity_Day Schedule,      !- Monday Schedule:Day
   Name
  Seated Adult Activity_Day Schedule,      !- Tuesday Schedule:Day
   Name
  Seated Adult Activity_Day Schedule,      !- Wednesday Schedule:Day
   Name
  Seated Adult Activity_Day Schedule,      !- Thursday Schedule:Day
   Name
  Seated Adult Activity_Day Schedule,      !- Friday Schedule:Day
   Name
  Seated Adult Activity_Day Schedule,      !- Saturday Schedule:Day
   Name
```

```
  Seated Adult Activity_Day Schedule,     !- Holiday Schedule:Day
   Name
  Seated Adult Activity_Day Schedule,     !- SummerDesignDay
   Schedule:Day Name
  Seated Adult Activity_Day Schedule,     !- WinterDesignDay
   Schedule:Day Name
  Seated Adult Activity_Day Schedule,     !- CustomDay1 Schedule:Day
    Name
  Seated Adult Activity_Day Schedule;     !- CustomDay2 Schedule:Day
    Name

Schedule:Year,
  Seated Adult Activity,                  !- Name
  Activity Level,                         !- Schedule Type Limits
   Name
  Seated Adult Activity Week Rule - Jan1-Dec31, !- Schedule:Week
   Name 1
  1,                                      !- Start Month 1
  1,                                      !- Start Day 1
  12,                                     !- End Month 1
  31;                                     !- End Day 1

Schedule:File,
  project_equipment,                      !- Name
  Fractional,                             !- Schedule Type Limits
   Name
  /content/drive/My Drive/Kuwait/reference_schedules/
   project_equipment.csv, !- File Name
  1,                                      !- Column Number
  1,                                      !- Rows to Skip at Top
  ,                                       !- Number of Hours of Data
  Comma,                                  !- Column Separator
  No,                                     !- Interpolate to Timestep
  60;                                     !- Minutes per Item

Schedule:File,
```

```
  project_gas,                              !- Name
  Fractional,                               !- Schedule Type Limits
   Name
  /content/drive/My Drive/Kuwait/reference_schedules/project_gas.csv
   , !- File Name
  1,                                        !- Column Number
  1,                                        !- Rows to Skip at Top
  ,                                         !- Number of Hours of Data
  Comma,                                    !- Column Separator
  No,                                       !- Interpolate to Timestep
  60;                                       !- Minutes per Item

Schedule:File,
  project_hot water,                        !- Name
  Fractional,                               !- Schedule Type Limits
   Name
  /content/drive/My Drive/Kuwait/reference_schedules/
   project_hot_water.csv, !- File Name
  1,                                        !- Column Number
  1,                                        !- Rows to Skip at Top
  ,                                         !- Number of Hours of Data
  Comma,                                    !- Column Separator
  No,                                       !- Interpolate to Timestep
  60;                                       !- Minutes per Item

Schedule:File,
  project_light,                            !- Name
  Fractional,                               !- Schedule Type Limits
   Name
  /content/drive/My Drive/Kuwait/reference_schedules/project_light.
   csv, !- File Name
  1,                                        !- Column Number
  1,                                        !- Rows to Skip at Top
  ,                                         !- Number of Hours of Data
  Comma,                                    !- Column Separator
  No,                                       !- Interpolate to Timestep
```

```
  60;                                     !- Minutes per Item

Schedule:Constant,
  Always On Continuous,                   !- Name
  ,                                       !- Schedule Type Limits
   Name
  1;                                      !- Hourly Value

OutdoorAir:Node,
  Model Outdoor Air Node;                 !- Name

AirLoopHVAC,
  Cooler - 15 Zone DOAS,                  !- Name
  ,                                       !- Controller List Name
  Air Loop HVAC 1 AvailabilityManagerAssignmentList, !- Availability
    Manager List Name
  AutoSize,                               !- Design Supply Air Flow
   Rate {m3/s}
  Cooler - 15 Zone DOAS Supply Branches,  !- Branch List Name
  ,                                       !- Connector List Name
  15 Zone DOAS Supply Inlet Node,         !- Supply Side Inlet Node
   Name
  15 Zone DOAS Demand Outlet Node,        !- Demand Side Outlet Node
    Name
  Cooler - 15 Zone DOAS Demand Inlet Nodes, !- Demand Side Inlet
   Node Names
  Cooler - 15 Zone DOAS Supply Outlet Nodes, !- Supply Side Outlet
   Node Names
  1;                                      !- Design Return Air Flow
   Fraction of Supply Air Flow

NodeList,
  Cooler - 15 Zone DOAS Supply Outlet Nodes, !- Name
  15 Zone DOAS Supply Outlet Node;        !- Node Name 1

NodeList,
```

```
  Cooler - 15 Zone DOAS Demand Inlet Nodes, !- Name
  15 Zone DOAS Demand Inlet Node;          !- Node Name 1

Sizing:System,
  Cooler - 15 Zone DOAS,                   !- AirLoop Name
  VentilationRequirement,                  !- Type of Load to Size On
  Autosize,                                !- Design Outdoor Air Flow
    Rate {m3/s}
  1,                                       !- Central Heating Maximum
    System Air Flow Ratio
  7,                                       !- Preheat Design
   Temperature {C}
  0.008,                                   !- Preheat Design Humidity
    Ratio {kgWater/kgDryAir}
  12.8,                                    !- Precool Design
   Temperature {C}
  0.008,                                   !- Precool Design Humidity
    Ratio {kgWater/kgDryAir}
  15.5555555555556,                        !- Central Cooling Design
   Supply Air Temperature {C}
  21.1111111111111,                        !- Central Heating Design
   Supply Air Temperature {C}
  Coincident,                              !- Type of Zone Sum to Use
  Yes,                                     !- 100% Outdoor Air in
   Cooling
  Yes,                                     !- 100% Outdoor Air in
   Heating
  0.0085,                                  !- Central Cooling Design
   Supply Air Humidity Ratio {kgWater/kgDryAir}
  0.008,                                   !- Central Heating Design
   Supply Air Humidity Ratio {kgWater/kgDryAir}
  DesignDay,                               !- Cooling Supply Air Flow
    Rate Method
  0,                                       !- Cooling Supply Air Flow
    Rate {m3/s}
```

```
0.0099676501,                           !- Cooling Supply Air Flow
  Rate Per Floor Area {m3/s-m2}
1,                                      !- Cooling Fraction of
 Autosized Cooling Supply Air Flow Rate
3.9475456e-05,                          !- Cooling Supply Air Flow
  Rate Per Unit Cooling Capacity {m3/s-W}
DesignDay,                              !- Heating Supply Air Flow
  Rate Method
0,                                      !- Heating Supply Air Flow
  Rate {m3/s}
0.0099676501,                           !- Heating Supply Air Flow
  Rate Per Floor Area {m3/s-m2}
1,                                      !- Heating Fraction of
 Autosized Heating Supply Air Flow Rate
1,                                      !- Heating Fraction of
 Autosized Cooling Supply Air Flow Rate
3.1588213e-05,                          !- Heating Supply Air Flow
  Rate Per Unit Heating Capacity {m3/s-W}
ZoneSum,                                !- System Outdoor Air
 Method
1,                                      !- Zone Maximum Outdoor
 Air Fraction {dimensionless}
CoolingDesignCapacity,                  !- Cooling Design Capacity
  Method
Autosize,                               !- Cooling Design Capacity
  {W}
234.7,                                  !- Cooling Design Capacity
  Per Floor Area {W/m2}
1,                                      !- Fraction of Autosized
 Cooling Design Capacity
HeatingDesignCapacity,                  !- Heating Design Capacity
  Method
Autosize,                               !- Heating Design Capacity
  {W}
157,                                    !- Heating Design Capacity
  Per Floor Area {W/m2}
```

```
  1,                                      !- Fraction of Autosized
   Heating Design Capacity
  OnOff;                                  !- Central Cooling
   Capacity Control Method

AvailabilityManagerAssignmentList,
  Air Loop HVAC 1 AvailabilityManagerAssignmentList, !- Name
  AvailabilityManager:NightCycle,         !- Availability Manager
   Object Type 1
  Availability Manager Night Cycle 1;     !- Availability Manager
   Name 1

AvailabilityManager:NightCycle,
  Availability Manager Night Cycle 1,     !- Name
  Always On Discrete,                     !- Applicability Schedule
   Name
  Standard_Ventilation,                   !- Fan Schedule Name
  CycleOnAnyZoneFansOnly,                 !- Control Type
  1,                                      !- Thermostat Tolerance {
   deltaC}
  FixedRunTime,                           !- Cycling Run Time
   Control Type
  3600;                                   !- Cycling Run Time {s}

BranchList,
  Cooler - 15 Zone DOAS Supply Branches,  !- Name
  Cooler - 15 Zone DOAS Main Branch;      !- Branch Name 1

Branch,
  Cooler - 15 Zone DOAS Main Branch,      !- Name
  ,                                       !- Pressure Drop Curve
   Name
  Fan:ConstantVolume,                     !- Component Object Type 1
  DOAS Exhaust Fan,                       !- Component Name 1
  15 Zone DOAS Supply Inlet Node,         !- Component Inlet Node
   Name 1
```

```
  DOAS Exhaust Fan Outlet Air Node,       !- Component Outlet Node
   Name 1
  AirLoopHVAC:OutdoorAirSystem,           !- Component Object Type 2
  15 Zone DOAS OA System,                 !- Component Name 2
  DOAS Exhaust Fan Outlet Air Node,       !- Component Inlet Node
   Name 2
  15 Zone DOAS Mixed Air Node,            !- Component Outlet Node
   Name 2
  CoilSystem:Cooling:DX,                  !- Component Object Type 3
  15 Zone DOAS 2spd DX Clg Coil CoilSystem, !- Component Name 3
  15 Zone DOAS Mixed Air Node,            !- Component Inlet Node
   Name 3
  15 Zone DOAS 2spd DX Clg Coil Outlet Air Node, !- Component Outlet
    Node Name 3
  CoilSystem:Heating:DX,                  !- Component Object Type 4
  15 Zone DOAS Htg Coil CoilSystem,       !- Component Name 4
  15 Zone DOAS 2spd DX Clg Coil Outlet Air Node, !- Component Inlet
   Node Name 4
  15 Zone DOAS Htg Coil Outlet Air Node,  !- Component Outlet Node
   Name 4
  Coil:Heating:Electric,                  !- Component Object Type 5
  15 Zone DOAS Backup Htg Coil,           !- Component Name 5
  15 Zone DOAS Htg Coil Outlet Air Node,  !- Component Inlet Node
   Name 5
  15 Zone DOAS Backup Htg Coil Outlet Air Node, !- Component Outlet
   Node Name 5
  Fan:ConstantVolume,                     !- Component Object Type 6
  DOAS Supply Fan,                        !- Component Name 6
  15 Zone DOAS Backup Htg Coil Outlet Air Node, !- Component Inlet
   Node Name 6
  15 Zone DOAS Supply Outlet Node;        !- Component Outlet Node
   Name 6

Fan:ConstantVolume,
  DOAS Exhaust Fan,                       !- Name
```

```
  Standard_Ventilation,                    !- Availability Schedule
   Name
  0.58175,                                 !- Fan Total Efficiency
  373.633365,                              !- Pressure Rise {Pa}
  AutoSize,                                !- Maximum Flow Rate {m3/s
   }
  0.895,                                   !- Motor Efficiency
  1,                                       !- Motor In Airstream
   Fraction
  15 Zone DOAS Supply Inlet Node,          !- Air Inlet Node Name
  DOAS Exhaust Fan Outlet Air Node,        !- Air Outlet Node Name
  DOAS Fans;                               !- End-Use Subcategory

SetpointManager:MixedAir,
  DOAS Exhaust Fan Outlet Air Node OS Default SPM, !- Name
  Temperature,                             !- Control Variable
  15 Zone DOAS Supply Outlet Node,         !- Reference Setpoint Node
    Name
  15 Zone DOAS Backup Htg Coil Outlet Air Node, !- Fan Inlet Node
   Name
  15 Zone DOAS Supply Outlet Node,         !- Fan Outlet Node Name
  DOAS Exhaust Fan Outlet Air Node;        !- Setpoint Node or
   NodeList Name

AirLoopHVAC:OutdoorAirSystem,
  15 Zone DOAS OA System,                  !- Name
  15 Zone DOAS OA System Controller List, !- Controller List Name
  15 Zone DOAS OA System Equipment List,  !- Outdoor Air Equipment
   List Name
  15 Zone DOAS OA System Availability Manager List; !- Availability
   Manager List Name

AirLoopHVAC:ControllerList,
  15 Zone DOAS OA System Controller List, !- Name
  Controller:OutdoorAir,                   !- Controller Object Type
   1
```

```
  15 Zone DOAS Outdoor Air Controller;    !- Controller Name 1

Controller:OutdoorAir,
  15 Zone DOAS Outdoor Air Controller,    !- Name
  15 Zone DOAS Relief Air Node,           !- Relief Air Outlet Node
   Name
  DOAS Exhaust Fan Outlet Air Node,       !- Return Air Node Name
  15 Zone DOAS Mixed Air Node,            !- Mixed Air Node Name
  15 Zone DOAS Outdoor Air Node,          !- Actuator Node Name
  Autosize,                               !- Minimum Outdoor Air
   Flow Rate {m3/s}
  Autosize,                               !- Maximum Outdoor Air
   Flow Rate {m3/s}
  NoEconomizer,                           !- Economizer Control Type
  ModulateFlow,                           !- Economizer Control
   Action Type
  ,                                       !- Economizer Maximum
   Limit Dry-Bulb Temperature {C}
  ,                                       !- Economizer Maximum
   Limit Enthalpy {J/kg}
  ,                                       !- Economizer Maximum
   Limit Dewpoint Temperature {C}
  ,                                       !- Electronic Enthalpy
   Limit Curve Name
  ,                                       !- Economizer Minimum
   Limit Dry-Bulb Temperature {C}
  NoLockout,                              !- Lockout Type
  FixedMinimum,                           !- Minimum Limit Type
  Standard_Ventilation,                   !- Minimum Outdoor Air
   Schedule Name
  ,                                       !- Minimum Fraction of
   Outdoor Air Schedule Name
  ,                                       !- Maximum Fraction of
   Outdoor Air Schedule Name
  15 Zone DOAS Mechanical Ventilation Controller, !- Mechanical
   Ventilation Controller Name
```

```
  ,                                       !- Time of Day Economizer
   Control Schedule Name
  No,                                     !- High Humidity Control
  ,                                       !- Humidistat Control Zone
    Name
  ,                                       !- High Humidity Outdoor
   Air Flow Ratio
  Yes,                                    !- Control High Indoor
   Humidity Based on Outdoor Humidity Ratio
  BypassWhenWithinEconomizerLimits;       !- Heat Recovery Bypass
   Control Type

AvailabilityManagerAssignmentList,
  15 Zone DOAS OA System Availability Manager List, !- Name
  AvailabilityManager:Scheduled,          !- Availability Manager
   Object Type 1
  15 Zone DOAS OA System Availability Manager; !- Availability
   Manager Name 1

AvailabilityManager:Scheduled,
  15 Zone DOAS OA System Availability Manager, !- Name
  Always On Discrete;                     !- Schedule Name

OutdoorAir:NodeList,
  15 Zone DOAS Outdoor Air Node;          !- Node or NodeList Name 1

AirLoopHVAC:OutdoorAirSystem:EquipmentList,
  15 Zone DOAS OA System Equipment List,  !- Name
  OutdoorAir:Mixer,                       !- Component Object Type 1
  15 Zone DOAS OA System Outdoor Air Mixer; !- Component Name 1

OutdoorAir:Mixer,
  15 Zone DOAS OA System Outdoor Air Mixer, !- Name
  15 Zone DOAS Mixed Air Node,            !- Mixed Air Node Name
  15 Zone DOAS Outdoor Air Node,          !- Outdoor Air Stream Node
    Name
```

```
  15 Zone DOAS Relief Air Node,           !- Relief Air Stream Node
   Name
  DOAS Exhaust Fan Outlet Air Node;       !- Return Air Stream Node
   Name

SetpointManager:MixedAir,
  15 Zone DOAS Mixed Air Node OS Default SPM, !- Name
  Temperature,                            !- Control Variable
  15 Zone DOAS Supply Outlet Node,        !- Reference Setpoint Node
    Name
  15 Zone DOAS Backup Htg Coil Outlet Air Node, !- Fan Inlet Node
   Name
  15 Zone DOAS Supply Outlet Node,        !- Fan Outlet Node Name
  15 Zone DOAS Mixed Air Node;            !- Setpoint Node or
   NodeList Name

CoilSystem:Cooling:DX,
  15 Zone DOAS 2spd DX Clg Coil CoilSystem, !- Name
  Always On Discrete,                     !- Availability Schedule
   Name
  15 Zone DOAS Mixed Air Node,            !- DX Cooling Coil System
   Inlet Node Name
  15 Zone DOAS 2spd DX Clg Coil Outlet Air Node, !- DX Cooling Coil
   System Outlet Node Name
  15 Zone DOAS 2spd DX Clg Coil Outlet Air Node, !- DX Cooling Coil
   System Sensor Node Name
  Coil:Cooling:DX:TwoSpeed,               !- Cooling Coil Object
   Type
  15 Zone DOAS 2spd DX Clg Coil;          !- Cooling Coil Name

Coil:Cooling:DX:TwoSpeed,
  15 Zone DOAS 2spd DX Clg Coil,          !- Name
  Always On Discrete,                     !- Availability Schedule
   Name
  Autosize,                               !- High Speed Gross Rated
   Total Cooling Capacity {W}
```

```
Autosize,                                 !- High Speed Rated
 Sensible Heat Ratio
4.5,                                      !- High Speed Gross Rated
 Cooling COP {W/W}
Autosize,                                 !- High Speed Rated Air
 Flow Rate {m3/s}
773.3,                                    !- Unit Internal Static
 Air Pressure {Pa}
15 Zone DOAS Mixed Air Node,              !- Air Inlet Node Name
15 Zone DOAS 2spd DX Clg Coil Outlet Air Node, !- Air Outlet Node
 Name
Curve Biquadratic 1,                      !- Total Cooling Capacity
 Function of Temperature Curve Name
Curve Quadratic 3,                        !- Total Cooling Capacity
 Function of Flow Fraction Curve Name
Curve Biquadratic 2,                      !- Energy Input Ratio
 Function of Temperature Curve Name
Curve Quadratic 4,                        !- Energy Input Ratio
 Function of Flow Fraction Curve Name
Curve Quadratic 5,                        !- Part Load Fraction
 Correlation Curve Name
Autosize,                                 !- Low Speed Gross Rated
 Total Cooling Capacity {W}
0.69,                                     !- Low Speed Gross Rated
 Sensible Heat Ratio
4.5,                                      !- Low Speed Gross Rated
 Cooling COP {W/W}
Autosize,                                 !- Low Speed Rated Air
 Flow Rate {m3/s}
Curve Biquadratic 3,                      !- Low Speed Total Cooling
  Capacity Function of Temperature Curve Name
Curve Biquadratic 4,                      !- Low Speed Energy Input
 Ratio Function of Temperature Curve Name
,                                         !- Condenser Air Inlet
 Node Name
AirCooled,                                !- Condenser Type
```

```
  -25,                                    !- Minimum Outdoor Dry-
   Bulb Temperature for Compressor Operation {C}
  0,                                      !- High Speed Evaporative
   Condenser Effectiveness {dimensionless}
  Autosize,                               !- High Speed Evaporative
   Condenser Air Flow Rate {m3/s}
  Autosize,                               !- High Speed Evaporative
   Condenser Pump Rated Power Consumption {W}
  0,                                      !- Low Speed Evaporative
   Condenser Effectiveness {dimensionless}
  Autosize,                               !- Low Speed Evaporative
   Condenser Air Flow Rate {m3/s}
  Autosize,                               !- Low Speed Evaporative
   Condenser Pump Rated Power Consumption {W}
  ,                                       !- Supply Water Storage
   Tank Name
  ,                                       !- Condensate Collection
   Water Storage Tank Name
  10,                                     !- Basin Heater Capacity {
   W/K}
  2;                                      !- Basin Heater Setpoint
   Temperature {C}

SetpointManager:MixedAir,
  15 Zone DOAS 2spd DX Clg Coil Outlet Air Node OS Default SPM, !-
   Name
  Temperature,                            !- Control Variable
  15 Zone DOAS Supply Outlet Node,        !- Reference Setpoint Node
    Name
  15 Zone DOAS Backup Htg Coil Outlet Air Node, !- Fan Inlet Node
   Name
  15 Zone DOAS Supply Outlet Node,        !- Fan Outlet Node Name
  15 Zone DOAS 2spd DX Clg Coil Outlet Air Node; !- Setpoint Node or
    NodeList Name

Curve:Biquadratic,
```

```
  Curve Biquadratic 1,                    !- Name
  0.42415,                                !- Coefficient1 Constant
  0.04426,                                !- Coefficient2 x
  -0.00042,                               !- Coefficient3 x**2
  0.00333,                                !- Coefficient4 y
  -8e-05,                                 !- Coefficient5 y**2
  -0.00021,                               !- Coefficient6 x*y
  17,                                     !- Minimum Value of x {
   BasedOnField A2}
  22,                                     !- Maximum Value of x {
   BasedOnField A2}
  13,                                     !- Minimum Value of y {
   BasedOnField A3}
  46;                                     !- Maximum Value of y {
   BasedOnField A3}

Curve:Quadratic,
  Curve Quadratic 3,                      !- Name
  0.77136,                                !- Coefficient1 Constant
  0.34053,                                !- Coefficient2 x
  -0.11088,                               !- Coefficient3 x**2
  0.75918,                                !- Minimum Value of x {
   BasedOnField A2}
  1.13877;                                !- Maximum Value of x {
   BasedOnField A2}

Curve:Biquadratic,
  Curve Biquadratic 2,                    !- Name
  1.23649,                                !- Coefficient1 Constant
  -0.02431,                               !- Coefficient2 x
  0.00057,                                !- Coefficient3 x**2
  -0.01434,                               !- Coefficient4 y
  0.00063,                                !- Coefficient5 y**2
  -0.00038,                               !- Coefficient6 x*y
  17,                                     !- Minimum Value of x {
   BasedOnField A2}
```

```
  22,                                     !- Maximum Value of x {
   BasedOnField A2}
  13,                                     !- Minimum Value of y {
   BasedOnField A3}
  46;                                     !- Maximum Value of y {
   BasedOnField A3}

Curve:Quadratic,
  Curve Quadratic 4,                      !- Name
  1.2055,                                 !- Coefficient1 Constant
  -0.32953,                               !- Coefficient2 x
  0.12308,                                !- Coefficient3 x**2
  0.75918,                                !- Minimum Value of x {
   BasedOnField A2}
  1.13877;                                !- Maximum Value of x {
   BasedOnField A2}

Curve:Quadratic,
  Curve Quadratic 5,                      !- Name
  0.771,                                  !- Coefficient1 Constant
  0.229,                                  !- Coefficient2 x
  0,                                      !- Coefficient3 x**2
  0,                                      !- Minimum Value of x {
   BasedOnField A2}
  1;                                      !- Maximum Value of x {
   BasedOnField A2}

Curve:Biquadratic,
  Curve Biquadratic 3,                    !- Name
  0.42415,                                !- Coefficient1 Constant
  0.04426,                                !- Coefficient2 x
  -0.00042,                               !- Coefficient3 x**2
  0.00333,                                !- Coefficient4 y
  -8e-05,                                 !- Coefficient5 y**2
  -0.00021,                               !- Coefficient6 x*y
```

```
  17,                                     !- Minimum Value of x {
   BasedOnField A2}
  22,                                     !- Maximum Value of x {
   BasedOnField A2}
  13,                                     !- Minimum Value of y {
   BasedOnField A3}
  46;                                     !- Maximum Value of y {
   BasedOnField A3}

Curve:Biquadratic,
  Curve Biquadratic 4,                    !- Name
  1.23649,                                !- Coefficient1 Constant
  -0.02431,                               !- Coefficient2 x
  0.00057,                                !- Coefficient3 x**2
  -0.01434,                               !- Coefficient4 y
  0.00063,                                !- Coefficient5 y**2
  -0.00038,                               !- Coefficient6 x*y
  17,                                     !- Minimum Value of x {
   BasedOnField A2}
  22,                                     !- Maximum Value of x {
   BasedOnField A2}
  13,                                     !- Minimum Value of y {
   BasedOnField A3}
  46;                                     !- Maximum Value of y {
   BasedOnField A3}

CoilSystem:Heating:DX,
  15 Zone DOAS Htg Coil CoilSystem,       !- Name
  Always On Discrete,                     !- Availability Schedule
   Name
  Coil:Heating:DX:SingleSpeed,            !- Heating Coil Object
   Type
  15 Zone DOAS Htg Coil;                  !- Heating Coil Name

Coil:Heating:DX:SingleSpeed,
  15 Zone DOAS Htg Coil,                  !- Name
```

```
Always On Discrete,                     !- Availability Schedule
 Name
Autosize,                               !- Gross Rated Heating
 Capacity {W}
3.3,                                    !- Gross Rated Heating COP
  {W/W}
Autosize,                               !- Rated Air Flow Rate {m3
 /s}
773.3,                                  !- Rated Supply Fan Power
 Per Volume Flow Rate {W/(m3/s)}
15 Zone DOAS 2spd DX Clg Coil Outlet Air Node, !- Air Inlet Node
 Name
15 Zone DOAS Htg Coil Outlet Air Node,  !- Air Outlet Node Name
15 Zone DOAS Htg Coil Htg Cap Func of Temp Curve, !- Heating
 Capacity Function of Temperature Curve Name
15 Zone DOAS Htg Coil Htg Cap Func of Flow Frac Curve, !- Heating
 Capacity Function of Flow Fraction Curve Name
15 Zone DOAS Htg Coil EIR Func of Temp Curve, !- Energy Input
 Ratio Function of Temperature Curve Name
15 Zone DOAS Htg Coil EIR Func of Flow Frac Curve, !- Energy Input
  Ratio Function of Flow Fraction Curve Name
15 Zone DOAS Htg Coil PLR Correlation Curve, !- Part Load Fraction
  Correlation Curve Name
15 Zone DOAS Htg Coil Defrost EIR Func of Temp Curve, !- Defrost
 Energy Input Ratio Function of Temperature Curve Name
-8,                                     !- Minimum Outdoor Dry-
 Bulb Temperature for Compressor Operation {C}
,                                       !- Outdoor Dry-Bulb
 Temperature to Turn On Compressor {C}
5,                                      !- Maximum Outdoor Dry-
 Bulb Temperature for Defrost Operation {C}
0,                                      !- Crankcase Heater
 Capacity {W}
10,                                     !- Maximum Outdoor Dry-
 Bulb Temperature for Crankcase Heater Operation {C}
ReverseCycle,                           !- Defrost Strategy
```

```
  OnDemand,                               !- Defrost Control
  0.166667,                               !- Defrost Time Period
   Fraction
  2000;                                   !- Resistive Defrost
   Heater Capacity {W}

Curve:Cubic,
  15 Zone DOAS Htg Coil Htg Cap Func of Temp Curve, !- Name
  0.758746,                               !- Coefficient1 Constant
  0.027626,                               !- Coefficient2 x
  0.000148716,                            !- Coefficient3 x**2
  3.4992e-06,                             !- Coefficient4 x**3
  -20,                                    !- Minimum Value of x {
   BasedOnField A2}
  20;                                     !- Maximum Value of x {
   BasedOnField A2}

Curve:Cubic,
  15 Zone DOAS Htg Coil Htg Cap Func of Flow Frac Curve, !- Name
  0.84,                                   !- Coefficient1 Constant
  0.16,                                   !- Coefficient2 x
  0,                                      !- Coefficient3 x**2
  0,                                      !- Coefficient4 x**3
  0.5,                                    !- Minimum Value of x {
   BasedOnField A2}
  1.5;                                    !- Maximum Value of x {
   BasedOnField A2}

Curve:Cubic,
  15 Zone DOAS Htg Coil EIR Func of Temp Curve, !- Name
  1.19248,                                !- Coefficient1 Constant
  -0.0300438,                             !- Coefficient2 x
  0.00103745,                             !- Coefficient3 x**2
  -2.3328e-05,                            !- Coefficient4 x**3
  -20,                                    !- Minimum Value of x {
   BasedOnField A2}
```

```
  20;                                     !- Maximum Value of x {
   BasedOnField A2}

Curve:Quadratic,
  15 Zone DOAS Htg Coil EIR Func of Flow Frac Curve, !- Name
  1.3824,                                 !- Coefficient1 Constant
  -0.4336,                                !- Coefficient2 x
  0.0512,                                 !- Coefficient3 x**2
  0,                                      !- Minimum Value of x {
   BasedOnField A2}
  1;                                      !- Maximum Value of x {
   BasedOnField A2}

Curve:Quadratic,
  15 Zone DOAS Htg Coil PLR Correlation Curve, !- Name
  0.85,                                   !- Coefficient1 Constant
  0.15,                                   !- Coefficient2 x
  0,                                      !- Coefficient3 x**2
  0,                                      !- Minimum Value of x {
   BasedOnField A2}
  1;                                      !- Maximum Value of x {
   BasedOnField A2}

Curve:Biquadratic,
  15 Zone DOAS Htg Coil Defrost EIR Func of Temp Curve, !- Name
  0.297145,                               !- Coefficient1 Constant
  0.0430933,                              !- Coefficient2 x
  -0.000748766,                           !- Coefficient3 x**2
  0.00597727,                             !- Coefficient4 y
  0.000482112,                            !- Coefficient5 y**2
  -0.000956448,                           !- Coefficient6 x*y
  -23.33333,                              !- Minimum Value of x {
   BasedOnField A2}
  29.44444,                               !- Maximum Value of x {
   BasedOnField A2}
```

```
  -23.33333,                              !- Minimum Value of y {
   BasedOnField A3}
  29.44444;                               !- Maximum Value of y {
   BasedOnField A3}

SetpointManager:MixedAir,
  15 Zone DOAS Htg Coil Outlet Air Node OS Default SPM, !- Name
  Temperature,                            !- Control Variable
  15 Zone DOAS Supply Outlet Node,        !- Reference Setpoint Node
    Name
  15 Zone DOAS Backup Htg Coil Outlet Air Node, !- Fan Inlet Node
   Name
  15 Zone DOAS Supply Outlet Node,        !- Fan Outlet Node Name
  15 Zone DOAS Htg Coil Outlet Air Node;  !- Setpoint Node or
   NodeList Name

Coil:Heating:Electric,
  15 Zone DOAS Backup Htg Coil,           !- Name
  Always On Discrete,                     !- Availability Schedule
   Name
  1,                                      !- Efficiency
  Autosize,                               !- Nominal Capacity {W}
  15 Zone DOAS Htg Coil Outlet Air Node,  !- Air Inlet Node Name
  15 Zone DOAS Backup Htg Coil Outlet Air Node, !- Air Outlet Node
   Name
  15 Zone DOAS Backup Htg Coil Outlet Air Node; !- Temperature
   Setpoint Node Name

SetpointManager:MixedAir,
  15 Zone DOAS Backup Htg Coil Outlet Air Node OS Default SPM, !-
   Name
  Temperature,                            !- Control Variable
  15 Zone DOAS Supply Outlet Node,        !- Reference Setpoint Node
    Name
  15 Zone DOAS Backup Htg Coil Outlet Air Node, !- Fan Inlet Node
   Name
```

```
  15 Zone DOAS Supply Outlet Node,        !- Fan Outlet Node Name
  15 Zone DOAS Backup Htg Coil Outlet Air Node; !- Setpoint Node or
   NodeList Name

Fan:ConstantVolume,
  DOAS Supply Fan,                        !- Name
  Standard_Ventilation,                   !- Availability Schedule
   Name
  0.58175,                                !- Fan Total Efficiency
  622.722275,                             !- Pressure Rise {Pa}
  AutoSize,                               !- Maximum Flow Rate {m3/s
   }
  0.895,                                  !- Motor Efficiency
  1,                                      !- Motor In Airstream
   Fraction
  15 Zone DOAS Backup Htg Coil Outlet Air Node, !- Air Inlet Node
   Name
  15 Zone DOAS Supply Outlet Node,        !- Air Outlet Node Name
  DOAS Fans;                              !- End-Use Subcategory

SetpointManager:OutdoorAirReset,
  15 Zone DOAS SAT Reset,                 !- Name
  Temperature,                            !- Control Variable
  21.1111111111111,                       !- Setpoint at Outdoor Low
    Temperature {C}
  12.7777777777778,                       !- Outdoor Low Temperature
    {C}
  15.5555555555556,                       !- Setpoint at Outdoor
   High Temperature {C}
  21.1111111111111,                       !- Outdoor High
   Temperature {C}
  15 Zone DOAS Supply Outlet Node;        !- Setpoint Node or
   NodeList Name

AirLoopHVAC:SupplyPath,
```

```
  Cooler - 15 Zone DOAS 15 Zone DOAS Demand Inlet Node Supply Path,
   !- Name
  15 Zone DOAS Demand Inlet Node,         !- Supply Air Path Inlet
   Node Name
  AirLoopHVAC:ZoneSplitter,               !- Component Object Type 1
  Air Loop HVAC Zone Splitter 1;          !- Component Name 1

AirLoopHVAC:ZoneSplitter,
  Air Loop HVAC Zone Splitter 1,          !- Name
  15 Zone DOAS Demand Inlet Node,         !- Inlet Node Name
  Room_16_3d8c5364 Air Terminal Inlet Air Node, !- Outlet Node Name
   1
  Room_17_fb615533 Air Terminal Inlet Air Node, !- Outlet Node Name
   2
  Room_18_6cc35095 Air Terminal Inlet Air Node, !- Outlet Node Name
   3
  Room_19_6ae0f9a9 Air Terminal Inlet Air Node, !- Outlet Node Name
   4
  Room_20_4d060559 Air Terminal Inlet Air Node, !- Outlet Node Name
   5
  Room_21_4c523269 Air Terminal Inlet Air Node, !- Outlet Node Name
   6
  Room_22_f3ee5a53 Air Terminal Inlet Air Node, !- Outlet Node Name
   7
  Room_23_e751e71f Air Terminal Inlet Air Node, !- Outlet Node Name
   8
  Room_24_159d21b7 Air Terminal Inlet Air Node, !- Outlet Node Name
   9
  Room_25_d27e0933 Air Terminal Inlet Air Node, !- Outlet Node Name
   10
  Room_26_f4ea3797 Air Terminal Inlet Air Node, !- Outlet Node Name
   11
  Room_27_0080b418 Air Terminal Inlet Air Node, !- Outlet Node Name
   12
  Room_28_d6ed2799 Air Terminal Inlet Air Node, !- Outlet Node Name
   13
```

```
  Room_29_2a634042 Air Terminal Inlet Air Node, !- Outlet Node Name
   14
  Room_30_98f1d6c8 Air Terminal Inlet Air Node; !- Outlet Node Name
   15

AirLoopHVAC:ReturnPath,
  Cooler - 15 Zone DOAS Return Path,      !- Name
  15 Zone DOAS Demand Outlet Node,        !- Return Air Path Outlet
   Node Name
  AirLoopHVAC:ZoneMixer,                  !- Component Object Type 1
  Air Loop HVAC Zone Mixer 1;             !- Component Name 1

AirLoopHVAC:ZoneMixer,
  Air Loop HVAC Zone Mixer 1,             !- Name
  15 Zone DOAS Demand Outlet Node,        !- Outlet Node Name
  Room_16_3d8c5364 Return Air Node,       !- Inlet Node Name 1
  Room_17_fb615533 Return Air Node,       !- Inlet Node Name 2
  Room_18_6cc35095 Return Air Node,       !- Inlet Node Name 3
  Room_19_6ae0f9a9 Return Air Node,       !- Inlet Node Name 4
  Room_20_4d060559 Return Air Node,       !- Inlet Node Name 5
  Room_21_4c523269 Return Air Node,       !- Inlet Node Name 6
  Room_22_f3ee5a53 Return Air Node,       !- Inlet Node Name 7
  Room_23_e751e71f Return Air Node,       !- Inlet Node Name 8
  Room_24_159d21b7 Return Air Node,       !- Inlet Node Name 9
  Room_25_d27e0933 Return Air Node,       !- Inlet Node Name 10
  Room_26_f4ea3797 Return Air Node,       !- Inlet Node Name 11
  Room_27_0080b418 Return Air Node,       !- Inlet Node Name 12
  Room_28_d6ed2799 Return Air Node,       !- Inlet Node Name 13
  Room_29_2a634042 Return Air Node,       !- Inlet Node Name 14
  Room_30_98f1d6c8 Return Air Node;       !- Inlet Node Name 15

AirConditioner:VariableRefrigerantFlow,
  15 Zone VRF System,                     !- Heat Pump Name
  Always On Discrete,                     !- Availability Schedule
   Name
```

```
Autosize,                               !- Gross Rated Total
 Cooling Capacity {W}
4.287,                                  !- Gross Rated Cooling COP
  {W/W}
-15,                                    !- Minimum Outdoor
 Temperature in Cooling Mode {C}
50,                                     !- Maximum Outdoor
 Temperature in Cooling Mode {C}
vrf_cool_cap_f_of_low_temp,             !- Cooling Capacity Ratio
 Modifier Function of Low Temperature Curve Name
vrf_cool_cap_ratio_boundary,            !- Cooling Capacity Ratio
 Boundary Curve Name
vrf_cool_cap_f_of_high_temp,            !- Cooling Capacity Ratio
 Modifier Function of High Temperature Curve Name
vrf_cool_eir_f_of_low_temp,             !- Cooling Energy Input
 Ratio Modifier Function of Low Temperature Curve Name
vrf_cool_eir_ratio_boundary,            !- Cooling Energy Input
 Ratio Boundary Curve Name
vrf_cool_eir_f_of_high_temp,            !- Cooling Energy Input
 Ratio Modifier Function of High Temperature Curve Name
vrf_cool_eir_f_of_low_temp 1,           !- Cooling Energy Input
 Ratio Modifier Function of Low Part-Load Ratio Curve Name
vrf_cooling_eir_high_plr,               !- Cooling Energy Input
 Ratio Modifier Function of High Part-Load Ratio Curve Name
vrf_cooling_comb_ratio,                 !- Cooling Combination
 Ratio Correction Factor Curve Name
vrf_cooling_cplffplr,                   !- Cooling Part-Load
 Fraction Correlation Curve Name
Autosize,                               !- Gross Rated Heating
 Capacity {W}
1,                                      !- Rated Heating Capacity
 Sizing Ratio {W/W}
4.147,                                  !- Gross Rated Heating COP
  {W/W}
-25,                                    !- Minimum Outdoor
 Temperature in Heating Mode {C}
```

```
16.1,                                   !- Maximum Outdoor
 Temperature in Heating Mode {C}
vrf_heat_cap_f_of_low_temp,             !- Heating Capacity Ratio
 Modifier Function of Low Temperature Curve Name
vrf_heat_cap_ratio_boundary,            !- Heating Capacity Ratio
 Boundary Curve Name
vrf_heat_cap_f_of_high_temp,            !- Heating Capacity Ratio
 Modifier Function of High Temperature Curve Name
vrf_heat_eir_f_of_low_temp,             !- Heating Energy Input
 Ratio Modifier Function of Low Temperature Curve Name
vrf_heat_eir_boundary,                  !- Heating Energy Input
 Ratio Boundary Curve Name
vrf_heat_eir_f_of_high_temp,            !- Heating Energy Input
 Ratio Modifier Function of High Temperature Curve Name
WetBulbTemperature,                     !- Heating Performance
 Curve Outdoor Temperature Type
vrf_heating_eir_low_plr,                !- Heating Energy Input
 Ratio Modifier Function of Low Part-Load Ratio Curve Name
vrf_heating_eir_hi_plr,                 !- Heating Energy Input
 Ratio Modifier Function of High Part-Load Ratio Curve Name
vrf_heating_comb_ratio,                 !- Heating Combination
 Ratio Correction Factor Curve Name
vrf_heating_cplffplr,                   !- Heating Part-Load
 Fraction Correlation Curve Name
0.25,                                   !- Minimum Heat Pump Part-
 Load Ratio {dimensionless}
Room_16_3d8c5364,                       !- Zone Name for Master
 Thermostat Location
LoadPriority,                           !- Master Thermostat
 Priority Control Type
,                                       !- Thermostat Priority
 Schedule Name
15 Zone VRF System Terminal List,       !- Zone Terminal Unit List
  Name
Yes,                                    !- Heat Pump Waste Heat
 Recovery
```

```
30.48,                                  !- Equivalent Piping
 Length used for Piping Correction Factor in Cooling Mode {m}
10.668,                                 !- Vertical Height used
 for Piping Correction Factor {m}
Air Conditioner Variable Refrigerant Flow 1
 CoolingLengthCorrectionFactor, !- Piping Correction Factor for
 Length in Cooling Mode Curve Name
-0.000386,                              !- Piping Correction
 Factor for Height in Cooling Mode Coefficient {1/m}
30.48,                                  !- Equivalent Piping
 Length used for Piping Correction Factor in Heating Mode {m}
,                                       !- Piping Correction
 Factor for Length in Heating Mode Curve Name
0,                                      !- Piping Correction
 Factor for Height in Heating Mode Coefficient {1/m}
15,                                     !- Crankcase Heater Power
 per Compressor {W}
3,                                      !- Number of Compressors {
 dimensionless}
0.33,                                   !- Ratio of Compressor
 Size to Total Compressor Capacity {W/W}
7,                                      !- Maximum Outdoor Dry-
 Bulb Temperature for Crankcase Heater {C}
ReverseCycle,                           !- Defrost Strategy
OnDemand,                               !- Defrost Control
vrf_defrost_eir_f_of_temp,              !- Defrost Energy Input
 Ratio Modifier Function of Temperature Curve Name
0.058333,                               !- Defrost Time Period
 Fraction {dimensionless}
1e-07,                                  !- Resistive Defrost
 Heater Capacity {W}
7,                                      !- Maximum Outdoor Dry-
 bulb Temperature for Defrost Operation {C}
AirCooled,                              !- Condenser Type
,                                       !- Condenser Inlet Node
 Name
```

```
,                                         !- Condenser Outlet Node
 Name
Autosize,                                 !- Water Condenser Volume
 Flow Rate {m3/s}
0.9,                                      !- Evaporative Condenser
 Effectiveness {dimensionless}
Autosize,                                 !- Evaporative Condenser
 Air Flow Rate {m3/s}
Autosize,                                 !- Evaporative Condenser
 Pump Rated Power Consumption {W}
,                                         !- Supply Water Storage
 Tank Name
0,                                        !- Basin Heater Capacity {
 W/K}
2,                                        !- Basin Heater Setpoint
 Temperature {C}
,                                         !- Basin Heater Operating
 Schedule Name
Electricity,                              !- Fuel Type
-10,                                      !- Minimum Outdoor
 Temperature in Heat Recovery Mode {C}
27.2,                                     !- Maximum Outdoor
 Temperature in Heat Recovery Mode {C}
,                                         !- Heat Recovery Cooling
 Capacity Modifier Curve Name
0.5,                                      !- Initial Heat Recovery
 Cooling Capacity Fraction {W/W}
0.083,                                    !- Heat Recovery Cooling
 Capacity Time Constant {hr}
,                                         !- Heat Recovery Cooling
 Energy Modifier Curve Name
1,                                        !- Initial Heat Recovery
 Cooling Energy Fraction {W/W}
0,                                        !- Heat Recovery Cooling
 Energy Time Constant {hr}
```

```
  ,                                       !- Heat Recovery Heating
   Capacity Modifier Curve Name
  0.5,                                    !- Initial Heat Recovery
   Heating Capacity Fraction {W/W}
  0.083,                                  !- Heat Recovery Heating
   Capacity Time Constant {hr}
  ,                                       !- Heat Recovery Heating
   Energy Modifier Curve Name
  0.5,                                    !- Initial Heat Recovery
   Heating Energy Fraction {W/W}
  0;                                      !- Heat Recovery Heating
   Energy Time Constant {hr}

Curve:Biquadratic,
  vrf_cool_cap_f_of_low_temp,             !- Name
  -1.69653019339465,                      !- Coefficient1 Constant
  0.207248180531939,                      !- Coefficient2 x
  -0.00343146229659024,                   !- Coefficient3 x**2
  0.016381597419714,                      !- Coefficient4 y
  -6.7387172629965e-05,                   !- Coefficient5 y**2
  -0.000849848402870241,                  !- Coefficient6 x*y
  13.9,                                   !- Minimum Value of x {
   BasedOnField A2}
  23.9,                                   !- Maximum Value of x {
   BasedOnField A2}
  -5,                                     !- Minimum Value of y {
   BasedOnField A3}
  43.3,                                   !- Maximum Value of y {
   BasedOnField A3}
  0.59,                                   !- Minimum Curve Output {
   BasedOnField A4}
  1.33;                                   !- Maximum Curve Output {
   BasedOnField A4}

Curve:Cubic,
  vrf_cool_cap_ratio_boundary,            !- Name
```

```
  25.73,                                  !- Coefficient1 Constant
  -0.03150043,                            !- Coefficient2 x
  -0.01416595,                            !- Coefficient3 x**2
  0,                                      !- Coefficient4 x**3
  11,                                     !- Minimum Value of x {
   BasedOnField A2}
  30;                                     !- Maximum Value of x {
   BasedOnField A2}

Curve:Biquadratic,
  vrf_cool_cap_f_of_high_temp,            !- Name
  0.6867358,                              !- Coefficient1 Constant
  0.0207631,                              !- Coefficient2 x
  0.0005447,                              !- Coefficient3 x**2
  -0.0016218,                             !- Coefficient4 y
  -4.259e-07,                             !- Coefficient5 y**2
  -0.0003392,                             !- Coefficient6 x*y
  15,                                     !- Minimum Value of x {
   BasedOnField A2}
  24,                                     !- Maximum Value of x {
   BasedOnField A2}
  16,                                     !- Minimum Value of y {
   BasedOnField A3}
  43;                                     !- Maximum Value of y {
   BasedOnField A3}

Curve:Biquadratic,
  vrf_cool_eir_f_of_low_temp,             !- Name
  -1.61908214818635,                      !- Coefficient1 Constant
  0.185964818731756,                      !- Coefficient2 x
  -0.00389610393381592,                   !- Coefficient3 x**2
  -0.00901995326324613,                   !- Coefficient4 y
  0.00030340007815629,                    !- Coefficient5 y**2
  0.000476048529099348,                   !- Coefficient6 x*y
  13.9,                                   !- Minimum Value of x {
   BasedOnField A2}
```

```
  23.9,                                   !- Maximum Value of x {
   BasedOnField A2}
  -5,                                     !- Minimum Value of y {
   BasedOnField A3}
  43.3,                                   !- Maximum Value of y {
   BasedOnField A3}
  0.27,                                   !- Minimum Curve Output {
   BasedOnField A4}
  1.15;                                   !- Maximum Curve Output {
   BasedOnField A4}

Curve:Cubic,
  vrf_cool_eir_ratio_boundary,            !- Name
  25.73473775,                            !- Coefficient1 Constant
  -0.03150043,                            !- Coefficient2 x
  -0.01416595,                            !- Coefficient3 x**2
  0,                                      !- Coefficient4 x**3
  15,                                     !- Minimum Value of x {
   BasedOnField A2}
  24;                                     !- Maximum Value of x {
   BasedOnField A2}

Curve:Biquadratic,
  vrf_cool_eir_f_of_high_temp,            !- Name
  -1.4395110176,                          !- Coefficient1 Constant
  0.1619850459,                           !- Coefficient2 x
  -0.0034911781,                          !- Coefficient3 x**2
  0.0269442645,                           !- Coefficient4 y
  0.0001346163,                           !- Coefficient5 y**2
  -0.0006714941,                          !- Coefficient6 x*y
  15,                                     !- Minimum Value of x {
   BasedOnField A2}
  23.9,                                   !- Maximum Value of x {
   BasedOnField A2}
  16.8,                                   !- Minimum Value of y {
   BasedOnField A3}
```

```
  43.3;                                   !- Maximum Value of y {
   BasedOnField A3}

Curve:Cubic,
  vrf_cool_eir_f_of_low_temp 1,           !- Name
  0.0734992169827752,                     !- Coefficient1 Constant
  0.334783365234032,                      !- Coefficient2 x
  0.591613015486343,                      !- Coefficient3 x**2
  0,                                      !- Coefficient4 x**3
  0.25,                                   !- Minimum Value of x {
   BasedOnField A2}
  1,                                      !- Maximum Value of x {
   BasedOnField A2}
  0,                                      !- Minimum Curve Output {
   BasedOnField A3}
  1;                                      !- Maximum Curve Output {
   BasedOnField A3}

Curve:Cubic,
  vrf_cooling_eir_high_plr,               !- Name
  1,                                      !- Coefficient1 Constant
  0,                                      !- Coefficient2 x
  0,                                      !- Coefficient3 x**2
  0,                                      !- Coefficient4 x**3
  1,                                      !- Minimum Value of x {
   BasedOnField A2}
  1.5;                                    !- Maximum Value of x {
   BasedOnField A2}

Curve:Cubic,
  vrf_cooling_comb_ratio,                 !- Name
  0.24034,                                !- Coefficient1 Constant
  -0.21873,                               !- Coefficient2 x
  1.97941,                                !- Coefficient3 x**2
  -1.02636,                               !- Coefficient4 x**3
```

```
  0.5,                                    !- Minimum Value of x {
   BasedOnField A2}
  2,                                      !- Maximum Value of x {
   BasedOnField A2}
  0.5,                                    !- Minimum Curve Output {
   BasedOnField A3}
  1.056;                                  !- Maximum Curve Output {
   BasedOnField A3}

Curve:Cubic,
  vrf_cooling_cplffplr,                   !- Name
  0.85,                                   !- Coefficient1 Constant
  0.15,                                   !- Coefficient2 x
  0,                                      !- Coefficient3 x**2
  0,                                      !- Coefficient4 x**3
  1,                                      !- Minimum Value of x {
   BasedOnField A2}
  1;                                      !- Maximum Value of x {
   BasedOnField A2}

Curve:Biquadratic,
  vrf_heat_cap_f_of_low_temp,             !- Name
  0.983220174655636,                      !- Coefficient1 Constant
  0.0157167577703294,                     !- Coefficient2 x
  -0.000835032422884084,                  !- Coefficient3 x**2
  0.0522939264581759,                     !- Coefficient4 y
  -0.000531556035364549,                  !- Coefficient5 y**2
  -0.00190605953116024,                   !- Coefficient6 x*y
  16.1,                                   !- Minimum Value of x {
   BasedOnField A2}
  23.9,                                   !- Maximum Value of x {
   BasedOnField A2}
  -25,                                    !- Minimum Value of y {
   BasedOnField A3}
  13.3,                                   !- Maximum Value of y {
   BasedOnField A3}
```

```
  0.515151515151515,                      !- Minimum Curve Output {
   BasedOnField A4}
  1.2;                                    !- Maximum Curve Output {
   BasedOnField A4}

Curve:Cubic,
  vrf_heat_cap_ratio_boundary,            !- Name
  58.577,                                 !- Coefficient1 Constant
  -3.0255,                                !- Coefficient2 x
  0.0193,                                 !- Coefficient3 x**2
  0,                                      !- Coefficient4 x**3
  15,                                     !- Minimum Value of x {
   BasedOnField A2}
  23.9;                                   !- Maximum Value of x {
   BasedOnField A2}

Curve:Biquadratic,
  vrf_heat_cap_f_of_high_temp,            !- Name
  2.5859872368,                           !- Coefficient1 Constant
  -0.0953227101,                          !- Coefficient2 x
  0.0009553288,                           !- Coefficient3 x**2
  0,                                      !- Coefficient4 y
  0,                                      !- Coefficient5 y**2
  0,                                      !- Coefficient6 x*y
  21.1,                                   !- Minimum Value of x {
   BasedOnField A2}
  27.2,                                   !- Maximum Value of x {
   BasedOnField A2}
  -944,                                   !- Minimum Value of y {
   BasedOnField A3}
  15;                                     !- Maximum Value of y {
   BasedOnField A3}

Curve:Biquadratic,
  vrf_heat_eir_f_of_low_temp,             !- Name
  0.756830029796909,                      !- Coefficient1 Constant
```

```
  0.0457499799042671,                     !- Coefficient2 x
  -0.00136357240431388,                   !- Coefficient3 x**2
  0.0554884599902023,                     !- Coefficient4 y
  -0.00120700875497686,                   !- Coefficient5 y**2
  -0.00303329271420931,                   !- Coefficient6 x*y
  16.1,                                   !- Minimum Value of x {
   BasedOnField A2}
  23.9,                                   !- Maximum Value of x {
   BasedOnField A2}
  -25,                                    !- Minimum Value of y {
   BasedOnField A3}
  13.3,                                   !- Maximum Value of y {
   BasedOnField A3}
  0.7,                                    !- Minimum Curve Output {
   BasedOnField A4}
  1.184;                                  !- Maximum Curve Output {
   BasedOnField A4}

Curve:Cubic,
  vrf_heat_eir_boundary,                  !- Name
  58.577,                                 !- Coefficient1 Constant
  -3.0255,                                !- Coefficient2 x
  0.0193,                                 !- Coefficient3 x**2
  0,                                      !- Coefficient4 x**3
  15,                                     !- Minimum Value of x {
   BasedOnField A2}
  23.9;                                   !- Maximum Value of x {
   BasedOnField A2}

Curve:Biquadratic,
  vrf_heat_eir_f_of_high_temp,            !- Name
  1.3885703646,                           !- Coefficient1 Constant
  -0.0229771462,                          !- Coefficient2 x
  0.000537274,                            !- Coefficient3 x**2
  -0.0273936962,                          !- Coefficient4 y
  0.0004030426,                           !- Coefficient5 y**2
```

```
  -5.9786e-05,                            !- Coefficient6 x*y
  21.1,                                   !- Minimum Value of x {
   BasedOnField A2}
  27.2,                                   !- Maximum Value of x {
   BasedOnField A2}
  0,                                      !- Minimum Value of y {
   BasedOnField A3}
  1;                                      !- Maximum Value of y {
   BasedOnField A3}

Curve:Cubic,
  vrf_heating_eir_low_plr,                !- Name
  0.0724906507105475,                     !- Coefficient1 Constant
  0.658189977561701,                      !- Coefficient2 x
  0.269259536275246,                      !- Coefficient3 x**2
  0,                                      !- Coefficient4 x**3
  0.25,                                   !- Minimum Value of x {
   BasedOnField A2}
  1,                                      !- Maximum Value of x {
   BasedOnField A2}
  0,                                      !- Minimum Curve Output {
   BasedOnField A3}
  1;                                      !- Maximum Curve Output {
   BasedOnField A3}

Curve:Cubic,
  vrf_heating_eir_hi_plr,                 !- Name
  1,                                      !- Coefficient1 Constant
  0,                                      !- Coefficient2 x
  0,                                      !- Coefficient3 x**2
  0,                                      !- Coefficient4 x**3
  1,                                      !- Minimum Value of x {
   BasedOnField A2}
  1.5;                                    !- Maximum Value of x {
   BasedOnField A2}
```

```
Curve:Cubic,
  vrf_heating_comb_ratio,                 !- Name
  0.62115,                                !- Coefficient1 Constant
  -1.55798,                               !- Coefficient2 x
  3.36817,                                !- Coefficient3 x**2
  -1.4224,                                !- Coefficient4 x**3
  0.5,                                    !- Minimum Value of x {
   BasedOnField A2}
  2,                                      !- Maximum Value of x {
   BasedOnField A2}
  0.5,                                    !- Minimum Curve Output {
   BasedOnField A3}
  1.155;                                  !- Maximum Curve Output {
   BasedOnField A3}

Curve:Cubic,
  vrf_heating_cplffplr,                   !- Name
  0.85,                                   !- Coefficient1 Constant
  0.15,                                   !- Coefficient2 x
  0,                                      !- Coefficient3 x**2
  0,                                      !- Coefficient4 x**3
  1,                                      !- Minimum Value of x {
   BasedOnField A2}
  1;                                      !- Maximum Value of x {
   BasedOnField A2}

Curve:Biquadratic,
  Air Conditioner Variable Refrigerant Flow 1
   CoolingLengthCorrectionFactor, !- Name
  2.0388158625,                           !- Coefficient1 Constant
  -0.0024260645,                          !- Coefficient2 x
  3.5512e-06,                             !- Coefficient3 x**2
  -1.6858129772,                          !- Coefficient4 y
  0.668703358,                            !- Coefficient5 y**2
  -4.5706e-05,                            !- Coefficient6 x*y
```

```
  7.62,                                   !- Minimum Value of x {
   BasedOnField A2}
  182.88,                                 !- Maximum Value of x {
   BasedOnField A2}
  0.8,                                    !- Minimum Value of y {
   BasedOnField A3}
  1.5;                                    !- Maximum Value of y {
   BasedOnField A3}

Curve:Biquadratic,
  vrf_defrost_eir_f_of_temp,              !- Name
  -1.61908214818635,                      !- Coefficient1 Constant
  0.185964818731756,                      !- Coefficient2 x
  -0.00389610393381592,                   !- Coefficient3 x**2
  -0.00901995326324613,                   !- Coefficient4 y
  0.00030340007815629,                    !- Coefficient5 y**2
  0.000476048529099348,                   !- Coefficient6 x*y
  13.9,                                   !- Minimum Value of x {
   BasedOnField A2}
  23.9,                                   !- Maximum Value of x {
   BasedOnField A2}
  -5,                                     !- Minimum Value of y {
   BasedOnField A3}
  50,                                     !- Maximum Value of y {
   BasedOnField A3}
  0.27,                                   !- Minimum Curve Output {
   BasedOnField A4}
  1.155;                                  !- Maximum Curve Output {
   BasedOnField A4}

ZoneTerminalUnitList,
  15 Zone VRF System Terminal List,       !- Zone Terminal Unit List
    Name
  Room_16_3d8c5364 VRF Terminal Unit,     !- Zone Terminal Unit Name
    1
```

```
  Room_17_fb615533 VRF Terminal Unit,     !- Zone Terminal Unit Name
    2
  Room_18_6cc35095 VRF Terminal Unit,     !- Zone Terminal Unit Name
    3
  Room_19_6ae0f9a9 VRF Terminal Unit,     !- Zone Terminal Unit Name
    4
  Room_20_4d060559 VRF Terminal Unit,     !- Zone Terminal Unit Name
    5
  Room_21_4c523269 VRF Terminal Unit,     !- Zone Terminal Unit Name
    6
  Room_22_f3ee5a53 VRF Terminal Unit,     !- Zone Terminal Unit Name
    7
  Room_23_e751e71f VRF Terminal Unit,     !- Zone Terminal Unit Name
    8
  Room_24_159d21b7 VRF Terminal Unit,     !- Zone Terminal Unit Name
    9
  Room_25_d27e0933 VRF Terminal Unit,     !- Zone Terminal Unit Name
    10
  Room_26_f4ea3797 VRF Terminal Unit,     !- Zone Terminal Unit Name
    11
  Room_27_0080b418 VRF Terminal Unit,     !- Zone Terminal Unit Name
    12
  Room_28_d6ed2799 VRF Terminal Unit,     !- Zone Terminal Unit Name
    13
  Room_29_2a634042 VRF Terminal Unit,     !- Zone Terminal Unit Name
    14
  Room_30_98f1d6c8 VRF Terminal Unit;     !- Zone Terminal Unit Name
    15

PlantLoop,
  Service Hot Water Loop,                 !- Name
  Water,                                  !- Fluid Type
  ,                                       !- User Defined Fluid Type
  Service Hot Water Loop Operation Schemes, !- Plant Equipment
   Operation Scheme Name
```

```
  Node 2,                                 !- Loop Temperature
   Setpoint Node Name
  60,                                     !- Maximum Loop
   Temperature {C}
  10,                                     !- Minimum Loop
   Temperature {C}
  Autosize,                               !- Maximum Loop Flow Rate
   {m3/s}
  0,                                      !- Minimum Loop Flow Rate
   {m3/s}
  Autocalculate,                          !- Plant Loop Volume {m3}
  Node 1,                                 !- Plant Side Inlet Node
   Name
  Node 2,                                 !- Plant Side Outlet Node
   Name
  Service Hot Water Loop Supply Branches, !- Plant Side Branch List
   Name
  Service Hot Water Loop Supply Connector List, !- Plant Side
   Connector List Name
  Node 4,                                 !- Demand Side Inlet Node
   Name
  Node 5,                                 !- Demand Side Outlet Node
    Name
  Service Hot Water Loop Demand Branches, !- Demand Side Branch List
    Name
  Service Hot Water Loop Demand Connector List, !- Demand Side
   Connector List Name
  Optimal,                                !- Load Distribution
   Scheme
  ,                                       !- Availability Manager
   List Name
  SingleSetpoint,                         !- Plant Loop Demand
   Calculation Scheme
  ;                                       !- Common Pipe Simulation

Sizing:Plant,
```

```
  Service Hot Water Loop,                 !- Plant or Condenser Loop
    Name
  Heating,                                !- Loop Type
  60,                                     !- Design Loop Exit
   Temperature {C}
  5,                                      !- Loop Design Temperature
    Difference {deltaC}
  NonCoincident,                          !- Sizing Option
  1,                                      !- Zone Timesteps in
   Averaging Window
  None;                                   !- Coincident Sizing
   Factor Mode

BranchList,
  Service Hot Water Loop Supply Branches, !- Name
  Service Hot Water Loop Supply Inlet Branch, !- Branch Name 1
  Service Hot Water Loop Supply Branch 1, !- Branch Name 2
  Service Hot Water Loop Supply Outlet Branch; !- Branch Name 3

ConnectorList,
  Service Hot Water Loop Supply Connector List, !- Name
  Connector:Splitter,                     !- Connector Object Type 1
  Service Hot Water Loop Supply Splitter, !- Connector Name 1
  Connector:Mixer,                        !- Connector Object Type 2
  Service Hot Water Loop Supply Mixer;    !- Connector Name 2

Connector:Splitter,
  Service Hot Water Loop Supply Splitter, !- Name
  Service Hot Water Loop Supply Inlet Branch, !- Inlet Branch Name
  Service Hot Water Loop Supply Branch 1; !- Outlet Branch Name 1

Connector:Mixer,
  Service Hot Water Loop Supply Mixer,    !- Name
  Service Hot Water Loop Supply Outlet Branch, !- Outlet Branch Name
  Service Hot Water Loop Supply Branch 1; !- Inlet Branch Name 1
```

```
Branch,
  Service Hot Water Loop Supply Inlet Branch, !- Name
  ,                                           !- Pressure Drop Curve
   Name
  Pump:ConstantSpeed,                         !- Component Object Type 1
  Service Hot Water Pump,                     !- Component Name 1
  Node 1,                                     !- Component Inlet Node
   Name 1
  Node 7;                                     !- Component Outlet Node
   Name 1

Pump:ConstantSpeed,
  Service Hot Water Pump,                     !- Name
  Node 1,                                     !- Inlet Node Name
  Node 7,                                     !- Outlet Node Name
  Autosize,                                   !- Design Flow Rate {m3/s}
  29891,                                      !- Design Pump Head {Pa}
  Autosize,                                   !- Design Power
   Consumption {W}
  0.9,                                        !- Motor Efficiency
  0,                                          !- Fraction of Motor
   Inefficiencies to Fluid Stream
  Intermittent,                               !- Pump Control Type
  ,                                           !- Pump Flow Rate Schedule
    Name
  ,                                           !- Pump Curve Name
  ,                                           !- Impeller Diameter {m}
  ,                                           !- Rotational Speed {rev/
   min}
  ,                                           !- Zone Name
  ,                                           !- Skin Loss Radiative
   Fraction
  PowerPerFlowPerPressure,                    !- Design Power Sizing
   Method
  348701.1,                                   !- Design Electric Power
   per Unit Flow Rate {W/(m3/s)}
```

```
  1.282051282,                            !- Design Shaft Power per
   Unit Flow Rate per Unit Head {W-s/m3-Pa}
  General;                                !- End-Use Subcategory

Branch,
  Service Hot Water Loop Supply Branch 1, !- Name
  ,                                       !- Pressure Drop Curve
   Name
  DistrictHeating,                        !- Component Object Type 1
  Service Hot Water District Heat,        !- Component Name 1
  Node 3,                                 !- Component Inlet Node
   Name 1
  Node 8;                                 !- Component Outlet Node
   Name 1

DistrictHeating,
  Service Hot Water District Heat,        !- Name
  Node 3,                                 !- Hot Water Inlet Node
   Name
  Node 8,                                 !- Hot Water Outlet Node
   Name
  1000000;                                !- Nominal Capacity {W}

Branch,
  Service Hot Water Loop Supply Outlet Branch, !- Name
  ,                                       !- Pressure Drop Curve
   Name
  Pipe:Adiabatic,                         !- Component Object Type 1
  Service Hot Water Loop Supply Outlet Pipe, !- Component Name 1
  Service Hot Water Loop Supply Outlet Pipe Node, !- Component Inlet
    Node Name 1
  Node 2;                                 !- Component Outlet Node
   Name 1

Pipe:Adiabatic,
  Service Hot Water Loop Supply Outlet Pipe, !- Name
```

```
  Service Hot Water Loop Supply Outlet Pipe Node, !- Inlet Node Name
  Node 2;                                  !- Outlet Node Name

BranchList,
  Service Hot Water Loop Demand Branches, !- Name
  Service Hot Water Loop Demand Inlet Branch, !- Branch Name 1
  Service Hot Water Loop Demand Branch 1, !- Branch Name 2
  Service Hot Water Loop Demand Branch 2, !- Branch Name 3
  Service Hot Water Loop Demand Branch 3, !- Branch Name 4
  Service Hot Water Loop Demand Branch 4, !- Branch Name 5
  Service Hot Water Loop Demand Branch 5, !- Branch Name 6
  Service Hot Water Loop Demand Branch 6, !- Branch Name 7
  Service Hot Water Loop Demand Branch 7, !- Branch Name 8
  Service Hot Water Loop Demand Branch 8, !- Branch Name 9
  Service Hot Water Loop Demand Branch 9, !- Branch Name 10
  Service Hot Water Loop Demand Branch 10, !- Branch Name 11
  Service Hot Water Loop Demand Branch 11, !- Branch Name 12
  Service Hot Water Loop Demand Branch 12, !- Branch Name 13
  Service Hot Water Loop Demand Branch 13, !- Branch Name 14
  Service Hot Water Loop Demand Branch 14, !- Branch Name 15
  Service Hot Water Loop Demand Branch 15, !- Branch Name 16
  Service Hot Water Loop Demand Bypass Branch, !- Branch Name 17
  Service Hot Water Loop Demand Outlet Branch; !- Branch Name 18

ConnectorList,
  Service Hot Water Loop Demand Connector List, !- Name
  Connector:Splitter,                      !- Connector Object Type 1
  Service Hot Water Loop Demand Splitter, !- Connector Name 1
  Connector:Mixer,                         !- Connector Object Type 2
  Service Hot Water Loop Demand Mixer;     !- Connector Name 2

Connector:Splitter,
  Service Hot Water Loop Demand Splitter, !- Name
  Service Hot Water Loop Demand Inlet Branch, !- Inlet Branch Name
  Service Hot Water Loop Demand Branch 1, !- Outlet Branch Name 1
  Service Hot Water Loop Demand Branch 2, !- Outlet Branch Name 2
```

```
  Service Hot Water Loop Demand Branch 3, !- Outlet Branch Name 3
  Service Hot Water Loop Demand Branch 4, !- Outlet Branch Name 4
  Service Hot Water Loop Demand Branch 5, !- Outlet Branch Name 5
  Service Hot Water Loop Demand Branch 6, !- Outlet Branch Name 6
  Service Hot Water Loop Demand Branch 7, !- Outlet Branch Name 7
  Service Hot Water Loop Demand Branch 8, !- Outlet Branch Name 8
  Service Hot Water Loop Demand Branch 9, !- Outlet Branch Name 9
  Service Hot Water Loop Demand Branch 10, !- Outlet Branch Name 10
  Service Hot Water Loop Demand Branch 11, !- Outlet Branch Name 11
  Service Hot Water Loop Demand Branch 12, !- Outlet Branch Name 12
  Service Hot Water Loop Demand Branch 13, !- Outlet Branch Name 13
  Service Hot Water Loop Demand Branch 14, !- Outlet Branch Name 14
  Service Hot Water Loop Demand Branch 15, !- Outlet Branch Name 15
  Service Hot Water Loop Demand Bypass Branch; !- Outlet Branch Name
    16

Connector:Mixer,
  Service Hot Water Loop Demand Mixer,    !- Name
  Service Hot Water Loop Demand Outlet Branch, !- Outlet Branch Name
  Service Hot Water Loop Demand Branch 1, !- Inlet Branch Name 1
  Service Hot Water Loop Demand Branch 2, !- Inlet Branch Name 2
  Service Hot Water Loop Demand Branch 3, !- Inlet Branch Name 3
  Service Hot Water Loop Demand Branch 4, !- Inlet Branch Name 4
  Service Hot Water Loop Demand Branch 5, !- Inlet Branch Name 5
  Service Hot Water Loop Demand Branch 6, !- Inlet Branch Name 6
  Service Hot Water Loop Demand Branch 7, !- Inlet Branch Name 7
  Service Hot Water Loop Demand Branch 8, !- Inlet Branch Name 8
  Service Hot Water Loop Demand Branch 9, !- Inlet Branch Name 9
  Service Hot Water Loop Demand Branch 10, !- Inlet Branch Name 10
  Service Hot Water Loop Demand Branch 11, !- Inlet Branch Name 11
  Service Hot Water Loop Demand Branch 12, !- Inlet Branch Name 12
  Service Hot Water Loop Demand Branch 13, !- Inlet Branch Name 13
  Service Hot Water Loop Demand Branch 14, !- Inlet Branch Name 14
  Service Hot Water Loop Demand Branch 15, !- Inlet Branch Name 15
  Service Hot Water Loop Demand Bypass Branch; !- Inlet Branch Name
    16
```

```
Branch,
  Service Hot Water Loop Demand Inlet Branch, !- Name
  ,                                         !- Pressure Drop Curve
   Name
  Pipe:Adiabatic,                           !- Component Object Type 1
  Service Hot Water Loop Demand Inlet Pipe, !- Component Name 1
  Node 4,                                   !- Component Inlet Node
   Name 1
  Service Hot Water Loop Demand Inlet Pipe Node; !- Component Outlet
    Node Name 1

Pipe:Adiabatic,
  Service Hot Water Loop Demand Inlet Pipe, !- Name
  Node 4,                                   !- Inlet Node Name
  Service Hot Water Loop Demand Inlet Pipe Node; !- Outlet Node Name

Branch,
  Service Hot Water Loop Demand Branch 1, !- Name
  ,                                         !- Pressure Drop Curve
   Name
  WaterUse:Connections,                     !- Component Object Type 1
  Water Use Connections 1,                  !- Component Name 1
  Node 6,                                   !- Component Inlet Node
   Name 1
  Node 9;                                   !- Component Outlet Node
   Name 1

WaterUse:Connections,
  Water Use Connections 1,                  !- Name
  Node 6,                                   !- Inlet Node Name
  Node 9,                                   !- Outlet Node Name
  ,                                         !- Supply Water Storage
   Tank Name
  ,                                         !- Reclamation Water
   Storage Tank Name
```

```
  60.0C Hot Water,                        !- Hot Water Supply
   Temperature Schedule Name
  ,                                       !- Cold Water Supply
   Temperature Schedule Name
  None,                                   !- Drain Water Heat
   Exchanger Type
  Plant,                                  !- Drain Water Heat
   Exchanger Destination
  ,                                       !- Drain Water Heat
   Exchanger U-Factor Times Area {W/K}
  hotwater..Room_16_3d8c5364;             !- Water Use Equipment
   Name 1

WaterUse:Equipment,
  hotwater..Room_16_3d8c5364,             !- Name
  General,                                !- End-Use Subcategory
  1.19318518518519e-06,                   !- Peak Flow Rate {m3/s}
  project_hot water,                      !- Flow Rate Fraction
   Schedule Name
  60.0C Hot Water,                        !- Target Temperature
   Schedule Name
  ,                                       !- Hot Water Supply
   Temperature Schedule Name
  ,                                       !- Cold Water Supply
   Temperature Schedule Name
  Room_16_3d8c5364,                       !- Zone Name
  0.2 Hot Water Sensible Fraction,        !- Sensible Fraction
   Schedule Name
  0.05 Hot Water Latent Fraction;         !- Latent Fraction
   Schedule Name

Branch,
  Service Hot Water Loop Demand Branch 2, !- Name
  ,                                       !- Pressure Drop Curve
   Name
  WaterUse:Connections,                   !- Component Object Type 1
```

```
  Water Use Connections 2,                !- Component Name 1
  Node 10,                                !- Component Inlet Node
   Name 1
  Node 11;                                !- Component Outlet Node
   Name 1

WaterUse:Connections,
  Water Use Connections 2,                !- Name
  Node 10,                                !- Inlet Node Name
  Node 11,                                !- Outlet Node Name
  ,                                       !- Supply Water Storage
   Tank Name
  ,                                       !- Reclamation Water
   Storage Tank Name
  60.0C Hot Water,                        !- Hot Water Supply
   Temperature Schedule Name
  ,                                       !- Cold Water Supply
   Temperature Schedule Name
  None,                                   !- Drain Water Heat
   Exchanger Type
  Plant,                                  !- Drain Water Heat
   Exchanger Destination
  ,                                       !- Drain Water Heat
   Exchanger U-Factor Times Area {W/K}
  hotwater..Room_17_fb615533;             !- Water Use Equipment
   Name 1

WaterUse:Equipment,
  hotwater..Room_17_fb615533,             !- Name
  General,                                !- End-Use Subcategory
  1.19318518518518e-06,                   !- Peak Flow Rate {m3/s}
  project_hot water,                      !- Flow Rate Fraction
   Schedule Name
  60.0C Hot Water,                        !- Target Temperature
   Schedule Name
```

```
  ,                                       !- Hot Water Supply
   Temperature Schedule Name
  ,                                       !- Cold Water Supply
   Temperature Schedule Name
  Room_17_fb615533,                       !- Zone Name
  0.2 Hot Water Sensible Fraction,        !- Sensible Fraction
   Schedule Name
  0.05 Hot Water Latent Fraction;         !- Latent Fraction
   Schedule Name

Branch,
  Service Hot Water Loop Demand Branch 3, !- Name
  ,                                       !- Pressure Drop Curve
   Name
  WaterUse:Connections,                   !- Component Object Type 1
  Water Use Connections 3,                !- Component Name 1
  Node 12,                                !- Component Inlet Node
   Name 1
  Node 13;                                !- Component Outlet Node
   Name 1

WaterUse:Connections,
  Water Use Connections 3,                !- Name
  Node 12,                                !- Inlet Node Name
  Node 13,                                !- Outlet Node Name
  ,                                       !- Supply Water Storage
   Tank Name
  ,                                       !- Reclamation Water
   Storage Tank Name
  60.0C Hot Water,                        !- Hot Water Supply
   Temperature Schedule Name
  ,                                       !- Cold Water Supply
   Temperature Schedule Name
  None,                                   !- Drain Water Heat
   Exchanger Type
```

```
  Plant,                                  !- Drain Water Heat
   Exchanger Destination
  ,                                       !- Drain Water Heat
   Exchanger U-Factor Times Area {W/K}
  hotwater..Room_18_6cc35095;             !- Water Use Equipment
   Name 1

WaterUse:Equipment,
  hotwater..Room_18_6cc35095,             !- Name
  General,                                !- End-Use Subcategory
  1.19318518518518e-06,                   !- Peak Flow Rate {m3/s}
  project_hot water,                      !- Flow Rate Fraction
   Schedule Name
  60.0C Hot Water,                        !- Target Temperature
   Schedule Name
  ,                                       !- Hot Water Supply
   Temperature Schedule Name
  ,                                       !- Cold Water Supply
   Temperature Schedule Name
  Room_18_6cc35095,                       !- Zone Name
  0.2 Hot Water Sensible Fraction,        !- Sensible Fraction
   Schedule Name
  0.05 Hot Water Latent Fraction;         !- Latent Fraction
   Schedule Name

Branch,
  Service Hot Water Loop Demand Branch 4, !- Name
  ,                                       !- Pressure Drop Curve
   Name
  WaterUse:Connections,                   !- Component Object Type 1
  Water Use Connections 4,                !- Component Name 1
  Node 14,                                !- Component Inlet Node
   Name 1
  Node 15;                                !- Component Outlet Node
   Name 1
```

```
WaterUse:Connections,
  Water Use Connections 4,                !- Name
  Node 14,                                !- Inlet Node Name
  Node 15,                                !- Outlet Node Name
  ,                                       !- Supply Water Storage
   Tank Name
  ,                                       !- Reclamation Water
   Storage Tank Name
  60.0C Hot Water,                        !- Hot Water Supply
   Temperature Schedule Name
  ,                                       !- Cold Water Supply
   Temperature Schedule Name
  None,                                   !- Drain Water Heat
   Exchanger Type
  Plant,                                  !- Drain Water Heat
   Exchanger Destination
  ,                                       !- Drain Water Heat
   Exchanger U-Factor Times Area {W/K}
  hotwater..Room_19_6ae0f9a9;             !- Water Use Equipment
   Name 1

WaterUse:Equipment,
  hotwater..Room_19_6ae0f9a9,             !- Name
  General,                                !- End-Use Subcategory
  5.96592592592586e-07,                   !- Peak Flow Rate {m3/s}
  project_hot water,                      !- Flow Rate Fraction
   Schedule Name
  60.0C Hot Water,                        !- Target Temperature
   Schedule Name
  ,                                       !- Hot Water Supply
   Temperature Schedule Name
  ,                                       !- Cold Water Supply
   Temperature Schedule Name
  Room_19_6ae0f9a9,                       !- Zone Name
  0.2 Hot Water Sensible Fraction,        !- Sensible Fraction
   Schedule Name
```

```
  0.05 Hot Water Latent Fraction;          !- Latent Fraction
   Schedule Name

Branch,
  Service Hot Water Loop Demand Branch 5, !- Name
  ,                                        !- Pressure Drop Curve
   Name
  WaterUse:Connections,                    !- Component Object Type 1
  Water Use Connections 5,                 !- Component Name 1
  Node 16,                                 !- Component Inlet Node
   Name 1
  Node 17;                                 !- Component Outlet Node
   Name 1

WaterUse:Connections,
  Water Use Connections 5,                 !- Name
  Node 16,                                 !- Inlet Node Name
  Node 17,                                 !- Outlet Node Name
  ,                                        !- Supply Water Storage
   Tank Name
  ,                                        !- Reclamation Water
   Storage Tank Name
  60.0C Hot Water,                         !- Hot Water Supply
   Temperature Schedule Name
  ,                                        !- Cold Water Supply
   Temperature Schedule Name
  None,                                    !- Drain Water Heat
   Exchanger Type
  Plant,                                   !- Drain Water Heat
   Exchanger Destination
  ,                                        !- Drain Water Heat
   Exchanger U-Factor Times Area {W/K}
  hotwater..Room_20_4d060559;              !- Water Use Equipment
   Name 1

WaterUse:Equipment,
```

```
  hotwater..Room_20_4d060559,             !- Name
  General,                                !- End-Use Subcategory
  5.96592592592586e-07,                   !- Peak Flow Rate {m3/s}
  project_hot water,                      !- Flow Rate Fraction
   Schedule Name
  60.0C Hot Water,                        !- Target Temperature
   Schedule Name
  ,                                       !- Hot Water Supply
   Temperature Schedule Name
  ,                                       !- Cold Water Supply
   Temperature Schedule Name
  Room_20_4d060559,                       !- Zone Name
  0.2 Hot Water Sensible Fraction,        !- Sensible Fraction
   Schedule Name
  0.05 Hot Water Latent Fraction;         !- Latent Fraction
   Schedule Name

Branch,
  Service Hot Water Loop Demand Branch 6, !- Name
  ,                                       !- Pressure Drop Curve
   Name
  WaterUse:Connections,                   !- Component Object Type 1
  Water Use Connections 6,                !- Component Name 1
  Node 18,                                !- Component Inlet Node
   Name 1
  Node 19;                                !- Component Outlet Node
   Name 1

WaterUse:Connections,
  Water Use Connections 6,                !- Name
  Node 18,                                !- Inlet Node Name
  Node 19,                                !- Outlet Node Name
  ,                                       !- Supply Water Storage
   Tank Name
  ,                                       !- Reclamation Water
   Storage Tank Name
```

```
  60.0C Hot Water,                        !- Hot Water Supply
   Temperature Schedule Name
  ,                                       !- Cold Water Supply
   Temperature Schedule Name
  None,                                   !- Drain Water Heat
   Exchanger Type
  Plant,                                  !- Drain Water Heat
   Exchanger Destination
  ,                                       !- Drain Water Heat
   Exchanger U-Factor Times Area {W/K}
  hotwater..Room_21_4c523269;             !- Water Use Equipment
   Name 1

WaterUse:Equipment,
  hotwater..Room_21_4c523269,             !- Name
  General,                                !- End-Use Subcategory
  5.96592592592604e-07,                   !- Peak Flow Rate {m3/s}
  project_hot water,                      !- Flow Rate Fraction
   Schedule Name
  60.0C Hot Water,                        !- Target Temperature
   Schedule Name
  ,                                       !- Hot Water Supply
   Temperature Schedule Name
  ,                                       !- Cold Water Supply
   Temperature Schedule Name
  Room_21_4c523269,                       !- Zone Name
  0.2 Hot Water Sensible Fraction,        !- Sensible Fraction
   Schedule Name
  0.05 Hot Water Latent Fraction;         !- Latent Fraction
   Schedule Name

Branch,
  Service Hot Water Loop Demand Branch 7, !- Name
  ,                                       !- Pressure Drop Curve
   Name
  WaterUse:Connections,                   !- Component Object Type 1
```

```
  Water Use Connections 7,                !- Component Name 1
  Node 20,                                !- Component Inlet Node
   Name 1
  Node 21;                                !- Component Outlet Node
   Name 1

WaterUse:Connections,
  Water Use Connections 7,                !- Name
  Node 20,                                !- Inlet Node Name
  Node 21,                                !- Outlet Node Name
  ,                                       !- Supply Water Storage
   Tank Name
  ,                                       !- Reclamation Water
   Storage Tank Name
  60.0C Hot Water,                        !- Hot Water Supply
   Temperature Schedule Name
  ,                                       !- Cold Water Supply
   Temperature Schedule Name
  None,                                   !- Drain Water Heat
   Exchanger Type
  Plant,                                  !- Drain Water Heat
   Exchanger Destination
  ,                                       !- Drain Water Heat
   Exchanger U-Factor Times Area {W/K}
  hotwater..Room_22_f3ee5a53;             !- Water Use Equipment
   Name 1

WaterUse:Equipment,
  hotwater..Room_22_f3ee5a53,             !- Name
  General,                                !- End-Use Subcategory
  1.19318518518517e-06,                   !- Peak Flow Rate {m3/s}
  project_hot water,                      !- Flow Rate Fraction
   Schedule Name
  60.0C Hot Water,                        !- Target Temperature
   Schedule Name
```

```
  ,                                       !- Hot Water Supply
   Temperature Schedule Name
  ,                                       !- Cold Water Supply
   Temperature Schedule Name
  Room_22_f3ee5a53,                       !- Zone Name
  0.2 Hot Water Sensible Fraction,        !- Sensible Fraction
   Schedule Name
  0.05 Hot Water Latent Fraction;         !- Latent Fraction
   Schedule Name

Branch,
  Service Hot Water Loop Demand Branch 8, !- Name
  ,                                       !- Pressure Drop Curve
   Name
  WaterUse:Connections,                   !- Component Object Type 1
  Water Use Connections 8,                !- Component Name 1
  Node 22,                                !- Component Inlet Node
   Name 1
  Node 23;                                !- Component Outlet Node
   Name 1

WaterUse:Connections,
  Water Use Connections 8,                !- Name
  Node 22,                                !- Inlet Node Name
  Node 23,                                !- Outlet Node Name
  ,                                       !- Supply Water Storage
   Tank Name
  ,                                       !- Reclamation Water
   Storage Tank Name
  60.0C Hot Water,                        !- Hot Water Supply
   Temperature Schedule Name
  ,                                       !- Cold Water Supply
   Temperature Schedule Name
  None,                                   !- Drain Water Heat
   Exchanger Type
```

```
  Plant,                                  !- Drain Water Heat
   Exchanger Destination
  ,                                       !- Drain Water Heat
   Exchanger U-Factor Times Area {W/K}
  hotwater..Room_23_e751e71f;             !- Water Use Equipment
   Name 1

WaterUse:Equipment,
  hotwater..Room_23_e751e71f,             !- Name
  General,                                !- End-Use Subcategory
  1.19318518518521e-06,                   !- Peak Flow Rate {m3/s}
  project_hot water,                      !- Flow Rate Fraction
   Schedule Name
  60.0C Hot Water,                        !- Target Temperature
   Schedule Name
  ,                                       !- Hot Water Supply
   Temperature Schedule Name
  ,                                       !- Cold Water Supply
   Temperature Schedule Name
  Room_23_e751e71f,                       !- Zone Name
  0.2 Hot Water Sensible Fraction,        !- Sensible Fraction
   Schedule Name
  0.05 Hot Water Latent Fraction;         !- Latent Fraction
   Schedule Name

Branch,
  Service Hot Water Loop Demand Branch 9, !- Name
  ,                                       !- Pressure Drop Curve
   Name
  WaterUse:Connections,                   !- Component Object Type 1
  Water Use Connections 9,                !- Component Name 1
  Node 24,                                !- Component Inlet Node
   Name 1
  Node 25;                                !- Component Outlet Node
   Name 1
```

```
WaterUse:Connections,
  Water Use Connections 9,                !- Name
  Node 24,                                !- Inlet Node Name
  Node 25,                                !- Outlet Node Name
  ,                                       !- Supply Water Storage
   Tank Name
  ,                                       !- Reclamation Water
   Storage Tank Name
  60.0C Hot Water,                        !- Hot Water Supply
   Temperature Schedule Name
  ,                                       !- Cold Water Supply
   Temperature Schedule Name
  None,                                   !- Drain Water Heat
   Exchanger Type
  Plant,                                  !- Drain Water Heat
   Exchanger Destination
  ,                                       !- Drain Water Heat
   Exchanger U-Factor Times Area {W/K}
  hotwater..Room_24_159d21b7;             !- Water Use Equipment
   Name 1

WaterUse:Equipment,
  hotwater..Room_24_159d21b7,             !- Name
  General,                                !- End-Use Subcategory
  1.19318518518517e-06,                   !- Peak Flow Rate {m3/s}
  project_hot water,                      !- Flow Rate Fraction
   Schedule Name
  60.0C Hot Water,                        !- Target Temperature
   Schedule Name
  ,                                       !- Hot Water Supply
   Temperature Schedule Name
  ,                                       !- Cold Water Supply
   Temperature Schedule Name
  Room_24_159d21b7,                       !- Zone Name
  0.2 Hot Water Sensible Fraction,        !- Sensible Fraction
   Schedule Name
```

```
  0.05 Hot Water Latent Fraction;         !- Latent Fraction
   Schedule Name

Branch,
  Service Hot Water Loop Demand Branch 10, !- Name
  ,                                       !- Pressure Drop Curve
   Name
  WaterUse:Connections,                   !- Component Object Type 1
  Water Use Connections 10,               !- Component Name 1
  Node 26,                                !- Component Inlet Node
   Name 1
  Node 27;                                !- Component Outlet Node
   Name 1

WaterUse:Connections,
  Water Use Connections 10,               !- Name
  Node 26,                                !- Inlet Node Name
  Node 27,                                !- Outlet Node Name
  ,                                       !- Supply Water Storage
   Tank Name
  ,                                       !- Reclamation Water
   Storage Tank Name
  60.0C Hot Water,                        !- Hot Water Supply
   Temperature Schedule Name
  ,                                       !- Cold Water Supply
   Temperature Schedule Name
  None,                                   !- Drain Water Heat
   Exchanger Type
  Plant,                                  !- Drain Water Heat
   Exchanger Destination
  ,                                       !- Drain Water Heat
   Exchanger U-Factor Times Area {W/K}
  hotwater..Room_25_d27e0933;             !- Water Use Equipment
   Name 1

WaterUse:Equipment,
```

```
  hotwater..Room_25_d27e0933,             !- Name
  General,                                !- End-Use Subcategory
  1.19318518518521e-06,                   !- Peak Flow Rate {m3/s}
  project_hot water,                      !- Flow Rate Fraction
   Schedule Name
  60.0C Hot Water,                        !- Target Temperature
   Schedule Name
  ,                                       !- Hot Water Supply
   Temperature Schedule Name
  ,                                       !- Cold Water Supply
   Temperature Schedule Name
  Room_25_d27e0933,                       !- Zone Name
  0.2 Hot Water Sensible Fraction,        !- Sensible Fraction
   Schedule Name
  0.05 Hot Water Latent Fraction;         !- Latent Fraction
   Schedule Name

Branch,
  Service Hot Water Loop Demand Branch 11, !- Name
  ,                                       !- Pressure Drop Curve
   Name
  WaterUse:Connections,                   !- Component Object Type 1
  Water Use Connections 11,               !- Component Name 1
  Node 28,                                !- Component Inlet Node
   Name 1
  Node 29;                                !- Component Outlet Node
   Name 1

WaterUse:Connections,
  Water Use Connections 11,               !- Name
  Node 28,                                !- Inlet Node Name
  Node 29,                                !- Outlet Node Name
  ,                                       !- Supply Water Storage
   Tank Name
  ,                                       !- Reclamation Water
   Storage Tank Name
```

```
  60.0C Hot Water,                        !- Hot Water Supply
   Temperature Schedule Name
  ,                                       !- Cold Water Supply
   Temperature Schedule Name
  None,                                   !- Drain Water Heat
   Exchanger Type
  Plant,                                  !- Drain Water Heat
   Exchanger Destination
  ,                                       !- Drain Water Heat
   Exchanger U-Factor Times Area {W/K}
  hotwater..Room_26_f4ea3797;             !- Water Use Equipment
   Name 1

WaterUse:Equipment,
  hotwater..Room_26_f4ea3797,             !- Name
  General,                                !- End-Use Subcategory
  1.19318518518517e-06,                   !- Peak Flow Rate {m3/s}
  project_hot water,                      !- Flow Rate Fraction
   Schedule Name
  60.0C Hot Water,                        !- Target Temperature
   Schedule Name
  ,                                       !- Hot Water Supply
   Temperature Schedule Name
  ,                                       !- Cold Water Supply
   Temperature Schedule Name
  Room_26_f4ea3797,                       !- Zone Name
  0.2 Hot Water Sensible Fraction,        !- Sensible Fraction
   Schedule Name
  0.05 Hot Water Latent Fraction;         !- Latent Fraction
   Schedule Name

Branch,
  Service Hot Water Loop Demand Branch 12, !- Name
  ,                                       !- Pressure Drop Curve
   Name
  WaterUse:Connections,                   !- Component Object Type 1
```

```
  Water Use Connections 12,               !- Component Name 1
  Node 30,                                !- Component Inlet Node
   Name 1
  Node 31;                                !- Component Outlet Node
   Name 1

WaterUse:Connections,
  Water Use Connections 12,               !- Name
  Node 30,                                !- Inlet Node Name
  Node 31,                                !- Outlet Node Name
  ,                                       !- Supply Water Storage
   Tank Name
  ,                                       !- Reclamation Water
   Storage Tank Name
  60.0C Hot Water,                        !- Hot Water Supply
   Temperature Schedule Name
  ,                                       !- Cold Water Supply
   Temperature Schedule Name
  None,                                   !- Drain Water Heat
   Exchanger Type
  Plant,                                  !- Drain Water Heat
   Exchanger Destination
  ,                                       !- Drain Water Heat
   Exchanger U-Factor Times Area {W/K}
  hotwater..Room_27_0080b418;             !- Water Use Equipment
   Name 1

WaterUse:Equipment,
  hotwater..Room_27_0080b418,             !- Name
  General,                                !- End-Use Subcategory
  1.19318518518517e-06,                   !- Peak Flow Rate {m3/s}
  project_hot water,                      !- Flow Rate Fraction
   Schedule Name
  60.0C Hot Water,                        !- Target Temperature
   Schedule Name
```

```
  ,                                       !- Hot Water Supply
   Temperature Schedule Name
  ,                                       !- Cold Water Supply
   Temperature Schedule Name
  Room_27_0080b418,                       !- Zone Name
  0.2 Hot Water Sensible Fraction,        !- Sensible Fraction
   Schedule Name
  0.05 Hot Water Latent Fraction;         !- Latent Fraction
   Schedule Name

Branch,
  Service Hot Water Loop Demand Branch 13, !- Name
  ,                                       !- Pressure Drop Curve
   Name
  WaterUse:Connections,                   !- Component Object Type 1
  Water Use Connections 13,               !- Component Name 1
  Node 32,                                !- Component Inlet Node
   Name 1
  Node 33;                                !- Component Outlet Node
   Name 1

WaterUse:Connections,
  Water Use Connections 13,               !- Name
  Node 32,                                !- Inlet Node Name
  Node 33,                                !- Outlet Node Name
  ,                                       !- Supply Water Storage
   Tank Name
  ,                                       !- Reclamation Water
   Storage Tank Name
  60.0C Hot Water,                        !- Hot Water Supply
   Temperature Schedule Name
  ,                                       !- Cold Water Supply
   Temperature Schedule Name
  None,                                   !- Drain Water Heat
   Exchanger Type
```

```
  Plant,                                  !- Drain Water Heat
   Exchanger Destination
  ,                                       !- Drain Water Heat
   Exchanger U-Factor Times Area {W/K}
  hotwater..Room_28_d6ed2799;             !- Water Use Equipment
   Name 1

WaterUse:Equipment,
  hotwater..Room_28_d6ed2799,             !- Name
  General,                                !- End-Use Subcategory
  1.19318518518518e-06,                   !- Peak Flow Rate {m3/s}
  project_hot water,                      !- Flow Rate Fraction
   Schedule Name
  60.0C Hot Water,                        !- Target Temperature
   Schedule Name
  ,                                       !- Hot Water Supply
   Temperature Schedule Name
  ,                                       !- Cold Water Supply
   Temperature Schedule Name
  Room_28_d6ed2799,                       !- Zone Name
  0.2 Hot Water Sensible Fraction,        !- Sensible Fraction
   Schedule Name
  0.05 Hot Water Latent Fraction;         !- Latent Fraction
   Schedule Name

Branch,
  Service Hot Water Loop Demand Branch 14, !- Name
  ,                                       !- Pressure Drop Curve
   Name
  WaterUse:Connections,                   !- Component Object Type 1
  Water Use Connections 14,               !- Component Name 1
  Node 34,                                !- Component Inlet Node
   Name 1
  Node 35;                                !- Component Outlet Node
   Name 1
```

```
WaterUse:Connections,
  Water Use Connections 14,               !- Name
  Node 34,                                !- Inlet Node Name
  Node 35,                                !- Outlet Node Name
  ,                                       !- Supply Water Storage
   Tank Name
  ,                                       !- Reclamation Water
   Storage Tank Name
  60.0C Hot Water,                        !- Hot Water Supply
   Temperature Schedule Name
  ,                                       !- Cold Water Supply
   Temperature Schedule Name
  None,                                   !- Drain Water Heat
   Exchanger Type
  Plant,                                  !- Drain Water Heat
   Exchanger Destination
  ,                                       !- Drain Water Heat
   Exchanger U-Factor Times Area {W/K}
  hotwater..Room_29_2a634042;             !- Water Use Equipment
   Name 1

WaterUse:Equipment,
  hotwater..Room_29_2a634042,             !- Name
  General,                                !- End-Use Subcategory
  1.19318518518518e-06,                   !- Peak Flow Rate {m3/s}
  project_hot water,                      !- Flow Rate Fraction
   Schedule Name
  60.0C Hot Water,                        !- Target Temperature
   Schedule Name
  ,                                       !- Hot Water Supply
   Temperature Schedule Name
  ,                                       !- Cold Water Supply
   Temperature Schedule Name
  Room_29_2a634042,                       !- Zone Name
  0.2 Hot Water Sensible Fraction,        !- Sensible Fraction
   Schedule Name
```

```
  0.05 Hot Water Latent Fraction;          !- Latent Fraction
   Schedule Name

Branch,
  Service Hot Water Loop Demand Branch 15, !- Name
  ,                                        !- Pressure Drop Curve
   Name
  WaterUse:Connections,                    !- Component Object Type 1
  Water Use Connections 15,                !- Component Name 1
  Node 36,                                 !- Component Inlet Node
   Name 1
  Node 37;                                 !- Component Outlet Node
   Name 1

WaterUse:Connections,
  Water Use Connections 15,                !- Name
  Node 36,                                 !- Inlet Node Name
  Node 37,                                 !- Outlet Node Name
  ,                                        !- Supply Water Storage
   Tank Name
  ,                                        !- Reclamation Water
   Storage Tank Name
  60.0C Hot Water,                         !- Hot Water Supply
   Temperature Schedule Name
  ,                                        !- Cold Water Supply
   Temperature Schedule Name
  None,                                    !- Drain Water Heat
   Exchanger Type
  Plant,                                   !- Drain Water Heat
   Exchanger Destination
  ,                                        !- Drain Water Heat
   Exchanger U-Factor Times Area {W/K}
  hotwater..Room_30_98f1d6c8;              !- Water Use Equipment
   Name 1

WaterUse:Equipment,
```

```
  hotwater..Room_30_98f1d6c8,             !- Name
  General,                                !- End-Use Subcategory
  1.19318518518519e-06,                   !- Peak Flow Rate {m3/s}
  project_hot water,                      !- Flow Rate Fraction
   Schedule Name
  60.0C Hot Water,                        !- Target Temperature
   Schedule Name
  ,                                       !- Hot Water Supply
   Temperature Schedule Name
  ,                                       !- Cold Water Supply
   Temperature Schedule Name
  Room_30_98f1d6c8,                       !- Zone Name
  0.2 Hot Water Sensible Fraction,        !- Sensible Fraction
   Schedule Name
  0.05 Hot Water Latent Fraction;         !- Latent Fraction
   Schedule Name

Branch,
  Service Hot Water Loop Demand Bypass Branch, !- Name
  ,                                       !- Pressure Drop Curve
   Name
  Pipe:Adiabatic,                         !- Component Object Type 1
  Service Hot Water Loop Demand Bypass Pipe, !- Component Name 1
  Service Hot Water Loop Demand Bypass Pipe Inlet Node, !- Component
    Inlet Node Name 1
  Service Hot Water Loop Demand Bypass Pipe Outlet Node; !-
   Component Outlet Node Name 1

Pipe:Adiabatic,
  Service Hot Water Loop Demand Bypass Pipe, !- Name
  Service Hot Water Loop Demand Bypass Pipe Inlet Node, !- Inlet
   Node Name
  Service Hot Water Loop Demand Bypass Pipe Outlet Node; !- Outlet
   Node Name

Branch,
```

```
  Service Hot Water Loop Demand Outlet Branch, !- Name
  ,                                        !- Pressure Drop Curve
   Name
  Pipe:Adiabatic,                          !- Component Object Type 1
  Service Hot Water Loop Demand Outlet Pipe, !- Component Name 1
  Service Hot Water Loop Demand Outlet Pipe Node, !- Component Inlet
    Node Name 1
  Node 5;                                  !- Component Outlet Node
   Name 1

Pipe:Adiabatic,
  Service Hot Water Loop Demand Outlet Pipe, !- Name
  Service Hot Water Loop Demand Outlet Pipe Node, !- Inlet Node Name
  Node 5;                                  !- Outlet Node Name

PlantEquipmentOperationSchemes,
  Service Hot Water Loop Operation Schemes, !- Name
  PlantEquipmentOperation:HeatingLoad,     !- Control Scheme Object
   Type 1
  Service Hot Water Loop Heating Operation Scheme, !- Control Scheme
    Name 1
  Always On Discrete;                      !- Control Scheme Schedule
    Name 1

PlantEquipmentOperation:HeatingLoad,
  Service Hot Water Loop Heating Operation Scheme, !- Name
  0,                                       !- Load Range Lower Limit
   1 {W}
  1000000000,                              !- Load Range Upper Limit
   1 {W}
  Service Hot Water Loop Heating Equipment List; !- Range Equipment
   List Name 1

PlantEquipmentList,
  Service Hot Water Loop Heating Equipment List, !- Name
  DistrictHeating,                         !- Equipment Object Type 1
```

```
  Service Hot Water District Heat;        !- Equipment Name 1

Output:Table:SummaryReports,
  AllSummary;                             !- Report Name 1

Site:Location,
  Site 1,                                 !- Name
  0,                                      !- Latitude {deg}
  0,                                      !- Longitude {deg}
  0,                                      !- Time Zone {hr}
  0;                                      !- Elevation {m}

Site:WaterMainsTemperature,
  CorrelationFromWeatherFile;             !- Calculation Method

SizingPeriod:DesignDay,
  Kuwait Intl Airport Ann Clg .4% Condns DB=>MWB, !- Name
  7,                                      !- Month
  21,                                     !- Day of Month
  SummerDesignDay,                        !- Day Type
  47.9,                                   !- Maximum Dry-Bulb
   Temperature {C}
  15.6,                                   !- Daily Dry-Bulb
   Temperature Range {deltaC}
  DefaultMultipliers,                     !- Dry-Bulb Temperature
   Range Modifier Type
  ,                                       !- Dry-Bulb Temperature
   Range Modifier Day Schedule Name
  Wetbulb,                                !- Humidity Condition Type
  20.9,                                   !- Wetbulb or DewPoint at
   Maximum Dry-Bulb {C}
  ,                                       !- Humidity Condition Day
   Schedule Name
  ,                                       !- Humidity Ratio at
   Maximum Dry-Bulb {kgWater/kgDryAir}
```

```
  ,                                       !- Enthalpy at Maximum Dry
   -Bulb {J/kg}
  ,                                       !- Daily Wet-Bulb
   Temperature Range {deltaC}
  100666,                                 !- Barometric Pressure {Pa
   }
  6.4,                                    !- Wind Speed {m/s}
  320,                                    !- Wind Direction {deg}
  No,                                     !- Rain Indicator
  No,                                     !- Snow Indicator
  No,                                     !- Daylight Saving Time
   Indicator
  ASHRAETau,                              !- Solar Model Indicator
  ,                                       !- Beam Solar Day Schedule
    Name
  ,                                       !- Diffuse Solar Day
   Schedule Name
  0.748,                                  !- ASHRAE Clear Sky
   Optical Depth for Beam Irradiance (taub) {dimensionless}
  1.315;                                  !- ASHRAE Clear Sky
   Optical Depth for Diffuse Irradiance (taud) {dimensionless}

SizingPeriod:DesignDay,
  Kuwait Intl Airport Ann Clg .4% Condns DP=>MDB, !- Name
  7,                                      !- Month
  21,                                     !- Day of Month
  SummerDesignDay,                        !- Day Type
  32.6,                                   !- Maximum Dry-Bulb
   Temperature {C}
  15.6,                                   !- Daily Dry-Bulb
   Temperature Range {deltaC}
  DefaultMultipliers,                     !- Dry-Bulb Temperature
   Range Modifier Type
  ,                                       !- Dry-Bulb Temperature
   Range Modifier Day Schedule Name
  Dewpoint,                               !- Humidity Condition Type
```

```
  26.4,                                   !- Wetbulb or DewPoint at
   Maximum Dry-Bulb {C}
  ,                                       !- Humidity Condition Day
   Schedule Name
  ,                                       !- Humidity Ratio at
   Maximum Dry-Bulb {kgWater/kgDryAir}
  ,                                       !- Enthalpy at Maximum Dry
   -Bulb {J/kg}
  ,                                       !- Daily Wet-Bulb
   Temperature Range {deltaC}
  100666,                                 !- Barometric Pressure {Pa
   }
  6.4,                                    !- Wind Speed {m/s}
  320,                                    !- Wind Direction {deg}
  No,                                     !- Rain Indicator
  No,                                     !- Snow Indicator
  No,                                     !- Daylight Saving Time
   Indicator
  ASHRAETau,                              !- Solar Model Indicator
  ,                                       !- Beam Solar Day Schedule
    Name
  ,                                       !- Diffuse Solar Day
   Schedule Name
  0.748,                                  !- ASHRAE Clear Sky
   Optical Depth for Beam Irradiance (taub) {dimensionless}
  1.315;                                  !- ASHRAE Clear Sky
   Optical Depth for Diffuse Irradiance (taud) {dimensionless}

SizingPeriod:DesignDay,
  Kuwait Intl Airport Ann Clg .4% Condns Enth=>MDB, !- Name
  7,                                      !- Month
  21,                                     !- Day of Month
  SummerDesignDay,                        !- Day Type
  35.1,                                   !- Maximum Dry-Bulb
   Temperature {C}
```

```
  15.6,                                   !- Daily Dry-Bulb
   Temperature Range {deltaC}
  DefaultMultipliers,                     !- Dry-Bulb Temperature
   Range Modifier Type
  ,                                       !- Dry-Bulb Temperature
   Range Modifier Day Schedule Name
  Enthalpy,                               !- Humidity Condition Type
  ,                                       !- Wetbulb or DewPoint at
   Maximum Dry-Bulb {C}
  ,                                       !- Humidity Condition Day
   Schedule Name
  ,                                       !- Humidity Ratio at
   Maximum Dry-Bulb {kgWater/kgDryAir}
  91200,                                  !- Enthalpy at Maximum Dry
   -Bulb {J/kg}
  ,                                       !- Daily Wet-Bulb
   Temperature Range {deltaC}
  100666,                                 !- Barometric Pressure {Pa
   }
  6.4,                                    !- Wind Speed {m/s}
  320,                                    !- Wind Direction {deg}
  No,                                     !- Rain Indicator
  No,                                     !- Snow Indicator
  No,                                     !- Daylight Saving Time
   Indicator
  ASHRAETau,                              !- Solar Model Indicator
  ,                                       !- Beam Solar Day Schedule
    Name
  ,                                       !- Diffuse Solar Day
   Schedule Name
  0.748,                                  !- ASHRAE Clear Sky
   Optical Depth for Beam Irradiance (taub) {dimensionless}
  1.315;                                  !- ASHRAE Clear Sky
   Optical Depth for Diffuse Irradiance (taud) {dimensionless}

SizingPeriod:DesignDay,
```

```
Kuwait Intl Airport Ann Clg .4% Condns WB=>MDB, !- Name
7,                                        !- Month
21,                                       !- Day of Month
SummerDesignDay,                          !- Day Type
35.2,                                     !- Maximum Dry-Bulb
 Temperature {C}
15.6,                                     !- Daily Dry-Bulb
 Temperature Range {deltaC}
DefaultMultipliers,                       !- Dry-Bulb Temperature
 Range Modifier Type
,                                         !- Dry-Bulb Temperature
 Range Modifier Day Schedule Name
Wetbulb,                                  !- Humidity Condition Type
28.2,                                     !- Wetbulb or DewPoint at
 Maximum Dry-Bulb {C}
,                                         !- Humidity Condition Day
 Schedule Name
,                                         !- Humidity Ratio at
 Maximum Dry-Bulb {kgWater/kgDryAir}
,                                         !- Enthalpy at Maximum Dry
 -Bulb {J/kg}
,                                         !- Daily Wet-Bulb
 Temperature Range {deltaC}
100666,                                   !- Barometric Pressure {Pa
 }
6.4,                                      !- Wind Speed {m/s}
320,                                      !- Wind Direction {deg}
No,                                       !- Rain Indicator
No,                                       !- Snow Indicator
No,                                       !- Daylight Saving Time
 Indicator
ASHRAETau,                                !- Solar Model Indicator
,                                         !- Beam Solar Day Schedule
  Name
,                                         !- Diffuse Solar Day
 Schedule Name
```

```
  0.748,                                  !- ASHRAE Clear Sky
   Optical Depth for Beam Irradiance (taub) {dimensionless}
  1.315;                                  !- ASHRAE Clear Sky
   Optical Depth for Diffuse Irradiance (taud) {dimensionless}

SizingPeriod:DesignDay,
  Kuwait Intl Airport Ann Clg 1% Condns DB=>MWB, !- Name
  7,                                      !- Month
  21,                                     !- Day of Month
  SummerDesignDay,                        !- Day Type
  46.9,                                   !- Maximum Dry-Bulb
   Temperature {C}
  15.6,                                   !- Daily Dry-Bulb
   Temperature Range {deltaC}
  DefaultMultipliers,                     !- Dry-Bulb Temperature
   Range Modifier Type
  ,                                       !- Dry-Bulb Temperature
   Range Modifier Day Schedule Name
  Wetbulb,                                !- Humidity Condition Type
  20.6,                                   !- Wetbulb or DewPoint at
   Maximum Dry-Bulb {C}
  ,                                       !- Humidity Condition Day
   Schedule Name
  ,                                       !- Humidity Ratio at
   Maximum Dry-Bulb {kgWater/kgDryAir}
  ,                                       !- Enthalpy at Maximum Dry
   -Bulb {J/kg}
  ,                                       !- Daily Wet-Bulb
   Temperature Range {deltaC}
  100666,                                 !- Barometric Pressure {Pa
   }
  6.4,                                    !- Wind Speed {m/s}
  320,                                    !- Wind Direction {deg}
  No,                                     !- Rain Indicator
  No,                                     !- Snow Indicator
```

```
  No,                                     !- Daylight Saving Time
   Indicator
  ASHRAETau,                              !- Solar Model Indicator
  ,                                       !- Beam Solar Day Schedule
    Name
  ,                                       !- Diffuse Solar Day
   Schedule Name
  0.748,                                  !- ASHRAE Clear Sky
   Optical Depth for Beam Irradiance (taub) {dimensionless}
  1.315;                                  !- ASHRAE Clear Sky
   Optical Depth for Diffuse Irradiance (taud) {dimensionless}

SizingPeriod:DesignDay,
  Kuwait Intl Airport Ann Clg 1% Condns DP=>MDB, !- Name
  7,                                      !- Month
  21,                                     !- Day of Month
  SummerDesignDay,                        !- Day Type
  31.2,                                   !- Maximum Dry-Bulb
   Temperature {C}
  15.6,                                   !- Daily Dry-Bulb
   Temperature Range {deltaC}
  DefaultMultipliers,                     !- Dry-Bulb Temperature
   Range Modifier Type
  ,                                       !- Dry-Bulb Temperature
   Range Modifier Day Schedule Name
  Dewpoint,                               !- Humidity Condition Type
  24.1,                                   !- Wetbulb or DewPoint at
   Maximum Dry-Bulb {C}
  ,                                       !- Humidity Condition Day
   Schedule Name
  ,                                       !- Humidity Ratio at
   Maximum Dry-Bulb {kgWater/kgDryAir}
  ,                                       !- Enthalpy at Maximum Dry
   -Bulb {J/kg}
  ,                                       !- Daily Wet-Bulb
   Temperature Range {deltaC}
```

```
  100666,                                 !- Barometric Pressure {Pa
   }
  6.4,                                    !- Wind Speed {m/s}
  320,                                    !- Wind Direction {deg}
  No,                                     !- Rain Indicator
  No,                                     !- Snow Indicator
  No,                                     !- Daylight Saving Time
   Indicator
  ASHRAETau,                              !- Solar Model Indicator
  ,                                       !- Beam Solar Day Schedule
    Name
  ,                                       !- Diffuse Solar Day
   Schedule Name
  0.748,                                  !- ASHRAE Clear Sky
   Optical Depth for Beam Irradiance (taub) {dimensionless}
  1.315;                                  !- ASHRAE Clear Sky
   Optical Depth for Diffuse Irradiance (taud) {dimensionless}

SizingPeriod:DesignDay,
  Kuwait Intl Airport Ann Clg 1% Condns Enth=>MDB, !- Name
  7,                                      !- Month
  21,                                     !- Day of Month
  SummerDesignDay,                        !- Day Type
  34,                                     !- Maximum Dry-Bulb
   Temperature {C}
  15.6,                                   !- Daily Dry-Bulb
   Temperature Range {deltaC}
  DefaultMultipliers,                     !- Dry-Bulb Temperature
   Range Modifier Type
  ,                                       !- Dry-Bulb Temperature
   Range Modifier Day Schedule Name
  Enthalpy,                               !- Humidity Condition Type
  ,                                       !- Wetbulb or DewPoint at
   Maximum Dry-Bulb {C}
  ,                                       !- Humidity Condition Day
   Schedule Name
```

```
  ,                                       !- Humidity Ratio at
   Maximum Dry-Bulb {kgWater/kgDryAir}
  82200,                                  !- Enthalpy at Maximum Dry
   -Bulb {J/kg}
  ,                                       !- Daily Wet-Bulb
   Temperature Range {deltaC}
  100666,                                 !- Barometric Pressure {Pa
   }
  6.4,                                    !- Wind Speed {m/s}
  320,                                    !- Wind Direction {deg}
  No,                                     !- Rain Indicator
  No,                                     !- Snow Indicator
  No,                                     !- Daylight Saving Time
   Indicator
  ASHRAETau,                              !- Solar Model Indicator
  ,                                       !- Beam Solar Day Schedule
    Name
  ,                                       !- Diffuse Solar Day
   Schedule Name
  0.748,                                  !- ASHRAE Clear Sky
   Optical Depth for Beam Irradiance (taub) {dimensionless}
  1.315;                                  !- ASHRAE Clear Sky
   Optical Depth for Diffuse Irradiance (taud) {dimensionless}

SizingPeriod:DesignDay,
  Kuwait Intl Airport Ann Clg 1% Condns WB=>MDB, !- Name
  7,                                      !- Month
  21,                                     !- Day of Month
  SummerDesignDay,                        !- Day Type
  34.7,                                   !- Maximum Dry-Bulb
   Temperature {C}
  15.6,                                   !- Daily Dry-Bulb
   Temperature Range {deltaC}
  DefaultMultipliers,                     !- Dry-Bulb Temperature
   Range Modifier Type
```

```
  ,                                       !- Dry-Bulb Temperature
   Range Modifier Day Schedule Name
  Wetbulb,                                !- Humidity Condition Type
  26.3,                                   !- Wetbulb or DewPoint at
   Maximum Dry-Bulb {C}
  ,                                       !- Humidity Condition Day
   Schedule Name
  ,                                       !- Humidity Ratio at
   Maximum Dry-Bulb {kgWater/kgDryAir}
  ,                                       !- Enthalpy at Maximum Dry
   -Bulb {J/kg}
  ,                                       !- Daily Wet-Bulb
   Temperature Range {deltaC}
  100666,                                 !- Barometric Pressure {Pa
   }
  6.4,                                    !- Wind Speed {m/s}
  320,                                    !- Wind Direction {deg}
  No,                                     !- Rain Indicator
  No,                                     !- Snow Indicator
  No,                                     !- Daylight Saving Time
   Indicator
  ASHRAETau,                              !- Solar Model Indicator
  ,                                       !- Beam Solar Day Schedule
    Name
  ,                                       !- Diffuse Solar Day
   Schedule Name
  0.748,                                  !- ASHRAE Clear Sky
   Optical Depth for Beam Irradiance (taub) {dimensionless}
  1.315;                                  !- ASHRAE Clear Sky
   Optical Depth for Diffuse Irradiance (taud) {dimensionless}

SizingPeriod:DesignDay,
  Kuwait Intl Airport Ann Clg 2% Condns DB=>MWB, !- Name
  7,                                      !- Month
  21,                                     !- Day of Month
  SummerDesignDay,                        !- Day Type
```

```
45.9,                                   !- Maximum Dry-Bulb
 Temperature {C}
15.6,                                   !- Daily Dry-Bulb
 Temperature Range {deltaC}
DefaultMultipliers,                     !- Dry-Bulb Temperature
 Range Modifier Type
,                                       !- Dry-Bulb Temperature
 Range Modifier Day Schedule Name
Wetbulb,                                !- Humidity Condition Type
20.3,                                   !- Wetbulb or DewPoint at
 Maximum Dry-Bulb {C}
,                                       !- Humidity Condition Day
 Schedule Name
,                                       !- Humidity Ratio at
 Maximum Dry-Bulb {kgWater/kgDryAir}
,                                       !- Enthalpy at Maximum Dry
 -Bulb {J/kg}
,                                       !- Daily Wet-Bulb
 Temperature Range {deltaC}
100666,                                 !- Barometric Pressure {Pa
 }
6.4,                                    !- Wind Speed {m/s}
320,                                    !- Wind Direction {deg}
No,                                     !- Rain Indicator
No,                                     !- Snow Indicator
No,                                     !- Daylight Saving Time
 Indicator
ASHRAETau,                              !- Solar Model Indicator
,                                       !- Beam Solar Day Schedule
  Name
,                                       !- Diffuse Solar Day
 Schedule Name
0.748,                                  !- ASHRAE Clear Sky
 Optical Depth for Beam Irradiance (taub) {dimensionless}
1.315;                                  !- ASHRAE Clear Sky
 Optical Depth for Diffuse Irradiance (taud) {dimensionless}
```

```
SizingPeriod:DesignDay,
  Kuwait Intl Airport Ann Clg 2% Condns DP=>MDB, !- Name
  7,                                      !- Month
  21,                                     !- Day of Month
  SummerDesignDay,                        !- Day Type
  30.2,                                   !- Maximum Dry-Bulb
   Temperature {C}
  15.6,                                   !- Daily Dry-Bulb
   Temperature Range {deltaC}
  DefaultMultipliers,                     !- Dry-Bulb Temperature
   Range Modifier Type
  ,                                       !- Dry-Bulb Temperature
   Range Modifier Day Schedule Name
  Dewpoint,                               !- Humidity Condition Type
  21.9,                                   !- Wetbulb or DewPoint at
   Maximum Dry-Bulb {C}
  ,                                       !- Humidity Condition Day
   Schedule Name
  ,                                       !- Humidity Ratio at
   Maximum Dry-Bulb {kgWater/kgDryAir}
  ,                                       !- Enthalpy at Maximum Dry
   -Bulb {J/kg}
  ,                                       !- Daily Wet-Bulb
   Temperature Range {deltaC}
  100666,                                 !- Barometric Pressure {Pa
   }
  6.4,                                    !- Wind Speed {m/s}
  320,                                    !- Wind Direction {deg}
  No,                                     !- Rain Indicator
  No,                                     !- Snow Indicator
  No,                                     !- Daylight Saving Time
   Indicator
  ASHRAETau,                              !- Solar Model Indicator
  ,                                       !- Beam Solar Day Schedule
    Name
```

```
  ,                                       !- Diffuse Solar Day
   Schedule Name
  0.748,                                  !- ASHRAE Clear Sky
   Optical Depth for Beam Irradiance (taub) {dimensionless}
  1.315;                                  !- ASHRAE Clear Sky
   Optical Depth for Diffuse Irradiance (taud) {dimensionless}

SizingPeriod:DesignDay,
  Kuwait Intl Airport Ann Clg 2% Condns Enth=>MDB, !- Name
  7,                                      !- Month
  21,                                     !- Day of Month
  SummerDesignDay,                        !- Day Type
  34.4,                                   !- Maximum Dry-Bulb
   Temperature {C}
  15.6,                                   !- Daily Dry-Bulb
   Temperature Range {deltaC}
  DefaultMultipliers,                     !- Dry-Bulb Temperature
   Range Modifier Type
  ,                                       !- Dry-Bulb Temperature
   Range Modifier Day Schedule Name
  Enthalpy,                               !- Humidity Condition Type
  ,                                       !- Wetbulb or DewPoint at
   Maximum Dry-Bulb {C}
  ,                                       !- Humidity Condition Day
   Schedule Name
  ,                                       !- Humidity Ratio at
   Maximum Dry-Bulb {kgWater/kgDryAir}
  75100,                                  !- Enthalpy at Maximum Dry
   -Bulb {J/kg}
  ,                                       !- Daily Wet-Bulb
   Temperature Range {deltaC}
  100666,                                 !- Barometric Pressure {Pa
   }
  6.4,                                    !- Wind Speed {m/s}
  320,                                    !- Wind Direction {deg}
  No,                                     !- Rain Indicator
```

```
  No,                                     !- Snow Indicator
  No,                                     !- Daylight Saving Time
    Indicator
  ASHRAETau,                              !- Solar Model Indicator
  ,                                       !- Beam Solar Day Schedule
     Name
  ,                                       !- Diffuse Solar Day
    Schedule Name
  0.748,                                  !- ASHRAE Clear Sky
    Optical Depth for Beam Irradiance (taub) {dimensionless}
  1.315;                                  !- ASHRAE Clear Sky
    Optical Depth for Diffuse Irradiance (taud) {dimensionless}

SizingPeriod:DesignDay,
  Kuwait Intl Airport Ann Clg 2% Condns WB=>MDB, !- Name
  7,                                      !- Month
  21,                                     !- Day of Month
  SummerDesignDay,                        !- Day Type
  34.2,                                   !- Maximum Dry-Bulb
    Temperature {C}
  15.6,                                   !- Daily Dry-Bulb
    Temperature Range {deltaC}
  DefaultMultipliers,                     !- Dry-Bulb Temperature
    Range Modifier Type
  ,                                       !- Dry-Bulb Temperature
    Range Modifier Day Schedule Name
  Wetbulb,                                !- Humidity Condition Type
  24.7,                                   !- Wetbulb or DewPoint at
    Maximum Dry-Bulb {C}
  ,                                       !- Humidity Condition Day
    Schedule Name
  ,                                       !- Humidity Ratio at
    Maximum Dry-Bulb {kgWater/kgDryAir}
  ,                                       !- Enthalpy at Maximum Dry
    -Bulb {J/kg}
```

```
  ,                                       !- Daily Wet-Bulb
   Temperature Range {deltaC}
  100666,                                 !- Barometric Pressure {Pa
   }
  6.4,                                    !- Wind Speed {m/s}
  320,                                    !- Wind Direction {deg}
  No,                                     !- Rain Indicator
  No,                                     !- Snow Indicator
  No,                                     !- Daylight Saving Time
   Indicator
  ASHRAETau,                              !- Solar Model Indicator
  ,                                       !- Beam Solar Day Schedule
    Name
  ,                                       !- Diffuse Solar Day
   Schedule Name
  0.748,                                  !- ASHRAE Clear Sky
   Optical Depth for Beam Irradiance (taub) {dimensionless}
  1.315;                                  !- ASHRAE Clear Sky
   Optical Depth for Diffuse Irradiance (taud) {dimensionless}

SizingPeriod:DesignDay,
  Kuwait Intl Airport Ann Htg 99% Condns DB, !- Name
  1,                                      !- Month
  21,                                     !- Day of Month
  WinterDesignDay,                        !- Day Type
  5.8,                                    !- Maximum Dry-Bulb
   Temperature {C}
  0,                                      !- Daily Dry-Bulb
   Temperature Range {deltaC}
  DefaultMultipliers,                     !- Dry-Bulb Temperature
   Range Modifier Type
  ,                                       !- Dry-Bulb Temperature
   Range Modifier Day Schedule Name
  Wetbulb,                                !- Humidity Condition Type
  5.8,                                    !- Wetbulb or DewPoint at
   Maximum Dry-Bulb {C}
```

```
  ,                                       !- Humidity Condition Day
   Schedule Name
  ,                                       !- Humidity Ratio at
   Maximum Dry-Bulb {kgWater/kgDryAir}
  ,                                       !- Enthalpy at Maximum Dry
   -Bulb {J/kg}
  ,                                       !- Daily Wet-Bulb
   Temperature Range {deltaC}
  100666,                                 !- Barometric Pressure {Pa
   }
  1.9,                                    !- Wind Speed {m/s}
  300,                                    !- Wind Direction {deg}
  No,                                     !- Rain Indicator
  No,                                     !- Snow Indicator
  No,                                     !- Daylight Saving Time
   Indicator
  ASHRAEClearSky,                         !- Solar Model Indicator
  ,                                       !- Beam Solar Day Schedule
    Name
  ,                                       !- Diffuse Solar Day
   Schedule Name
  ,                                       !- ASHRAE Clear Sky
   Optical Depth for Beam Irradiance (taub) {dimensionless}
  ,                                       !- ASHRAE Clear Sky
   Optical Depth for Diffuse Irradiance (taud) {dimensionless}
  0;                                      !- Sky Clearness

SizingPeriod:DesignDay,
  Kuwait Intl Airport Ann Htg 99.6% Condns DB, !- Name
  1,                                      !- Month
  21,                                     !- Day of Month
  WinterDesignDay,                        !- Day Type
  4.1,                                    !- Maximum Dry-Bulb
   Temperature {C}
  0,                                      !- Daily Dry-Bulb
   Temperature Range {deltaC}
```

```
  DefaultMultipliers,                     !- Dry-Bulb Temperature
   Range Modifier Type
  ,                                       !- Dry-Bulb Temperature
   Range Modifier Day Schedule Name
  Wetbulb,                                !- Humidity Condition Type
  4.1,                                    !- Wetbulb or DewPoint at
   Maximum Dry-Bulb {C}
  ,                                       !- Humidity Condition Day
   Schedule Name
  ,                                       !- Humidity Ratio at
   Maximum Dry-Bulb {kgWater/kgDryAir}
  ,                                       !- Enthalpy at Maximum Dry
   -Bulb {J/kg}
  ,                                       !- Daily Wet-Bulb
   Temperature Range {deltaC}
  100666,                                 !- Barometric Pressure {Pa
   }
  1.9,                                    !- Wind Speed {m/s}
  300,                                    !- Wind Direction {deg}
  No,                                     !- Rain Indicator
  No,                                     !- Snow Indicator
  No,                                     !- Daylight Saving Time
   Indicator
  ASHRAEClearSky,                         !- Solar Model Indicator
  ,                                       !- Beam Solar Day Schedule
    Name
  ,                                       !- Diffuse Solar Day
   Schedule Name
  ,                                       !- ASHRAE Clear Sky
   Optical Depth for Beam Irradiance (taub) {dimensionless}
  ,                                       !- ASHRAE Clear Sky
   Optical Depth for Diffuse Irradiance (taud) {dimensionless}
  0;                                      !- Sky Clearness

SizingPeriod:DesignDay,
  Kuwait Intl Airport Ann Htg Wind 99% Condns WS=>MCDB, !- Name
```

```
1,                                      !- Month
21,                                     !- Day of Month
WinterDesignDay,                        !- Day Type
16.6,                                   !- Maximum Dry-Bulb
 Temperature {C}
0,                                      !- Daily Dry-Bulb
 Temperature Range {deltaC}
DefaultMultipliers,                     !- Dry-Bulb Temperature
 Range Modifier Type
,                                       !- Dry-Bulb Temperature
 Range Modifier Day Schedule Name
Wetbulb,                                !- Humidity Condition Type
16.6,                                   !- Wetbulb or DewPoint at
 Maximum Dry-Bulb {C}
,                                       !- Humidity Condition Day
 Schedule Name
,                                       !- Humidity Ratio at
 Maximum Dry-Bulb {kgWater/kgDryAir}
,                                       !- Enthalpy at Maximum Dry
 -Bulb {J/kg}
,                                       !- Daily Wet-Bulb
 Temperature Range {deltaC}
100666,                                 !- Barometric Pressure {Pa
 }
10.2,                                   !- Wind Speed {m/s}
300,                                    !- Wind Direction {deg}
No,                                     !- Rain Indicator
No,                                     !- Snow Indicator
No,                                     !- Daylight Saving Time
 Indicator
ASHRAEClearSky,                         !- Solar Model Indicator
,                                       !- Beam Solar Day Schedule
  Name
,                                       !- Diffuse Solar Day
 Schedule Name
```

```
  ,                                       !- ASHRAE Clear Sky
   Optical Depth for Beam Irradiance (taub) {dimensionless}
  ,                                       !- ASHRAE Clear Sky
   Optical Depth for Diffuse Irradiance (taud) {dimensionless}
  0;                                      !- Sky Clearness

SizingPeriod:DesignDay,
  Kuwait Intl Airport Ann Htg Wind 99.6% Condns WS=>MCDB, !- Name
  1,                                      !- Month
  21,                                     !- Day of Month
  WinterDesignDay,                        !- Day Type
  16.9,                                   !- Maximum Dry-Bulb
   Temperature {C}
  0,                                      !- Daily Dry-Bulb
   Temperature Range {deltaC}
  DefaultMultipliers,                     !- Dry-Bulb Temperature
   Range Modifier Type
  ,                                       !- Dry-Bulb Temperature
   Range Modifier Day Schedule Name
  Wetbulb,                                !- Humidity Condition Type
  16.9,                                   !- Wetbulb or DewPoint at
   Maximum Dry-Bulb {C}
  ,                                       !- Humidity Condition Day
   Schedule Name
  ,                                       !- Humidity Ratio at
   Maximum Dry-Bulb {kgWater/kgDryAir}
  ,                                       !- Enthalpy at Maximum Dry
   -Bulb {J/kg}
  ,                                       !- Daily Wet-Bulb
   Temperature Range {deltaC}
  100666,                                 !- Barometric Pressure {Pa
   }
  11.3,                                   !- Wind Speed {m/s}
  300,                                    !- Wind Direction {deg}
  No,                                     !- Rain Indicator
  No,                                     !- Snow Indicator
```

```
  No,                                     !- Daylight Saving Time
   Indicator
  ASHRAEClearSky,                         !- Solar Model Indicator
  ,                                       !- Beam Solar Day Schedule
    Name
  ,                                       !- Diffuse Solar Day
   Schedule Name
  ,                                       !- ASHRAE Clear Sky
   Optical Depth for Beam Irradiance (taub) {dimensionless}
  ,                                       !- ASHRAE Clear Sky
   Optical Depth for Diffuse Irradiance (taud) {dimensionless}
  0;                                      !- Sky Clearness

SizingPeriod:DesignDay,
  Kuwait Intl Airport Ann Hum_n 99% Condns DP=>MCDB, !- Name
  1,                                      !- Month
  21,                                     !- Day of Month
  WinterDesignDay,                        !- Day Type
  26.8,                                   !- Maximum Dry-Bulb
   Temperature {C}
  0,                                      !- Daily Dry-Bulb
   Temperature Range {deltaC}
  DefaultMultipliers,                     !- Dry-Bulb Temperature
   Range Modifier Type
  ,                                       !- Dry-Bulb Temperature
   Range Modifier Day Schedule Name
  Dewpoint,                               !- Humidity Condition Type
  -9,                                     !- Wetbulb or DewPoint at
   Maximum Dry-Bulb {C}
  ,                                       !- Humidity Condition Day
   Schedule Name
  ,                                       !- Humidity Ratio at
   Maximum Dry-Bulb {kgWater/kgDryAir}
  ,                                       !- Enthalpy at Maximum Dry
   -Bulb {J/kg}
```

```
  ,                                       !- Daily Wet-Bulb
   Temperature Range {deltaC}
  100666,                                 !- Barometric Pressure {Pa
   }
  1.9,                                    !- Wind Speed {m/s}
  300,                                    !- Wind Direction {deg}
  No,                                     !- Rain Indicator
  No,                                     !- Snow Indicator
  No,                                     !- Daylight Saving Time
   Indicator
  ASHRAEClearSky,                         !- Solar Model Indicator
  ,                                       !- Beam Solar Day Schedule
    Name
  ,                                       !- Diffuse Solar Day
   Schedule Name
  ,                                       !- ASHRAE Clear Sky
   Optical Depth for Beam Irradiance (taub) {dimensionless}
  ,                                       !- ASHRAE Clear Sky
   Optical Depth for Diffuse Irradiance (taud) {dimensionless}
  0;                                      !- Sky Clearness

SizingPeriod:DesignDay,
  Kuwait Intl Airport Ann Hum_n 99.6% Condns DP=>MCDB, !- Name
  1,                                      !- Month
  21,                                     !- Day of Month
  WinterDesignDay,                        !- Day Type
  27.7,                                   !- Maximum Dry-Bulb
   Temperature {C}
  0,                                      !- Daily Dry-Bulb
   Temperature Range {deltaC}
  DefaultMultipliers,                     !- Dry-Bulb Temperature
   Range Modifier Type
  ,                                       !- Dry-Bulb Temperature
   Range Modifier Day Schedule Name
  Dewpoint,                               !- Humidity Condition Type
```

```
  -11.9,                                  !- Wetbulb or DewPoint at
   Maximum Dry-Bulb {C}
  ,                                       !- Humidity Condition Day
   Schedule Name
  ,                                       !- Humidity Ratio at
   Maximum Dry-Bulb {kgWater/kgDryAir}
  ,                                       !- Enthalpy at Maximum Dry
   -Bulb {J/kg}
  ,                                       !- Daily Wet-Bulb
   Temperature Range {deltaC}
  100666,                                 !- Barometric Pressure {Pa
   }
  1.9,                                    !- Wind Speed {m/s}
  300,                                    !- Wind Direction {deg}
  No,                                     !- Rain Indicator
  No,                                     !- Snow Indicator
  No,                                     !- Daylight Saving Time
   Indicator
  ASHRAEClearSky,                         !- Solar Model Indicator
  ,                                       !- Beam Solar Day Schedule
    Name
  ,                                       !- Diffuse Solar Day
   Schedule Name
  ,                                       !- ASHRAE Clear Sky
   Optical Depth for Beam Irradiance (taub) {dimensionless}
  ,                                       !- ASHRAE Clear Sky
   Optical Depth for Diffuse Irradiance (taud) {dimensionless}
  0;                                      !- Sky Clearness

ZoneList,
  kuwait_apartment_building,              !- Name
  Room_16_3d8c5364,                       !- Zone Name 1
  Room_17_fb615533,                       !- Zone Name 2
  Room_18_6cc35095,                       !- Zone Name 3
  Room_19_6ae0f9a9,                       !- Zone Name 4
  Room_20_4d060559,                       !- Zone Name 5
```

```
  Room_21_4c523269,                       !- Zone Name 6
  Room_22_f3ee5a53,                       !- Zone Name 7
  Room_23_e751e71f,                       !- Zone Name 8
  Room_24_159d21b7,                       !- Zone Name 9
  Room_25_d27e0933,                       !- Zone Name 10
  Room_26_f4ea3797,                       !- Zone Name 11
  Room_27_0080b418,                       !- Zone Name 12
  Room_28_d6ed2799,                       !- Zone Name 13
  Room_29_2a634042,                       !- Zone Name 14
  Room_30_98f1d6c8;                       !- Zone Name 15

Lights,
  lights,                                 !- Name
  kuwait_apartment_building,              !- Zone or ZoneList Name
  project_light,                          !- Schedule Name
  Watts/Area,                             !- Design Level
   Calculation Method
  ,                                       !- Lighting Level {W}
  5,                                      !- Watts per Zone Floor
   Area {W/m2}
  ,                                       !- Watts per Person {W/
   person}
  0,                                      !- Return Air Fraction
  0.6,                                    !- Fraction Radiant
  0.2,                                    !- Fraction Visible
  1,                                      !- Fraction Replaceable
  General;                                !- End-Use Subcategory

People,
  occupancy,                              !- Name
  kuwait_apartment_building,              !- Zone or ZoneList Name
  MidriseApartment Building_People_Occ Schedule, !- Number of People
    Schedule Name
  People/Area,                            !- Number of People
   Calculation Method
  ,                                       !- Number of People
```

```
  0.01,                                   !- People per Zone Floor
   Area {person/m2}
  ,                                       !- Zone Floor Area per
   Person {m2/person}
  0.3,                                    !- Fraction Radiant
  ,                                       !- Sensible Heat Fraction
  Seated Adult Activity,                  !- Activity Level Schedule
    Name
  0.0000000382,           !- Carbon Dioxide Generation Rate {m3/s-W
   }
  No,                     !- Enable ASHRAE 55 Comfort Warnings
  ZoneAveraged,           !- Mean Radiant Temperature Calculation
   Type
  ,                       !- Surface Name/Angle Factor List Name
  Work Eff Sch,           !- Work Efficiency Schedule Name
  ClothingInsulationSchedule,  !- Clothing Insulation Calculation
   Method
  ,                       !- Clothing Insulation Calculation Method
    Schedule Name
  Clothing Sch,           !- Clothing Insulation Schedule Name
  Air Velo Sch,           !- Air Velocity Schedule Name
  Fanger,                 !- Thermal Comfort Model 1 Type
  Pierce,                 !- Thermal Comfort Model 2 Type
  AdaptiveASH55,          !- Thermal Comfort Model 3 Type
  KSU;                    !- Thermal Comfort Model 4 Type

Schedule:Compact,
    Air Velo Sch,           !- Name
    Fractional,             !- Schedule Type Limits Name
    Through: 12/31,         !- Field 1
    For: AllDays,           !- Field 2
    Until: 24:00,           !- Field 3
    0.35;                      !- Field 4

Schedule:Compact,
    Clothing Sch,           !- Name
```

```
    Fractional,               !- Schedule Type Limits Name
    Through: 12/31,           !- Field 1
    For: AllDays,             !- Field 2
    Until: 24:00,             !- Field 3
    0.5;                      !- Field 4

Schedule:Compact,
    Work Eff Sch,             !- Name
    Fractional,               !- Schedule Type Limits Name
    Through: 12/31,           !- Field 1
    For: AllDays,             !- Field 2
    Until: 24:00,             !- Field 3
    0;                      !- Field 4

Schedule:Compact,
    fan_sch,                  !- Name
    Fractional,               !- Schedule Type Limits Name
    Through: 12/31,           !- Field 1
    For: AllDays,             !- Field 2
    Until: 24:00,             !- Field 3
    1;                        !- Field 4

ElectricEquipment,
    ceiling_fan,              !- Name
    Room_16_3d8c5364,                   !- Zone or ZoneList Name
    fan_sch,                  !- Schedule Name
    EquipmentLevel,           !- Design Level Calculation Method
    345,                      !- Design Level {W}
    ,                         !- Watts per Zone Floor Area {W/m2}
    ,                         !- Watts per Person {W/person}
    0,                        !- Fraction Latent
    0.4,                      !- Fraction Radiant
    0,                        !- Fraction Lost
    General;                  !- End-Use Subcategory

ElectricEquipment,
```

```
  electric_equip,                         !- Name
  kuwait_apartment_building,              !- Zone or ZoneList Name
  project_equipment,                      !- Schedule Name
  Watts/Area,                             !- Design Level
   Calculation Method
  ,                                       !- Design Level {W}
  13.4,                                   !- Watts per Zone Floor
   Area {W/m2}
  ,                                       !- Watts per Person {W/
   person}
  0,                                      !- Fraction Latent
  0.5,                                    !- Fraction Radiant
  0,                                      !- Fraction Lost
  General;                                !- End-Use Subcategory

GasEquipment,
  gas equipment,                          !- Name
  kuwait_apartment_building,              !- Zone or ZoneList Name
  project_gas,                            !- Schedule Name
  Watts/Area,                             !- Design Level
   Calculation Method
  ,                                       !- Design Level {W}
  5.5,                                    !- Power per Zone Floor
   Area {W/m2}
  ,                                       !- Power per Person {W/
   person}
  0,                                      !- Fraction Latent
  0.2,                                    !- Fraction Radiant
  0,                                      !- Fraction Lost
  ,                                       !- Carbon Dioxide
   Generation Rate {m3/s-W}
  General;                                !- End-Use Subcategory

ZoneInfiltration:DesignFlowRate,
  infiltration,                           !- Name
  kuwait_apartment_building,              !- Zone or ZoneList Name
```

```
  Always On,                                !- Schedule Name
  Flow/ExteriorArea,                        !- Design Flow Rate
   Calculation Method
  ,                                         !- Design Flow Rate {m3/s}
  ,                                         !- Flow per Zone Floor
   Area {m3/s-m2}
  0.0003,                                   !- Flow per Exterior
   Surface Area {m3/s-m2}
  ,                                         !- Air Changes per Hour
   {1/hr}
  1,                                        !- Constant Term
   Coefficient
  0,                                        !- Temperature Term
   Coefficient
  0,                                        !- Velocity Term
   Coefficient
  ;                                         !- Velocity Squared Term
   Coefficient

Curve:Biquadratic,
  Air Conditioner Variable Refrigerant Flow 1 VRFCoolCapFT, !- Name
  0.576882692,                              !- Coefficient1 Constant
  0.017447952,                              !- Coefficient2 x
  0.000583269,                              !- Coefficient3 x**2
  -1.76324e-06,                             !- Coefficient4 y
  -7.474e-09,                               !- Coefficient5 y**2
  -1.30413e-07,                             !- Coefficient6 x*y
  15,                                       !- Minimum Value of x {
   BasedOnField A2}
  24,                                       !- Maximum Value of x {
   BasedOnField A2}
  -5,                                       !- Minimum Value of y {
   BasedOnField A3}
  23;                                       !- Maximum Value of y {
   BasedOnField A3}
```

```
Curve:Biquadratic,
  Air Conditioner Variable Refrigerant Flow 1 VRFCoolCapFTHi, !-
   Name
  0.6867358,                              !- Coefficient1 Constant
  0.0207631,                              !- Coefficient2 x
  0.0005447,                              !- Coefficient3 x**2
  -0.0016218,                             !- Coefficient4 y
  -4.259e-07,                             !- Coefficient5 y**2
  -0.0003392,                             !- Coefficient6 x*y
  15,                                     !- Minimum Value of x {
   BasedOnField A2}
  24,                                     !- Maximum Value of x {
   BasedOnField A2}
  16,                                     !- Minimum Value of y {
   BasedOnField A3}
  43;                                     !- Maximum Value of y {
   BasedOnField A3}

Curve:Biquadratic,
  Air Conditioner Variable Refrigerant Flow 1 VRFCoolEIRFT, !- Name
  0.989010541,                            !- Coefficient1 Constant
  -0.02347967,                            !- Coefficient2 x
  0.000199711,                            !- Coefficient3 x**2
  0.005968336,                            !- Coefficient4 y
  -1.0289e-07,                            !- Coefficient5 y**2
  -0.00015686,                            !- Coefficient6 x*y
  15,                                     !- Minimum Value of x {
   BasedOnField A2}
  24,                                     !- Maximum Value of x {
   BasedOnField A2}
  -5,                                     !- Minimum Value of y {
   BasedOnField A3}
  23;                                     !- Maximum Value of y {
   BasedOnField A3}

Curve:Biquadratic,
```

```
  Air Conditioner Variable Refrigerant Flow 1 VRFCoolEIRFTHi, !-
   Name
  -1.4395110176,                          !- Coefficient1 Constant
  0.1619850459,                           !- Coefficient2 x
  -0.0034911781,                          !- Coefficient3 x**2
  0.0269442645,                           !- Coefficient4 y
  0.0001346163,                           !- Coefficient5 y**2
  -0.0006714941,                          !- Coefficient6 x*y
  15,                                     !- Minimum Value of x {
   BasedOnField A2}
  23.9,                                   !- Maximum Value of x {
   BasedOnField A2}
  16.8,                                   !- Minimum Value of y {
   BasedOnField A3}
  43.3;                                   !- Maximum Value of y {
   BasedOnField A3}

Curve:Biquadratic,
  Air Conditioner Variable Refrigerant Flow 1 VRFHeatCapFT, !- Name
  1.012090154,                            !- Coefficient1 Constant
  -0.0012467553,                          !- Coefficient2 x
  -0.0001271847,                          !- Coefficient3 x**2
  0.0267564328,                           !- Coefficient4 y
  -4.986e-07,                             !- Coefficient5 y**2
  -0.0002635239,                          !- Coefficient6 x*y
  21.1,                                   !- Minimum Value of x {
   BasedOnField A2}
  27.2,                                   !- Maximum Value of x {
   BasedOnField A2}
  -20,                                    !- Minimum Value of y {
   BasedOnField A3}
  3.33;                                   !- Maximum Value of y {
   BasedOnField A3}

Curve:Biquadratic,
```

```
  Air Conditioner Variable Refrigerant Flow 1 VRFHeatCapFTHi, !-
   Name
  2.5859872368,                           !- Coefficient1 Constant
  -0.0953227101,                          !- Coefficient2 x
  0.0009553288,                           !- Coefficient3 x**2
  0,                                      !- Coefficient4 y
  0,                                      !- Coefficient5 y**2
  0,                                      !- Coefficient6 x*y
  21.1,                                   !- Minimum Value of x {
   BasedOnField A2}
  27.2,                                   !- Maximum Value of x {
   BasedOnField A2}
  -9.44,                                  !- Minimum Value of y {
   BasedOnField A3}
  15;                                     !- Maximum Value of y {
   BasedOnField A3}

Curve:Biquadratic,
  Air Conditioner Variable Refrigerant Flow 1 VRFHeatEIRFT, !- Name
  0.7224292683,                           !- Coefficient1 Constant
  0.0034566628,                           !- Coefficient2 x
  0.0006507028,                           !- Coefficient3 x**2
  -0.0026435362,                          !- Coefficient4 y
  0.0012464766,                           !- Coefficient5 y**2
  -0.0001009161,                          !- Coefficient6 x*y
  21.1,                                   !- Minimum Value of x {
   BasedOnField A2}
  27.2,                                   !- Maximum Value of x {
   BasedOnField A2}
  -20,                                    !- Minimum Value of y {
   BasedOnField A3}
  3.33;                                   !- Maximum Value of y {
   BasedOnField A3}

Curve:Biquadratic,
```

```
  Air Conditioner Variable Refrigerant Flow 1 VRFHeatEIRFTHi, !-
   Name
  1.3885703646,                           !- Coefficient1 Constant
  -0.0229771462,                          !- Coefficient2 x
  0.000537274,                            !- Coefficient3 x**2
  -0.0273936962,                          !- Coefficient4 y
  0.0004030426,                           !- Coefficient5 y**2
  -5.9786e-05,                            !- Coefficient6 x*y
  21.1,                                   !- Minimum Value of x {
   BasedOnField A2}
  27.2,                                   !- Maximum Value of x {
   BasedOnField A2}
  0,                                      !- Minimum Value of y {
   BasedOnField A3}
  1;                                      !- Maximum Value of y {
   BasedOnField A3}

Curve:Cubic,
  Air Conditioner Variable Refrigerant Flow 1 CoolingCombRatio, !-
   Name
  0.576593263,                            !- Coefficient1 Constant
  0.6349408697,                           !- Coefficient2 x
  -0.3076093963,                          !- Coefficient3 x**2
  0.0960752636,                           !- Coefficient4 x**3
  1,                                      !- Minimum Value of x {
   BasedOnField A2}
  1.5;                                    !- Maximum Value of x {
   BasedOnField A2}

Curve:Cubic,
  Air Conditioner Variable Refrigerant Flow 1 CoolingEIRHiPLR, !-
   Name
  1,                                      !- Coefficient1 Constant
  0,                                      !- Coefficient2 x
  0,                                      !- Coefficient3 x**2
  0,                                      !- Coefficient4 x**3
```

```
  1,                                      !- Minimum Value of x {
   BasedOnField A2}
  1.5;                                    !- Maximum Value of x {
   BasedOnField A2}

Curve:Cubic,
  Air Conditioner Variable Refrigerant Flow 1 CoolingEIRLowPLR, !-
   Name
  0.4541226192,                           !- Coefficient1 Constant
  -0.1729687081,                          !- Coefficient2 x
  1.0828661347,                           !- Coefficient3 x**2
  -0.3618480897,                          !- Coefficient4 x**3
  0.5,                                    !- Minimum Value of x {
   BasedOnField A2}
  1;                                      !- Maximum Value of x {
   BasedOnField A2}

Curve:Cubic,
  Air Conditioner Variable Refrigerant Flow 1 HeatingCombRatio, !-
   Name
  0.7667196604,                           !- Coefficient1 Constant
  0.2617302019,                           !- Coefficient2 x
  -0.0159110245,                          !- Coefficient3 x**2
  -0.0125388376,                          !- Coefficient4 x**3
  1,                                      !- Minimum Value of x {
   BasedOnField A2}
  1.5;                                    !- Maximum Value of x {
   BasedOnField A2}

Curve:Cubic,
  Air Conditioner Variable Refrigerant Flow 1 HeatingEIRHiPLR, !-
   Name
  1,                                      !- Coefficient1 Constant
  0,                                      !- Coefficient2 x
  0,                                      !- Coefficient3 x**2
  0,                                      !- Coefficient4 x**3
```

```
  1,                                      !- Minimum Value of x {
   BasedOnField A2}
  1.5;                                    !- Maximum Value of x {
   BasedOnField A2}

Curve:Cubic,
  Air Conditioner Variable Refrigerant Flow 1 HeatingEIRLowPLR, !-
   Name
  0.3924742025,                           !- Coefficient1 Constant
  0.076016374,                            !- Coefficient2 x
  0.6983235783,                           !- Coefficient3 x**2
  -0.1688407813,                          !- Coefficient4 x**3
  0.5,                                    !- Minimum Value of x {
   BasedOnField A2}
  1;                                      !- Maximum Value of x {
   BasedOnField A2}

Curve:Cubic,
  Air Conditioner Variable Refrigerant Flow 1 VRFCoolCapFTBoundary,
   !- Name
  25.73,                                  !- Coefficient1 Constant
  -0.03150043,                            !- Coefficient2 x
  -0.01416595,                            !- Coefficient3 x**2
  0,                                      !- Coefficient4 x**3
  11,                                     !- Minimum Value of x {
   BasedOnField A2}
  30;                                     !- Maximum Value of x {
   BasedOnField A2}

Curve:Cubic,
  Air Conditioner Variable Refrigerant Flow 1 VRFCoolEIRFTBoundary,
   !- Name
  25.73473775,                            !- Coefficient1 Constant
  -0.03150043,                            !- Coefficient2 x
  -0.01416595,                            !- Coefficient3 x**2
  0,                                      !- Coefficient4 x**3
```

```
  15,                                     !- Minimum Value of x {
   BasedOnField A2}
  24;                                     !- Maximum Value of x {
   BasedOnField A2}

Curve:Cubic,
  Air Conditioner Variable Refrigerant Flow 1 VRFCPLFFPLR, !- Name
  0.85,                                   !- Coefficient1 Constant
  0.15,                                   !- Coefficient2 x
  0,                                      !- Coefficient3 x**2
  0,                                      !- Coefficient4 x**3
  1,                                      !- Minimum Value of x {
   BasedOnField A2}
  1;                                      !- Maximum Value of x {
   BasedOnField A2}

Curve:Cubic,
  Air Conditioner Variable Refrigerant Flow 1 VRFHeatCapFTBoundary,
   !- Name
  58.577,                                 !- Coefficient1 Constant
  -3.0255,                                !- Coefficient2 x
  0.0193,                                 !- Coefficient3 x**2
  0,                                      !- Coefficient4 x**3
  15,                                     !- Minimum Value of x {
   BasedOnField A2}
  23.9;                                   !- Maximum Value of x {
   BasedOnField A2}

Curve:Cubic,
  Air Conditioner Variable Refrigerant Flow 1 VRFHeatEIRFTBoundary,
   !- Name
  58.577,                                 !- Coefficient1 Constant
  -3.0255,                                !- Coefficient2 x
  0.0193,                                 !- Coefficient3 x**2
  0,                                      !- Coefficient4 x**3
```

```
  15,                                     !- Minimum Value of x {
   BasedOnField A2}
  23.9;                                   !- Maximum Value of x {
   BasedOnField A2}

Curve:Cubic,
  Curve Cubic 1,                          !- Name
  0.758746,                               !- Coefficient1 Constant
  0.027626,                               !- Coefficient2 x
  0.000148716,                            !- Coefficient3 x**2
  3.4992e-06,                             !- Coefficient4 x**3
  -20,                                    !- Minimum Value of x {
   BasedOnField A2}
  20;                                     !- Maximum Value of x {
   BasedOnField A2}

Curve:Cubic,
  Curve Cubic 2,                          !- Name
  0.84,                                   !- Coefficient1 Constant
  0.16,                                   !- Coefficient2 x
  0,                                      !- Coefficient3 x**2
  0,                                      !- Coefficient4 x**3
  0.5,                                    !- Minimum Value of x {
   BasedOnField A2}
  1.5;                                    !- Maximum Value of x {
   BasedOnField A2}

Curve:Cubic,
  Curve Cubic 3,                          !- Name
  1.19248,                                !- Coefficient1 Constant
  -0.0300438,                             !- Coefficient2 x
  0.00103745,                             !- Coefficient3 x**2
  -2.3328e-05,                            !- Coefficient4 x**3
  -20,                                    !- Minimum Value of x {
   BasedOnField A2}
```

```
  20;                                     !- Maximum Value of x {
   BasedOnField A2}

Curve:Quadratic,
  Curve Quadratic 1,                      !- Name
  1.3824,                                 !- Coefficient1 Constant
  -0.4336,                                !- Coefficient2 x
  0.0512,                                 !- Coefficient3 x**2
  0,                                      !- Minimum Value of x {
   BasedOnField A2}
  1;                                      !- Maximum Value of x {
   BasedOnField A2}

Curve:Quadratic,
  Curve Quadratic 2,                      !- Name
  0.75,                                   !- Coefficient1 Constant
  0.25,                                   !- Coefficient2 x
  0,                                      !- Coefficient3 x**2
  0,                                      !- Minimum Value of x {
   BasedOnField A2}
  1;                                      !- Maximum Value of x {
   BasedOnField A2}

SetpointManager:Scheduled,
  Setpoint Manager Scheduled 1,           !- Name
  Temperature,                            !- Control Variable
  60C Hot Water,                          !- Schedule Name
  Node 2;                                 !- Setpoint Node or
   NodeList Name




LifeCycleCost:NonrecurringCost,
  Default Cost,                           !- Name
  Construction,                           !- Category
  0,                                      !- Cost
```

```
  ServicePeriod;                          !- Start of Costs

Site:GroundTemperature:BuildingSurface,

    23.07,                      !- January Ground Temperature {C}

    23.01,                      !- February Ground Temperature {C}

    23.2,                      !- March Ground Temperature {C}

    23.43,                      !- April Ground Temperature {C}

    23.84,                      !- May Ground Temperature {C}

    24.14,                      !- June Ground Temperature {C}

    24.32,                      !- July Ground Temperature {C}

    24.39,                      !- August Ground Temperature {C}

    24.22,                      !- September Ground Temperature {C}

    23.97,                      !- October Ground Temperature {C}

    23.56,                      !- November Ground Temperature {C}

    23.14;                      !- December Ground Temperature {C}

!!*****************************************

  ElectricLoadCenter:Distribution,
    PV Array Load Center,    !- Name
    Generator List,          !- Generator List Name
    TrackElectrical,         !- Generator Operation Scheme Type
    0,                       !- Generator Demand Limit Scheme
   Purchased Electric Demand Limit {W}
```

```
    ,                         !- Generator Track Schedule Name Scheme
    Schedule Name
    ,                         !- Generator Track Meter Scheme Meter
   Name
    DirectCurrentWithInverterDCStorage,  !- Electrical Buss Type
    PV Inverter,              !- Inverter Name
    LiIonBattery,              !- Electrical Storage Object Name
    ,                          !- Transformer Object Name
    TrackChargeDischargeSchedules,    !- Storage Operation Scheme
    ,                          !- Storage Control Track Meter Name
    Storage Converter,         !- Storage Converter Object Name
    0.95,                      !- Maximum Storage State of Charge
   Fraction
    0.2,                       !- Minimum Storage State of Charge
   Fraction
    16978,                      !- Design Storage Control Charge
   Power
    charge_sch,                !- Storage Charge Power Fraction
   Schedule Name
    10700,                      !- Design Storage Control Discharge
   Power
    discharge_sch,             !- Storage Discharge Power Fraction
   Schedule Name
    ,                          !- Storage Control Utility Demand
   Target
    ;                          !- Storage Control Utility Demand
   Target Fraction Schedule Name

ElectricLoadCenter:Storage:Converter ,
    Storage Converter , !- Name
    ALWAYS_ON , !- Availability Schedule Name
    SimpleFixed , !- Power Conversion Efficiency Method
    0.95 ,          !- Simple Fixed Efficiency
    ,       !- Design Maximum Continuous Input Power
    ,        !- Efficiency Function of Power Curve Name 20
    ,          !- Ancillary Power Consumed In Standby
```

```
  ,           !- Zone Name 0.25
  ;           !- Radiative Fraction

Curve:DoubleExponentialDecay,
  Doubleexponential,       !- Name
  1380,                    !- Coefficient1 C1
  6834,                    !- Coefficient2 C2
  -8.75,                   !- Coefficient3 C3
  6747,                    !- Coefficient4 C4
  -6.22,                   !- Coefficient5 C5
  0,                       !- Minimum Value of x
  1,                       !- Maximum Value of x
  ,                        !- Minimum Curve Output
  ,                        !- Maximum Curve Output
  Dimensionless,           !- Input Unit Type for x
  Dimensionless;           !- Output Unit Type

ElectricLoadCenter:Storage:LiIonNMCBattery,
  LiIonBattery,            !- Name
  ALWAYS_ON,               !- Availability Schedule Name
  ,                        !- Zone Name
  0,                       !- Radiative Fraction
  KandlerSmith,            !- Lifetime Model
  139,                     !- Number of Cells in Series
  50,                      !- Number of Strings in Parallel
  0.7,                     !- Initial Fractional State of Charge
  ,                        !- DC to DC Charging Efficiency
  342,                     !- Battery Mass
  4.26,                    !- Battery Surface Area
  ,                        !- Battery Specific Heat Capacity
  ;                        !- Heat Transfer Coefficient Between
 Battery and Ambient

ElectricLoadCenter:Inverter:LookUpTable,
  PV Inverter,             !- Name
  ALWAYS_ON,               !- Availability Schedule Name
```

```
  ,                         !- Zone Name
  0.25,                     !- Radiative Fraction
  14000,                    !- Rated Maximum Continuous Output
 Power {W}
  200.0,                    !- Night Tare Loss Power {W}
  368,                      !- Nominal Voltage Input {V}
  0.839,                    !- Efficiency at 10% Power and Nominal
 Voltage
  0.897,                    !- Efficiency at 20% Power and Nominal
 Voltage
  0.916,                    !- Efficiency at 30% Power and Nominal
 Voltage
  0.931,                    !- Efficiency at 50% Power and Nominal
 Voltage
  0.934,                    !- Efficiency at 75% Power and Nominal
 Voltage
  0.930;                    !- Efficiency at 100% Power and Nominal
  Voltage

ElectricLoadCenter:Generators,
  Generator List,           !- Name
  PV_roof_front,  !- Generator 1 Name
  Generator:Photovoltaic,  !- Generator 1 Object Type
  9000.0,                   !- Generator 1 Rated Electric Power
 Output {W}
  ,                         !- Generator 1 Availability Schedule
 Name
  ,                         !- Generator 1 Rated Thermal to
 Electrical Power Ratio
  PV_roof_left,  !- Generator 2 Name
  Generator:Photovoltaic,  !- Generator 1 Object Type
  9000.0,                   !- Generator 1 Rated Electric Power
 Output {W}
  ,                         !- Generator 1 Availability Schedule
 Name
```

```
  ,                         !- Generator 1 Rated Thermal to
 Electrical Power Ratio
  PV_roof_middle,  !- Generator 3 Name
  Generator:Photovoltaic,  !- Generator 1 Object Type
  9000.0,                  !- Generator 1 Rated Electric Power
 Output {W}
  ,                         !- Generator 1 Availability Schedule
 Name
  ,                         !- Generator 1 Rated Thermal to
 Electrical Power Ratio
  PV_roof_right,  !- Generator 4 Name
  Generator:Photovoltaic,  !- Generator 1 Object Type
  9000.0,                  !- Generator 1 Rated Electric Power
 Output {W}
  ,                         !- Generator 1 Availability Schedule
 Name
  ,                         !- Generator 1 Rated Thermal to
 Electrical Power Ratio
  PV_roof_back,  !- Generator 5 Name
  Generator:Photovoltaic,  !- Generator 2 Object Type
  9000.0,                  !- Generator 2 Rated Electric Power
 Output {W}
  ,                         !- Generator 2 Availability Schedule
 Name
  ;                         !- Generator 2 Rated Thermal to
 Electrical Power Ratio




PhotovoltaicPerformance:Simple,
  20percentEffPVhalfArea,  !- Name
  1,                      !- Fraction of Surface Area with Active
 Solar Cells {dimensionless}
  Fixed,                   !- Conversion Efficiency Input Mode
  0.20,                    !- Value for Cell Efficiency if Fixed
```

```
  ;                         !- Efficiency Schedule Name

Generator:Photovoltaic,
  PV_roof_front,  !- Name
  Room_18_6cc35095..Face5,!- Surface Name
  PhotovoltaicPerformance:Simple,  !- Photovoltaic Performance
 Object Type
  20percentEffPVhalfArea,  !- Module Performance Name
  Decoupled,               !- Heat Transfer Integration Mode
  1.0,                     !- Number of Series Strings in Parallel
  {dimensionless}
  1.0;                     !- Number of Modules in Series {
 dimensionless}

ComponentCost:LineItem,
  PV_roof_front,  !- Name
  ,                         !- Type
  Generator:Photovoltaic,  !- Line Item Type
  PV_roof_front,  !- Item Name
  ,                         !- Object End-Use Key
  ,                         !- Cost per Each {$}
  ,                         !- Cost per Area {$/m2}
  9000.0000,                !- Cost per Unit of Output Capacity {$/
 kW}
  ,                         !- Cost per Unit of Output Capacity per
  COP {$/kW}
  ,                         !- Cost per Volume {$/m3}
  ,                         !- Cost per Volume Rate {$/(m3/s)}
  ,                         !- Cost per Energy per Temperature
 Difference {$/(W/K)}
  ;                         !- Quantity {dimensionless}

Generator:Photovoltaic,
  PV_roof_left,  !- Name
  Room_19_6ae0f9a9..Face5,!- Surface Name
```

```
  PhotovoltaicPerformance:Simple,  !- Photovoltaic Performance
 Object Type
  20percentEffPVhalfArea,  !- Module Performance Name
  Decoupled,               !- Heat Transfer Integration Mode
  1.0,                     !- Number of Series Strings in Parallel
  {dimensionless}
  1.0;                     !- Number of Modules in Series {
 dimensionless}

ComponentCost:LineItem,
  PV_roof_left,  !- Name
  ,                        !- Type
  Generator:Photovoltaic,  !- Line Item Type
  PV_roof_left,             !- Item Name
  ,                        !- Object End-Use Key
  ,                        !- Cost per Each {$}
  ,                        !- Cost per Area {$/m2}
  9000.0000,               !- Cost per Unit of Output Capacity {$/
 kW}
  ,                        !- Cost per Unit of Output Capacity per
  COP {$/kW}
  ,                        !- Cost per Volume {$/m3}
  ,                        !- Cost per Volume Rate {$/(m3/s)}
  ,                        !- Cost per Energy per Temperature
 Difference {$/(W/K)}
  ;                        !- Quantity {dimensionless}

Generator:Photovoltaic,
  PV_roof_middle,  !- Name
  Room_22_f3ee5a53..Face5,!- Surface Name
  PhotovoltaicPerformance:Simple,  !- Photovoltaic Performance
 Object Type
  20percentEffPVhalfArea,  !- Module Performance Name
  Decoupled,               !- Heat Transfer Integration Mode
  1.0,                     !- Number of Series Strings in Parallel
  {dimensionless}
```

```
  1.0;                      !- Number of Modules in Series {
 dimensionless}

ComponentCost:LineItem,
  PV_roof_middle,  !- Name
  ,                         !- Type
  Generator:Photovoltaic,   !- Line Item Type
  PV_roof_middle,  !- Item Name
  ,                         !- Object End-Use Key
  ,                         !- Cost per Each {$}
  ,                         !- Cost per Area {$/m2}
  9000.0000,                !- Cost per Unit of Output Capacity {$/
 kW}
  ,                         !- Cost per Unit of Output Capacity per
  COP {$/kW}
  ,                         !- Cost per Volume {$/m3}
  ,                         !- Cost per Volume Rate {$/(m3/s)}
  ,                         !- Cost per Energy per Temperature
 Difference {$/(W/K)}
  ;                         !- Quantity {dimensionless}

Generator:Photovoltaic,
  PV_roof_right,  !- Name
  Room_25_d27e0933..Face5,!- Surface Name
  PhotovoltaicPerformance:Simple,  !- Photovoltaic Performance
 Object Type
  20percentEffPVhalfArea,  !- Module Performance Name
  Decoupled,                !- Heat Transfer Integration Mode
  1.0,                      !- Number of Series Strings in Parallel
  {dimensionless}
  1.0;                      !- Number of Modules in Series {
 dimensionless}

ComponentCost:LineItem,
  PV_roof_right,  !- Name
  ,                         !- Type
```

```
  Generator:Photovoltaic,  !- Line Item Type
  PV_roof_right,  !- Item Name
  ,                        !- Object End-Use Key
  ,                        !- Cost per Each {$}
  ,                        !- Cost per Area {$/m2}
  9000.0000,               !- Cost per Unit of Output Capacity {$/
 kW}
  ,                        !- Cost per Unit of Output Capacity per
  COP {$/kW}
  ,                        !- Cost per Volume {$/m3}
  ,                        !- Cost per Volume Rate {$/(m3/s)}
  ,                        !- Cost per Energy per Temperature
 Difference {$/(W/K)}
  ;                        !- Quantity {dimensionless}

Generator:Photovoltaic,
  PV_roof_back,  !- Name
  Room_28_d6ed2799..Face5,!- Surface Name
  PhotovoltaicPerformance:Simple,  !- Photovoltaic Performance
 Object Type
  20percentEffPVhalfArea,  !- Module Performance Name
  Decoupled,               !- Heat Transfer Integration Mode
  1.0,                     !- Number of Series Strings in Parallel
  {dimensionless}
  1.0;                     !- Number of Modules in Series {
 dimensionless}

ComponentCost:LineItem,
  PV_roof_back,  !- Name
  ,                        !- Type
  Generator:Photovoltaic,  !- Line Item Type
  PV_roof_back,  !- Item Name
  ,                        !- Object End-Use Key
  ,                        !- Cost per Each {$}
  ,                        !- Cost per Area {$/m2}
```

```
    9000.0000,               !- Cost per Unit of Output Capacity {$/
   kW}
    ,                        !- Cost per Unit of Output Capacity per
    COP {$/kW}
    ,                        !- Cost per Volume {$/m3}
    ,                        !- Cost per Volume Rate {$/(m3/s)}
    ,                        !- Cost per Energy per Temperature
   Difference {$/(W/K)}
    ;                        !- Quantity {dimensionless}



Output:VariableDictionary,
    IDF;                     !- Key Field

Output:Variable,*,Site Outdoor Air Drybulb Temperature,hourly; !-
   Zone Average [C]

Output:Variable,*,Facility Total Electricity Demand Rate,hourly; !-
   HVAC Average [W]


Output:Variable,*,Zone Thermal Comfort Pierce Model Standard
   Effective Temperature,hourly; !- Zone Average [C]

Output:Variable,*,Electric Load Center Produced Electricity Rate,
   hourly;

Output:Variable,
    *,                        !- Key Value
    Electric Storage Charge Power,    !- Variable Name
    hourly;                   !- Reporting Frequency

Output:Variable,
    *,                        !- Key Value
    Electric Storage Discharge Power,    !- Variable Name
```

```
    hourly;                   !- Reporting Frequency

Output:Variable,*,Facility Net Purchased Electricity Rate,hourly;
```

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